EVALUATION OF INTEGRATED CATCHMENT MANAGEMENT IN A WET TROPICAL ENVIRONMENT:

Collected Papers of LWRRDC R&D Project CTC7

Land & Water Resources Research & Development Corporation

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Compiled by Jennifer A. Bellamy

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Chapter 1

Tracking Progress in Natural Resource Management: A systems approach to evaluation

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Abstract: The emerging focus on ecologically sustainable development (ESD) has caused a paradigm shift in the theory underpinning natural resource management. Increasingly, this shift is reflected in policy. The adoption of the new paradigm for natural resource and environmental policy and research demands a new approach to evaluation. This paper develops a systems framework for the evaluation of natural resource management programmes based on a consideration of the changing nature of approaches to natural resource management programs and observation of and experience in the practical assessment of on-the-ground projects. The framework provides the basis for an integrated evaluation of the different perspectives (i.e. social, economic, environmental, institutional and technological) on the natural resource management and planning process. It recognizes the multiple levels and nested nature of natural resource management policy and research, namely: problem characterisation, policy formulation and intent, program logic, and on-ground implementation. Having developed and presented this framework on the basis of practical experience, we demonstrate its utility through application to six contrasting case studies and discuss the implications.

1. INTRODUCTION

Recent theoretical developments in the natural, social, policy, information and management sciences reveal parallel development of a new paradigm of progress toward sustainable development that emphasise continuous change, adaptation and learning (e.g. Funtowicz and Ravetz 1990, Orlikowski 1992, Boehmer-Christiansen 1994, Gunderson *et al.* 1995, Chambers 1997, Ison *et al.* 1997, Wallace *et al.* 1996, Dovers and Mobbs 1997). Although there is limited consensus on exactly what sustainable development means, it has become the widely accepted term that describes "the goal of achieving a high, equitable and sustainable quality of life by integrating into a single conceptual framework the social, economic and environmental activities, outcomes and impacts of human society" (Eckersley 1998, p.6). Continuous change is perceived to be inherent in social, political, economic, technological and environmental systems. Realities are multiple, in constant flux, sometimes in conflict, difficult to measure and demand judgement. Change is increasingly recognised as being non-linear and dynamic, and to be more interconnected and instantly communicated than ever before. For change to be acceptable and beneficial, it must be socially, economically, institutionally and environmentally sustainable. Coping with and managing accelerated change requires a systemic approach characterised by pluralism, adaptation and learning that is incumbent upon personal responsibility and opportunity at the local level.

Increasingly, this shift in theory is reflected in policy. A range of new natural resource and environmental policy models and other sustainability initiatives are emerging worldwide (e.g. Gunderson *et al.* 1995; Wallace *et al.* 1996; Gardner and Stern 1996; Bellamy *et al.* 1999). In general these policy models are framed at the macro level (eg. national, state, regional, catchment) with the intent of facilitating the emergence of adaptive processes and progress towards sustainable development at the micro or local level (eg. sub-catchment, municipal/local government area or farm enterprise). The predominant rhetoric of these approaches is grounded in the underlying assumptions of the new paradigm of change, adaptation and learning and includes:

- Systemic approaches
- Long term perspectives and multiple scales of relevance
- 'Wicked' problems
- Inherent ignorance
- Relevance of the human and cultural context of implementation
- Pluralism in individual, community and professional values, agendas and behaviours
- Responsibility and accountability (eg. duty of care) at both individual and institutional levels.

In practice, implementation of natural resource management policy models is proving challenging to the individuals, the institutions and the communities concerned (eg. Dorcey 1991; Gunderson *et al.* 1995; Syme *et al.* 1994; Gardner and Stern 1996, Bellamy *et al.* 1999)).

As a consequence, actual impact has often fallen short of expectation. Chambers (1997) remarks that "myths have led to massive misallocation of funds and human resources, to misguided programmes, to missed opportunities and among professionals to deception, cynicism and loss of commitment" (p.100). We argue that such difficulties can be attributed in part to the inadequacy in evaluation of the efficacy of policies, planning and research on natural resource management initiatives that can contribute to on-going improvement in their development and implementation.

2. EVALUATION IN NATURAL RESOURCE MANAGEMENT

Program evaluation and policy analysis are recognised as critical elements of successful policy development and implementation (Dovers 1996). With increasing demands for both adaptive approaches and better scrutiny of the use of public funds, and greater accountability for environmental protection and equity in natural resource use, the focus of policy analysis and program evaluation and implementation has shifted. The new focus is on improving transparency and accountability including how effectively and equitably resources are used, making explicit the purpose of the policy or program, monitoring the process of implementation and assessing value and general performance. In Australia, monitoring and evaluation has become a high priority for funding bodies in order to address the need for responsible accountability in the investment of taxpayers funds for on-ground works projects (e.g. ANAO 1997) and on research (e.g. LWRRDC 1997). However, performance monitoring, evaluation and review in natural resource management policy have been widely neglected, with a substantial gap emerging between theory and practice (Wallace *et al.* 1995; Curtis *et al.* 1998; Bellamy *et al.* 1999).

2.1 The Practice

Within the context of integrated resource management policy implementation, Bellamy *et al.* (1999) have challenged the efficacy of conventional models of evaluation. Evaluation of natural resource management and planning has generally been:

- fragmented in terms of reconciling the different domain perspectives in evaluation (Bellamy *et al.* 1999);
- insensitive to the socio-economic, policy/institutional, and environmental context within which performance is assessed (Syme and Sadler 1994; Bellamy *et al.* 1999);
- hampered by an inherent lack of assessable goals and outcome measures (Wallace *et al.* 1995; ANAO 1997); and
- broad one-off overviews conducted as a cross-sectoral snap-shot in time rather than a systematic longitudinal study (Bellamy *et al.* 1999).

Although approaches to natural resource management based on the integration of community involvement, technical knowledge, and organisational structure and policy objectives are endorsed both in Australia and overseas, there are no generally accepted models of evaluation of such initiatives. Existing frameworks may provide a checklist of multiple-disciplinary criteria relating to the environmental, social, economic and institutional perspectives but not an integrated evaluation (Bellamy *et al.* 1999). Significantly, no clear evaluative framework has emerged to guide continuous improvements in the way natural resource management policy initiatives and research contribute to on-going improvements in the sustainability of resource use and social well-being of the communities concerned. In effect, an over-arching systemic framework to guide the evaluation of NRM policy initiatives is lacking.

2.2 Theory Development

Theory development for the evaluation of complex and integrated approaches to natural resource use management and planning, in general, is poorly constructed. Ison *et al.* (1997) argue that the emerging systems perspectives of complexity science, 'chaos' and self-organising theories and complex adaptive systems can "bridge the natural, socio-economic and management sciences by serving either as explanations of phenomena or as metaphors which can guide thinking and action" (p.261). General systems theory has the potential to provide evaluation with a powerful conceptual tool for analysing complex uncertain impact chains. We argue that natural resource management initiatives need to be evaluated as a system that links the objectives and instrumental rationale of the policy, program or product to actual performance on the ground. An effective framework for evaluating the success of natural resource management and planning approaches needs to be based on pragmatic considerations and draw on evaluation principles and methods from a broad spectrum of other disciplines (e.g. evaluation research, social psychology, impact assessment, ecology, economics, organisational science, management science, and technology assessment) to characterise, monitor and evaluate the process and its outcomes. Synthesis of these multiple perspectives to define the construct space for evaluation of these phenomena requires the development of an integrated or systems approach (Bellamy *et al.* 1999).

2.3 Bridging the Gap

Developing an improved framework and methodologies for analysing situations, incorporating institutional concerns and, in turn, informing the process requires a systemic and integrated approach that needs to:

(a) evaluate public and private investment in integrated approaches to natural resource management;
(b) identify critical social, economic, institutional, environmental and technological factors that influence the success of natural resource management initiatives;
(c) develop appropriate performance criteria for assessing the potential impacts of an approach not only on the management of natural resource systems, but also on institutional arrangements and society as a whole; and
(d) identify what the outcomes and expectations of an integrated resource management initiative might be;
(e) establish guidelines and techniques for self-evaluation of progress towards the achievement of agreed objectives and planned outcomes, including consideration of equity and social justice issues.

It is critical that policy makers, researchers, project managers and so on are able to implement effective evaluation of their programs and activities. However, these people inevitably have limited time and skills to apply to the evaluation process, at the very least because it is incumbent on them to undertake evaluation efficiently so that the evaluation process does not in itself adversely affect achievement of operational objectives. Our practical experience suggests, however, that both community-based resource management groups and resource management agencies are very amenable to the suggestion that a significant investment might usefully be made on evaluation. In the remainder of the paper we consider, on the basis of our broad case study experience, some of the operational challenges that these objectives pose. These in turn provide a basis for presenting an integrative systems-based framework to structure the evaluation of natural resource management initiatives. Finally we demonstrate the application of the systems-based framework through six case studies and discuss the implications.

3. EVALUATION CHALLENGES

3.1 Implementational Issues in Evaluation

Our experience in evaluation of a range of different natural resource management policy initiatives, including policy issues and evaluation (eg. Syme *et al.* 1994, Syme and Sadler 1994; McDonald and Bellamy 1997, Bellamy and Johnson 1999; Bellamy *et al.* 1999; Hooper *et al.* 1999), methods and tools for management and planning (e.g. Bellamy *et al.* 1996; Walker and Johnson, 1996; Johnson and Walker, 1997; Bellamy and MacLeod 1999) and natural resource management research and development (e.g. Bellamy and MacLeod 1998; Walker *et al.* 1997; Bellamy and Dale 1998) demonstrates that there are a number of common factors that make the natural resource management evaluation process implementationally demanding and potentially costly. These difficulties are particularly pertinent to evaluation of sustainability initiatives with broad societal purposes. The key challenges on the basis of our experience are breadth of evaluation, multi-dimensionality of impacts, intangible objectives and outcomes, additionality, short term versus long term impacts, evolution or drift in objectives, multiple perspectives on criteria for success, transaction costs and intrusiveness.

Breadth of evaluation. Evaluation of impact against a single criterion or overly limited set of criteria may miss important benefits and lead to significant costs remaining unrecognised. There is a need for a multi-disciplinary approach that provides for an integrated evaluation of multiple perspectives and worldviews on natural resources initiatives.

Multi-dimensionality of impacts. The impact or influence of a sustainability initiative is potentially multidimensional. It may encompass, for example:

- Individual and organisational learning effects (e.g. new collaborations, partnerships or strategic alliances, networking);
- Behavioural changes (e.g. new skills, new planning processes, sharing of information);
- Impacts on norms/standards (e.g. new ways of technical assessment, accessibility of information);
- Social effects (e.g. system and networking externalities); and
- Contributions to knowledge bases, scientific progress, and human and social development.

Intangible objectives and outcomes. Many policy programs and planning processes have vague and even unrealistic aims and objectives. In addition, many of the important measures of progress or success are intangible and difficult to measure and are innate to the elusive nature of sustainability concept. These factors make the identification of appropriate criteria for evaluation difficult.

Relationships between initiatives/Additionality There is considerable ambiguity associated with cause-and-effect relationships in natural resource management problems. These problems involve dynamic, complex, multi-dimensional processes that are affected by a number of factors. There are many influences on resource use and management such that it is not generally possible to provide definitive answers with regard to causality, that is to identify uniquely the difference that particular policies or programs can make to what would have happened without their implementation. However, as Patton (1989) observes, it is possible to arrive at some "reasonable estimation of the likelihood that particular activities have had particular effects" (p. 376).

Short term needs versus long-term impacts. Impacts or outcomes of a sustainability policy or research initiative may take a considerable time to be realised and only become visible beyond the lifetime of any evaluation. Although the outputs or products may be easier to

measure and track than the ultimate outcomes of an initiative, they do not generally provide a good rigorous measure of achievement of stated goals and objectives.

Evolution or drift in objectives. There are difficulties related to the dynamic nature of the context of implementation of natural resource management initiatives and the potential for changing 'fit' of objectives with instrumental assumptions and context. For example, a sustainability initiative may, at inception have a clear relationship between issue, intent, assumptions, criteria and context. At a somewhat later date the issue and intent may have evolved markedly either in conjunction with or independently of changes in context. However, instrumental assumptions and evaluative criteria may not have co-evolved, leading to a complex distortion that needs to be dealt with in the evaluation process.

Multiple perspectives on criteria for success. In the case of policies promoting sustainability by multiple stakeholder participation the 'views' of the purposes of the program and the criteria of success of the different stakeholders may be quite diverse. Establishment of an evaluation framework which includes the perception of each stakeholder according to their function within the overall system, can be problematic. Depending on one's role there may be subtle or distinctly different priorities for outcome and criteria for measuring whether the outcomes have been achieved. These differences may be necessary for the healthy functioning of the system as a whole.

Transaction costs. Because of the complexity of holistic natural resource policies there is a tension as to how "internal" or "external' the evaluation should be. This can only be solved on a case by case study. The decision on the balance of the evaluation becomes increasingly complex with increasingly multi-faceted environments and complex communities and economies. Outsiders may know too little about how the system operates to be efficient and effective evaluators. "Insiders" may be blinkered by their past history. The transaction costs in limiting both impediments and achieving a balance can be large.

Intrusiveness. There is a fundamental requirement that the evaluation process should be as non-intrusive as possible on effective implementation of the project, policy, or research initiative. As Heisenberg's uncertainty principle has shown, the act of observation itself can interfere with the very system one is observing.

3.2 Evaluation Principles for NRM Policy Implementation

These common implementational issues do not provide a justification for seeking a common framework for evaluation in natural resource management. However, they highlight some clear commonalties in relation to the evaluation process. As such, evaluation in natural resource management, therefore, needs to:

(a) address a system that links objective to consequence;
(b) be conducted in terms of the fundamental assumptions and instrumental hypotheses that underpin core policy, program or research objectives;
(c) be grounded in the natural resource, policy/institutional, economic, socio-cultural and technological contexts of implementation in practice;
(d) be based on the establishment of practical, valid and equitable evaluation criteria by which change can be monitored and assessed;
(e) involve methodological pluralism (including both quantitative and qualitative methods) to ensure rigour and comprehensiveness in assessment; and
(f) provide for the integration of the different disciplinary perspectives on evaluation (i.e. social, economic, environmental, policy and technological perspectives).

Furthermore, evaluation has not only to allow for the assessment of *impact (*i.e. environmental, economic, social, institutional, and technological) but importantly it also had to be implemented as a *process tool* (Bellamy and MacLeod 1999) that:

- supports purposeful and informative stakeholder participation;
- creates improved opportunities for the incorporation of on-going learning processes at individual, organisational and policy levels;
- facilitates negotiation and mediation processes; and
- supports the move towards the amelioration of, or improvement in, the tractability of problems.

In summary, evaluation of natural resource management and planning initiatives needs to be directed towards assessing both impact (social, economic, institutional, environmental, and technological), and influencing what emerges in an on-going positive and constructive way. This can be facilitated through a participatory approach that improves understanding of processes and causal linkages, fosters learning (by stakeholders and researchers), and facilitates negotiation and mediation. Evaluation therefore should be interactive, iterative, and influential (Bellamy *et al.* 1999). As the evaluation process itself inevitably will be influential, evaluation needs to be implemented as an ongoing collaborative learning process involving all stakeholders.

4. DEVELOPMENT OF A SYSTEMS-BASED FRAMEWORK

The challenges outlined in the previous section provide a set of requirements of any framework for guiding the evaluation of natural resource management initiatives. Figure 1 illustrates a framework derived from these key principles. This framework recognises the multiple levels and nested nature of natural resource management policy, namely: issue characterisation, policy formulation and intent, program logic, and on-ground implementation. It links both the intent and rationale of the natural resource management policy, process or tool to its implementation and performance 'on the ground'. It also provides the basis for synthesising the multiple perspectives on the evaluation of the phenomenon of interest. The fundamental elements of this framework are defined in Table 1 and discussed in the following sections of this report.

Table 1: Definition of elements of a natural resource management initiative.

Element	Definition
Context	The social, economic, environmental, institutional and technological factors that influence the framing or characterisation of the problem, rationality underlying the policy response, the implementation process and on-ground performance.
Issue characterisation	The nature of the issue or problem underlying the initiative being evaluated (e.g. program or policy, activity, process, method/tool, body of knowledge), and the context in which the issue or problem developed.
Intent/Objective	The objectives or intent of (a) the initiative being evaluated, its expected outcomes and key stakeholders, and (b) the evaluation itself.
Instrumental assumptions	Statement of the theoretical assumptions and instrumental hypotheses or rationality underpinning the implementation of the initiative.
Evaluation criteria	Environmental, economic, social, policy/institutional and technological measures or indicators that reflect on performance in achieving key objectives and outcomes. In turn, performance is influenced by contextual factors (e.g. environmental, economic, social, institutional, technological) that constrain or otherwise influence the implementation of the initiative.
Process of implementation	The activities, strategies or operations by which the initiative is implemented or delivered and which produce the outputs and, in turn, outcomes of the initiative.
Evaluation Methods	The quantitative and qualitative performance assessment methods for (a) the evaluation of performance measures/criteria and (b) the interpretation or analysis of findings.
Products	The outputs or deliverables produced by an initiative over which it has control.
Outcomes	The impacts that are achieved, both anticipated and unanticipated, by the initiative

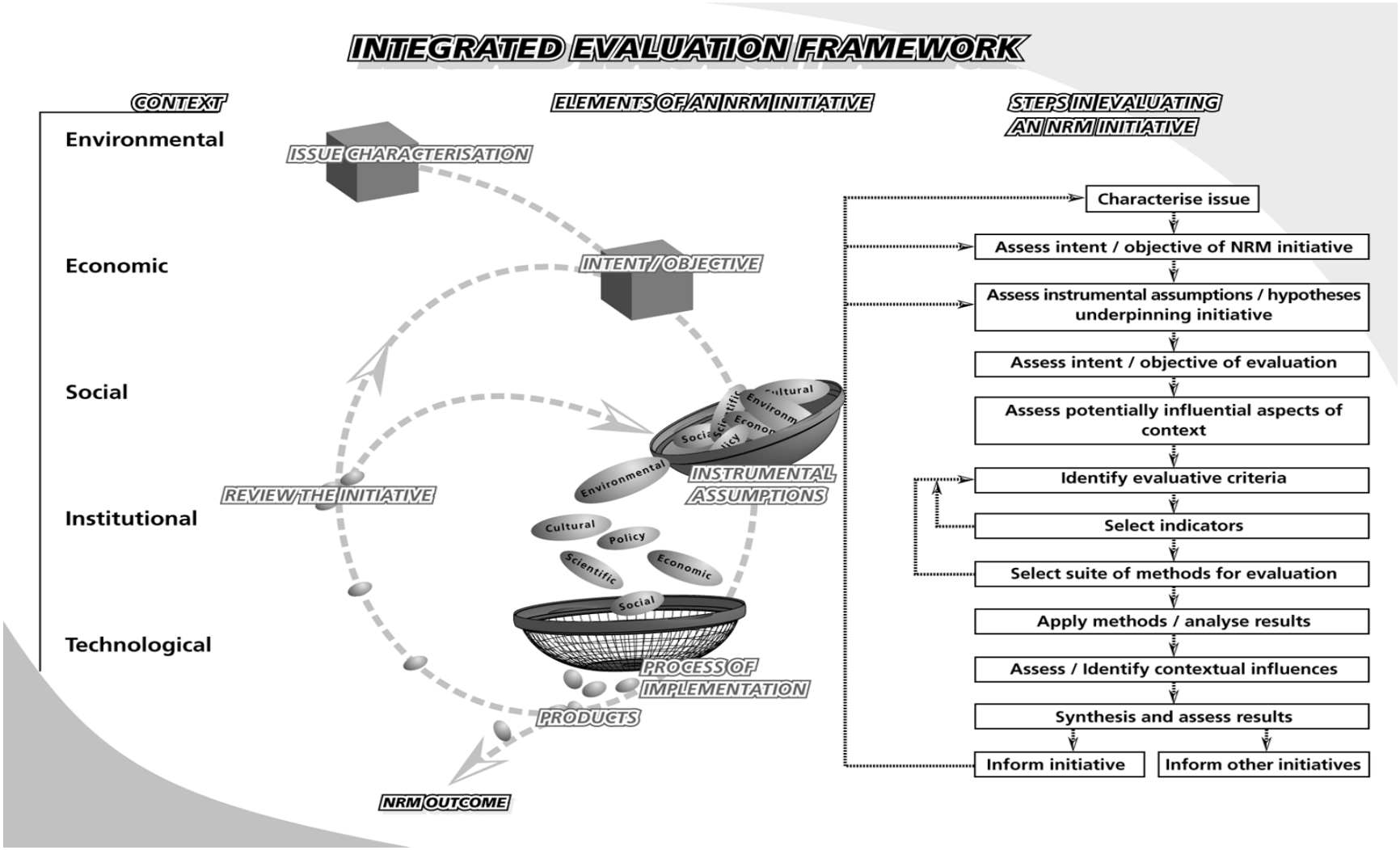

Figure 1. Integrated framework for the evaluation of natural resource management policy initiatives.

4.1 Context

The implementation of policy or program initiatives for natural resource management is context sensitive. That is, a wide range of socio-cultural, economic, environmental, institutional and technological factors at a range of administrative levels or geographical scales (eg. state, regional, catchment, local) will influence *all* aspects of the implementation of a natural resource management initiative from the initial framing of the issue or problem itself and the conceptualisation of the policy response through to the implementation process and finally to on-ground performance.

Importantly, within a particular community established social networks and interactions, societal values, legal policy frameworks and historical influences have shaped human association with the natural resource environment and will continue to influence that association and the pattern of behaviour in the future. As a consequence the impact of a particular initiative on the community of interest concerned, and ultimately the sustainability of the natural resources, may vary considerably for different situational contexts. Therefore, characterising the environmental, social, economic, institutional and technological influences that affect the achievement of key objectives and outcomes of the initiative being evaluated is fundamental to an understanding of its performance. The evaluative context will also impact on an evaluation and influence its analysis and interpretation.

4.2 Issue Characterisation.

The nature of the issue or problem underpinning a policy, program or other natural resource management initiative requires careful definition. A poorly defined problem leads to a poorly formulated policy, program or research activity. It is necessary to clearly characterise both the general background to the phenomenon or issue being evaluated and the context in which the issue evolved. This provides the basis for matching progress in the policy response or research initiative to the impact on the tractability of the sustainability problem. In practice, the issue characterisation required to underpin evaluation of the initiative may lead to reconsideration of the issue and, thereby, the initiative.

4.3 Intent/Objectives

The objectives and intent of the phenomenon being evaluated (e.g. policy, program, activity, process, method, tool, and body of knowledge) and the expected outcomes need to be clearly identified so that they can be linked to the on-ground impacts of implementation. The stakeholders are likely to include a range of government agencies, industry and community interests that may evolve over time as the issue or problem is better defined.

Clear identification of the purpose of an evaluation is also fundamental to planning an effective evaluation. The agreed limits and boundary conditions of the evaluation, and the nature of the involvement of participants and/or collaborators in the evaluation, should be negotiated and clearly defined to develop common expectations and ownership of the evaluation findings and to focus the performance assessment on the critical evaluative criteria for measuring change. Although not necessarily mutually exclusive, five broad purposes for evaluation and a range of potential outcomes are identified in Table 2.

Table 2. Purposes of an evaluation and possible outcomes.

Evaluation Purpose
Improving Research or Program Management • Develop a common understanding of objectives and expected outcomes • Provide a basis for informed decision-making on program/research direction, resource allocation and attainable levels of performance. • Identify and focus attention on factors influencing the initiative's outputs and outcomes • Identify gaps in performance and insights on how they might be addressed • Facilitate a robust and integrated approach to program planning and implementation.
Improving Transparency and Accountability • Evaluate costs and benefits of an investment of public or private resources • Improving efficiency and effectiveness of a program or process • Early identification of unanticipated outcomes
Reducing Risk and Uncertainty • Identify impacts of a project, program or process • Identify information pathways and processes and their role • Develop understanding of causal relationships • Identify equity and social justice issues
Fostering Learning • Influence decision-making and policy development • Support on going information exchange, feedback and learning • Improve awareness of equity and social justice problems as they arise
Improving Process • Facilitate continuous participation • Support the public consultation process • Build stakeholder capacity • Develop ownership of project outcomes • Provide information and a structural framework to underpin negotiations • Provide a platform for cultural change.

4.4 Instrumental Assumptions

Theories represent the most systematic way of building synthesising and integrating diverse knowledge. Theory describes the phenomenon of interest by identifying: (i) the boundary that defines the domain of interest, (ii) key constructs or "entities of interest" in that domain, (iii) the values or states these constructs or entities can take, and (iv) the relationship among the key constructs or entities (Eierman *et al.* 1995). Theory can be used in evaluation, for example, to propose and test links among key factors indicating the direction and degree of influence they have on natural resource management implementation and impact. An atheoretical research or evaluation approach may collect interesting facts but there is a danger that no unifying theme or predictable patterns or relationships emerge. Defining the construct space of a phenomenon provides the basis for establishing validity and ultimately sound measures that can be applied to a variety of contexts.

Whether explicitly identified or, more often, implicit, a policy or research initiative will have some basis in theory. Each theory base brings with it different methodologies, assumptions and value systems. In evaluation, identifying the theory underpinning the implementation of the phenomenon of interest therefore will highlight the underlying assumptions and instrumental hypotheses, clarify what evaluation measures are needed, and contribute to an understanding of causal linkages (Bellamy *et al.* 1999). Significantly, it is necessary to make explicit and transparent the rationale of the phenomenon being evaluated, that is the hidden or implicitly held assumptions, behaviours and motivations reflected in identified goals of that phenomenon and which influence decision-making and policy implementation processes and ultimately the outcomes. Such underlying assumptions or instrumental hypotheses may relate to: program or policy logic; stakeholder involvement; collaboration; implementation process; policy and institutional arrangements; technical information and support; communication and interaction process; policy impacts; or program products and outcomes. Some examples are provided in Table 3.

Table 3. Types of assumptions or hypotheses underling the rationale for a policy or program.

Element	Assumptions or Instrumental Hypotheses may relate to:
Program or policy logic	• The appropriateness of the underlying theory base. • Adequacy of inferences of causal theory for achieving objectives and desired outcomes/changes.
Stakeholder/ participant involvement	• Expectations of the benefits and costs of participation (e.g the role and influence of participatory processes; development of understanding or learnings; acceptance and ownership of results). • The need for inclusiveness or the extent to which the program, project or activity as implemented takes into account all relevant stakeholder groups who have a stake in the research, project or policy process. • Cooperation amongst participants. • Effectiveness of a partnership approach (e.g. synergies developed, value of informational exchange and joint evaluation of alternatives, prevention and resolution of conflict). • Adequacy of the provisions/arrangements for access by stakeholders and the general public.
Policy and institutional arrangements	• Adequacy of government policy (eg. Landcare and ICM.), statutory and regulatory controls: (e.g. water allocation, land management and control, local government planning schemes) and industry or voluntary standards (tree clearing, pest management, etc.) in accomplishing their goals/intent. • Effectiveness of guiding principles underlying a policy. • Clarity, understanding of, and consistency in, policy objectives and outcomes. • Existence or effectiveness of a complementary implementation process to a strategy or plan. • Coordination across levels of decision-making, including all three tiers of government. • Resourcing, commitment and skill of those responsible for implementation. • Support of stakeholders and politicians for policy or arrangements. • Alignment of objectives with government priorities and policy objectives.
Process	• Perceptions of appropriate role, responsibilities and influence. • Representativeness of participants and capacity to maintain a mandate • Emergence of collaborative learning processes. • Democratic involvement (i.e. the degree to which persons directly influenced, or the general public are empowered to contribute to the planning, implementation, improvement, or termination of the project, program or policy). • Expectations on fairness and equity of processes. • Perceptions of change in socio-economic conditions, and community attitudes and behaviour as outcomes. • Need for community or regional processes to be put in place. • Acceptance and success of expected outcomes of a negotiatory approach. • Stakeholder needs and expectations of the process. • Understanding of objectives, process and outcomes of object of evaluation, or an evaluation itself. • Acceptability of solutions identified. • Responsiveness of policy formulation and institutional learning processes. • Support that technical information and modelling tools and mechanisms can provide. • Nature and rate of adoption/uptake of research findings or product. • Adequacy and sufficiency of technical knowledge base or understanding to guide substantive action. • Importance of context (social, economic, institutional, technological) on implementation, performance and use.
IT system/tool development	• Feasibility, adequacy, and equitableness of data sharing in practice. • Accessibility of technology to stakeholders. • Design needs and their effectiveness or impacts. • Impact and effectiveness of system development and implementation processes. • Role of information and technology in planning. • Role of and need for information and knowledge. • Acceptance and degree of use of technology as outcomes. • Importance of context on use and influence.
Communication	• Adequacy and effectiveness of feedback mechanisms in policy and planning approaches • Equity in, and accessibility of, information technology and other communication mechanisms. • Adequacy and effectiveness of network of social interactions (at individual and organisational levels) and their linkages to decision-making processes. • Acceptability and ownership of results.
Impact	• Cost-effectiveness and efficiency of one approach relative to other possible alternative approaches in achieving the goals of the object of interest. • Equitableness (e.g. the extent to which the distribution of benefits and risks associated with the impact of the object of interest on the different groups of people affected by it are fair and just). • Effectiveness of project, activity or methodological approach in achieving stated or agreed objectives.
Project products and outcomes	• Expectations of the program or project by researchers, R&D providers, or stakeholders. • Adequacy of expected outcomes (the degree to which the policy, program or project or accomplishes its goals, eg. reduction in adverse impact or tractability of the problem). • Alignment of outcomes with government priorities and policy as well as funders, stakeholder or client needs.

4.5 Evaluative Criteria

The fundamental basis for evaluation is the establishment of practical criteria by which change can be monitored and assessed in order to evaluate what influence or impact the policy initiative of interest is having on the problem or issue it was set up to tackle. Criteria also provide the basis for testing underlying assumptions and instrumental hypotheses relating to the natural resource management policy initiative.

Evaluative criteria should reflect the achievement of key objectives of the initiative. Criteria can be measured by one or more indicators, which may be defined as:

> *a statistic or parameter that if tracked over time provides information on changes in the condition of the phenomenon, which has significance beyond the properties of the statistic itself* (Eckersley 1998, p.11).

Brown (1998) defines a good indicator for measuring progress toward environmental sustainability as "sensitive to matters of time and social priorities, of place and scale, and in a framework that links social, economic and environmental data" (p.272). Importantly, indicators should be emergent from a deeper understanding of complex system function (Eckersley 1998).

Scope of criteria

Because of the evolving and holistic nature of the concept of sustainability, Bellamy *et al.* (1999) have proposed that the selection of evaluation criteria for natural resource management initiatives should be informed by the context of implementation. Evaluative criteria therefore may be:

(i) *Environmental*: for example, the evolution of resource use and management systems in the region, the major resource use issues and their on-site and offsite implications and impacts, attitudes and behaviour to natural resource management and environmental issues, and the nature and extent of behavioural change in resource use and management practices required across catchment stakeholders.

(ii) *Economic*: for example, the nature and status of, and interdependencies within, the regional economy overall and on a sectoral basis, perceptions of future development and economic prospects, the distribution of wealth and resources within the community, the economic vulnerability of the regional economy, and economic viability of land managers.

(iii) *Social/cultural:* for example, the regional demography and related sustainability issues, cultural diversity and related resource use issues, the nature and commonality in community expectations (both within and outside the region) regarding the catchment's environment and socioeconomic situation, as well as the catchment management and land use planning process, perceptions of equity and social justice, political and media support for catchment issues and NRM processes, and social history and demographic change.

(iv) *Policy/institutional:* for example, relevant policies and the organisational structures and processes for natural resource management across government, industry and community, the resourcing and coordination characteristics of policies, plans and processes, and the stability and volatility of local and state political process.

(v) *Scientific/technological:* for example, the characteristics of the existing technology system; technical knowledge base and competencies to use advanced technologies across stakeholders, the availability and feasibility of technical solutions, and the adequacy of scientific knowledge including appropriateness of scientific understanding and its ability to assist decision-making.

The relative importance of the influence of each of these elements will vary depending on the particular objectives of the initiative, the objective of the evaluation itself and the characteristics of the context of implementation. Importantly, each criterion will measure only a portion of the total construct space of the context of implementation.

Bellamy *et al.* (1999) identified a set of factors influencing community-based natural resource management initiatives based on an integration of three models from the social and institutional sciences:

- Mazmanian-Sabatier policy implementation model (Mazmanian and Sabatier 1981; Sabatier 1986) which identified variables relating to: the tractability of the problem(s) being addressed by the statute; the ability of the statute to favourably structure the implementation process; and the net effect of a variety of non-statutory variables on the balance of support for the statutory objectives.
- Crane's (1988) socially significant evaluation indices, that is inclusiveness, adequacy, equitableness, effectiveness/efficiency, and democratic involvement; and
- Syme *et al.*'s (1994) PRIME procedural model which emphasises that evaluation needs to cope with multiple parallel tasks occurring at all times. Some of these tasks will be dealing with planning; some with research monitoring and evaluation. It also recognises that there should be appropriate areas of influence in the evaluation process by the community as well as the implementing agencies.

The set of factors identified is presented in Table 4. In effect, it provides a series of variables to consider in developing hypotheses for appropriate responsibilities and influence against which the evaluation can identify criteria to measure progress in a developmental context. For natural resource management initiatives, these hypotheses may relate, for example, to:

- state or tractability of natural resource management issues (social, economic, environmental, institutional; technological);
- stakeholder perspectives and behaviours on natural resource issues;
- knowledge base on natural resource issues and their management,
- institutional arrangements and policy frameworks;
- stakeholder coordination and communication processes;
- stakeholder capacity to adapt and to undertake natural resource management and planning; and
- equity and fairness of resource use outcomes.

Such hypotheses provide a basis for identifying criteria for use in evaluation of a natural resource management policy initiative. The hypotheses that are relevant to a particular situation will inevitably change in response to the social, economic and political context as well as the stage of development of the natural resource management initiative.

Iterative development process

Potentially there is scope for a whole suite of measures that will reflect the influences and impacts of the natural resource management initiative. For practical and efficiency reasons, each evaluation will need to focus on a selected number of critical evaluation criteria and indicators that are relatively readily measurable over time, yet rigorous and effective in reflecting change in an evaluative criteria. Therefore, the identification of evaluation criteria and their related indicators for a particular natural resource management initiative necessarily involves an iterative process of development to continually refine the criteria to a critical but manageable set. This process of refinement needs to take into account:

(i) the objectives or intent of the phenomenon of interest (ie. the natural resource management initiative);
(ii) the objectives or intent of the evaluation itself; and

(iii) the feasibility and practicality of methods given the resources available and the constraints of the context of implementation.

Inevitably criteria need to be reviewed and revised in light of experience and in order to capture emerging issues that need to be evaluated.

Table 4. Variables influencing natural resource management initiatives (after Bellamy *et al.* 1999).

1. Natural resource issue characterisation, eg.:
   - Historical context and evolution of resource use
   - Diversity of stakeholder perspectives on natural resource use and management
   - Status of the technical knowledge base to guide substantive action
   - Extent of problem recognition and acceptance of change required by different stakeholders

2. Context of implementation of natural resource management initiative, eg.:
   - Evolution of on-ground policy or program implementation
   - Socio-economic conditions and trends of context of implementation
   - Media coverage and attention
   - Attitudes and resources of local constituency groups
   - Support from politicians and industry leaders
   - Commitment and skills of implementing staff/agencies

3. Institutional structures for natural resource management, eg.:
   - Clarity and consistency of objectives of NRM initiative
   - Financial resources
   - Coordination among implementing agencies
   - Policies, plans and decision rules of implementing agencies
   - Commitment of implementing staff
   - Opportunities for formal access by wider community

4. Analysis of community processes, eg.:
   - Expectations/knowledge of process by stakeholders, including the degree to which they are shared or separate
   - Coordination of resources
   - Degree of motivation, commitment, cooperation and support
   - Efficiency and effectiveness of process
   - Equity and procedural justice/trust in process
   - Agreed influence
   - Agreed responsibilities and roles
   - Integration (that is degree of incorporation of processes in structure and context)
   - Systems implementation

4.6 Evaluative Methods

Methodological pluralism

No single evaluation method will be comprehensively applicable. As Patton (1987) notes "evaluation has moved into a period of methodological diversity with a focus on methodological appropriateness". As a consequence, the framework for evaluation presented in this report is designed to be independent of the methods for evaluation applied. Methodological pluralism can contribute to rigour in evaluation research (e.g. Patton 1987; Chambers 1997). Multiple methods will be needed at different stages of the project, for different project components, and for different implementational contexts. These may include both quantitative and qualitative methods. Moreover, many will be concurrent, involving multiple parallel tasks.

The purpose and design of an evaluation will determine, and be influenced by, the timing of evaluation. There are three well-recognised stages of evaluation: *ex-ante* evaluation undertaken before implementation; *progress* evaluation during implementation; and *ex-post* evaluation after completion of a project or program. Across all of these stages, the Department of Finance (1994) proposes four fundamental criteria to guide the design of an

evaluation: usefulness and relevance to the evaluation purpose, feasibility and cost-effectiveness, equity and social justice, and technical validity. As there is no recognised best or generic evaluation methodology, a balance is required amongst these various considerations when designing an evaluation.

Managing Bias
The conventional scientific paradigm conceives a research process that yields an objective, rational, political neutral body of knowledge that informs decision-making processes (e.g. Ozawa 1996). However, a multitude of discretionary judgments is made during the course of an evaluation. The formulation of the problem, the analytical models used, the methodological approach adopted, the information selected as relevant, the data collection techniques, the scope and construction of questions addressed, and so on will reflect the world views (e.g. the values, priorities, experience and organisational culture) of those who participate in the design, development, implementation and interpretation of the evaluation. For example, Wong (1997) has shown embedded bias to be an inescapable feature of the design and development of information technology innovations for integrated environmental management.

Some form of bias is inevitable in evaluation. In the context of natural resource management initiatives, there is a strong case for methodological pluralism. There is not likely to be one best, let alone all encompassing, perspective for understanding and evaluating complex problems. Multiple methods and triangulation of observation can contribute to methodological rigour in evaluation (Patton 1987). In particular diversity in methods allows 'triangulation' of theory and methods to make effective use of their complementarities, particularly in ameliorating in any one perspective or approach (Yin 1994). Values and instrumental assumptions need to be made explicit in theoretical frameworks, principles of inquiry and evaluative methods adopted.

Design Criteria
In designing a pluralistic approach to evaluation of the performance and impact of an natural resource management initiative, a number of criteria need to be considered including:

1. *Scope of assessment* (eg. scale or level of impact, as ell as impact of overall approach or focussed evaluations of specific components).
2. *Form of evaluation* (eg. self-evaluation or external assessment).
3. *Mode(s) of analysis* (eg. longitudinal study, cross-sectorial study, focussed/case study, needs analysis, on-going monitoring).
4. *Unit(s) of analysis* (eg. individual, group, organisational, regional resources, regional economy, regional community, state policy development).
5. *Information required and types of comparisons* to be made (eg. description, judgments, interpretation, qualitative assessments, quantitative assessments).
6. *Method(s) for inferring process of change* (eg. methods for representing raw data to identify process patterns, comparison of change in performance criteria).

Evaluations need to be clear about "matching research methods to the nuances of particular evaluation questions, the idiosyncrasies of specific program situations, and information needs of identifiable stakeholders" (Patton 1987, p.169). Therefore, the choice of methods needs to be appropriate and sensitive to the realities of the specific context of natural resource management policy or program implementation.

4.7 Process of Implementation

The influence of the actual process of implementation on performance of the natural resource management initiative needs to be recognised and accounted for in analysing the

findings. The evolution of the process of implementation may vary from one situational context to another for a host of local community (ie. catchment, region) contextual factors as identified in Section 4.1 above. Monitoring of the evolution of the process of implementation for the initiative and the 'local' social, economic, environmental, institutional and technological context is an essential element of evaluating an natural resource management policy initiative.

4.8 Products and Outcomes

The products of an natural resource management initiative are the tangible outputs of that initiative over which it has some degree of control, such as the establishment of a multi-stakeholder coordinating committee or the development of a catchment management plan. In contrast, the outcomes of an initiative relate to the anticipated and unanticipated impacts of those products and the implementation process for the initiative, such as improved adoption on-farm of sustainable practices or improved water quality.

4.9 Implementing an Evaluation

Evaluation needs to be directed toward influencing what emerges in a positive and constructive way, rather than focussing only on *post hoc* evaluation related to mere achievement of initially proposed means of reaching objectives. Importantly, the evaluation may be influential in modifying the objectives themselves. The evaluation therefore needs to incorporate an effective process of continuing feedback and improvement to the natural resource management implementation process as a whole. The different stages in the evaluation process will therefore be iterative, interactive and inevitably influential. However it has some distinctly recognisable steps as identified in Figure 1.

5. APPLICATION OF THE FRAMEWORK

The framework presented above has been derived from our collective professional experience, the analysis of relevant literature and more specifically through a long term R&D initiative to evaluate an Integrated Catchment Management process in the Herbert River catchment in wet tropical north Queensland (Bellamy *et al.* 1999). In this section, we now 'validate' the framework for a range of different natural resource management initiatives and contexts to explore its applicability and evaluability for natural resource management in general.

5.1 NRM Case Studies

Case studies can shed light on the conceptual problems involved in the practice of evaluation in natural resource management. Moreover, it can be argued that the strong trend towards participatory and integrative initiatives in resource management in policy design and implementation, research and development and on-the-ground resource management initiatives means that these traditionally discrete spheres of activity in resource management are developing many commonalities – thus justifying a common or generic approach to evaluation as presented above. We examine this proposition through its application to six case studies concerned with natural resource management initiatives including policy processes, research projects, technology development and increments to knowledge base, that is:

1. Implementation of ICM in Queensland (McDonald *et al.* 1999; Bellamy *et al.* 1999)
2. R&D on Regional Resource Use Planning in the Queensland Central Highlands (Bellamy and Dale 1998)

3. Development of Landassess DSS for sustainable grazing management (Bellamy *et al.* 1996; Bellamy and MacLeod 1999)
4. Herbert Resources Information Centre (Walker *et al* 1999)
5. Integrating R&D in catchment management planning (Sarah Ewing, University of Melbourne, *pers. comm*).
6. Assessing information needs for ICM (Walker and Bellamy 1999).

These six broad ranging NRM case studies relate to experience in research and development activities in Australia and were selected to illustrate a range of:

- *scales of application* (national/state policy, regional, catchment, local community, individual/farm enterprise);
- *type of product* (improved process, a tool or method or increments to knowledge);
- *level of intervention* (research, information & extension, planning, implementation & negotiation) and
- *stage of evaluation* (ie. ex-ante, progress, ex-poste).

The case studies are compared in terms of these factors in Figures 3 and Table 5 and using the framework as a reporting structure they are presented in Boxes 1 to 6 below.

5.2 Role and Effectiveness of Framework

The six case studies provide an assessment of the use of the integrated evaluation framework developed in this report for three different situations:

1. Establishment of comprehensive evaluation criteria and methods for on-going evaluations of natural resource management policy initiatives (ie. Case studies 1 and 2).
2. Clarification, structuring and comprehensive presentation of previous evaluations of tools for natural resource management (ie. Case studies 3 and 4).
3. Development of descriptive criteria for R&D on research integration and information issues in catchment management planning (ie. Case studies 5 and 6).

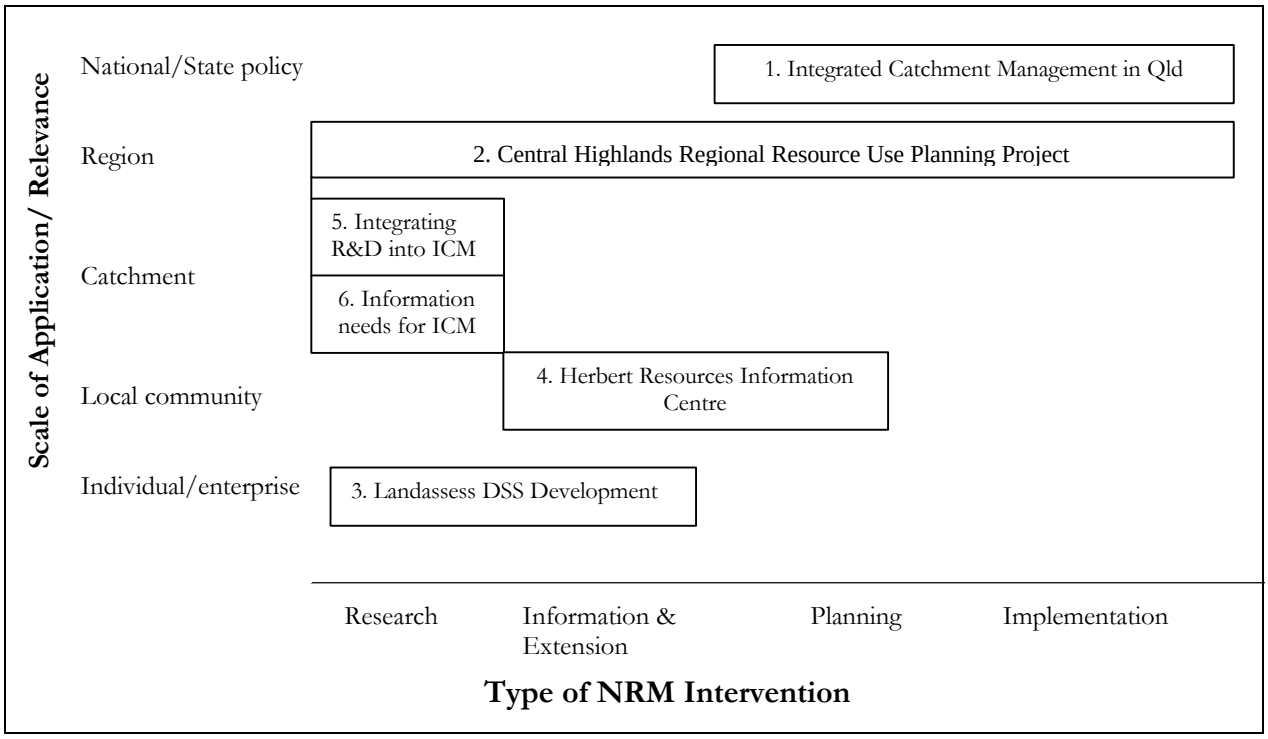

Figure 3. Comparison of Case Studies

Table 5. Case studies for the evaluation framework

Case Study	Scale of Application	Type of NRM Intervention	Principal Product	Evaluation stage
1. Implementation of ICM in Queensland	State policy	Planning; Implementation	Improved process	Progress
2. R&D on Regional Resource Use Planning in the Queensland Central Highlands	Region	Research; Information & extension; Implementation, Planning	Improved process	Progress
3. Development of Landassess DSS for sustainable grazing management	Property/ paddock	Research; Information & extension	Tool/method	Progress and Ex poste
4. Herbert Resources Information Centre	Local community	Information & extension; Planning	Tool/method	Progress
5. Integrating R&D in catchment management planning	Catchment	Research	Increment to Knowledge	Ex poste
6. Assessing information needs for ICM	Catchment	Research	Increment to Knowledge	Ex poste

Based on our collective experience in applying the framework in these case studies, it was found to have a number of strengths:

- *Multiple perspectives:* the framework forces a broad perspective through facilitating the consideration of a wide range of hypotheses or underlying assumptions and therefore evaluation criteria (eg. environmental, social, economic, institutional and technological). Specifically, the logic of the framework was not confined to traditional program evaluation methods.
- *Integration of perspectives on the evaluation:* the framework provided the basis for integration of the multiple perspectives on the evaluation of each initiative, particularly when used in a formative evaluation context (eg. Case studies 1 and 2).
- *Problem bounding*: the framework forced a 'bounding' of the problem or issue of interest through forcing a focus on the specific elements of relevance to the assumptions underlying an initiative and importantly the purpose of the evaluation.
- *Structuring logic:* the framework provides a logical structure and set of steps for undertaking an evaluation.
- *Reporting structure:* the framework provided an effective structure for rapidly reporting on an evaluation (eg. Case studies 3 and 4).
- *Descriptive assessment*: the framework was found to facilitate the development of descriptors for critical or comparative assessment of natural resource management initiatives rather than being confined to only evaluations of performance of initiatives (eg. Case studies 5 and 6).

However, there were a number of important challenges posed in applying the framework:

- *Manageable array of criteria*: a significant challenge was how to deal with the potentially unbounded scope of possible evaluation criteria in light of the practical realities of available resources and the need for 'sensitive' evaluation that moves the process forward rather than undermines it.
- *Motivation:* the framework challenged the user to carefully consider the purpose of the evaluation, that is what is motivating the evaluation and in this sense it was considered that the evaluation process could be seen as threatening.
- *Capacity to address:* in fostering a focus on the big picture, the framework encourages the development of a whole suite of indicators or evaluative measures. However, it is not

usually possible to address all the elements of the big picture such that the extent that the evaluation can address each criterion may vary greatly.

- *Demanding iterative process*: in recognition of the dynamic nature of the implementational context of natural resource management policy initiatives, evaluation objectives and related criteria need to be reviewed and refined regularly to ensure continuing relevance and this can be very demanding.

In summary, the framework proved effective in all case studies, that is across a range of contexts of use and for different scales of application and levels of intervention. However, there were some important issues relating to the scope and complexity of the task at hand that need to be considered in the evaluation of complex issues relating to natural resource management policy.

BOX 1. Case Study: Integrated Catchment Management (ICM) in Queensland

ELEMENT	DESCRIPTION
Issue Characterisation	• Resource degradation of waterways, pastoral and agricultural lands, concern for biological diversity • Fragmented centralised governance approaches need to be replaced by more adaptive and integrated approaches at a catchment scale involving partnerships between government, industry and communities • There is considerable public and private investment in integrated approaches with high community expectations but the translation of the concept into practice is experimental and evolutionary. • Evaluation is necessary to determine whether strategies are achieving desired resource management outcomes • Evaluation is fundamental to identifying impact, supporting an adaptive integrated approach that is flexible to meet the challenges of change, and informing on-going learning at individual, community, institutional and policy levels.
Intent/Objective	The stated intent of the Integrated Catchment Management (ICM) policy initiative in Queensland is a coordinated approach to integrate the management of land, water and related biological resources in order to achieve their sustainable and balanced use by: a. generating a better understanding of ecosystem interactions at a catchment scale by the community and Government and moving towards common or agreed goals through development of a catchment management strategy; b. facilitating coordination and cooperation within and between Government agencies and the community to enable the prioritisation of actions, and joint or independent action to seek solutions to problems. Evaluation of ICM in practice is needed to guide continuous improvements in the way the policy initiative contributes to on-going change.
Instrumental Assumptions	• Land and water resources are basic and interactive components of natural ecosystems and therefore management of land and water resources should be based on geographic units which account for the interactions between these resources. • Management of land and water resources must be coordinated. • Land and water resource management decisions must be based on the best available information • Sound land and water management is best achieved through the informed action of the individual users and managers of these resources • For change in resource use to be acceptable and beneficial it must be socially, economically, institutionally and environmentally sustainable. Therefore, a balance between economic development and conservation of land and water resources must be maintained.
Context of Implementation	*Policy/Institutional*: • ICM is a community-based policy initiative with no legislative base implemented through admin. and fin. arrangements of State Government. • Evolving political and legislative context. *Environmental:* • Competing and conflicting resource use issues with increasing demands and values being placed on resources for a range of uses. *Economic:* • ICM program poorly resourced, relying heavily on federal funding with short term financing arrangements and work plans. • Focus of policy on technical solutions with a failure to clearly address the public and private costs and benefits and their social/ cultural implications. *Social/cultural:* • Requires voluntary coordinated local community-based support and action in the context of no previous experience in these issues at community level. • Costs largely borne by individual resource users in the short term, while many benefits accrue to society as a whole.

BOX 1. Case Study: Integrated Catchment Management (ICM) in Queensland (cont.)

EVALUATION CRITERIA	EVALUATION MEASURE/INDICATORS	METHODS FOR ASSESSMENT
Resource Use Context	Tractability of resource use issues and tensions in the catchment: a. External environment vigilance in community b. Characteristics of catchment resource use c. Community attitudes and behaviour	Longitudinal study involving: • Participant observation at State level policy and program meetings • Questionnaire surveys of Chairs and Coordinators of all Catchment Committees • Literature survey including minutes of all State level ICM coordinators meetings, policy releases, reviews • Analysis of financial and other reports • Media monitoring and content analysis
Institutional Structure	• Adequacy of policy frameworks and institutional arrangements to address issues at a catchment scale • Community capacity to plan and implement catchment management strategy	
Community Process	Adequacy and equity of community processes: a. mechanisms for communication and interaction on catchment issues b. Equity of opportunity for involvement c. Level of strategic alliances/partnerships developed to exploit future synergy	
Technology Context	Adequacy of available technology: a. Capability to identify and address catchment resource use issues b. Technical support for effective implementation of on-ground activities.	
KEY FINDINGS	• There are clear enough technical solutions to many of the natural resources management problems in Queensland. The biggest obstacle to ICM is the process within the community and within government to redress and prevent resource management problems - political and social processes to apply technological solutions. Not surprisingly, this change of philosophy is accompanied by uncertainty and resistance especially when the way forward is not signposted. As yet there is no well tested solution to this problem as a guide to action • The difficulty of promoting a program with relatively few immediate benefits but often with immediate cost implications for land holders. Those catchments with more apparent and visible resource issues will have a better chance of focussing community attention. • While considerable progress has been achieved in some catchments and in some regions, the depth, coverage, and effectiveness of the Queensland integrated resource management system is very patchy. • Catchment Coordinating Committees (CCCs) conduct a wide range of activities reflecting largely the age and maturity of the CCCs. A progression of activities can be recognised from organisational activities - public awareness and involvement - issues generation - catchment planning - technical studies. Most respondents believed that support from the general public was low due largely to the public's low level of awareness about natural resource management issues. • Dept. of Natural resources (DNR) is the lead agency for ICM which was perceived to be a successful partnership between DNR and the rural land owner interests and not much more than that. There was a widely held view that local governments, both politically and at officer level have not been involved effectively in the ICM process although this is evolving. • There was a disturbing low level of satisfaction amongst the respondents at the state level (especially the Coordinators). CCCs have to contend with low awareness in the general public about resources management issues and a general resistance to external intervention. A surprising, consistent and very significant result from the survey was respondents universal view that there is too much government regulation. • There is a clear absence of a "whole of government" approach, commitment or involvement in ICM. State politicians seemed to ignore ICM and there was ineffective, even counter productive involvement of some state agencies. • Financial resources for a program with such ambitious goals has been erratic and low. A key source of funds has been the NLP, without which ICM would struggle to survive. CCCs are required to find funding on their own initiative rather than use established revenue sources as do most public programs. At present they have no revenue raising capacities and there is a lack of confidence in government funding for implementation, which is of particular concern given that once CCCs have been established and created strategies, their requirement for funds for on-ground works will increase their financial requirements. Planning is inexpensive relative to action.	

BOX 2. Case Study: R&D on Regional Resource Use Planning in the Central Highlands of Queensland

ELEMENT	DESCRIPTION
Issue Characterisation	Many natural resource use and management problems cannot be effectively addressed by individual action at the local or farm level but require regionally-based solutions through the agreed actions of a number of actors. Regional planning approaches in the past have tended to take a sectoral or a single issue focus, such as economic development, social planning and nature conservation management. A new emerging paradigm of a regionally-driven, integrated and ecosystem management approach to resource use planning is now being advocated. This new approach aims to achieve more sustainable and equitable resource use and management outcomes at a regional level. The effectiveness of such approaches at meeting these objectives has not been systematically addressed. Their impact is likely to be multi-dimensional; involving social, economic, institutional, environmental, and technological elements. However the implementation of such sustainability initiatives is experimental and there have been few evaluations of their long term impact. Where evaluations have been undertaken, regional economic development and growth management has often overshadowed the importance of environmental considerations.
Intent/Objective	The project is being undertaken as an active partnership with a range of government, industry and community groups with a stake in the region. It aims to define and assess the nature of existing regional resource use planning in the Central Highlands, and to evaluate the effectiveness of a regionally-driven and negotiated planning systems approach to achieve more sustainable and equitable resource use outcomes. In essence, the project is designed to: (a) strengthen human resource and institutional capacities to undertake regional resource use planning in the Queensland Central Highlands region, and (b) generate research results and new innovations that have the potential to support a shift towards more sustainable and equitable resource use within rangelands.
Instrumental Assumptions	The instrumental hypothesis of this R&D is that improving the *overall system* of resource use planning in the region will increase the level of positive interaction among regional stakeholder groups over time, and lead to better informed and more negotiated solutions to natural resource problems. The fundamental assumptions of this approach relate to: • the representativeness of regional stakeholder groups and peak bodies; • the degree to which individuals, groups and the general public are empowered to be involved in regional resource planning; • the role and value of a participatory approach to the R&D; • the role and value of capacity building; • the importance and value of learning processes; • perceptions of roles, responsibilities and influence of regional stakeholders; • perceptions of community/regional processes that need to be put in place; • technical information and modelling tools that can guide substantive action; • adequacy of a negotiatory approach; • importance of context (social, economic, environmental, institutional, technological); and • stakeholder perceptions and understanding of the project's objectives, processes and outcomes.
Context of Implementation	Natural resource use issue/problem: Diversity of significant issues and problems rather than a single chronic problem (eg. of magnitude of salinity) to focus regional community attention Institutional: Multitude of poorly coordinated agencies/organisations responsible for natural resource management with few formal or effective linkages as well as a multiplicity of relevant policy frameworks which are invariably sectorally or single-issue based. Economic: region emerging from a long-term 'drought' with economic hardship and industry downturn in major rural industries and mining sectors. A growing area with opportunities for development. Social: Diverse cultures within the community with very different perspectives and value-systems on natural resource management. Cultural: indigenous land rights an emerging issue. Growing community interest in cultural heritage. Technology: Communication technology constrained in many areas such that opportunities for use not equally distributed/accessible through the community. Capacity to change constrained by these factors as well as social and economic contextual factors.

BOX 2. Case Study: R&D on Regional Resource Use Planning in the Central Highlands of Queensland (Cont.)

EVALUATION CRITERIA	EVALUATION MEASURE/INDICATORS	METHODS FOR ASSESSMENT
1. Progress towards regional sustainability of resource use	*Resource use context:* • Reduction in the severity of impact or improvement in the tractability of regional resource use issues and tensions. • Contribution to improvement in regional sustainability indicators *Equity of resource use:* • Enhanced perceptions of fairness in the overall regional resource use planning system and related decision-making processes. *Regional Processes:* • Improved mechanisms for communication or interaction on regional issues. • Improved recognition of importance of a regional perspective in planning.	• Bench-marking of attitudes, perspectives and behaviour through semi-structured interviews with key stakeholders and individual RSG workshops. • Self-evaluation by individual Regional Stakeholder Groups of their planning processes using questionnaires. • On-going monitoring and document analysis of the research process and stakeholder interactions. • Monitoring of key regional indicators through State-of-the-Region reporting. • Organisational mapping • Interactive annual forums involving representatives of all stakeholders. • Meta-analysis of other activity specific evaluations
2. Improvement in the degree of involvement and participant capacity to undertake regional resource use planning.	*Technical Capacity:* • Improvement in technical capacity to undertake planning initiatives *Planning Systems:* • Improvement in planning structures and processes within individual stakeholder groups. *Institutional Arrangements:* • Improvement in broader institutional structures at the regional level to undertake regional planning. *Research Capacity* • Influence/impact on peer researchers and regional planning practitioners of Regional Stakeholder Groups within and outside the region.	
3. Role and effectiveness of additional information and IT development for regional resource use planning	*Knowledge base* • Improvement in the body of knowledge to support regional resource use planning *Analytical Capability* • Improvement in regional analytical capacity to formulate and evaluate regional options, their likely implications and current trends for planning and negotiation.	
4. Effectiveness of the collaborative and participatory approaches to the R&D and regional planning processes;	*Participation:* • Improvement in and satisfaction with stakeholder involvement in regional decision making *Collaboration:* • Improvement in stakeholder capacity to collaborate and opportunities for future collaboration	
KEY FINDINGS	R&D In-progress.	

BOX 3. Case Study: Development of Landassess DSS for sustainable grazing management

ELEMENT	DESCRIPTION
Issue Characterisation	• Increasing public concern for resource conservation and environmental quality of our pastoral lands. • Land degradation occurred over a long timeframe of use but a lack of methods for (a) identification of early warning of sustainability problems, or (b) the assessment of potential effects of management options and implications for future use. • Perceived need for government agencies and industry to determine the current state of lands, monitor change and foster a 'voluntary' approach to sustainable land use. • The role and effectiveness of computer-based agricultural IT innovations are being strongly questioned by R&D and industry organisations.
Intent/Objective	• Develop methods for a computer based decision support system to assess the current state of a grazing management unit (eg. paddock) and to assist pastoral resource managers to formulate and evaluate alternative strategies for the sustainable use of the management unit. • Better define the role of IT innovations in sustainable resource management. • Develop methods to evaluate the effectiveness of science-based IT innovations for achieving a move toward sustainable resource use outcomes.
Instrumental Assumptions	• Considerable public and private investment is being made in multiple objective IT innovations to address complex decision-making on natural resource use and management. The expectation being that the technology will increase the effectiveness of decisions and the efficiency of the decision process for individuals and organisations involved with its use. Research supporting such outcomes is generally lacking. • The perceived need for integration of the multiple levels and concerns regarding natural system functionality and grazing impact requires an interdisciplinary approach at scales relevant to grazing management decision-making (ie. paddock, property). • Evaluations of IT effectiveness generally approached as an applied problem (eg. user acceptance, level of usage of product, task efficiency, user/ organisational relevance, system functionality and ease of use) and has not recognised IT innovations as social constructs. In particular, the relationship between the collaborative processes involved with most IT development and complex evolving natural and human systems has generally been ignored. • Need to deal with the dynamic and varied situational context of key stakeholders and to manage end user expectations of R&D over a relatively long development timeframes.
Context of Implementation	Policy/Institutional : • New legislation required land managers to demonstrate sustainable use of pastoral lands. • Fragmentation of land management responsibilities for across three agencies with very different 'cultures'. Environmental: • Land degradation continuing to occur through impact of grazing of beef cattle. • Large heterogeneous grazing management units • New management practices changing spatial and temporal distribution of grazing impact. Economic: • Industry export-oriented, with fluctuating prices, low input and low return operations. Social/cultural: • Divergence of views on what sustainable use means within and between government, industry and the community. • Past focus of industry and government on development (ie. improving animal production, infrastructure) rather than land resource management. Technological: • No system of appraisal of sustainability of pastoral activities exists. • Poor integration, access to, and sharing of existing data and knowledge.

BOX 3. Case Study: Development of Landassess DSS for sustainable grazing management (Cont.)

EVALUATION CRITERIA	EVALUATION MEASURE/INDICATORS	METHODS FOR ASSESSMENT
1. Progress toward sustainable grazing resource use:	• Contribution to improved interaction and communication on sustainable use of pastoral lands between government agencies. • Contribution to improved understanding of sustainable use in grazing systems to support advisory and extension activities.	• The evaluation involved a collaborative between a scientific research agency and three government agencies responsible for pastoral land management, and grazing industry representatives. The evaluation methods included the assessment of needs, the evaluation of process, and stakeholder reflections on potential impact through: a. process evaluation through documentation of the dynamics of the IT development process and its organisational context; b. formative evaluation in order to improve the DSS system development process • An ex poste strategic constituency assessment of key stakeholder group expectations of the effectiveness of the DSS innovation as a product based on stakeholder workshops. • An ex poste strategic constituency assessment of the overall effectiveness of the participative system development process based on face to face interviews using a scenario approach..
2. Stakeholder capacity building	• Improved access, sharing and meaningful use of data/ knowledge on sustainable grazing practices. • Improvement in analytical capacity to assess current state of the land resource and to formulate and evaluate management options. • Endurance of collaborative R&D alliance.	
Effectiveness of IT development process	• Stakeholder satisfaction with level of involvement and influence in IT development process. • Stakeholder views of costs/benefits of collaboration. • Stakeholder satisfaction with relevance, functionality and ease of use of IT product.	
KEY FINDINGS	*R&D on Sustainability:* • IT innovations are characterised by: a. multiple stakeholders and multiple and evolving objectives. b. focus on broad societal purposes, c. a broad outcomes and impacts (eg. learning processes and stakeholder behaviour modifications). • Learning processes occur through participatory process of IT development, and the interactive use of an IT tool. • DSS have the potential to foster an adaptive and flexible approach to resource management decision-making at policy, advisory and enterprise levels. *IT Evaluation:* • An iterative, participative and pluralistic approach is needed to evaluate IT development in terms of both a process tool and product success, i.e., one that encompasses: a. intangible outcomes (eg. stakeholder learning processes and behavioural change, improved stakeholder relationships and interaction processes, broader societal benefits), and b. tangible outputs (e.g. technical quality, institutional efficiency, usage). • Impacts will accrue over a long time frame and are often not visible to beyond the life of the IT development process.	

BOX 4. Case Study: Herbert Resource Information Centre

ELEMENT	DESCRIPTION
Issue Characterisation	Building Stakeholder Capacity Traditionally, most decision-making in planning natural resource use options has been vested with regulatory authorities. In recent years significant changes have occurred to involve the community in the decision-making process. Initiatives are needed to ensure that communities have access to the information needed to underpin this decision-making and to develop the capacity of stakeholders to use that information. Evaluation Such initiatives will impact on the decision making process. What impacts occur?
Intent/Objective	Herbert Resource Information Centre *(HRIC)* To build capacity for stakeholder participation in resource use planning by providing four fundamental requirements for effective participation: • effective access to information pertinent to resource use planning; • access to the analytical tools required to make effective use of that information: • the capacity to make appropriate use of those analytical tools and data sets; and • an organisational structure that fosters effective collaboration. Evaluation To assess the impact of one such initiative
Instrumental Assumptions	The HRIC structure and functions can deliver the following : • improved quality of data available for the Herbert catchment; • improved access to data; • better informed decisions in planning & implementing data collection & use projects; • better informed decisions in natural resource management; and, • improved collaboration.
Context of Implementation	*Technological:* • Use of spatial data in decision-making is map-based • Limited existing GIS capacity used solely for map production • No network facilities for data-sharing • Existing data dispersed within and between agencies • No rigorous data/meta data management • High quality base data available from Herbert Mapping Project *Institutional* • Limited use of spatial data within stakeholder groups • Very limited sharing of spatial data across groups • Limited computing ability in stakeholder agencies • Almost no GIS skills • Staff willing and able to take on new skills

BOX 4. Case Study: Herbert Resource Information Centre (Cont.)

EVALUATION CRITERIA	EVALUATION MEASURE/INDICATORS	METHODS FOR ASSESSMENT
Operational Impacts	• Intentions in using new data sets that became available, implications for existing data, constraints to use. • Impacts of involvement in the HRIC on data availability, data collection, data storage, data access, complexity of decision-making, efficiency of decision-making, quality of decisions made, presentation of decisions. • Impact of the HRIC on the resolution of resource management issues within the catchment. • Impacts of participation in the HRIC on the types of activities agency involved in	Qualitative research techniques. Individual, face-to-face interviews using a semi-structured interview schedule with key participants in the HRIC each year over three years : 19 in February 1996 (6 months before completion of the joint venture agreement and employment of HRIC staff), 19 in February 1997; 17 in March 1998 (17 interviewees). With some change in key participants a total of 41 individuals were interviewed over the three years with a core group of 7 individuals being interviewed at each of the three times.
Evaluation of Process	• Importance of Herbert Mapping Project in triggering HRIC. • Constraints to use of HRIC. • Impact on other agencies. • Use of the HRIC by non-partners & impacts on those users • Interaction with other organisations: changes to general levels frequency of interaction; understanding of the objectives of each agency; understanding of the constraints under which each agency operates; understanding of the data needs of each agency, willingness to work with the other agencies, nature and process of interactions, confidence in other groups. • Evaluation of the dynamics of the process (key participants; positives, negatives).	
Changes in Understanding	• Awareness of the quality and availability of data. • Credibility of data resources. • Understanding of the limitations associated with spatial data. • Understanding of data resources used by other groups in the project. • Understanding of the data needs of other groups. • Most important things learnt from involvement in HRIC. • Understanding of the tractability of resource management issues • Understanding of the quality and limitations of data; awareness of the availability of data,.	
KEY FINDINGS	*Improved quality of data available for the Herbert catchment and improved access to that data:* Data access improved dramatically with participants becoming more aware of the range of data available and having access to all but that which was 'commercial-in-confidence'. *Better informed decisions in planning and implementing data collection and use:* While processes for data collection were only moderately impacted for most parties, compatibility with other data had become a significant criteria such that data storage and management collectively and individually had been significantly impacted. *Better informed decisions in resource management:* Formal spatial analyses were being used in planning decisions, often with a substantial cost saving and resulted in decisions perceived to be as good as, and frequently better than, would have been achieved with previous processes. *Improved collaboration:* Willingness to work together increased amongst the partners to the Centre and external use of the HRIC by businesses and the broader community began to occur. *Contributions to success: The* key contributions to the success of the Centre were identified as : skilled professional staff, common goals, lack of pre-existing (and therefore potentially competitive) infrastructure, neutrality of location, credibility, and an evolutionary history. *Threats::* Issues of intellectual property, 'head office' pressures within partners to the initiative, and over-commitment	

BOX 5. Case Study: Integrating R&D in Catchment Management Planning (Sarah Ewing, University of Melbourne, Pers. Comm)

ELEMENT	DESCRIPTION
Issue Characterisation	There is much R&D going on in relation to catchment management but this effort is lost if research results are not taken up and implemented by land, water and vegetation managers. The catchment planning process is one which has the potential to embrace R&D outcomes but the question remains how that R&D might best be made available to the planning process. As a first step, it would be helpful to know how R&D has been made available to planners thus far, particularly where explicit attempts have been made to facilitate technical and/or research input.
Intent/Objective	A major element of Australia's approach to ICM is the development and implementation of catchment-based land and water management plans that are driven by local communities. Indeed, regional ICM strategies form the basis of partnership agreements between federal, state and local governments and the community. Typically, catchment plans seek to document the key land and water management issues in the catchment; to develop integrated strategies for their remediation; to identify roles and responsibilities for action; to allocate priorities to the recommended actions; and to raise community awareness of catchment issues. The objective of this research is to document the range of approaches (or models) used by catchment planners in Australia to access technical information in support of the planning task. Specifically, the project is seeking to provide examples of face-to-face information exchange through fora such as workshops, technical advisory groups, workshops and expert panels.
Instrumental Assumptions	That: • In the course of an ICM planning process, knowledge gaps will be identified • An important objective of an ICM plan is to ensure that it is built upon the best available advice and information • The strategic use of R&D outcomes will help ensure that the plan is built on best available information • R&D can help address gaps in understanding • R&D is useful/applicable for a range of institutional contexts and planning needs

BOX 5. Case Study: Integrating R&D in Catchment Management Planning (Cont.)

EVALUATION CRITERIA	EVALUATION MEASURE/INDICATORS	METHODS FOR ASSESSMENT
Characteristics of approach to the integration of R&D through face-to-face information exchange	• Type of approach • Rationale for the approach (ie on what basis the approach was chosen) • Role/model of community participation/engagement employed • Stage(s) in planning task for which model used (eg. identification of need for planning, documenting key issues, developing strategies for remediation, identifying roles and responsibilities, allocating priorities, raising awareness, informing on-ground action, monitoring, plan review) • Purpose(s)/stages for which R&D useful within model (see previous) • Other information sources used (eg. local knowledge, database) • Outcomes of approach • Perceived strengths of approach • Perceived weaknesses of approach	• Review of literature to identify and review documented approaches • Case study • Survey/interviews • Content analysis
Characteristics of context of application of approach/model	• Requirements/imperatives for catchment planning • Political/legislative context in which the model/approach has been (or is being) used in catchment management planning. • Geographical context (urban, peri-urban, rural) • Environmental context of catchment (eg. key issues being addressed) • Resourcing context (eg. funding, level of agency support, staffing) • Sources and accessibility of relevant data • Scale of planning (eg. local, catchment, region, national) • Role of local community in planning • Timeframe for planning • Prior experience of constituents with planning processes.	
KEY FINDINGS	R&D in Progress	

BOX 6. Case Study: Information Needs for Integrated Catchment Management

ELEMENT	DESCRIPTION
Issue Characterisation	Significant investments are being made throughout Australia in approaches to natural resource management based on the integration of community involvement, technical knowledge, and organisational structure and policy objectives. A fundamental principle invariably underpinning these approaches is that land and water resource management decisions must be based on the best available information. However there is a lack of guiding principles or recommendations on information needs and provision for those responsible for planning and implementing these approaches to support an effective process.
Intent/Objective	The research objective is to explore key issues and considerations for planning information needs and provision for community-based approaches to integrated resource management through case study investigation of Integrated Catchment Management (ICM) in Queensland, and the Herbert River ICM process in particular. The evaluation objective is to develop a framework to guide the assessment of information needs for ICM based on the experience in the Herbert River catchment ICM process.
Instrumental Assumptions	• The sustained and balanced use of land, water and related biological resources can be achieved through the integrated catchment management approaches. • A successful ICM initiative requires four fundamental tasks to be undertaken: ↳ the development of a catchment strategy; ↳ raising community awareness of catchment scale issues and solutions; ↳ the precipitation of action to bring about solutions; and ↳ an effective ICM implementation program. • Decisions relating to these planning tasks must be based on the best available information. • Information on land and water resources, particularly on the interactions between these resources, is often deficient or not readily accessible. While additional information is often desired, management decisions will need to be made using available data to avoid unacceptable delays.

BOX 6. Case Study: Information Needs for Integrated Catchment Management (Cont,)

EVALUATION CRITERIA	DESCRIPTIVE MEASURES/DESCRIPTORS	METHODS FOR ASSESSMENT
Information needs for developing a catchment management strategy	• Categories of information required to underpin the development of an ICM strategy document • Requirements for collating, storing and accessing the information that underpins strategy development • Role local experience plays in developing a catchment strategy • Contribution R&D plays	• On-going monitoring and analysis of documentation relating to the Herbert River ICM process. • Face-to-face interviews of key participants using a semi-structured questionnaire. • Meta-analysis of other specific evaluations.
Information needs for raising awareness of issues	• Specific information needs for raising community and agency/organisational awareness on land & water management issues • Requirements for the integration of information to raise awareness of issues amongst community and agencies • Role of local experience, information & networks play in raised awareness • Role R&D plays	
Information needs for precipitating / catalysing action	• Information needs associated with enabling action aimed at the resolution of specific resource management issues • Requirements for the collection, storage, access and sharing of information to facilitate action by participants in the ICM process seeking to resolve resource management problems • Role local experience and information plays in precipitating action to resolve problems • Role R&D plays	
Information needs for implementing an effective ICM program	• Specific information needs faced by a CCC in establishing and implementing an effective ICM program • Role local experience plays in the effective management of the ICM process • Role R&D plays and how incorporated into the initiative	
Characterisation of Context	• Availability of previous integrative technical reports • Organisational infrastructure in stakeholder groups for information management and analysis • Experience and skills of stakeholder groups, particularly HRCCC members	
KEY FINDINGS	R&D in Progress	

6. CONCLUSION

While natural resource management and environmental planning are increasingly being promoted globally as mechanisms to resolve intractable resource use problems and conflicts, there still remains no common theoretical base upon which such approaches are developed and implemented. Consequently, a clear evaluative framework has failed to emerge to guide continuous improvements in the way that such initiatives actually contribute toward achieving sustainable and equitable resource use and management. This report has sought to place natural resource management policy implementation and related research in a clear theoretical context as a first step to establishing an integrated framework for evaluating such initiatives.

Natural resource management policy and planning initiatives need to be evaluated as a system that links the initiative's objectives and rationale to performance 'on the ground'. The evaluation strategy presented here provides a basis for an integrated evaluation of the different perspectives (i.e. social, economic, environmental, policy and institutional) on the performance of the policy, program or research processes, a framework for guiding its implementation and a rigorous basis for synthesising findings. The strategy recognises evaluation as a means of not only assessing impact but also as a critical process tool for improving program and research management, providing a basis for assessing accountability, fostering learning, improving the body of knowledge, and improving the implementation of natural resource management policy.

The framework established has sought to overcome significant challenges to evaluation in complex natural resource and human systems. We have used the findings of a number of case studies of sustainability initiatives in Australia (i.e. policy programs, research processes and knowledge development) to develop a systems-based analytical framework for evaluation in these contexts. It needs to be stressed, however, that this is a framework only. Key measures and criteria developed within this framework need to be developed to meet the specific needs of particular application contexts, as well as being negotiated with those actors involved in the policy and planning process.

Unless there are structured and coordinated attempts to adopt improved evaluative frameworks appropriate to the theoretical context within which natural resource management and planning occurs, we do not believe that there can be significant and continuous improvements in the way that policy initiatives can contribute to sustainable and equitable resource use outcomes at the local, regional, national and global levels. As a consequence, integrated approaches to natural resource management may be discarded before a fair and comprehensive assessment of their potential role and impact is determined. This would be counter to the general theoretical developments in systems theory, ecology and the participative and adaptive management philosophies that currently drive natural resource management policy reform.

Importantly, the challenge to create policy processes, institutional arrangements and natural resource management practices which enable the choice of methods, tools and mechanisms most suited to moving communities towards achieving sustainable and equitable outcomes of resource use and management needs rigorous evaluation incorporated as part of the change process. Evaluation is fundamental to identifying change, supporting an adaptive approach that is flexible enough to meet the challenge of this change, and enabling learning at individual, community, institutional and policy levels.

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Chapter 2

Evaluating Natural Resource Management Policy Initiatives

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1 INTRODUCTION

Program evaluation and policy analysis are recognised as critical elements of successful policy development and implementation. With increasing demands for better scrutiny of the use of public funds, and greater accountability for environmental protection and equity in resource use, the focus of policy, program and research evaluation and implementation has shifted.

Recent thinking on ecological sustainable development (ESD) emphasises continuous change, adaptation and learning. This emerging focus has caused a shift in the theory underpinning Natural Resource Management (NRM). Increasingly, this shift in theory is reflected in policy. The adoption of new policy models for natural resource and environmental management demands a new approach to evaluation.

The booklet provides the basis for an integrated evaluation of the different perspectives (i.e. social, economic, environmental, institutional and technological) on the effectiveness of NRM **policy initiatives**.

WHAT IS A POLICY INITIATIVE?

- A ***process*** (e.g. an Integrated Catchment Management (ICM) program implementation);
- A ***product*** (e.g. Decision Support System (DSS) to support a process);
- An ***increment to a body of knowledge*** to help NRM understanding (e.g. a research activity).

The framework for the booklet is a compilation of information developed as part of a project investigating factors that influence the success of community based approaches to Integrated Catchment Management in the Herbert River Catchment [1].

This evaluation guide complements SHEF (Self Help Evaluation Framework for Integrated Catchment Management), which was designed to provide ICM evaluation questions for catchment group members, individual landholders, interested community members and committees as a method of self-assessment (Self Help Evaluation Framework for Integrated Catchment Management, CSIRO, LWWRDC) for **informing action**.

[1] LWRRDC R&D Project CTC7 – Evaluation of Integrated Catchment Management in a Wet Tropical Environment.

WHAT IS THE PURPOSE OF THIS FRAMEWORK?

Increasingly, governments and community are placing a high priority on performance monitoring, evaluation and review of NRM policy initiatives.

This framework is an evaluation tool to help facilitate improved development and management of policy initiatives in Natural Resource Management. In particular, it aims to guide continuous improvements in the way policy development contributes to the sustainability of resource use and the general well-being of the communities concerned.

Where SHEF is concerned with informing action, this framework deals with **informing policy**.

WHO WILL BENEFIT FROM USING THIS BOOKLET?

- Policy makers;
- Program managers;
- Catchment and regional coordinators; and
- Community facilitators.

WHY IS EVALUATION OF NRM POLICY IMPORTANT?

The challenge to create policy processes, institutional arrangements and NRM practices that can contribute towards achieving sustainable and equitable resource use outcomes requires rigorous evaluation as part of the change process.

Evaluation is fundamental to:

- identifying change;
- supporting an adaptive approach that is flexible enough to meet the challenge of this change; and
- enabling learning at individual, community, institutional and policy levels.

Although approaches to NRM, based on the integration of community involvement, technical knowledge, organisational structure and policy objectives, are endorsed in both Australia and overseas, there are no generally accepted models of evaluation of such initiatives.

Existing frameworks may provide a *checklist* of multi-disciplinary criteria but not an **integrated evaluation**.

Significantly, no clear evaluative framework has emerged to guide continuous development in the way NRM policy initiatives contribute to on-going improvements in resource use sustainability and social well-being of the communities concerned.

In effect, an over-arching **systemic framework to guide the evaluation of NRM** policy initiatives is lacking.

HOW CAN EVALUATION IMPROVE NRM?

- Assess **public and private investment** in integrated approaches to NRM.
- **Identify** the most critical social, economic, institutional, environmental and technological **factors that influence** NRM approaches.
- **Identify** what the **outcomes and expectations** of an NRM initiative might realistically be.
- **Develop appropriate performance criteria** for assessing the potential impacts and influences on the management of resources, on institutional arrangements and on society as a whole.
- **Establish guidelines and techniques** for identifying progress towards agreed objectives and outcomes, including consideration of equity and social justice issues.

THE FORMAT

This evaluation guide deals with the rationale behind NRM evaluation together with the steps required:

- WHY A SYSTEMS APPROACH TO EVALUATION?
- WHY IS CONTEXT IMPORTANT?
- AN INTEGRATED APPROACH: ESTABLISHING CRITERIA AND IDENTIFYING METHODS:
  - Issue characterisation
  - Intent/objective
  - Instrumental assumptions
  - Evaluative criteria
  - Evaluation methods
  - Process of implementation
- REASONS FOR EVALUATION AND EXPECTED BENEFITS

2 WHY A SYSTEMS APPROACH?

A systems approach integrates knowledge from several fields of study to design projects that generate knowledge and understanding of the issue at hand (Fig. 1).

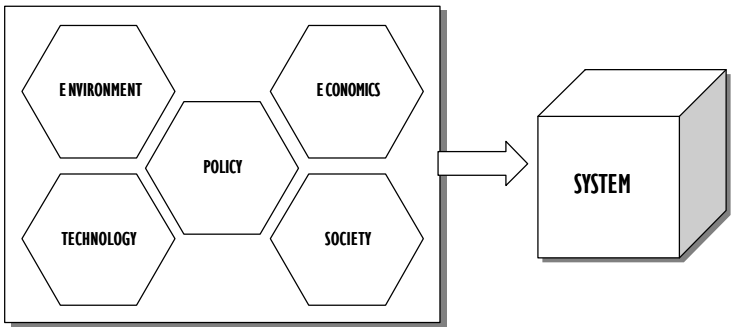

Figure 1.
In the context of NRM evaluation, the fields of study would include environmental, social, economic and political sciences.

Sustainable development is widely accepted as being the intent of achieving an equitable and sustainable quality of life by integrating social, economic and environmental activities, along with outcomes and impacts of human society into a single conceptual framework.

Continuous change is inherent in most systems. For change to be acceptable and beneficial, it must be socially, economically, institutionally and environmentally sustainable.

Coping with and managing accelerated change requires a **systemic** approach characterised by adaptation and learning that is incumbent upon personal responsibility and opportunity at the local level.

NRM initiatives need to be evaluated as such a system, linking the objectives and instrumental rationale of the policy, program or product to on-ground performance.

An effective framework for evaluating NRM and planning approaches needs to be based on practical considerations. Another important requirement is to draw on a broad spectrum of other disciplines to characterise, monitor and evaluate the process and its outcomes. These disciplines include evaluation research, social psychology, impact assessment, ecology, economics, organisational science, management science, and technology assessment. An **integrated systems approach** is needed to synthesise these multiple perspectives.

3 WHY IS CONTEXT IMPORTANT?

The implementation of policy and program initiatives for natural resource management is context sensitive and a wide range of factors make a difference to their implementation and impact. The context of implementation is multi-dimensional. Environmental, economic, social, policy/institutional and technological elements at various administrative levels or geographical scales (eg. state, regional, catchment, local) influence *all* aspects of implementation. This context evolves over time and influences the progress and impact of a policy initiative. The areas influenced include the initial framing of the issue or problem itself and the conceptualisation of the policy response through to the implementation process and finally to the on-ground performance.

Characterising the contextual elements that affect the achievement of key objectives and outcomes of the implementation processes of the initiative being evaluated is fundamental to an understanding of its performance. The influence of context on performance of the initiative and the evaluation itself needs to be recognised and accounted for in analysing the findings.

Importantly, within a particular community, established social networks and interactions, societal values, legal policy frameworks and historical influences have shaped human association with the natural resource environment and will continue to influence the association and pattern of behaviour in the future. As a consequence, the impact of a particular initiative on the community concerned and ultimately the sustainability of the natural resources concerned may vary considerably for different situational contexts.

CONTEXTUAL FACTORS

Each regional context will have its own particular social, economic, environmental, institutional and cultural backgrounds. An important part of evaluation is to define the context in which that evaluation takes place. The contextual factors will differ in different regions.

The evolution of natural resource use within a region:

The importance of understanding an evaluation of a program or process within the historical natural resource, economic, institutional, social and cultural context of resource use and management is well recognised. The historical background to the initiation and development of an NRM program determines the context of that program and thus its implementation.

Perspectives on NRM and use across stakeholder groups:

The perspectives, expectations and behavioural responses on resource use and management may vary significantly across stakeholders and over time, and may be in conflict or contested by others. This means that the evaluation model must incorporate both community and agency views.

Community attitudes, perceptions, involvement, and awareness of the NRM process can significantly influence the effectiveness of the process.

Stakeholder perspectives and attitudes to natural resource issues can be significantly influenced by the opinions of, and support provided by, political and industry leaders.

The quality and capability commitment of implementing staff and their supporting agencies are very important.

The nature and degree of media coverage on NRM issues and the presentation of NRM may significantly influence stakeholder perspectives.

Status of technical solutions:

The technical knowledge base (i.e. scientific, disciplinary and local expert) that can be brought to bear on the natural resource issues of concern and on the community acceptability to guide substantive action is a key influence on the potential for achieving sustainability in practice.

Extent of behavioural change required:

Depending on the particular NRM issue, the number of resource users and managers responsible for its existence or required to take action to ameliorate or resolve the problem may be numerous and widespread, or small in number and localised. Therefore important considerations are:

- the severity and extent of environmental threat;
- the number of persons responsible for its existence and management;
- the divergence in stakeholder opinions on the problem and its perceived solution; and
- how much the likely solutions are at variance with common practice.

Table 1. Examples of context of implementation from three case studies.

i. ICM IN QUEENSLAND

Policy/Institutional:
- ICM is a community-based policy initiative with no legislative base implemented though administrative and financial arrangements of State Government.
- Evolving political and legislative context.

Environmental:
- Competing and conflicting resource use issues with increasing demands and values being placed on resources for a range of uses.

Economic:
- ICM program poorly resourced, relying heavily on federal funding with short term financing arrangements and work plans.
- Focus of policy on technical solutions with a failure to clearly address the public and private costs and benefits and their social/ cultural implications.

Social/cultural:
- Requires voluntary coordinated local community-based support and action in the context of no previous experience in these issues at community level.
- Costs largely borne by individual resource users in the short term, while many benefits accrue to society as a whole.

ii. REGIONAL RESOURCE USE PLANNING IN THE CENTRAL HIGHLANDS OF QUEENSLAND

Natural resource use issue/problem:
- Diversity of significant issues and problems rather than a single chronic problem (eg. of magnitude of salinity) to focus regional community attention

Institutional:
- Multitude of poorly coordinated agencies/organisations responsible for natural resource management with few formal or effective linkages as well as a multiplicity of relevant policy frameworks which are invariably sectoral or single-issue based.

Economic:
- Region emerging from a long-term 'drought' with economic hardship and industry downturn in major rural industries and mining sectors. A growing area with opportunities for development.

Social:
- Diverse cultures within the community with very different perspectives and value-systems on natural resource management.

Cultural:
- Indigenous land rights an emerging issue. Growing community interest in cultural heritage.

Technology:
- Communication technology constrained in many areas such that opportunities for use not equally distributed/accessible through the community. Capacity to change constrained by these factors as well as social and economic contextual factors.

iii. LANDASSESS DSS FOR SUSTAINABLE GRAZING MANAGEMENT

Policy/Institutional:
- New legislation required land managers to demonstrate sustainable use of pastoral lands.
- Fragmentation of land management responsibilities for across three agencies with very different 'cultures'.

Environmental:
- Land degradation continuing to occur through impact of grazing of beef cattle.
- Large heterogeneous grazing management units
- New management practices changing spatial and temporal distribution of grazing impact.

Economic:
- Industry export-oriented, with fluctuating prices, low input and low return operations.

Social/cultural:
- Divergence of views on what sustainable use means within and between government, industry and the community.
- Past focus of industry and government on development (ie. improving animal production, infrastructure) rather than land resource management.

Technological:
- No system of appraisal of sustainability of pastoral activities exists.
- Poor integration, access to, and sharing of existing data and knowledge.

4 AN INTEGRATED SYSTEMS APPROACH: ESTABLISHING CRITERIA & IDENTIFYING METHODS

In the past, evaluation of NRM policy processes has generally been:

- fragmented in reconciling perspectives from different fields of knowledge;
- largely insensitive to the socio-economic, policy/institutional, environmental and technological contexts;
- hampered by a lack of assessable goals and outcome measures; and
- broad one-off overviews conducted as a cross-sectional snapshot rather than a systematic longitudinal study.

The **integrated approach** to evaluation recognises many levels in NRM policy and research:

- problem characterisation;
- policy formulation and intent;
- program logic; and
- on-ground implementation.

Furthermore, evaluation must allow for assessment of *impact* (i.e. environmental, economic, social, institutional and technological) and be implemented as a *process tool* that:

- Supports purposeful and informative stakeholder participation;
- Creates improved opportunities for the incorporation of on-going learning processes at individual, organisational and policy levels;
- Facilitates negotiation and mediation processes; and
- Supports the move towards the amelioration of, or improvement in, the tractability of problems.

Evaluation in NRM needs to be addressed as a system that:

- Links objective to consequence;
- Considers the fundamental assumptions and instrumental hypotheses that underpin core policy, program or research objectives;
- Is grounded in natural resource, policy/institutional, economic, socio-cultural and technological contexts;
- Establishes practical, valid and equitable evaluation criteria by which change can be monitored and assessed;
- Involves methodological pluralism (including both quantitative and qualitative methods) to ensure rigour and comprehensiveness in assessment; and
- Integrates different disciplinary perspectives (i.e. social, economic, environmental, policy and technological perspectives)
- **= *AN INTEGRATED SYSTEMS APPROACH***

Evaluation of NRM initiatives should be interactive, iterative and meaningful and be directed towards influencing what emerges in an on-going positive and constructive way. As the evaluation process itself will inevitably be influential, it also needs to be implemented as a collaborative learning process involving all stakeholders.

The framework presented here demonstrates the need for considering the various elements of evaluation within a regional context (Table 2). The elements of the implementation of the policy initiative and the necessary iterative process within the evaluation are seen in Figure 2.

Table 2. Definition of elements of the evaluation framework.

ELEMENT	DEFINITION
Context	The social, economic, environmental, institutional and technological factors that influence the framing or characterisation of the problem, rationality underlying the policy response, the implementation process and on-ground performance.
Issue characterisation	The nature of the issue or problem underlying the initiative being evaluated (e.g. program or policy, activity, process, method/tool, body of knowledge), and the context in which the issue or problem developed.
Intent/Objective	The objectives or intent of (a) the initiative being evaluated, its expected outcomes and key stakeholders, and (b) the evaluation itself.
Instrumental assumptions	Statement of the theoretical assumptions and instrumental hypotheses or rationality underpinning the implementation of the initiative.
Evaluation criteria	Environmental, economic, social, policy/institutional and technological measures or indicators that reflect on performance in achieving key objectives and outcomes. In turn, performance is influenced by contextual factors (e.g. environmental, economic, social, institutional, technological) that constrain or otherwise influence the implementation of the initiative.
Evaluation Methods	The quantitative and qualitative performance assessment methods for (a) the evaluation of performance measures/criteria and (b) the interpretation or analysis of findings.
Process of implementation	The activities, strategies or operations by which the initiative is implemented or delivered and which produce the outputs and, in turn, outcomes of the initiative.
Products	The outputs or deliverables produced by an initiative over which it has control.
Outcomes	The impacts that are achieved, both anticipated and unanticipated, by the initiative

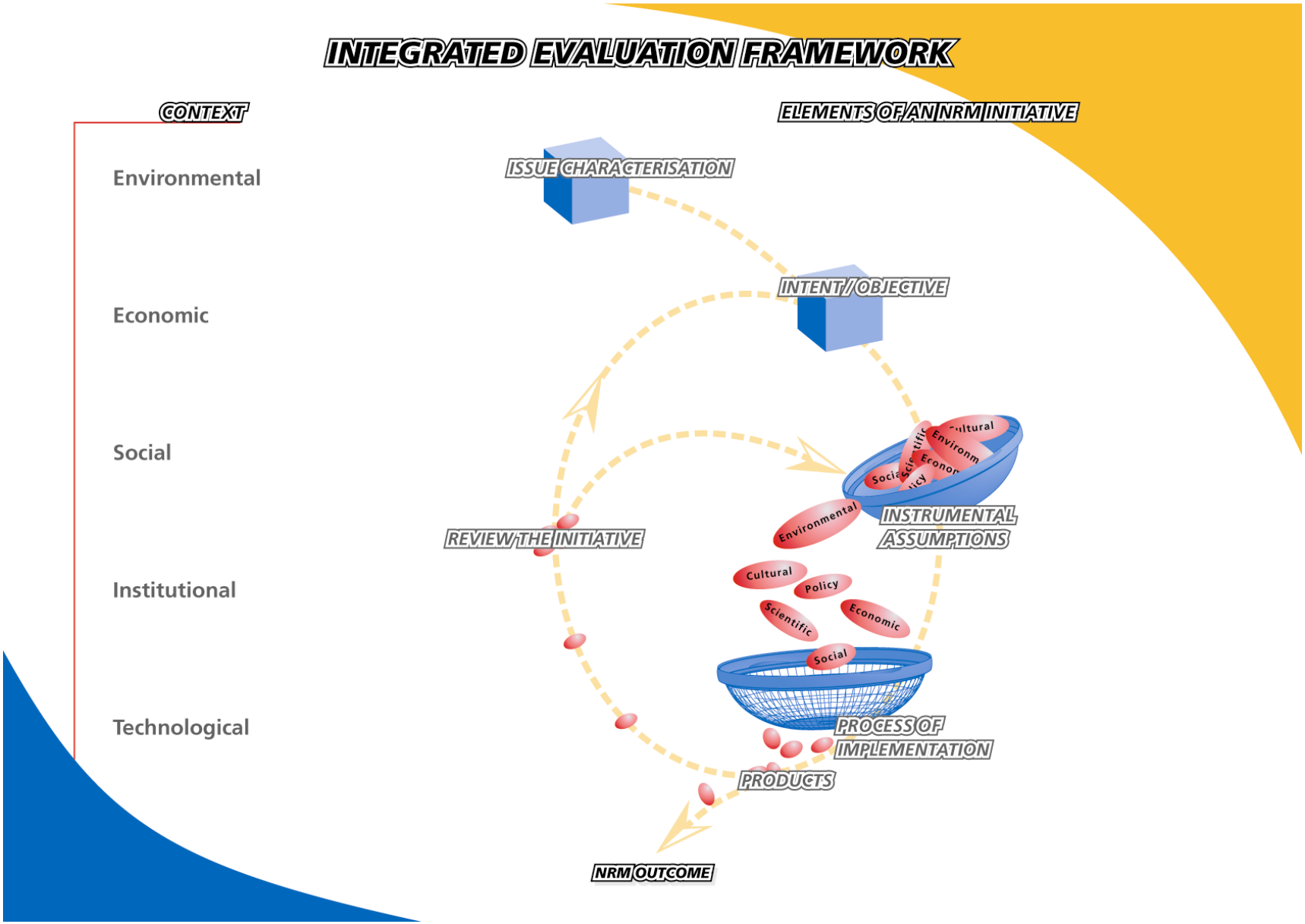

Figure 2 Integrated NRM evaluation framework, using a systemic approach encompasses scientific, economic, policy, social and environmental issues.

ISSUE CHARACTERISATION

The nature of the issue or problem underpinning a policy, program or other NRM initiative requires careful definition.

A poorly defined problem leads to a poorly formulated policy or program. Both the general background to the initiative or issue being evaluated and the context in which the issue evolved must be clearly characterised.

This provides the basis for matching progress in the policy response or program initiative to the impact on the tractability (i.e. manageability) of the sustainability problem.

In practice (Table 3), the issue characterisation required to underpin evaluation may lead to reconsideration of the issue and, thereby, the initiative.

Table 3. Examples of Issue Characterisation from case studies.

i. ICM in Queensland

- Resource degradation of waterways, pastoral and agricultural lands, concern for biological diversity
- Fragmented centralised governance approaches need to be replaced by more adaptive and integrated approaches at a catchment scale involving partnerships between government, industry and communities
- There is considerable public and private investment in integrated approaches with high community expectations but the translation of the concept into practice is experimental and evolutionary.
- Evaluation is necessary to determine whether strategies are achieving desired resource management outcomes
- Evaluation is fundamental to identifying impact, supporting an adaptive integrated approach that is flexible to meet the challenges of change, and informing on-going learning at individual, community, institutional and policy levels.

ii. Regional Resource Use Planning in the Central Highlands of Queensland

- Many natural resource use and management problems cannot be effectively addressed by individual action at the local or farm level but require regionally-based solutions through the agreed actions of a number of actors.
- Regional planning approaches in the past have tended to take a sectoral or a single issue focus, such as economic development, social planning and nature conservation management.
- A new emerging paradigm of a regionally-driven, integrated and ecosystem management approach to resource use planning is now being advocated. This new approach aims to achieve more sustainable and equitable resource use and management outcomes at a regional level.
- The effectiveness of such approaches at meeting these objectives has not been systematically addressed.
- Their impact is likely to be multi-dimensional; involving social, economic, institutional, environmental, and technological elements.
- However the implementation of such sustainability initiatives is experimental and there have been few evaluations of their long term impact.
- Where evaluations have been undertaken, regional economic development and growth management has often overshadowed the importance of environmental considerations.

iii. Landassess Decision Support System (DSS) for sustainable grazing management

- Increasing public concern for resource conservation and environmental quality of our pastoral lands.
- Land degradation occurred over a long timeframe of use but a lack of methods for (a) identification of early warning of sustainability problems, or (b) the assessment of potential effects of management options and implications for future use.
- Perceived need for government agencies and industry to determine the current state of lands, monitor change and foster a 'voluntary' approach to sustainable land use.
- The role and effectiveness of computer-based agricultural IT innovations are being strongly questioned by R&D and industry organisations.

INTENT/OBJECTIVE

Evaluations need to be clear about matching research methods to the nuances of particular evaluation questions, the idiosyncrasies of specific program situations, and information needs of identifiable stakeholder clients (Table 4).

Firstly, the **objectives and intent of the initiative** being evaluated and the expected outcomes need to be clearly identified so that they can be linked to the on-ground impacts of implementation. The stakeholders are likely to include a range of government agencies, industry and community interests that may evolve over time as the issue or problem is better defined.

Clear identification of the purpose of an evaluation is also fundamental to planning an effective evaluation. The agreed limits and boundary conditions of the evaluation, and the nature of the involvement of participants and/or collaborators in the evaluation, should be negotiated and clearly defined to develop common expectations and ownership of the evaluation findings and to focus the performance assessment on the critical evaluative criteria for measuring change.

Table 4. Examples of Intent/Objective from case studies.

i. ICM in Queensland

The stated intent of the Integrated Catchment Management (ICM) policy initiative in Queensland is a coordinated approach to integrate the management of land, water and related biological resources in order to achieve their sustainable and balanced use by:

- generating a better understanding of ecosystem interactions at a catchment scale by the community and Government and moving towards common or agreed goals through development of a catchment management strategy;
- facilitating coordination and cooperation within and between Government agencies and the community to enable the prioritisation of actions, and joint or independent action to seek solutions to problems.

Evaluation of ICM in practice is needed to guide continuous improvements in the way the policy initiative contributes to on-going change.

ii. Regional Resource Use Planning in the Central Highlands of Queensland

The project is being undertaken as an active partnership with a range of government, industry and community groups with a stake in the region. It aims to define and assess the nature of existing regional resource use planning in the Central Highlands, and to evaluate the effectiveness of a regionally-driven and negotiated planning systems approach to achieve more sustainable and equitable resource use outcomes. In essence, the project is designed to:

- strengthen human resource and institutional capacities to undertake regional resource use planning in the Queensland Central Highlands region, and
- generate research results and new innovations that have the potential to support a shift towards more sustainable and equitable resource use within rangelands.

iii. Landassess DSS for sustainable grazing management

- Develop methods for a computer based decision support system to assess the current state of a grazing management unit (eg. paddock) and to assist pastoral resource managers to formulate and evaluate alternative strategies for the sustainable use of the management unit.
- Better define the role of IT innovations in sustainable resource management.
- Develop methods to evaluate the effectiveness of science-based IT innovations for achieving a move toward sustainable resource use outcomes.

INSTRUMENTAL ASSUMPTIONS

Theories represent the most systematic way of building, synthesising and integrating diverse knowledge. They identify:

- the boundary that defines the area of interest;
- key constructs of that area;
- the values these constructs can take; and
- the relationship among the key constructs.

Theory can be used in evaluation to propose and test links among key factors indicating the direction and degree of influence they have on NRM implementation and impact.

An atheoretical research or evaluation approach may collect interesting facts but the danger is that no unifying theme or patterns or relationships may emerge. Defining the construct space of an initiative provides the basis for establishing validity and, ultimately, sound measures that can be applied to a variety of contexts.

Whether explicitly or, more often implicitly, identified, a policy or research initiative will have some basis in theory. Each theory base brings with it different methodologies, assumptions and value systems.

In evaluation, identifying the theory underpinning the implementation of the initiative, therefore, will highlight:

- the underlying assumptions and instrumental hypotheses;
- clarify what evaluation measures are needed; and
- contribute to an understanding of causal linkages.

Significantly, the rationale of the initiative being evaluated must be made explicit. Such underlying assumptions or instrumental hypotheses may relate to:

- state or tractability of NRM issues (social, economic, environmental, institutional; technological);
- stakeholder perspectives and behaviours on natural resource issues;
- knowledge base on natural resource issues and their management,
- institutional arrangements and policy frameworks;
- stakeholder coordination and communication processes;
- stakeholder capacity to adapt and to undertake NRM and planning; and
- equity and fairness of resource use outcomes.
-

The **systems approach** presented here provides a framework for identifying a series of hypotheses for appropriate responsibilities and influence against which the evaluation can identify criteria to measure progress in a developmental context (Table 5).

Table 5. Examples of Instrumental Assumptions from case studies.

i. ICM in Queensland

- Land and water resources are basic and interactive components of natural ecosystems and therefore management of land and water resources should be based on geographic units which account for the interactions between these resources.
- Management of land and water resources must be coordinated.
- Land and water resource management decisions must be based on the best available information
- Sound land and water management is best achieved through the informed action of the individual users and managers of these resources
- For change in resource use to be acceptable and beneficial it must be socially, economically, institutionally and environmentally sustainable. Therefore, a balance between economic development and conservation of land and water resources must be maintained.

ii. Regional Resource Use Planning in the Central Highlands of Queensland

The instrumental hypothesis of this R&D is that improving the *overall system* of resource use planning in the region will increase the level of positive interaction among regional stakeholder groups over time, and lead to better informed and more negotiated solutions to natural resource problems. The fundamental assumptions of this approach relate to:

- the representativeness of regional stakeholder groups and peak bodies;
- the degree to which individuals, groups and the general public are empowered to be involved in regional resource planning;
- the role and value of a participatory approach to the R&D;
- the role and value of capacity building;
- the importance and value of learning processes;
- perceptions of roles, responsibilities and influence of regional stakeholders;
- perceptions of community/regional processes that need to be put in place;
- technical information and modelling tools that can guide substantive action;
- adequacy of a negotiatory approach;
- importance of context (social, economic, environmental, institutional, technological); and
- stakeholder perceptions and understanding of the project's objectives, processes and outcomes.

iii. Landassess DSS for sustainable grazing management

- Considerable public and private investment is being made in multiple objective IT innovations to address complex decision-making on natural resource use and management. The expectation being that the technology will increase the effectiveness of decisions and the efficiency of the decision process for individuals and organisations involved with its use. Research supporting such outcomes is generally lacking.
- The perceived need for integration of the multiple levels and concerns regarding natural system functionality and grazing impact requires an interdisciplinary approach at scales relevant to grazing management decision-making (ie. paddock, property).
- Evaluations of IT effectiveness generally approached as an applied problem (eg. user acceptance, level of usage of product, task efficiency, user/ organisational relevance, system functionality and ease of use) and has not recognised IT innovations as social constructs. In particular, the relationship between the collaborative processes involved with most IT development and complex evolving natural and human systems has generally been ignored.
- Need to deal with the dynamic and varied situational context of key stakeholders and to manage end user expectations of R&D over a relatively long development timeframes.

EVALUATIVE CRITERIA

The fundamental basis for evaluation is the establishment of practical criteria by which change can be monitored and assessed in order to evaluate progress and impact.

Criteria also provide the basis for testing underlying assumptions and instrumental hypotheses relating to the NRM initiative.

Evaluative criteria should reflect the achievement of key objectives of the initiative.

DEFINITIONS:

Criteria can be measured by one or more indicators, which may be defined as:

> *a parameter tracked over time that provides information on changes in the condition of the phenomenon, which has significance beyond the properties of the parameter itself* (Eckersley 1998, p.11).

A good **indicator** for measuring progress toward environmental sustainability is:

> *sensitive to temporal and social priorities, to place and scale, and in a framework that links social, economic and environmental data* (Brown 1998, p. 272).

Importantly, indicators should result from a deep understanding of **complex system function**.

SCOPE OF CRITERIA

Because of the evolving and holistic nature of the concept of sustainability, evaluation of NRM initiatives requires criteria from the biophysical, social, economic, policy, and institutional perspectives.

Some examples of evaluative criteria, therefore, may be:

Environmental:

- the evolution of resource use and management systems in the region;
- the major resource use issues and their on-site and off-site implications and impacts;
- attitudes and behaviour to NRM and environmental issues; and
- the nature and extent of behavioural change in resource use and management practices required across stakeholders.

Economic:

- the nature and status of, and inter-dependencies within, the overall regional economy;
- perceptions of future development and economic prospects;
- the distribution of wealth and resources within the community;
- the economic vulnerability of the regional economy;
- economic viability of land managers; and
- financial resourcing of policy initiatives.

Social/cultural:

- social history and regional demographic change;
- cultural diversity and related resource use issues;
- the nature of, and commonality in, community expectations (within and outside the region) regarding the environment and socio-economic situation, and resource management and planning processes;
- perceptions of equity and social justice trust in process; and
- political and media support for NRM processes.

Policy/institutional:

- adequacy and consistency of relevant policies and the organisational structures and processes for NRM across government, industry and community;
- the resourcing and coordination characteristics of policies, plans and processes;
- the stability and volatility of local and state political process;
- opportunities for access to policy processes by the wider community; and
- perceptions of responsibilities and roles.

Scientific/technological:

- the characteristics of the existing technology system;
- technical knowledge base and competencies to use advanced technologies across stakeholders;
- the availability and feasibility of technical solutions; and
- the adequacy of scientific knowledge including appropriateness of scientific understanding and its ability to assist decision-making.

The relative importance of the influence of each of these elements will vary depending on the particular objectives of the initiative and the objective of the evaluation itself. Importantly, each criterion will measure only a portion of the total context of implementation. Examples of Evaluative Criteria from three case studies are shown in Table 6.

Table 6. Examples of Evaluative Criteria from case studies

i. ICM IN QUEENSLAND

Resource Use Context

⇒ Tractability of resource use issues and tensions in the catchment:
- External environment vigilance in community
- Characteristics of catchment resource use
- Community attitudes and behaviour

Institutional Structure

⇒ Adequacy of policy frameworks and institutional arrangements to address issues at a catchment scale

⇒ Community capacity to plan and implement catchment management strategy

Community Process

⇒ Adequacy and equity of community processes:
- Mechanisms for communication and interaction on catchment issues
- Equity of opportunity for involvement
- Level of strategic alliances/partnerships developed to exploit future synergy

Technology Context

⇒ Adequacy of available technology:
- Capability to identify and address catchment resource use issues
- Technical support for effective implementation of on-ground activities.

ii. REGIONAL RESOURCE USE PLANNING IN THE CENTRAL HIGHLANDS OF QUEENSLAND

Progress towards regional sustainability of resource use

⇒ Resource use context::
- Reduction in the severity of impact or improvement in the tractability of regional resource use issues and tensions.
- Contribution to improvement in regional sustainability indicators

⇒ Equity of resource use:
- Enhanced perceptions of fairness in the overall regional resource use planning system and related decision-making processes.

⇒ Regional processes:
- Improved mechanisms for communication or interaction on regional issues.
- Improved recognition of importance of a regional perspective in planning.

Improvement in the degree of involvement and participant capacity to undertake regional resource use planning.

⇒ Technical capacity:
- Improvement in technical capacity to undertake planning initiatives

⇒ Planning systems:
- Improvement in planning structures and processes within individual stakeholder groups.

⇒ Institutional arrangements*:*
- Improvement in broader institutional structures at the regional level to undertake regional planning.

⇒ Research capacity:
- Influence/impact on peer researchers and regional planning practitioners of Regional Stakeholder Groups within and outside the region.

Role and effectiveness of additional information and IT development for regional resource use planning

⇒ Knowledge base:
- Improvement in the body of knowledge to support regional resource use planning

⇒ Analytical capability:
- Improvement in regional analytical capacity to formulate and evaluate regional options, their likely implications and current trends for planning and negotiation.

Effectiveness of the collaborative and participatory approaches to the R&D and regional planning processes;

⇒ Participation:
- Improvement in and satisfaction with stakeholder involvement in regional decision making

⇒ Collaboration:
- Improvement in stakeholder capacity to collaborate and opportunities for future collaboration

Table 6 (continued). Examples of Evaluative Criteria from case studies

iii. LANDASSESS DSS FOR SUSTAINABLE GRAZING MANAGEMENT

Progress toward sustainable grazing resource use:

⇒ Contribution to improved interaction and communication on sustainable use of pastoral lands between government agencies.

⇒ Contribution to improved understanding of sustainable use in grazing systems to support advisory and extension activities.

Stakeholder capacity building:

⇒ Improved access, sharing and meaningful use of data/ knowledge on sustainable grazing practices.

⇒ Improvement in analytical capacity to assess current state of the land resource and to formulate and evaluate management options.

⇒ Endurance of collaborative R&D alliance

Effectiveness of IT development process:

⇒ Stakeholder satisfaction with level of involvement and influence in IT development process.

⇒ Stakeholder views of costs/benefits of collaboration.

⇒ Stakeholder satisfaction with relevance, functionality and ease of use of IT product.

ITERATIVE DEVELOPMENT PROCESS

A whole suite of measures has the potential to reflect the influences and impacts of the NRM initiative. For practical and efficiency reasons, each evaluation will need to focus on a selected number of critical evaluation criteria and indicators that are relatively readily measurable over time, yet rigorous and effective in reflecting change.

It is important to note that the identification of evaluation criteria and their related indicators for a particular NRM initiative necessarily involves an iterative process of development to continually refine the criteria to a critical but manageable set.

This process of refinement needs to take into account:

- the objectives or intent of the phenomenon of interest (ie. the NRM initiative);
- the objectives or intent of the evaluation itself;
- the feasibility and practicality of methods given the resources available; and
- the constraints of the context of implementation.

Inevitably, criteria need to be reviewed and revised in light of experience in order to capture emerging issues that need to be evaluated.

EVALUATION METHODS

The purpose and design of an evaluation will determine, and be influenced by, timing. Three well-recognised stages of evaluation are:

- *ex-ante* evaluation undertaken before implementation;
- progress evaluation during implementation; and
- *ex-post* evaluation after completion of a project or program.

Across all of these stages, four fundamental criteria guide the design of an evaluation:

- usefulness and relevance to the evaluation purpose;
- feasibility and cost-effectiveness;
- equity and social justice; and
- technical validity.

As there is no recognised *best* or *generic* evaluation methodology, a balance is required among the various considerations when designing an evaluation.

MANAGING BIAS

The conventional scientific model sees an objective, rational, political and neutral body of knowledge that informs decision-making processes. However, a multitude of discretionary judgments is made during the course of an evaluation. The formulation of the problem, the analytical models, the methodological approach, the relevant information, the data collection techniques, the scope and construction of questions, and so on reflect the views of those who participate in the design, development, implementation and interpretation of the evaluation.

Some form of bias is inevitable in evaluation. In the context of NRM initiatives, there is a strong case for **methodological pluralism**. There is not likely to be one best, let alone all encompassing, perspective for understanding and evaluating complex problems. Diversity in methods allows 'triangulation' of theory and methods to make effective use of their complementarities, particularly in ameliorating any one perspective or approach. Values and instrumental assumptions need to be made explicit in theoretical frameworks, principles of inquiry and evaluative methods.

No single evaluation method will be totally applicable. Evaluation has moved into a period of methodological diversity with a focus on methodological appropriateness. As a consequence, the framework for evaluation presented here is designed to be independent of the methods applied for evaluation.

Methodological pluralism can contribute to rigour in evaluation. Multiple methods are needed at different stages of the project, for different project components, and for different planning contexts. These may include both

quantitative and qualitative methods. Moreover, many will be concurrent, involving multiple parallel tasks.

DESIGN CRITERIA

In designing a pluralistic approach to evaluation of the performance and impact of an NRM initiative, criteria that need to be considered include:

- ***Scope of assessment*** (eg. scale or level of impact, as well as impact of overall approach or focussed evaluations of specific components).
- ***Form of evaluation*** (eg. self-evaluation or external assessment).
- ***Mode(s) of analysis*** (eg. longitudinal study, cross-sectorial study, focussed/case study, needs analysis, on-going monitoring).
- ***Unit(s) of analysis*** (eg. individual, group, organisational, regional resources, regional economy, regional community, state policy development).
- ***Information required and types of comparisons*** to be made (eg. description, judgments, interpretation, qualitative assessments, quantitative assessments).
- ***Method(s) for inferring process of change*** (eg. methods for representing raw data to identify process patterns, comparison of change in performance criteria).

Finally, the choice of methods needs to be **appropriate and sensitive to the realities of the specific context** of NRM policy or program implementation.

PROCESS OF IMPLEMENTATION

Activities associated with a policy initiative (such as planning, research, implementation, monitoring and evaluation) usually occur simultaneously rather than sequentially. The evaluation process, therefore, needs to deal with all activities simultaneously rather than sequentially.

The evolution of the process of implementation of a policy initiative will vary from one particular region to another for a host of local contextual factors. The influence of this process on the on-ground success of the NRM initiative needs to be recognised and accounted for in analysing the findings.

PRODUCTS AND OUTCOMES

The products of an natural resource management initiative are the tangible outputs of that initiative over which it has some degree of control, such as the establishment of a multi-stakeholder coordinating committee or a catchment management plan. In contrast, the outcomes of an initiative relate to the anticipated and unanticipated impacts of those products and the implementation

process for the initiative, such as improved adoption on-farm of sustainable practices or improved water quality.

This impact or influence is potentially multi-dimensional. It may encompass, for example:

- Individual and organisational learning effects (e.g. new collaborations, partnerships or strategic alliances, networking);
- Behavioural changes (e.g. new skills, new planning processes, sharing of information);
- Impacts on norms/standards (e.g. new ways of technical assessment, accessibility of information);
- Social effects (e.g. system and networking externalities); and
- Contributions to knowledge bases, scientific progress, and human and social development.

IMPLEMENTING AN EVALUATION

The necessary steps to implement evaluation of the policy initiative are seen in Figure 3.

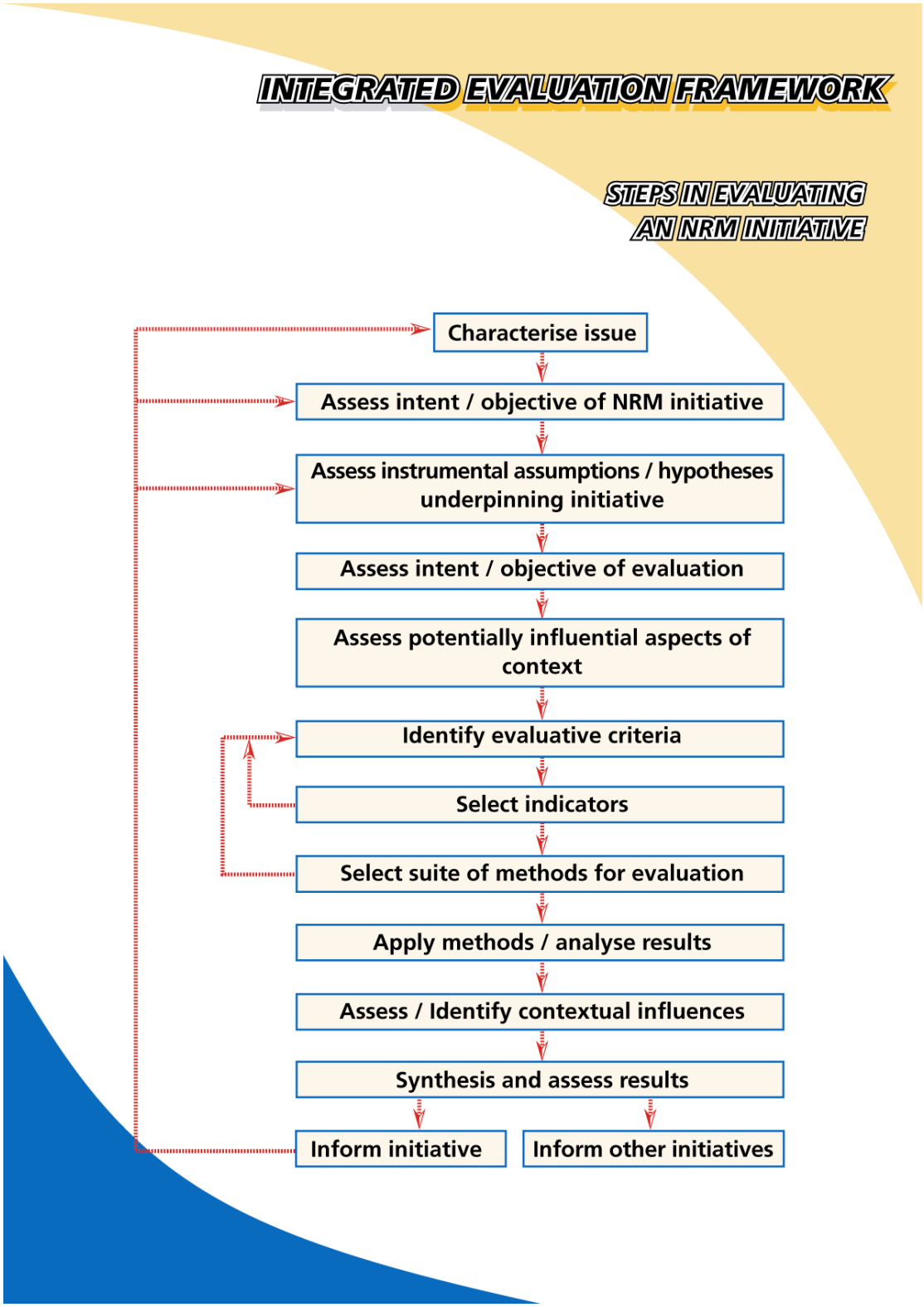

Figure 3. Steps in implementing and NRM evaluation process.

5 REASONS FOR EVALUATION AND EXPECTED BENEFITS

Evaluation needs to be directed toward influencing what emerges in a positive and constructive way, rather than focussing only on *post hoc* evaluation, which is related to achievement of initially proposed means of reaching objectives.

Importantly, the evaluation may be influential in modifying the objectives themselves. The evaluation therefore needs to incorporate an effective process of continuing feedback and improvement to the NRM implementation process as a whole. The different stages in the evaluation process will therefore be iterative, interactive and inevitably influential (Figures 2 & 3).

While natural resource management and environmental planning are increasingly being promoted globally as mechanisms to resolve intractable resource use problems and conflicts, there still remains no common theoretical base upon which such approaches are developed and implemented. Consequently, a clear evaluative framework has failed to emerge to guide continuous improvements in the way that such initiatives actually contribute toward achieving sustainable and equitable resource use and management. This guide has sought to place NRM evaluation in a clear context as a first step to establishing an integrated framework for evaluating such initiatives.

Natural resource management policy and planning initiatives need to be evaluated as a system that links the initiative's objectives and rationale to performance 'on the ground'. The evaluation strategy presented here provides:

- a basis for an integrated evaluation of the different perspectives (i.e. social, economic, environmental, policy and institutional) on the performance of the policy, program or research processes;
- a framework for guiding its implementation; and
- a rigorous basis for synthesising findings.

The strategy recognises evaluation as a means of not only assessing impact but also as a critical process tool (Table 7) for:

- improving program and research management;
- providing a basis for assessing accountability;
- fostering learning;
- improving the body of knowledge; and
- improving the implementation of natural resource management policy.

The framework established has sought to overcome significant challenges to evaluation in complex natural resource and human systems. We have used the

findings of a number of case studies of sustainability initiatives in Australia (i.e. policy programs, research processes and knowledge development) to develop a systems-based analytical framework for evaluation in these contexts.

It needs to be stressed, however, that this is a framework only. Key measures and criteria developed within this framework need to be developed to meet the specific needs of particular application contexts, as well as being negotiated with those actors involved in the policy and planning process.

Unless there are structured and coordinated attempts to adopt improved evaluative frameworks appropriate to the theoretical context within which natural resource management and planning occurs, we do not believe there can be significant and continuous improvements in the way policy initiatives can contribute to sustainable and equitable resource use outcomes at the local, regional, national and global levels.

As a consequence, integrated approaches to natural resource management may be discarded before a fair and comprehensive assessment of their potential role and impact is determined. This would be counter to the general theoretical developments in systems theory, ecology and the participatory and adaptive management philosophies that currently drive natural resource management policy reform.

Importantly, the challenge to create policy processes, institutional arrangements and natural resource management practices, which enable the choice of methods, tools and mechanisms most suited to moving communities towards achieving sustainable and equitable outcomes of resource use and management, needs rigorous evaluation incorporated as part of the change process.

Table 7. Benefits of NRM evaluation.

Improve program management

- Develop a common understanding of objectives and expected outcomes.
- Provide a basis for informed decision making on program/research direction, resource allocation and attainable levels of performance.
- Identify and focus attention on factors influencing program outputs and outcomes.
- Identify gaps in performance and insights on how they might be addressed.
- Facilitate a robust and integrated approach to program planning and implementation.

Improve transparency and accountability

- Evaluate costs and benefits of an investment of public or private resources.
- Improve efficiency and effectiveness of a program or process.
- Identify unanticipated outcomes early.
- Identify equity and social justice issues.

Reduce risk and uncertainty

- Identify impacts of a project, program or process.
- Identify information pathways and processes and their roles.
- Develop understanding of causal relationships.

Foster learning

- Influence decision-making policy development.
- Support an ongoing information exchange, feedback and learning.
- Improve awareness of equity and social justice programs as they arise.
- Identify impacts of a project, program or process.
- Identify information pathways and processes and their roles.

Improve process

- Facilitate continuous participation.
- Support the public consultation process.
- Build stakeholder capacity.
- Develop ownership of project outcomes.
- Provide information and structural framework to underpin negotiations.
- Provide a platform for cultural change.

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Chapter 3

The Herbert River Integrated Catchment Management Process: A Longitudinal Study – 1993-1998

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1. INTRODUCTION

1.1 The LWRRDC CTC7 R&D Project

In 1994, the Land and Water Resources Research and Development Corporation (LWRRDC) funded research staff of the CSIRO Tropical Agriculture (in Brisbane and Townsville), CSIRO Land and Water (in Perth), and the University of Queensland Department of Geographical Sciences and Planning (in Brisbane) to undertake research on Integrated Catchment Management (ICM) processes[1]. This longitudinal study over five years focuses on the community-driven ICM program in Queensland using the Herbert River Catchment process as a case study. The objectives of the investigation are to.

1. Monitor and document the process of implementation of ICM in the Herbert River catchment and identify the social, economic and institutional factors that facilitate or hinder this process.
2. Evaluate key impacts of the implementation of the ICM process in terms of attitude and behaviour changes in the community and changes in the severity or tractability of the resource use conflicts for the catchment.
3. Assess the specific technical and related information needs that are relevant to an effective ICM implementation process in a wet tropical environment.
4. Develop a framework and related methods for evaluating the process of ICM implementation that will facilitate the development of more effective catchment management programs in Australia.

The project acknowledges that ICM requires systematic evaluation (Bellamy *et al.* 1999). For example, ICM as a process needs to take many and often conflicting considerations into account, and it operates in a complex environment where uncertainty is more often the rule than the exception. Indicators of progress are not easily defined and, to date, this area of investigation has largely been neglected (Bellamy *et al.* 1999). As such, practice is well ahead of theory as community-based catchment management programs are in place before any sound proposition of how they work best has been formulated (Mobbs and Dovers 1999). The complexities of catchment management are such that longitudinal studies of processes are extremely valuable, if not essential, if the issues of catchment management are to be better understood and appropriate lessons learned.

In responding to these challenges, the LWRRDC CTC7 R&D Project adopted an interdisciplinary approach and drew on areas of expertise in natural resource science, social science, land use planning, resource economics, policy science, evaluation research and information technology to address the following key questions relating to the integrated catchment management program implementation in the Herbert River catchment:

- Does it work? What can realistically be expected? What difference does it make to the way resources are managed?
- What makes it work? What fosters or hinders the ICM implementation processes? Are these technical, economic, institutional or social?
- How does it work best? What are the necessary arrangements, procedures and processes that need to be put in place?

1 LWRRDC Project Reference: CTC7 - *Evaluation of Integrated Catchment Management in a wet tropical environment*

1.2 ICM Policy in Queensland

The Queensland State Government released an ICM Strategy for Queensland outlining the broad policy and structural arrangements in October 1991 (DPIQ 1991). It provided a framework for encouraging cooperation and coordination between landholders and other resource users, community groups and government agencies from all levels involved in the use and management of natural resources. The Queensland Department of Natural Resources (DNR) is currently the lead government agency for implementing the Strategy. Other state government agencies, including the Department of Primary Industries (DPI), Environmental Protection Authority (EPA) and the Department of Communication, Information and Local Government and Planning (DCILGP), also play a role in promoting and supporting the ICM policy initiative.

The key elements of this ICM policy initiative promoted in Queensland are:

- *Voluntary program*. Participation in ICM is voluntary for both community and government.
- *Community based*, meaning that all structures have a majority of community members. Formation of catchment coordinating committees (CCCs) is dependent on interest from the community and other sectors.
- *Partnership* between the levels of government, industry and the community. All sectors and key stakeholders are to be involved. As the CCCs do not have statutory "teeth", implementation of strategies relies on negotiated and voluntary action by responsible agencies and individuals.
- Processes used by the committees in coordinating and integrating management of the catchment are *participative and consultative*.
- ICM is about taking a *strategic and planned* approach to tackling important issues (Rowland and Begbie 1997).

Central to the implementation of ICM in Queensland is the establishment of Catchment Coordinating Committees (CCC). The Queensland Integrated Catchment management Strategy (QDPI 1991) identifies that:

> Catchment Coordinating Committees are established to address complex catchment management issues that involve many community groups and government agencies. Catchment Coordinating Committees comprise representatives of the major sectors of the community and government that are involved in, or influenced by the management of land and water resources in the catchment. Their major roles are to provide a forum for community input and discussion, to prioritise the issues and to develop and promote the adoption of catchment management strategies.

At the catchment level land use and resource management is influenced, managed and controlled by a complex domain of government and industry-based natural resource management programs. Of these, the most important are related to state and federal government land administration, river management, nature conservation (including World Heritage Areas and National Parks), and local government infrastructure and town planning (McDonald and Bellamy 1997; Vella 1999) and industry arrangements (such as the sugar land allocation process (Shrubsole and Johnson 1999). The ICM policy initiative is only one of a number of processes and policy initiatives all designed to influence the way natural resources are used and managed.

To-date implementation of the ICM Strategy in Queensland has occurred in 36 catchments covering nearly 80% of the area of the state. The impact of the impact of land and water use on freshwater and marine ecosystems, water quality, soil erosion and sedimentation of watercourses, salinity induced through clearing of vegetation, loss of habitat on land in rivers and streams, the spread of weeds by water and competition for land and water resources are

the important issues requiring a new approach under ICM. A plethora of groups and organisations in government, industry and the community are stakeholders, making an integrated approach through coordinated action even more challenging. McDonald *et al.* (1999) provides an anthology of ICM in Queensland that traces its development from the launch of the ICM Strategy in 1991.

The Herbert River Catchment was one of the earliest priority catchments to be endorsed by the Queensland State Government in 1993.

1.3 The Herbert River Catchment

1.3.1 Resource Use Context

The Herbert River Catchment drains an area of approximately 10,000 km^2 with its major river outlet flowing into the extensive mangrove areas of the Hinchinbrook channel. It is the largest of the river systems located in Australia's sub-humid to humid tropical north east (Figure 1). The catchment has a dominantly summer rainfall with approximately 75% on average falling between December and March. The lower catchment encompasses the shire of Hinchinbrook and the upper catchment area the shire of Herberton.

At the commencement of European settlement in the late 1800s, the Herbert catchment was heavily timbered with extensive freshwater wetlands in the coastal lowlands. The catchment has since undergone significant modifications. Although large areas of the catchment still remain under natural vegetation, about 40% of the coastal lowlands in the lower catchment have been cleared for crop production or improved pastures. Agricultural and pastoral activities are the largest users of land (in area) in the catchment. The sugar industry located in the lower catchment is dominant both socially and economically. Other important industries are forestry and small crops such as pineapples, melons and pumpkins but given its proximity to the wet tropical coast including the Great Barrier Reef Marine Park fishing and recreational activities are also important contributors. The middle and upper catchment have significant areas of rainforest in protected areas and State Forest Reserves. The upper catchment is, however, dominated by natural pastures for beef cattle production. Small areas of the catchment are utilised for mining and industrial activities, or alienated for urban development.

The population in 1996 was approximately 18000 people (1996 National Census), of which 75% live in the lower catchment. The contrast in the physical and socio-economic contexts of the upper and lower parts of the catchment is very strong, with little interaction between authorities or community members largely due to logistical and accessibility constraints imposed by the rugged topography of the middle catchment. Since the early 1980s, the catchment has experienced strong economic growth, underpinned predominantly by its agricultural and tourist sectors. The performance of these sectors in the future is dependent to a large extent on the ecologically sustainable development of the natural resource base.

Sugarcane production which is confined to the lower Herbert coastal plain is expanding its area under production at about 7% per annum. Currently approximately 75,000 ha of land is cultivated to supply the two mills in the region (Victoria and Macknade). Only about 5,500 ha of this area is licensed to be irrigated from surface supplies. The rapid expansion of sugarcane in recent years has largely occurred on the more marginal lands for production, that is on poorly drained coastal wetlands, and previous grazing lands.

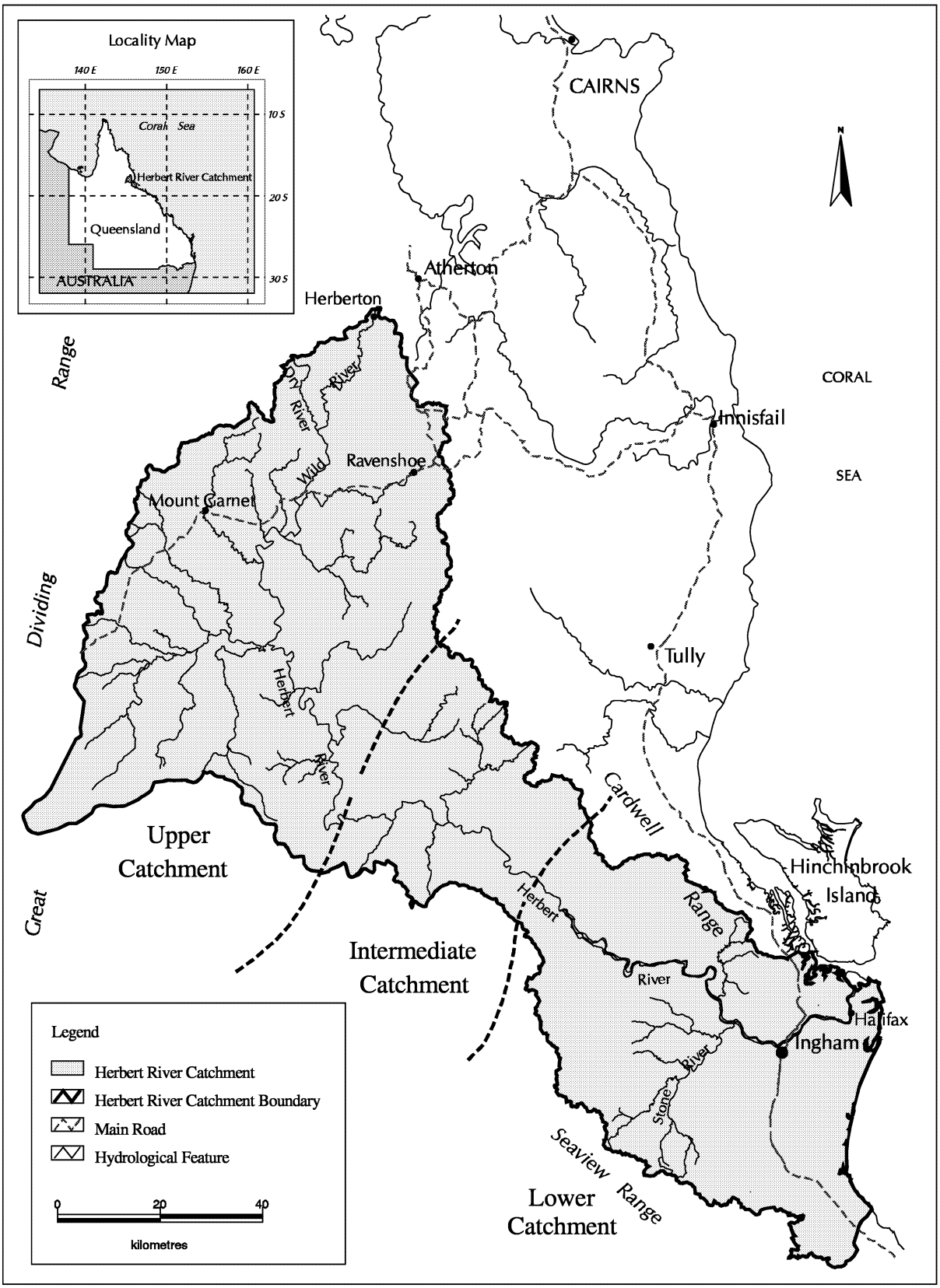


Figure 1. Herbert River Catchment.

Considerable areas of riparian vegetation have been removed from the stream banks (Johnson *et al.* 1998b). The wetlands, swamps, billabongs and waterholes of coastal areas play an important role in floodplain ecology (eg. providing wildlife habitats) and as an integral part of the surface and ground water hydrological regimes of floodplains (eg. providing important hyrological functions). Clearing for sugarcane has significantly reduced the area of this habitat type in the Herbert River floodplain. Johnson *et al.* (1997) have shown a 60% decrease in the area of *Melaleuca* dominated vegetation patterns and a 50% decrease in riparian rainforest patterns since European settlement. Significantly, current natural resource use in the catchment is having an impact on terrestrial and riverine systems and on the adjacent marine environment. Significant issues are diffuse source pollution of waterways, heavy metal contamination, and soil erosion and sedimentation (Johnson 1995).

As previously noted, the economy of the lower catchment is heavily dependent on the sugar industry and the economy of the upper catchment is dependent on the cattle industry. The economic impact of these industries on the regional economy of North Queensland shows that, together, these industries make a significant contribution (both direct and flow-on effects) to gross output and employment in the region. Specifically, in 1995 the contribution to regional output and employment of sugar production in the Herbert River District and the Cattle industry in the upper catchment have been estimated as (Robinson *et al.* 1999):

- *Output*: the sugar industry of the lower Herbert River catchment contributed to over $354m of output in the regional economy, including $206m of output from sugar production and a further $148m in flow-on impacts from other industries in the region. The cattle industry in the upper Herbert River catchment contributed $16m in output to the regional economy, including $13m in output from Cattle production and a further $3m in flow-on impacts.
- *Regional employment*: the sugar industry of the lower Herbert River catchment provided employment for over 3,300 people in the Northern statistical division in 1995. Over 1,300 of these people are estimated to be employed directly in the production of sugar with a further 1,936 people employed in industries supporting the sugar industry. The cattle industry in the upper Herbert River catchment is estimated to provide employment for 170 people, which includes 120 people employed directly in cattle production and a further 49 in support industries.

This information suggests that the economic sustainability of these industries, particularly the sugar industry, is important to the regional economy. However, the financial viability of cane farmers in the future is not optimistic. Although the real prices of agriculture have increased steadily over the past 25 years, the rate of increase has not been as rapid as the increase in costs of inputs to production. Deterioration in cane growers terms of trade coupled with financial inability to implement sustainable management practices represents a significant threat to sustainable development of the Herbert River catchment.

1.3.2 Previous Land and Water Management Studies

ICM is the most recent attempt to address the resource management challenges of the Herbert River catchment. Concern over flooding has been a community issue in the lower catchment since the 1880s. However flood mitigation works and the development of uncoordinated drainage systems have been the cause of considerable community conflict. Since the 1970s, there have been five major studies commissioned by the Herbert River Improvement Trust (HRIT) and the Hinchinbrook Shire Council in collaboration with state government agencies that have examined water management related issues with respect to flooding management, rural drainage planning, and stream management planning (Gutteridge Haskins and Davey 1976, 1977; Gutteridge Haskins and Davey 1977, 1980;

Cameron McNamara 1980; Cameron McNamara 1984; Ian Drummond and Associates 1993).

A major flood caused a very significant reduction in sugar cane yield in 1991 and fuelled continuing concerns for flooding and drainage. Mining dams, some of which were abandoned in the late 1890s, were also perceived to pose a hazard to downstream residents. These and other resource use issues led to community conflict that impeded economic and social development for the Herbert River catchment community and prompted the call for an ICM process for the catchment in 1992.

2. CONCEPTUAL APPROACH TO THE RESEARCH

2.1 Conceptual Framework for NRM Research

Program evaluation and policy analysis are recognised as critical elements of successful policy development and implementation. However, although approaches to NRM based on the integration of community involvement, technical knowledge, organisational structure and policy objectives are endorsed in both Australia and overseas, there are no generally accepted models of evaluation of such initiatives. In particular, evaluation of NRM policy processes has generally been:

- fragmented in reconciling perspectives from different fields of knowledge;
- largely insensitive to the socio-economic, policy/institutional, environmental and technological contexts;
- hampered by a lack of assessable goals and outcome measures; and
- broad one-off overviews conducted as a cross-sectional snapshot rather than a systematic longitudinal study.

Conventional cost benefit analysis, cost-effectiveness and other policy analysis methods do not apply well in this context (ANAO 1997). In a review of the literature on policy evaluation in natural resources, Wallace *et al.* (1995) identified three common problems facing implementing agencies of natural resource management policies:

- how to respond to a general call for increased public participation in policy making;
- how to evaluate programs in light of poorly defined and understood objectives; and
- how to monitor programs in light of new scientific understanding and changes in management philosophy and practice.

In practice there is a general lack of use and development of substantive policy evaluation theory. Wallace *et al.* also claim that using the traditional empirical model of evaluation, in which the referents for study are the formal programs and goals and objectives articulated in legislative acts or policy statements, is not practical for most natural resource policies. Natural resources policy statements are often vague and unclear about their objectives and their intended policy effects and, hence, difficult to achieve or even define. Palfrey *et al.* (1992) propose an evaluation approach that ultimately refers effectiveness back to the 'guiding principles' in which the policy is embedded. Valid indicators of mental constructs such as justice, equity, equality and choice are however difficult to establish. Palfrey *et al.* point to the relevance and importance of 'processes' as indicators of both efficiency and effectiveness of policy implementation. 'Process' in this context refers not only to administrative, organisational and legislative mechanisms, but also the total network of operations involved in implementing and sustaining policy in action, including social interactions and participant perceptions of issues and how the program is progressing.

To this end, we argue that the challenge to create policy processes, institutional arrangements and NRM practices that can contribute towards achieving sustainable and equitable resource use outcomes requires rigorous evaluation as part of the change process (Bellamy *et al.* 1999). Evaluation is fundamental to**:**

- identifying change;
- supporting an adaptive approach that is flexible enough to meet the challenge of this change; and
- enabling learning at individual, community, institutional and policy levels.

Coping with and managing accelerated change requires a systemic approach characterised by adaptation and learning that is incumbent upon personal responsibility and opportunity at the local level. NRM initiatives need to be evaluated as such a system that:

- links objective to consequence;
- considers the fundamental assumptions and instrumental hypotheses that underpin core policy, program or research objectives;
- is grounded in natural resource, policy/institutional, economic, socio-cultural and technological contexts;
- establishes practical, valid and equitable evaluation criteria by which change can be monitored and assessed;
- involves methodological pluralism (including both quantitative and qualitative methods) to ensure rigour and comprehensiveness in assessment; and
- integrates different disciplinary perspectives (i.e. social, economic, environmental, policy and technological perspectives).

Significantly, at the commencement of the CTC7 R&D project, no clear evaluative framework had emerged to guide continuous development in the way NRM policy initiatives contribute to on-going improvements in resource use sustainability and social well-being of the communities concerned. In effect, an over-arching systemic framework to guide the evaluation of NRM policy initiatives is lacking.

2.2 An Integrated Systems Approach

In response to these issues, in the first year of the project the CTC7 research team members developed a conceptual framework for evaluating integrated resource management programs that identifies a range of environmental, policy/institutional, economic, social and technological factors). This framework adapts the Mazmanian-Sabatier framework (Mazmanian and Sabatier 1981; Sabatier 1986) that identified a variety of legal, political and 'tractability' factors that impact on the different stages of policy implementation. The framework also includes socially significant evaluation indices such as inclusiveness, adequacy, equitableness, effectiveness, efficiency, and democratic involvement (eg. Crane 1988), and recognition of the principles of the PRIME procedural model (Syme *et al.* 1994). This latter model recognises that evaluation needs to cope with multiple parallel tasks occurring at all times. Some of these tasks will be dealing with planning; some with research monitoring and evaluation. The PRIME model also recognises that there should be appropriate areas of influence in the evaluation process by the community as well as agencies.

The framework is presented in Table 1 and it identifies the four fundamental elements of the framework developed for evaluating ICM in the Herbert River catchment (Bellamy *et al.* 1999a) as:

(i) Characterisation of the natural resource issue
(ii) Implementation context for the ICM policy initiative
(iii) Policy frameworks and institutional arrangements for ICM
(iv) Community processes for ICM.

Based on an assessment of the underlying assumptions and instrumental hypotheses underpinning the objectives of the ICM policy initiative in Queensland and with consideration of the variability in the multi-dimensional contexts of most catchment situations, the team members developed a set of variables for each of these four elements that can potentially influence the ICM process and its outcomes. The steps in the process undertaken in this exercise to develop criteria and identify investigative methods for evaluating ICM in the Herbert River Catchment is illustrated in Figure 2 and described in more detail in Bellamy *et al.* 1999b; 1999c).

Table 1. Variables influencing natural resource management initiatives (after Bellamy *et al.* 1999a).

1. Natural resource issue characterisation in the catchment:
   - Historical context and evolution of resource use and management
   - Stakeholder perspectives on natural resource use and management
   - Status of the technical knowledge base to guide substantive action
   - Extent of problem recognition and acceptance of change required by different stakeholders

2. Implementational context for the ICM initiative:
   - Evolution of on-ground policy or program implementation
   - Socio-economic conditions and technology
   - Media coverage and attention
   - Attitudes and resources of local constituency groups
   - Support from politicians and industry leaders

3. Policy frameworks and institutional arrangements for ICM:
   - Clarity and consistency of objectives of NRM initiative
   - Financial resources
   - Coordination among implementing agencies
   - Policies, plans and decision rules of implementing agencies
   - Commitment and skills of implementing staff
   - Opportunities for formal access by wider community

4. Community processes for ICM:
   - Expectations/knowledge of process by stakeholders, including the degree to which they are shared or separate
   - Coordination of resources
   - Degree of motivation, commitment, cooperation and support
   - Efficiency and effectiveness of process
   - Equity and procedural justice/trust in process
   - Agreed influence
   - Agreed responsibilities and roles
   - Integration (that is degree of incorporation of processes in structure and context)

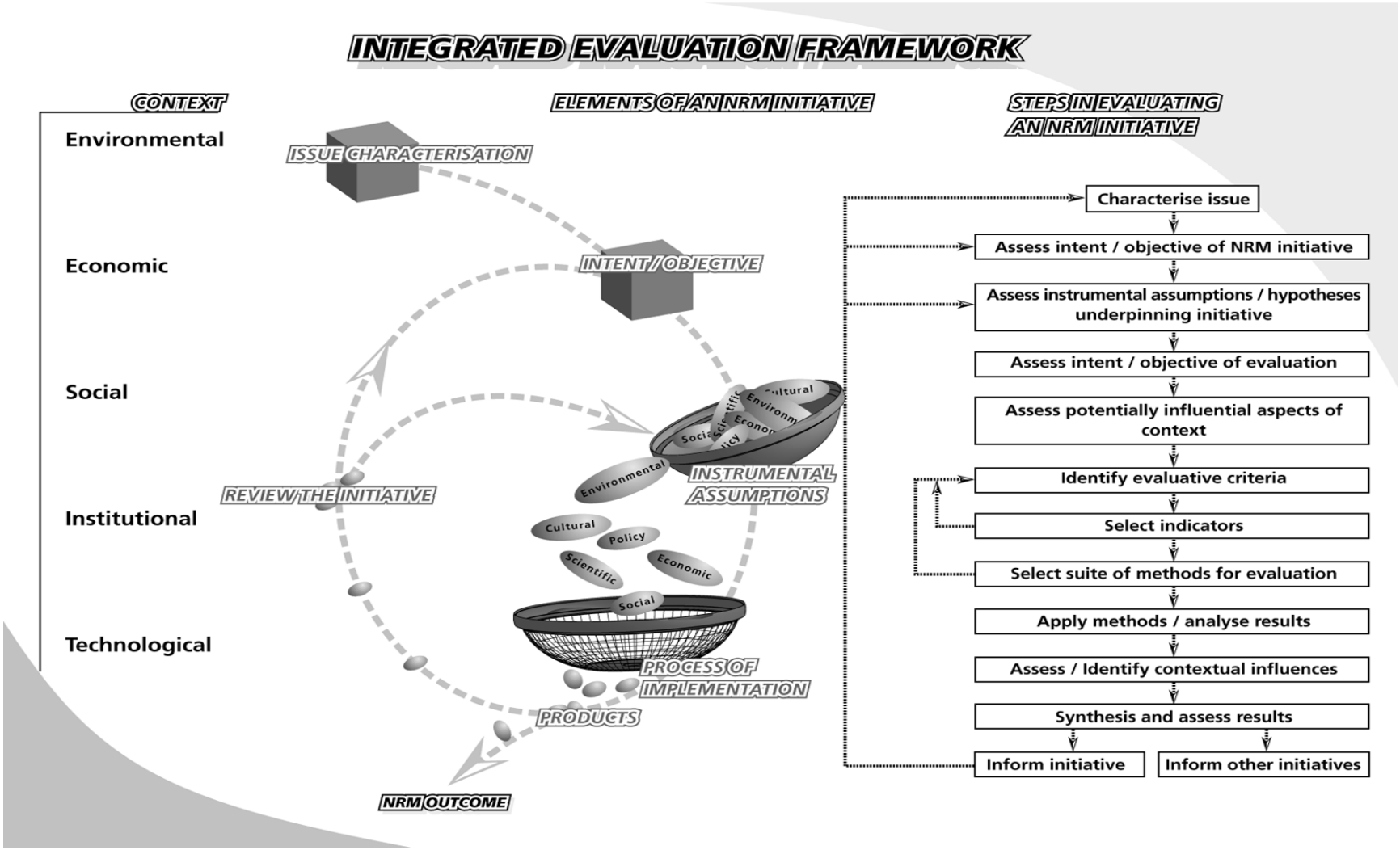


Figure 2. Integrated Evaluation Framework for NRM Policy Initiatives (see Bellamy et al. 1999b; 1999c).

3. METHODS FOR MONITORING & EVALUATING AN ICM POLICY INITIATIVE

3.1 Overview of Methodology

The CTC7 Project's approach to R&D on the integration of natural resource management and policy in the Herbert River catchment through a community-based ICM initiative had two basic characteristics:

(a) *interdisciplinary research* to integrate disciplines and balance economic, social, institutional and environmental considerations; and
(b) *methodological pluralism* involving matching quantitative and qualitative forms of analysis to ensure research rigour.

An interdisciplinary research approach is defined as:

> …. the use of an integrating theory or framework to link two or more disciplines, such that experts in each field work together to address a problem, or such that a single researcher draws on the different disciplines to address a problem. (Mobbs and Dovers 1999, p.3)

The conceptual framework presented in Figure 1 was developed by the research team members in the first year of the project to provide the theoretical underpinning and integrating framework for the research. It provided the basis for:

- the development of *evaluation criteria* for monitoring change and assessing progress and influence;
- structuring the implementation of disciplinary-based *research activities*;
- guiding the selection of investigative methods; and
- the *synthesis of findings* to provide an integrated evaluation.

3.2 A framework of Evaluation Criteria

The framework of evaluation criteria used in this study is identified in Table 2 and the process for their development and the related investigative methods is illustrated in Figure 2 and described in more detail in Bellamy *et al.* 1999b and c). Methodological pluralism through the use of a diversity of qualitative and quantitative techniques contributes to rigour in evaluation (Patton 198?). This diversity in methods allowed for 'triangulation' of theory and methods that make effective use of their complementarities in the analysis of findings.

3.3 Research Activity Summaries

Based on the framework of evaluative criteria, eleven separate and disciplinary-based research activities were established as the core investigative units for this interdisciplinary research project. These research activities are listed in Table 3. A full summary of each research activity that identifies its objectives, relationship to the evaluation framework, description of methods, key findings, recommendations and further reading is provided in Appendix 1 to this report.

Table 2. A framework of evaluation criteria and methods for ICM in the Herbert River catchment.

Evaluation Criteria/Measures	Methods (RA = Research Activity – see Appendix 1)
Characterisation of NRM Issues in the Catchment ➢ Extent and severity of resource use problems and progress of management responses ➢ Diversity of stakeholder knowledge, attitudes and values on natural resource use and management ➢ Scientific understanding, feasibility and acceptability of technical solutions to natural resource problems ➢ Extent of behavioural change required and by whom	• Spatial and temporal analysis of change in land cover and land use since European settlement using airphoto interpretation and GIS techniques and ABS and local mill data **(RA1)** • Integration of existing natural resource information (map and textual) from local state and federal agencies in a Herbert River Catchment Atlas **(RA 1)** • Spatial and temporal analysis of nutrient and pesticide usage in the lower Herbert catchment through analysis of sugar industry records, chemical company sales records and producer interviews **(RA 1)** • Bench-marking attitudes, values and behaviour through two surveys of Herbert community residents in 1995 and 1998 **(RA 6)** • Assessment of the local understanding on catchment processes and its potential contribution to progress in ICM through trial stakeholder interviews and workshops **(RA 2)** • Mapping of change in the system of organisational structures and linkages on NRM in the Herbert catchment from 1993 to 1998 through interviews of key informants and review of documentation **(RA 4)** • Spatial and temporal analysis of the sugarcane assignment process from 1993-1996 in the Herbert through review of official records, semi-structured interviews of key informants, GIS techniques and geo-statistical analysis **(RA 5)**
Implementation Context for the ICM Policy Initiative in the Herbert River Catchment ➢ Local rationale and motivation for the commencement and on-going development of the Herbert River ICM initiative ➢ Socio-economic conditions and use of technology ➢ Community attitudes and support for ICM ➢ Attitudes and resources of local constituency groups ➢ Support from politicians ➢ Media coverage and attention to NRM issues and ICM	• On-going monitoring and analysis of documentation on the ICM process including consultancy reports, HRCCC meeting minutes, stakeholder organisation annual reports **(RA 4)** • Analysis of ABS Census data for 1991 and 1996 for the catchment **(RA 4, RA 9)** • Bench-marking attitudes, values and behaviour through two mail-out surveys of Herbert community residents in 1995 and 1998 **(RA6)** • Bench-marking attitudes, values and behaviour through semi-structured interviews of HRCCC members in 1995, 1997 and 1998 **(RA 4)** • Catchment stakeholder workshop to benchmark attitudes and values on natural resource issues and ICM in 1995 **(RA 4)** • Interactive annual forums with HRCCC members as a group **(RA 4)** • Content analysis of a local tabloid newspaper to assess change in presentation of NRM issues and ICM since initial inception of ICM in 1990 **(RA 8)** • Input-output economic analysis of the Herbert catchment regional economy in 1996 **(RA 9)**

Evaluation Criteria/Measures	Methods (RA = Research Activity – see Appendix 1)
Adequacy of Policy Frameworks and Institutional Arrangements for ICM at state and local catchment levels ➢ Clarity and consistency of roles and objectives of ICM and other responsible agencies/groups for NRM ➢ Adequacy of financial resources for ICM ➢ Coordination among ICM and other responsible agencies/groups for NRM ➢ Adequacy and effectiveness of policies, plans and decision rules of ICM and other responsible agencies/groups for NRM ➢ Commitment and skill of staff in ICM and other responsible agencies/groups for NRM ➢ Opportunities for formal access by wider community	• On-going monitoring of the evolving legislative and administrative arrangements for ICM and NRM at the local, state and Commonwealth level though annual open-ended interviews with government officials/key informants/participants and compilation and review of documentary sources (**RA 3)** • On-going monitoring and analysis of documentation on the ICM process and arrangements in the Herbert including consultancy reports, HRCCC meeting minutes, agency annual reports. (**RA 4)** • Catchment stakeholder workshop to benchmark attitudes and values on institutional arrangements and ICM in 1995 **(RA 4)** • Bench-marking attitudes, values and behaviour through mail-out surveys of Catchment Coordinators and Chairs across Queensland in 1995 and 1997 **(RA 3)** • Interactive annual forums with HRCCC members as a group **(RA 4)** • Bench-marking attitudes, values and behaviour through semi-structured interviews of HRCCC members in 1995, 1997 and 1998 **(RA 4)** • Review of ICM and Local Government Planning schemes based on review of legislation, consultancy reports and documentation on institutional and administrative arrangements as well as semi-structured interviews with key informants in the Herbert River catchment (**RA 4)** • Mapping of change in the system of organisational structures and linkages on NRM in the Herbert catchment from 1993 to 1998 through semi-structured interviews of key informants and review of documentation (**RA 4)** • Valuation of the establishment and operational costs of the HRCCC based on a review of official records and semi-structured interviews of key informants **(RA 9)**

Evaluation Criteria/Measures	Methods (RA = Research Activity – see Appendix 1)
Adequacy and Equity of the Herbert River ICM Processes ➢ Knowledge and expectations of the process by stakeholders ➢ Degree of coordination of resources to address catchment issues ➢ Degree of motivation, commitment , cooperation and support for the process ➢ Efficiency and effectiveness of process ➢ Equity and procedural justice and perceptions of trust in process ➢ Influence of ICM on planning activities in the catchment ➢ Agreed responsibilities and roles ➢ Integration (of processes in structure and context)	• Catchment stakeholder workshop to benchmark perspectives on community-based policy initiatives and ICM in 1995 **(RA 4)** • Bench-marking attitudes, values and behaviour through two mail-out surveys of Herbert community residents in 1995 and 1998 **(RA6)** • Bench-marking attitudes, values and behaviour through semi-structured interviews of HRCCC members in 1995, 1997 and 1998 **(RA 4)** • Bench-marking attitudes and values through mail-out surveys of Catchment Coordinators and Chairs across Queensland in 1995 and 1997 **(RA 3)** • On-going monitoring of the evolving legislative and administrative arrangements for ICM and NRM at the local, state and Commonwealth level though annual open-ended interviews with government officials/key informants/participants and compiling documentary sources (**RA 3)** • Review of ICM and Local Government Planning schemes based on review of legislation, consultancy reports and documentation on institutional and administrative arrangements as well as semi-structured interviews with key informants in the Herbert River catchment (**RA 4)** • Content analysis of a local tabloid newspaper to assess change in presentation of NRM issues and ICM from 1990 to 1998 **(RA 8)** • Spatial and temporal analysis of the sugarcane assignment process from 1993-1996 in the Herbert through review of official records, semi-structured interviews of key informants, GIS techniques and geo-statistical analysis **(RA 5)** • Telephone interview questionnaire of 60 stakeholders to assess the degree of communication among stakeholders and effectiveness of organisational communication networks of ICM in the Herbert **(RA 7)** • Cost-benefit Analysis of the activities of the Herbert River Catchment Coordinating Committee **(RA 9)** • Mapping of the change in the system of organisational structures and linkages on NRM in the Herbert catchment from 1993 to 1998 through semi-structured interviews of key informants and review of documentation (**RA 4)**

Table 3: Listing of Research Activities in LWRRDC R&D Project CTC7.

Research Activity No.	Title
1	Analysis of Resource use in the Herbert River Catchment
2	Local Knowledge and Integrated Catchment Management
3	Institutional Arrangements for the ICM Program in Queensland
4	Monitoring the Implementation of ICM in the Herbert River Catchment
5	Analysis of the Sugar Cane Assignment Process in the Herbert River Catchment
6	Community Survey
7	Organisational Communication among ICM Stakeholders
8	Media Study
9	An Economic Evaluation of ICM in the Herbert River Catchment
10	Information Needs for ICM

4. ICM IN THE HERBERT RIVER CATCHMENT

4.1 Inception of ICM in the Herbert River Catchment

ICM in the Herbert River catchment is a voluntary process initiated by key actors in the local community from the sugar industry and local government with the convening of Catchment Management Steering Committee in July 1992. The impetus for principal stakeholders in the catchment to lobby the then Minister for Primary Industries for support and endorsement of an ICM process in the Herbert River catchment was threefold:

a. Broad community-based concern over the ineffectiveness of fragmented government decision making on river management issues (in particular flooding and drainage), and the failure of past studies to move beyond the development of plans and lead to action on the ground to resolve these issues;
b. The perceived need within the catchment for more active and meaningful community involvement in decision making on these issues, that is beyond a basic consultative approach; and
c. The personal and political agendas of influential actors in the lower Herbert catchment, who were in part motivated by a desire for 'a piece of the action' (i.e. ICM in Queensland), including potential funding opportunities for 'pet projects' of interest to specific stakeholders (such as on-ground drainage works in sugarcane producing areas).

In February 1993 the Herbert River Catchment ICM Steering Committee sent letters of invitation to 14 organisations to nominate representatives for the HRCCC. The key issues that were identified in this invitation as needing to be addressed in the Herbert catchment were:

1. *Land Management* (erosion control, drainage coordination, land use practices, interface of drainage with coastal outlets);
2. *River management* (stream bank erosion/slippage, habitat protection, coordination of levee bank structures, bed rejuvenation, flood management planning);
3. *Community awareness* (education regarding catchment management, environmentally friendly sustainable agriculture and its linkages with the well being of the total community);
4. *Coordination of agencies and resources* (RIT, Drainage Boards, CSIRO CZP, SRDC, DEH, DPI); and
5. *Land use planning* (formulating advice regarding Crown land allocation and use, liaison with industry, local authorities and Govt. agencies regarding land sue and infrastructure planning).

The Herbert River Catchment Coordinating Committee (HRCCC) was officially launched by the Minister in March 1993. A Catchment Coordinator was appointed in April 1994 by the HRCCC in collaboration with the Queensland Government lead agency for ICM (currently DNR) to formally facilitate the process.

Community views on natural resource issues in the Herbert catchment

In the 1970s and 1980s, there were a number of major studies commissioned by local government and statutory river management authorities in the Herbert catchment in collaboration with the State government. These were largely engineering studies that examined water management issues in the lower catchment relating to flooding, rural drainage planning, and stream management. Table 4 compares the issues identified in these studies with two subsequent workshops; the first being a meeting of community stakeholders held in 1992 that was the catalyst for the establishment of ICM in the Herbert, and the second a workshop held in late 1995 as part of this case study research to evaluate the Herbert ICM process.

Table 4. Comparison of Issue Characterisation in the Herbert River catchment prior to 1995.

	Herbert Technical Studies 1976, 1980, 1984	Community Workshop August 1992	ICM Evaluation Project Stakeholder Workshop June 1995
Key Issues Identified	Lower Herbert Catchment focus: • flood mitigation • stream and river bank erosion • uncoordinated drainage on river floodplain	• flooding • sedimentation • bank erosion • major river course changes • rural drainage • tourism and recreation • biological issues (including wildlife habitats) • water quality and quantity	• lack of long term planning of water management and land development • lack of coordinated drainage strategies • conflict over flood protection works • riparian zone management • habitat management and protection • increased erosion and sedimentation in river • pest management planning • long term sustainability of agriculture • land development/conservation conflicts
Perceived Key Impacts	• economic consequences (e.g. major crop losses) • infrastructure and property damage	• loss of valued land • loss of production • infrastructure/asset damage • access difficulties • loss of recreational and tourism opportunities	• loss of crop production and profitability • land degradation • river aggradation • reduced stream capacity • stream bank destabilisation • habitat destruction/modification • water quality and quantity problems • localised flooding • conservation impacts • social conflicts • alienation of land for other uses
Key Mechanisms Identified for Addressing Issues	• a range of largely engineering-based studies to investigate stream processes/river morphology for flood management and rural drainage coordination • flood mitigation works (e.g. levees, floodgates, overflow channels, rock works) • removal of river vegetation	• a range of infrastructure and related works programs (eg. removal of river sediment, bank stabilisation; rationalisation of levee system; increased capacity of flood gates; stream bank revegetation) • review/reform of institutional structures and arrangements for river management • ICM implementation to support a coordinated approach to decision-making and to facilitate community participation • community education and PR plan	• create a common understanding of ICM • foster and maintain a long term commitment to an ICM process which is seen as a "way of doing business" for government and the community • local government as action agency - use planning and development controls • state government to foster cooperation • use controls on leasehold land • industry codes of practice

A comparison of these suggests that (a) the 'solutions' established by the earlier engineering studies and methods used to arrive at those solutions were not in line with community expectations, and (b) community perspectives on issues across catchment interests have evolved over time to encompass a broader range of natural resource management issues including riparian zone management, habitat management and protection, impacts of agricultural activities on tourism and recreation, and calls for greater community involvement in decision-making. Most significantly at the 1995 workshop (Bellamy *et al.*1995) several stakeholder groups identified the lack of long term planning of water management and rural land development activities as a major issue needing to be addressed for the first time.

Perceived impacts of natural resource management issues have broadened from an initial focus on productivity and infrastructure impacts to encompass loss of alternative use opportunities and environmental and ecological factors. Perceptions of the key mechanisms for resolution have also shifted from an initial focus on "engineering based" approaches to include policy incentives and legislative controls or individual action. The key mechanisms for a more integrated planning approach to resource management and land development were seen as an effective ICM process with the support of state government to foster cooperation, the development of industry codes of practice, and the use local government planning and development controls.

This was the local background to the commencement of the ICM process in the Herbert River catchment.

4.2 External Context, Funding and Organisational Arrangements

As only one small catchment in Queensland, the progress of community based ICM in the Herbert is greatly affected by the State's ICM program in particular, but also the complex set of resource management and resource allocation programs that impinge on development, decisions and finances in the area. Successes and failures, factors that constrain and assist the ICM program can only be judged against this baseline.

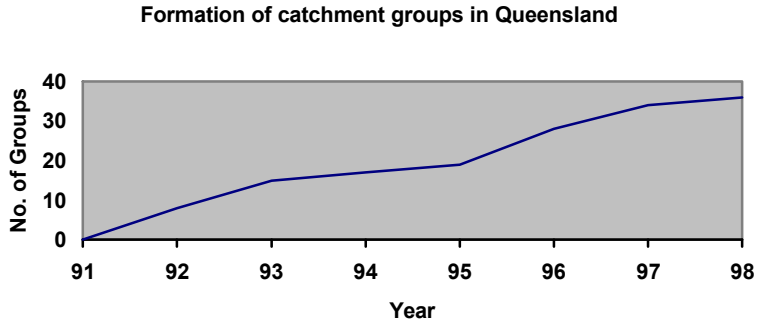
In Australia, land use planning and natural resources management are State Government functions, undertaken by a range of conventional and essentially single-purpose agencies. All of the Australian States have adopted programs of integrated catchment management under a variety of names and using a variety of policy and legislative frameworks. In some states ICM is called Total Catchment Management (TCM) or Integrated Catchment Management. At present the application of ICM varies widely throughout Australia, with some states such as NSW having established legislation, whilst others such as WA and Qld have no generic legislative powers. In effect there have been six experiments running in parallel but as yet no dominant model has emerged. Clearly, events in the Herbert may have been different if it had been located, for example, in Victoria.

The initial stage of the ICM program focused on five Pilot Study Areas: Johnstone River, Lockyer Valley, Pioneer River, Mitchell River and the Mary River. Catchment coordinating committees were established for each study area, comprising representatives from key interests groups from government, industry and the community. The committees role is to hold forums on catchment issues for community comments, identify and prioritise issues of concern in the catchment and develop and promote the implementation of catchment management strategies.

Critical to the survival and success of any program is the level of commitment through funding and staffing. ICM at the State level has survived using a mixture of state program and core funds and, most importantly through the National Landcare Program and its

successor, the Natural Heritage Trust. It is difficult to define accurately just what resources have been available for the ICM program and the Catchment Committees. Most significantly, the host Department, DPI then DNR (from 1995), provide in-kind support centrally and in the regions in the form of staff time and operational expenses. No one has estimated this accurately. Because catchment related research, planning and implementation support are closely interconnected with many programs. Disentangling specific ICM related expenditures (eg river improvement, water allocation) is difficult and conceptually dangerous. Most of the funding has been directed towards the appointment of catchment coordinators and to awareness raising and planing activities. Implementation of ICM priority projects and changes to resource allocation process require the cooperation of government agencies with finance and responsibilities in areas such as river improvement, land use planning, conservation and water allocation. The role of ICM committees in Queensland is to influence these activities not to take them over.

The ICM program in Queensland has been experimental, evolutionary and incremental. The early pilot studies informed the expansion and maturing process to the point that over 35 catchments are now formally included in the program as illustrated in the diagram below.



The ICM program has been surprisingly robust – its philosophy and implementation have remained relatively constant since 1991. Notable changes to the policy and institutional context include:

- Catchment Coordinating Committees are formally endorsed by the (now) Landcare and Catchment Management Council. Until 'committees' gain this recognition they are termed 'groups'. This developmental process has depended on improved understanding of community-based processes and the diffusion of ideas and experiences across the State
- The adoption of a strategic approach post-1993 was encouraged by strong incentives – no strategy, no funding. In general there has been acceptance of the need for strategies to guide catchment action and to focus the ICM process
- More recently strategic approaches have been adopted at the regional level in the form of regional NRM strategies.
- The NHT has played a significant role in funding ICM projects and process since 1995.

4.3 The Herbert River Catchment Coordinating Committee

4.3.1 Membership

The membership of the HRCCC is based on a representational structure. The steering committee set up in July 1992 identified key stakeholder organisations in the Herbert with a responsibility or interest in natural resource management in the catchment and in February 1993 invited them to nominate representatives for the HRCCC. Since then the HRCCC has reviewed membership and opportunistically invited additional stakeholder groups to participate in ICM through membership on the HRCCC as they saw fit. The number of

members on the HRCCC therefore has fluctuated since it was formally established in March 1993. The sector groups represented on the ICM Steering Committee in 1992 and on the HRCCC in 1993, 1995, 1997, 1998 are compared in Table 5.

Table 5. HRCCC membership 1992-1998.

Stakeholder Group	1992	1993	1995	1997	1998
INDUSTRY:					
CANEGROWERS	3	1	1	1	1
CSR Herbert River Mills	2	1	1	1	1
Cattlemans Union	-	1	1	1	1
Fruit and Vegetable Growers	-	1	1	1	1
Queensland Commercial Fishing Org	-	1	1	1	1
COMMUNITY GROUP:					
Hinchinbrook Citizen's Association	-	1	1	1	-
Recreational/Sporting Fishing	-		-	1	1
Landcare - lower catchment	1	1	1	1	1
Wildlife Preservation Society of Queensland	-	1	1	1	1
Herberton Shire Community/Landcare	-	-	-	1	0.5
GOVT/STATUTORY BODIES					
Catchment Coordinator (DNR)	a	a	b	b	b
Hinchinbrook Shire Council	1	1	1	3	3
Herberton Shire Council	-	1	1	1	0.5
Herbert River Improvement Trust	-	1	1	0.5	0.5
Drainage Boards	1	1	1	0.5	1
Hinchinbrook Development Bureau (tourism, business)	-	1	1	1	1
Herbert Pest and Productivity Board	-	-	1	1	0.5
TOTAL	8	13	14	17	15

a. Facilitation from Water Resources Commission and Catchment Coordinator for Johnstone River ICM (part time)
b. Facilitation from Herbert Catchment Coordinator (full-time)

Current representation on the HRCCC is diverse involving local industry (sugar, cattle, fishing, horticulture), local government and other statutory bodies, conservation and community interests. In 1998, nine of the current members (50%) had been involved with the HRCCC since its inception in March 1993. For example, one of the local government representatives on the HRCCC is also a sugarcane farmer and a beef cattle producer. Most of the members are active community members with multiple sectoral interests or 'hats'. Eleven of the seventeen HRCCC members are either sugarcane farmers or employed within the sugar industry reflecting the economic, social and cultural importance of the sugar industry in the lower Herbert catchment community. Until the beginning of 1999, the HRCCC has no state government departmental representation. However, the process is consultative with government and a Catchment Coordinator informally facilitates this.

The diverse membership reflects the influential groups, power structures, and community interest in the Herbert River catchment. For example, although the ICM initiative originated from community action in the lower catchment, the HRCCC from its inception recognised the need and actively sought the involvement of representatives from the upper catchment. In support of this involvement, the HRCCC negotiated funding for on-ground works to address problems and concerns relating to derelict tin mining dams in the upper catchment which were becoming a potentially divisive issue between the upper and lower catchment communities (i.e. poor domestic water quality and reduced river capacity due to increased sedimentation in the lower catchment caused by abandoned mine waste and tailing dams in the upper catchment).

Catchment Coordinator

The Catchment Coordinator's position is funded through the federal government's National Landcare Program and based in the Department of Natural Resources, the lead government agency for ICM in Queensland. In addition, local stakeholder groups including Local Government and sugar industry bodies have provided in-kind support in terms of office accommodation, administrative support and their HRCCC member's time. State and federal government grants that are awarded through a competitive bidding process also financially support most HRCCC activities.

On appointment in April 1994, the Catchment Coordinator adopted a strongly proactive role within the HRCCC in setting the initial agenda. This served to establish a legitimate role for the Coordinator within the committee and also for him to gain personal credibility with the 'established' community leaders of the HRCCC membership. Over time the Coordinator has moved to play a more facilitatory role within the HRCCC, particularly with the appointment in 1996 of a new Chairman. The new Chair has taken a more influential and proactive approach in setting the agenda, negotiating the functional role of the HRCCC, and in attempting to raise the profile of ICM within the Herbert community.

The Upper Herbert River Catchment Group

A Sub-Committee of the HRCCC was formally formed for the upper catchment in December 1998 to discuss and raise issues of particular relevance to the upper catchment. This sub-committee, the Upper Herbert River Catchment Group, arose because community members in the upper catchment felt that they were not equally represented on the HRCCC. The HRCCC membership has been overwhelmingly dominated by members from the lower catchment and has inevitably tended to have a focus on issues affecting the lower floodplain. In addition, there were logistical issues relating to the long distance between the upper and lower catchments (ie. a 4-5 hour drive). The new sub-Committee has 16 members selected to represent a broad range of catchment stakeholders from the community, industry and government as identified in Table 6.

In early 1999, the new Upper Herbert River Catchment Group identified and prioritised the key issues for the upper catchment as detailed in Table 7. Although there are some commonalities with those issues identified by the formal HRCCC, the focus of the issues identified by the upper catchment sub-committee is quite different in that they are largely concerned with specific land and water management issues rather than including broader planning and public good issues.

Table 6. Upper Herbert River Catchment Group representation.

Sector	**Stakeholder Group**
Industry Organisations	Mining industry Cattle industry/AG FORCE (2) Dairy industry Timber industry Red Bend Irrigators
Community Organisations	Herberton community Innot Springs community Ravenshoe community and tourism Coolgarra mining area Mt. Garnet Landcare Conservation (2)
Government	Herberton Shire Council Queensland National Parks and Wildlife Service Environmental Protection Agency

Table 7. Key issues in priority order for the Upper catchment.

1.	Weeds in general (ie. noxious weeds, ponded pastures, stream blockers)
2.	Erosion (ie. cost effective measures)
3.	Water conservation (ie. crop water requirements, changed water requirements (eg. for dairy, cane), best practices water harvesting, storage)
4.	Water quality (ie. turbidity, chemical, sediment)
5.	Land clearing (ie. best practice in native forest, management (fire, grazing, timber), potential cropping areas)
6.	Soil fertility (ie. potential for cropping – forage and fruit, salinity, manganese, nitrification)
7.	Wetland/wildlife preservation (ie. birds/maintenance of habitat (natural, artificial), feral animals)
8.	Land subdivision (ie. more and larger approvals, water quality implications, licensing, multiplier effects of dams)
9.	Creek and river restoration (ie. repair and cleaning)

4.3.2 Role of the HRCCC.

Since its formation the HRCCC has provided a forum for discussion and a marshalling of agency and community interests in a way that did not happen before the introduction of the institutional framework provided by ICM. In particular, the HRCCC has provided the functional roles of fostering coordination and cooperation across natural resource management interests in the catchment and of information provider and distributor on catchment resource issues.

The HRCCC's perception of its role has evolved from one of delivering natural resource outcomes and solving natural resource management issues on the ground to a more strategic role (McDonald and Bellamy 1997). The emerging attitude amongst HRCCC members to their role involves establishing a decision-making culture relating to natural resource use and agricultural development based on ICM principles as 'a way of doing business', and providing a strategic direction on resource management for the catchment through influencing catchment decision-making and planning processes. Notably, the HRCCC is facilitating a move within the catchment community from a prime focus of concern on disaster management (i.e. issues of river management including flood mitigation and drainage) to one that embraces the broader concept of natural resource management and community responsibility for the environment.

Specifically in 1998 HRCCC members identified ICM's role in terms of the activities of high to very high importance to ICM in the Herbert as (in order of relative importance):

- Encouraging Local Government to take an active role in environmental management issues
- Encouraging joint projects between community, industry and state and local government
- Providing a continuing source of advice to local government on catchment issues
- Encouraging discussion between community interest groups on environmental issues
- Raising the level of local awareness and knowledge of environmental issues on the catchment
- Encouraging coordination of state government programs
- Encouraging research
- Developing solutions for, and better understanding of, environmental problems in the Herbert catchment.

However the HRCCC considered roles of moderate to high importance were:

- Undertaking specific on-ground projects with other bodies.

A set of objectives were identified for the ICM initiative in the Herbert Catchment by the HRCCC in its draft Catchment Management Strategy for the first time (HRCCC 1996, p.i):

- Co-ordinate government agencies and the community to pursue common goals
- Seek community involvement in catchment management
- Reflect the requirements of the wider community within the Catchment
- Identify and rectify natural resource degradation
- Promote ways to prevent and reduce natural resource degradation
- Promote the wise use of all natural resources within the Catchment
- Identify key indicators of biodiversity and monitor as a measure of catchment health
- Encourage the retention of significant natural habitats within the Catchment.

These objectives are caste in general terms that encompass both ICM's role as a coordinator for natural resource management and planning processes between the catchment community, industry and government agencies as well as its role as a monitor of catchment health.

Beyond influencing perspectives on natural resource management and establishing a strategic direction for the future, the real challenge for the HRCCC and the Herbert community in general is to achieve its vision for the catchment as identified in the Catchment Management Strategy. Importantly, the potential lies for this approach, particularly through its key linkages and involvement of Local Government bodies to significantly influence future decision-making culture on agricultural development and resource use planning in the catchment. Early evidence of this is the incorporation of ICM principles into the new Hinchinbrook Shire Planning Scheme (McDonald and Bellamy 1997; Vella 1999).

4.3.3 HRCCC Priorities in NRM

The most important resource management issues in the catchment identified by HRCCC members since the inception of ICM are compared in Table 8. In general, member's perspectives on natural resource management issues had broadened and become more strategic in scope since 1995.

Table 8. Comparison of Perceived Key Resource Management Issues by the HRCCC 1993-1998.

March 1993	November 1995	November 1997	November 1998
Rural drainage	Rural drainage	Rural drainage	Drainage coordination/ management on floodplains
River improvement	Stream bed and bank erosion	River management	Waterways management and flooding
Rehabilitation of mining dams in upper catchment (water quality)	Urban flooding	Water quality	Water quality
Land management database	Allocation of sugar caneland	Caneland expansion	Land clearing/ sugar industry expansion
	Land clearing	Riparian management	Riparian vegetation management
		Wetland degradation	Wetland degradation/ management
Sugar industry infrastructure		Pest and weed management	Weed management
		Coordinated extension approach	Land use planning, catchment management
		Catchment planning	Grazing land degradation/erosion
			Water quantity/availability (upper)

Rural drainage, flooding, river management and sugar industry expansion and related land clearing have remained key issues for the HRCCC members across all surveys. However since 1997 additional issues identified were water quality (particularly relating to fish kills,

and stream sedimentation), riparian vegetation and wetlands management, pest and weed management, land use planning and a coordinated approach to catchment management. While in 1998, with closer linkages to the upper catchment community seeming to develop, two further issues largely important to the upper catchment were also identified as grazing land degradation/erosion and water availability issues.

4.4 HRCCC Activities and Achievements in NRM

4.4.1 Catchment Management Strategy

In May 1997, the HRCCC released a Herbert River Catchment Management Strategy for public comment (HRCCC 1996). This strategy is intended to provide a strategic framework for the future management of the Herbert River catchment's natural resources. It is issues-based and it identifies a broad range of priority management and planning issues, which are summarised in Table 9. Specifically, the strategy discusses key management and planning issues, identifies what needs to be done, who should take responsibility for undertaking the work and how the issue is to be addressed. An example of a strategy and the stakeholders to be involved is provided in Table 10. The strategy's issue focus is consistent with Laut and Taplin's (1989) view that an emerging trend for catchment management would be to concentrate on *issues* rather than on establishing a holistic strategic management approach in the catchment. Importantly, it clearly identifies the need for a coordinated effort amongst stakeholders in order to address these issues and move the community towards achieving sustainable development.

The strategy reflects the rhetoric of the Queensland ICM policy initiative in that it presents ICM in the Herbert as a partnership approach among local communities, local government, state government agencies, and industry bodies aimed at solving the priority resource use problems in the catchment. However, at this early stage in the implementation of ICM in the Herbert River catchment, members do not perceive the strategy guiding catchment stakeholders to implement substantive action to resolve catchment resource management issues. Rather HRCCC members perceive the strategy more as a vision for the future and a means at this point in time of securing eligibility for funding for projects and a Catchment Coordinator from federal and state government sources. Once State Government endorsement is obtained, members expect that it will provide the basis for gaining commitment of responsible State Government agencies to undertake projects in the Herbert catchment to address these issues. Importantly, the development of the Catchment Management Strategy is perceived by members to have been of value because of a number of qualities and outcomes of the development process that include:

1. *inclusive and transparent* to all members involved; bringing all viewpoints across organisations on issues together and out into the open.
2. *establishing a clear direction* for the HRCCC; helping to focus the HRCCC as an organisation and providing an overall vision for the catchment and a guide for action in the future.
3. *raising awareness* of catchment issues; especially improving Committee member's awareness of issues as well as other stakeholder's viewpoints on those issues.
4. *highlighting areas of common ground*; by identifying areas of agreement across diverse sector groups on some catchment issues, it provided a basis for the Committee to move ahead and develop better natural resource management and planning projects.

Table 9. Issues and key strategies identified in the Herbert River Catchment strategy (HRCCC 1996).

Key Issues	Recommended Strategies
Land Management (LM) • Inappropriate land use allocation and its impact on resources and natural systems • Impacts of land management on productivity • Impacts on other values of land and adjacent land and water resources	LM1 Coordinate land use planning to achieve balanced use of land, water and related natural resources LM2 Encourage best management practices in all rural industries LM3 Implement arrangements to reduce adverse impacts of agricultural drainage on natural systems and existing developments LM4 Reduce adverse impacts of non-agricultural land uses.
Water Management (WM) • Full and over-allocation of existing resources • Increasing demands on finite surface and groundwater supplies • Limited monitoring of water quantity and quality • Threats to quality of surface and groundwater supplies	WM1 Assess available resources and develop appropriate allocation policies in consultation with stakeholders WM2 Promote efficient use of water resources within the Catchment WM3 Promote the coordinated planning and implementation of water management schemes in the catchment WM4 Reduce contaminant inputs to surface and groundwater systems from point and diffuse sources WM5 Establish and promote water monitoring priorities and standards for the catchment.
Stream Management (SM) • Lack of awareness of stream values shown in development actions • Stream bank erosion and stream migration • Sedimentation • Impact of uncoordinated levee banks and flood mitigation schemes • Impacts of degradation of riparian zones • Instream habitat degradation such as weed invasion and loss of water holes	SM1 Continue implementation of a strategic approach to stream management SM2 Facilitate appropriate protection and management of riparian zones throughout the catchment SM3 Ensure development and engineering works associated with streams take account of all stream functions and issues SM4 Identify and protect sensitive areas, to retain the function and health of our stream systems SM5 Develop fisheries and habitat management plan for the stream systems of the catchment, involving stakeholder groups and the broad community SM6 Provide community awareness, support and involvement in stream management
Habitat Management (HM) • Threats to significant terrestrial and aquatic habitats and species • Loss of wetland and instream habitat quality and subsequent impacts on fish stocks • Fragmentation of remaining habitats through loss of connectivity (ie. corridors)	HM1 Promote the values of habitat retention and restoration to the broader community through awareness, technical support and incentives HM2 Maximise the habitat values of existing protected areas HM3 Ensure the retention of significant habitat values outside protected area reserves HM4 Protect and rehabilitate wetland habitats on the Floodplain HM5 Re-establish and manage riparian vegetation on watercourses throughout the catchment and ensure retention of existing riparian vegetation.

The first draft of the Herbert River Catchment Management Strategy took three years for the HRCCC to prepare, and was an important process in revealing the diversity and often conflicting perspectives across stakeholder groups represented on the committee. It was prepared by HRCCC members through a series of working groups and internal workshopping and released initially for public comment in June 1997. This received only interim endorsement from DNR. A revision of the strategy was made in 1998 and full endorsement of the strategy is currently being negotiated with the relevant State government agencies. Planned improvements to the strategy will address their concerns relating to better recognition of indigenous land issues and an apparent over emphasise on state government activities and responsibilities in addressing some catchment issues, that is the need for better recognition of local community responsibilities and action

Table 10. Example of the format for a strategy as identified in the Herbert River Catchment Management Strategy (HRCCC 1996).

What is to be done?	Who can do it?#	Priority*
Strategy HM1 : Promote the values of habitat retention and restoration to the broader community through awareness, technical support and incentives		
a) Provide technical support in the areas of: • land development planning • habitat retention • habitat management	DEH, DPI, DNR	1 1
b) Encourage all levels of Government to provide for habitat management through realistic incentives and/or sufficient funding.	CCC, LG	
c) Develop and promote awareness programs to highlight the values of habitat retention and implement through farm planning	DEH, CCC, DPI, DNR	2
#	*	
CCC Catchment Coordinating Committee DEH Department of Environment and Heritage DNR Department of Natural Resources DPI Department of Primary Industries LG Local Government (Hinchinbrook and Herberton Shire Council	1. Immediate, commences within 6 months 2. Short-term, commences within 12 months 3. Mid-term, commences within 2 years 4. Long term, commence within 3-5 years	

4.4.2 Achievements of ICM in the Herbert Catchment

The key achievements of ICM in the Herbert in its first five years of activity may be summarised as:

(i) Initiating a range of focussed or single-issue land management projects to establish credibility and raise awareness of ICM process and natural resource management in general with the Herbert community (rather than focussing on issues of strategic importance to catchment management).

(ii) Achieving recognition as a legitimate community referral agency for the state and local government authorities on proposed developmental and infrastructure projects and other natural resource issues in the catchment.

(iii) Providing an effective community forum for discussing and progressing catchment issues, including revealing the range of different stakeholder perspectives on these issues as well as highlighting potential areas of community conflict.

(iv) Development of a Herbert River Catchment Management Plan that provides the essential elements of a 'sustainable' vision for the catchment.

(v) Establishing a coordinative role within the Herbert River community as principal broker negotiating funding for industry and community groups to undertake natural resource management projects and activities in the catchment.
(vi) Information provider and disseminator through HRCCC meetings providing a 'community forum', initiating focussed activities that locally have a relatively high profile, as well as through the existing communication networks of HRCCC member organisations.
(vii) Influencing development proposals and planning processes in the catchment to incorporate ICM principles.

Progress on the Herbert ICM process has been incremental and evolutionary. The specific development in these major achievements identified by HRCCC members in the 1995, 1997 and 1998 are summarised in Table 11. The achievements recognised have broadened since 1997 to encompass community impact (e.g. awareness raising) and an HRCCC role as a recognised and influential body on natural resource management issues in the catchment.

Table 11. Members opinions of HRCCC achievements.

1995 Achievements	1997 Achievements	1998 Achievements
• Establishing a group that is bringing key catchment group representatives together to talk and share ideas. • Preparation of an initial draft catchment strategy. • Assisting community groups and agencies to undertake projects (e.g. tin mining sites in upper catchment).	• HRCCC meetings providing a forum that brings people together in the catchment with very different views. • The preparation and launching for public review of the Draft Herbert River Catchment Strategy. • Getting funding and undertaking a range of projects. • Raising awareness of catchment problems amongst HRCCC members and within the community • Taking on a coordinative and integrative role on natural resource issues in region • Recognition as a source of advice on natural resource issues in the catchment.	• Providing a forum that brings very different people in the catchment together to exchange ideas and providing a catalyst for change • Supporting and brokering funding for a wide range of projects on natural resource management (including the development of a catchment management strategy) • Raising community awareness of catchment NRM issues • As an influential group on NRM in the catchment

4.4.3 Significant Projects

From 1995 to 1998, there was a significant increase in the number and variety of project that the HRCCC became engaged in as shown in Table 12. They broadened from tin mines and tailing dam inventory in the upper catchment in 1995 to include in 1997 and 1998 a joint project with Herbert River Improvement Trust (HRIT) at Long Pocket on bank stabilisation, the owl nesting box program, a Catchment Atlas, several restoration and revegetation projects, riparian vegetation mapping study, weed control, riparian "community" forum, acid sulphate soils awareness, and a cooperative project to link ICM and local government planning.

Table 12. Comparison of key projects undertaken by the HRCCC, 1995-1998.

November 1995	November 1997	December 1998
• Funding for tin mine and tailing dams inventory.	• Project with HRIT at Long Pocket wash away. • Several Owl nesting box program • Joint restoration and revegetation projects (e.g. Wharps area, riparian area management, artificial wetland development, tree planting). • Riparian vegetation mapping study • Riparian "community" forum. • Acid sulphate soils awareness.	• Mine tailing dam survey (upper) • Joint project with HRIT at Long Pocket on riverbank rehabilitation • Owl nesting boxes • Getting community involved in Landcare projects (eg. Wharps Estate, creek restoration, tree planting, Waterwatch) • Riparian vegetation mapping • Acid sulfate soils awareness • Herbert River Catchment Management Strategy • Catchment Atlas • Support for Herbert Mapping Project which led to the establishment of the Herbert Resources Information Centre (HRIC) • Weed control/clearing of waterways • ICM/Local Government wetlands study

These projects have been undertaken by the HRCCC to meet its stated objectives and they have been funded from both the public purse as well as from the catchment community. Evaluations have been undertaken of a number of activities relating to specific issues identified in the Herbert Catchment Management Strategy. These are the preservation of natural habitats, management of vegetation in riparian areas, management of floodplain drainage, management of wetlands, management of acid sulfate soils, strategic river bank protection, and stabilisation of mining dams in the upper catchment. If the activities undertaken did result in changed resource management practices, the estimated costs and benefits incurred are summarised in Table 13. They are also described in more detail in Activity Summary 9 of Appendix 1 of this report.

Overall, the activities undertaken by the HRCCC have the potential to significantly improve or preserve the condition of natural resources in the catchment.

Table 13. Summary of potential costs and benefits of HRCCC activities (from Robinson *et al.* 1999*)*.

Issue	HRCCC Activity	Potential Costs of Activity	Potential Benefits
Management of vegetation in riparian areas	• Mapping of riparian vegetation • Raising community awareness of restoration and retention of riparian vegetation • Organising a Community Riparian Forum with guest speakers	*Individual landowners:* • Cost of revegetation/restoration of riparian areas varies with width required along watercourse and extent of revegetation (eg. 40m buffer corridor costs $120K/km) • Opportunity cost of land which varies with cane assignment/farm size (eg. a 4ha riparian area, with 40% normally under cane would incur a net income loss of $4,000 per annum. This would represent 4% per annum of the net income for a farm with 100ha assignment but 10% per annum net income loss for a farm with 40ha assignment)	*Individual landowners:* • Reduced rat damage to cane crop (eg. value of protection of 8ha area of riparian vegetation is $23K per annum) • Avoided cost of baiting control (where applicable) • Reduced damage to cane resulting from aquatic weed inundation • Improved drainage • Stabilisation of river bank leading to reduced risk of cane loss due to stream bank collapse and scouring *Catchment Community:* • Improved water quality downstream • Improved habitat for fish and crustacea leading to reduced fish kills • Improved natural habitat and source of nutrients for riverine plants and wildlife • Aesthetic benefits (eg. Native wildlife habitat)
Preservation of natural habitats	• Owl box program in support of an integrated approach to pest management	*Individual landowners* • Cost of building owl nesting box and hunting perches ($80/box) *Catchment Community:* • Cost of hire of cherry picker of $1500	*Individual landowners* • Reduced rat damage to cane (see above) *Catchment Community:* • Adoption of ecologically sensitive pest control • Aesthetic benefits
Management of drainage	• Lobbying for technical drainage expert extension officer • Fostering of Landcare group to resolve Wharps Sub-division drainage problems	*Catchment Community:* • Cost of drainage reparation works	*Individual landowners* • Reduction in loss of cane production due to poor drainage *Catchment Community:* • Reduction in adverse impacts of inappropriate drainage infrastructure on other land-owners and habitats • Reduced social conflicts and reduction in litigation and transaction costs associated with negotiation over drainage management

Issue	HRCCC Activity	Potential Costs of Activity	Potential Benefits
Management of wetlands	• Raising awareness of ecological importance of retaining natural wetlands on farm • Fostering the development of artificial wetlands on cane farms	*Individual landowners:* • Opportunity cost of land • Construction costs of wetland vary according to size and site of area to be constructed and availability of suitable areas for disposal of soil (eg. Cost of 0.3ha lagoon up to 3m deep range from $15K to $20K) *Catchment Community:* • Contribution to salary and on-costs for DNR extension officer	*Individual landowners:* • Improvement to on-farm drainage • Source of water in dry periods • Aesthetic attraction of habitat etc. *Catchment Community:* • Retention of significant natural habitats on the Herbert floodplain for fish and wildlife • Providing a retention basin for nutrients and sediments in wetland leading to improved water quality downstream • Improve recharge of groundwater • Aesthetic benefits
Management of acid sulfate soils	• Raising farmer awareness of potential problems of acid sulfate soils	*Individual landowners:* • Estimated opportunity cost of land (eg. decision not to convert grazing land to caneland) for area 'at risk' in catchment (approx. 787ha) is approx. $1,772K per annum. *Catchment Community:* • Costs of media releases and distribution of literature to "at risk" farmers	*Individual landowners:* • Avoided costs of loss of cane production (eg. 1% reduction in yield on current caneland in ASS prone areas is approx. $20K per annum) varies with size of area of potential impact *Catchment Community:* • Avoided costs (eg. Avoidance of fish kills and degradation of estuarine habitat)) varies with size of area of potential impact
Strategic river bank protection	• Joint project with Herbert River Improvement Trust at Long Pocket	*Catchment Community:* • Cost of works (eg. bank stablisation using vegetation and rock protection as well as land use changes)	*Individual landowners:* • Avoided costs of loss of cane production *Catchment Community:* • Protection of existing infrastructure (eg. cane railway link to mill and road bridge across river) • Prevention of river bank erosion upstream causing loss of riparian vegetation and adjacent productive cane land • Reduction in siltation downstream
Stabilising relict mining dams in the upper catchment	• Inventory of derelict tin dams in upper catchment to assess risk and prioritise work needed • Fostering of coordinated action between government agencies and landowners	*Individual landowners:* • In-kind contribution of time and earth moving equipment *Catchment Community:* • NLP Project grant of $21K p.a. for dam wall stabilisation	*Individual landowners:* • Improved water supply to property owners *Catchment Community:* • Improved water quality downstream • Avoidance of risk of dam failure

5. EVALUATION OF ICM IN THE HERBERT RIVER CATCHMENT

The evaluation of the ICM process in the Herbert River catchment presented below uses the framework identified previously in Table 2 and presents a synthesis of the findings of the eleven project activities, which are presented in summary form in Appendix 1 to this report. The reports and other publications relating to each of these research activities are also identified in Appendix 1.

5.1 Characterisation of NRM Issues in the Catchment

5.1.1 Extent and severity of resource use problems and progress of management responses in the catchment

The Herbert River catchment is a rural catchment of approximately 10,000 sq km in the wet tropics area of north-eastern Queensland. It does not have a single compelling natural resource management issue of the magnitude of salinity to focus community attention to catchment scale issues. Rather it has a range of significant land and water management issues relating to land clearing, flood protection and drainage management for rural land use over a long time frame of development.

Land use and cover
Agricultural and pastoral production are the largest uses of land in the catchment. In terms of arable agricultural production, the sugar industry located in the lower catchment is dominant, with approximately 65000 ha of sugarcane under cultivation (6.5% of the total catchment area). Other important industries are plantation forestry (1.3%) and small crops such as pineapple, melon and pumpkin (1%). Less important crops include papaya, banana, lychee and mango. Lands not used for arable agriculture or forestry are mainly under native vegetation or improved pastures for beef cattle production (90% of the area). This is especially the case in the upper catchment. Small areas are utilised for mining (in the upper catchment only) and industrial activities, or are alienated for urban development.

There have been substantial changes in land cover and land use in the Herbert River catchment since European settlement, particularly in the lower catchment. Prior to European settlement in the 1860's, the area was dominated by open grassland, rainforest, mangrove s, Eucalypt woodlands and *Melaleuca* communities. However, by the 1940's large losses of rainforest and *Melaleuca* dominated patterns had occurred and much of the native grassland had been converted either to grazing or sugarcane. Land cover remained relatively stable throughout the 1960's and early 1970's. However, the period between 1977 and 1996 saw a rapid expansion in the area of land under sugarcane from 27000 ha in 1977 to approximately 65000 ha in 1996. The consequences of this expansion have been a decrease of approximately 65% in the area of *Melaleuca* dominated patterns when compared to pre-European estimates, a 60 % decrease in the area of beachside vegetation, a 20% decrease in the area of Eucalypt woodland; and a 10% decrease in the areas of rainforest patterns. The area of mangrove communities and open water has remained relatively stable since 1943, while the area of sugarcane has more than tripled between 1943 and 1996. However the total area alienated for urban and industrial land in the catchment is small within the context of the total catchment area (ie <1%). Land cover and land use in the upper catchment (predominantly extensive grazing of unimproved pastures) has remained relatively constant since the 1940s.

Chemical usage
Total fertiliser N (nitrogen) and P (phosphorus) use in the catchment has increased with time, however it is important that these increases are placed in the context of changes in land

use. The total area of rural land fertilised is approximately 7.5% of the total catchment area, with the majority of this (ie. 6.5% of the total area fertilised) for sugarcane cultivation. As the area of sugarcane cultivated has continued to increase, N fertiliser inputs (kg ha^{-1}) has also increased, reaching a peak in the late 1980's. Early indications are that this trend may be declining as sales of fertiliser post 1990 have declined and current Bureau of Sugar Experimental Stations (BSES) fertiliser recommendations for the Herbert River district advocate reduced rates of N. P fertiliser inputs (kg ha^{-1}) have also increased, although both rates and total use declined for a period in the 1970's coinciding with the removal of the government fertiliser subsidy and the energy crisis. Inputs of N and P to improved pastures increased dramatically during the 1980's, however their relative contribution to total catchment inputs was small. Subsequent conversion of pastures to sugar cane has meant that the area of this land type fertilised has declined to negligible levels by 1998. The area of exotic pine plantations has increased since their establishment in the 1970's, although additions of N and P (kg ha^{-1}) have decreased since the late 1980's. The area of horticulture and small crops in the catchment has varied with time, although N and P usage (kg ha^{-1}) has remained relatively stable.

A large number of agrochemicals have been applied in the Herbert River catchment since European settlement. In 1995 approximately 7% of the total catchment area was receiving pesticide applications, with approximately 95% of total applications (by volume) occurring in cane growing areas of the lower catchment. With an increasing land area under sugarcane and other crops, total agrochemical use in the catchment has increased with time and it provides a potential source of contaminants to the adjacent water of the Great Barrier Reef Marine Park (GBRMP). While many of the highly persistent pesticides were withdrawn from usage in the late 1980's and early 1990's, their fate in aquatic and marine environments of the Herbert River and adjacent GBRMP are unknown.

Integration for natural resource management
Established social networks and interactions, fundamental social values, legal and institutional frameworks and historical influences have shaped the current human/community association with the natural resource environment in the Herbert River catchment and will inevitably continue to influence the pattern in future. At the inception of ICM in the Herbert in 1992, a broad range of community, industry and local and state government organisations with some level of responsibility or an interest in resource use management and planning were present in the Herbert River Catchment. However, there was a clear lack of integration or formal linkages between these organisations on natural resource management that would support an integrated approach to the management of the land and water resources of the catchment.

5.1.2 Diversity of stakeholder knowledge, attitudes and values on natur al resource use and management

At the commencement of ICM in 1992 in the Herbert River catchment there was a relatively low level of awareness of ICM issues in industry, local government and the broader community, except for the compelling issues of flooding and drainage in the lower catchment. Since ICM's inception in 1992, rural drainage, flooding, river management and sugar industry expansion and related land clearing have remained key issues in the catchment. However, emerging issues since 1995 are water quality (particularly relating to fish kills), riparian vegetation and wetlands management, integrated pest and weed management and a coordinated approach to land use planning and resource management in the catchment. With closer linkages with the upper catchment community particularly since 1998, grazing land degradation/erosion and water availability are also identified by HRCCC members as key issues of concern.

The focus of the issues identified by the new upper catchment sub-committee of the HRCCC formed in early 1999 relate largely to specific land and water management issues (eg. weeds, soil erosion, land clearing). This contrasts with the current views of the lower catchment-dominated HRCCC, which is now more focussed on broader planning and public good issues (eg. land use planning, coordinated drainage management, and riparian and wetland management).

Opinions in relation to key resource management issues and constraints are impacted significantly by understanding. Although there is good agreement among HRCCC members on the key catchment resource management issues, individual stakeholder/member diagnosis of their causes and possible solutions varies significantly. The decision context is also perceived to vary with the type of catchment issue. In 1998, members identified that three catchment issues - water quality (particularly relating to fish kills), waterways management and flooding, and floodplain drainage coordination – had both a high to very high degree of technical complexity and a high to very high intensity of community conflict. While industry expansion, land/vegetation clearing and land use planning had a moderate level of technical complexity but a high to very high intensity of community conflict in the decision context. In contrast, riparian management and wetland degradation have a low to moderate level of technical complexity and a moderate intensity of conflict. This situation has distinct implications for the type of community involvement required for each issue in seeking their resolution (eg. consensual, consultative).

HRCCC members perceive that the key catchment issues are difficult for ICM to address because of (a) 'institutional failure' (eg. slow government responses and strategies, departmental conflicts, lack of government commitment to a 'whole of government' approach) and (b) economic issues (eg. high costs of solutions and lack of financial capacity in the community).

5.1.3 Scientific understanding, feasibility and acceptability of technical solutions to natural resource problems

Concern over flooding has been a community issue in the lower catchment since the 1880s. However flood mitigation works and the development of uncoordinated drainage systems have been the cause of considerable community conflict. Since the late 1970s, there have been five major technical studies commissioned by the Herbert River Improvement Trust (HRIT) and the Hinchinbrook Shire Council in collaboration with state government agencies that have examined water management related issues with respect to flooding management, rural drainage planning, and stream management planning. Continuing conflict over these predominantly engineering-based technical solutions was perceived to be impeding economic and social development for the Herbert River catchment community and prompted the call for an ICM process from key actors in the catchment in 1992. Importantly, at the time of inception of ICM in the catchment, technical information and understanding of the catchment resources was either not widely shared or in an inaccessible form for key decision-makers.

Since the establishment of an ICM process in the catchment, water quality has increasingly become recognised within the local community as a major issue of concern. These concerns relate to the quality of town water supplies in the lower catchment, several significant fish kills since 1998 in streams draining the lower floodplain and the potential detrimental impact on the adjacent the estuarine and marine environments of the Great Barrier Reef lagoon.

Understanding of cause-effect relationships and 'solutions' to major issues in the Herbert River catchment have varied along a scale of 'speculative' (eg. fish kills) to 'uncontested' (eg. acid sulfate soils). The lack of technically uncontested 'solutions' for highly sensitive issues in the catchment at times has led to substantial community conflict and lack of confidence in government, research and other relevant agencies and therefore has inhibited progress on these issues. The resolution of such sensitive issues requires clear local interpretation supported by appropriate and locally credible data.

5.1.4 Extent of problem recognition and acceptance of change required and by whom

Land allocation

Inappropriate land allocation is identified in the Herbert River Catchment Management Strategy as the major land use issue for the catchment. Its major impacts are lost opportunity for other uses, loss of prime agricultural land, excessive soil erosion and downstream sedimentation, water quality issues (surface and groundwater), loss of significant native vegetation and wildlife habitats and conflicts between adjacent incompatible land users. Past land and water management practices in the catchment (eg. land clearing and expansion of intensive agriculture by rural producers, and reactive, ad hoc floodplain drainage and flood mitigation works) were encouraged and/or inadvertently promoted under a past development ethos by both government and industry alike without an overall systemic or catchment planning approach or full knowledge or understanding of the environmental or social consequences. Changes to existing institutional arrangements for land development/allocation and in particular caneland assignment are required if sustainable development is to be achieved.

Riparian and wetland management

The impact of these issues has been an extensive decline of riparian and wetland ecosystems and a rise in total use of agrochemicals in the lower Herbert River catchment with long term implications for the sustainability of riverine, coastal and marine ecosystems. The mangroves and wetlands of the Herbert River Catchment are of national and local significance. Riparian vegetation management and wetland destruction have been identified by the community as major issues needing to be addressed at a catchment level. This issue came to a high point in 1996 with a significant conflict within the community and at a State level over the clearing of Pomona Station, an area perceived to be Mahogany glider habitat. This community conflict was reflected in a failure to reach agreement on action within the HRCCC. Members of the HRCCC have reported that they considered that there was enough information to know there was a problem, but not enough to precipitate a solution. Furthermore, access to information was reported as a problem as was the apparently conflicting advice coming from different agencies. As a consequence, personal opinions and local politics dominated the issue. Significant issues underpinning the conflict included:

- agreement on the definition of a water course and swamp or lake;
- basic inventory data about water resources in the area;
- understanding of mahogany glider habitat; and
- poor understanding of the legislation associated with these issues.

The Pomona issue did precipitate changes within the HRCCC specifically and in the catchment more broadly in seeking better ways to resolve resource use conflicts. Thus the HRCCC agreed that the issue had been exacerbated by inadequate basic information and successfully lobbied the Minister for a water resources extension officer to be based in the catchment, thereby extending the expertise available locally.

To-date the conservation of riparian vegetation, wetlands and mangroves has been ineffective in the Herbert floodplain because of fragmented management arrangements, a failure to address environmental issues in the rural land development process and limited ability of government authorities to control harmful land management practices particularly on freehold land. This potentially could lead to high transaction costs in negotiating the appropriate management of riparian areas with relevant authorities and individual land managers.

Water quality
Water quality has increasingly been recognised within the local community as a major issue of concern. Tin mining dams in the upper catchment, some of which were abandoned in the late 1890s, are perceived to pose a hazard to downstream water-users, natural drainage in the Lower Herbert, and the biodiversity of aquatic habitats. This was initially a divisive issue between the upper and lower catchment communities due poor domestic water quality at certain times in the lower catchment, as well as concerns that increased sedimentation from abandoned mine waste was reducing the river capacity and contributing to greater flooding problems. It requires remedial works to stabilise these dams and mining waste through collaborative efforts of local government and a limited number of relevant landowners in the upper catchment. Disturbance of wetlands as a result of drainage works and agricultural development in the Herbert coastal wetlands has led to acidification of adjacent waters (with pH levels as low as 2 or 3) and have been locally linked to fish kills. Areas prone to risk of acid sulfate soils are confined to a limited number of properties adjacent to coastal lowland wetland and mangrove areas. Diffuse source pollution of waterways from intensive agricultural production however continues to be a problem of significant social conflict both within the Herbert community and between the community and relevant government agencies. It has been highlighted in 1998 with the high profile fish kills in streams draining the floodplain.

Rural producers/land managers (and in particular cane growers) are the principal responsible groups requiring change in behaviour to a more precautionary approach, in particular in regard to land clearing and nutrient enrichment of waterways. However, long term solutions are frequently not in a landowners self-interest financially to undertake. These issues therefore require the political commitment and will of relevant local and state government agencies to apply their relevant powers in land development decision-making and approval processes to ensure ICM principles are taken into account and to establish cost-sharing arrangements.

5.2 Implementation Context for the ICM Policy Initiative in the Herbert River Catchment

5.2.1 Rationale and motivation for the commencement and on-going development of the Herbert River ICM initiative

The prominent history of flooding and drainage issues in the catchment has created significant social conflict over a long timeframe. Previous local and state government responses were to undertake 5 major technical studies since the late 1970s. However, there was concern within the local catchment community that (a) despite the major public and private investment in these studies, government had failed to achieve on-ground outcomes on drainage management, and (b) the local community needed a greater influence on decision-making on these issues. To this end, prominent actors in the catchment from the sugar industry and local government lobbied the State Government for the initiation of an ICM process in the catchment in 1992.

The steering committee for ICM set up in July 1992 identified key stakeholder organisations with a responsibility or interest in natural resource management in the Herbert catchment and in February 1993 invited them to nominate representatives to form the HRCCC. Since then the HRCCC has opportunistically invited additional stakeholder groups to participate in the HRCCC as they saw fit. The number of members on the HRCCC therefore has fluctuated between 13 and 17 members since it was formally established in March 1993. Current representation on the HRCCC is diverse involving local industry (sugar, cattle, fishing, horticulture), local government and other statutory bodies, conservation and community interests. However, the HRCCC has been dominated by the lower catchment with only one representative from the upper catchment. State government have not been formally represented until early 1999 with the appointment of a representative from the EPA for the first time. Informally DNR officers have provided technical advice on a regular basis.

Over its life, the HRCCC membership has been remarkably stable with approx. 60% of the members in 1999 being the original foundation members. All members are active community leaders who belong to a wide range of different organisations in the catchment holding executive and other leadership positions. They therefore have multiple allegiances and interests.

The lower Herbert catchment is topographically, hydrologically, socially and politically 'divorced' from the upper catchment. This means that at the catchment scale inclusiveness of all interests, integrated solutions, and communication are major challenges for a whole of catchment ICM process. A Sub-Committee of the HRCCC was formed for the upper catchment in December 1998 to discuss and raise issues of particular relevance to the upper catchment. This sub-committee, the Upper Herbert River Catchment Group, arose because community members in the upper catchment felt that they were not equally represented on the HRCCC. The HRCCC membership has been overwhelmingly dominated by members from the lower catchment and has inevitably tended to have a focus on issues affecting the lower floodplain. In addition, there were logistical issues relating to the long distance between the upper and lower catchments (ie. a 4-5 hour drive) in attending meetings and activities.

5.2.2 Socio-economic conditions and use of technology

Socio-demographic profile

The population of the catchment was 18,615 persons in 1996 with approximately 70% living in the lower catchment. The growth rate between 1991 to 1996 was approximately 3% with most of this increase being in the upper catchment. Approximately 20% of those employed in the catchment are employed in the agriculture, forestry, fishing industries, 18% in community services, 14% in wholesale and retail and 13% in manufacturing industries.

A lack of financial resources in the community is considered an issue by the Herbert catchment community for both solutions to natural resource problems and for personal planning. The economy of the lower catchment is heavily dependent on the sugar industry and the economy of the upper catchment is dependent on the cattle industry. The economic impact of these industries on the regional economy of North Queensland shows that, together, these industries make a significant contribution (both direct and flow-on effects) to gross output and employment in the catchment:

- *Output*: the sugar industry of the lower Herbert River catchment in 1996 contributed to over $354m of output in the regional economy, including $206m of output from sugar production and a further $148m in flow-on impacts from other industries in the region. The cattle industry in the upper Herbert River catchment contributed $16m in output to

the regional economy, including $13m in output from cattle production and a further $3m in flow-on impacts.

- *Regional employment*: the sugar industry of the lower Herbert River catchment provided employment for over 3,300 people in the Northern statistical division in 1996. Over 1,300 of these people are estimated to be employed directly in the production of sugar with a further 1,936 people employed in industries supporting the sugar industry. The cattle industry in the upper Herbert River catchment is estimated to provide employment for 170 people, which includes 120 people employed directly in cattle production and a further 49 in support industries.

The economic sustainability of these industries therefore is critical to the catchment economy. However, the financial viability of both cane farmers and beef producers in the future is not optimistic. The possibility of reduced financial viability could result in reluctance, on the part of farmers, to engage in farm management practices which, though regarded as improving the state of the environment, would not directly improve the financial status of individual framers.

Use of technology

Lack of relevant information is not perceived by HRCCC members as a constraint for ICM in the Herbert. Since 1995, there has been an emergence in the catchment of a number of collaborative ventures between local government, industry and state and federal government agencies to improve the capture of relevant data on NRM issues (eg. Herbert Mapping Project and a Catchment Atlas) and provide locally accessible mechanisms for integrating data and information delivery or service provision (ie. Herbert Resource Information Centre). The HRCCC to-date has not made extensive use of the available Information Technology in its own right. Nevertheless, the availability to other stakeholders of technologies to underpin resource management has been important to the HRCCC, which has, therefore, fostered the further adoption of such technologies. The most significant example of this in the Herbert has been the HRCCC's support for the establishment of the Herbert Resource Information Centre (HRIC), a collaborative GIS venture for the management and use of spatial resource data for the catchment. The HRCCC is not a partner to the HRIC per se (the HRIC is a joint venture between Hinchinbrook Shire Council, CSR Ltd., the Herbert Cane Protection and Productivity Board, CANEGROWERS Herbert River District, CSIRO and the Queensland Department of Natural Resources), nor is it a significant user of the HRIC's data sets or services. Nevertheless, the HRCCC has had a role to play in facilitating and encouraging the use of those data and services by resource managers and planners.

The HRCCC was also instrumental in bringing about the Herbert River Catchment Atlas in collaboration with CSIRO and the Herbert River CANEGROWERS. The Atlas was created by CSIRO and was extensively used by HRCCC members in the development of the Herbert Catchment Management Strategy. The HRCCC has contributed funding for production costs and it has been instrumental in the broad dissemination of the Atlas, particularly to schools, TAFE and for other awareness raising and educational purposes.

5.2.3 Community attitudes and support for ICM

Awareness of ICM

At a project workshop of key stakeholders on the ICM process held in April 1995, it was argued that in order to gain a long term commitment to the ICM process amongst the community, it was necessary to create a common and widespread understanding of the ICM conceptual process. At that stage, it was argued by the workshop participants that the development of a Catchment Management Strategy was a critical process in gaining

community consensus on key issues and the role of ICM. The Catchment Management Strategy that was subsequently developed explicitly acknowledged this role and is being used to seek a consensus on key resource use issues amongst community leaders. The Community Survey in 1998 demonstrated that improved community awareness of ICM through exposure to the Strategy has been limited to-date with only approximately 40% of community respondents either aware of ICM or the Strategy.

However this awareness level is increasing. In particular, over the period 1995-98, HRCCC members considered that the rural community's *awareness* on natural resource issues and the HRCCC organisation itself had improved substantially largely due to the occurrence of specific well publicised or controversial issues/events (such as land conversion from cattle-to-cane, land clearing for cane land expansion, Mahogany glider habitat destruction, owl boxes activity, fish kills in the river, damming of streams and acid sulfate soils).

Support for ICM

In principle there is considerable support for ICM in the community with all ICM activities being seen as of moderate to high importance in the Community survey. Community perceptions of the priority responsibilities for ICM were:

- encouraging joint projects between government, industry and research;
- raising local awareness of natural resource management;
- gaining a better understanding of environmental problems;
- developing solutions for environmental problems;
- encouraging research; and
- communicating on this work to the community.

The Community surveys in 1995 and 1998 showed that people were generally satisfied with many aspects of living in the Herbert River catchment and perceived many advantages of living in the area. The majority of respondents would therefore possibly not support any changes threatening these aspects of their community. The most important issues identified by respondents were: unemployment; a lack of opportunities for young people; and a lack of diversity in industry. Further issues related to land and water management and included clearing of marginal land, flooding, drainage, water quantity issues (ie. lack of water), fishing issues, the impact of weather and changing weather conditions on primary industry, and environmental issues. The awareness within the community of land and water problems and the perception that these issues are important, both personally and on a catchment scale, signifies general support for ICM to tackle land and water management on a number of fronts. However, land and water management issues were not uppermost in people's minds which suggests that there needs to be awareness and acknowledgment by ICM that while people may support land and water management of various kinds, their first priorities lie with 'life issues'.

Perceived impediments to ICM

For those catchment community respondents involved in ICM, the major issues were the environment in general, ineffective decision making processes and communication, water quality, and flooding, drainage and their management. However, for those not involved in ICM, flooding, drainage and their management were of greatest concern.

While there was community interest in issues for the Herbert, the influence people felt was not particularly high, it appeared that there may be some conflict and not all respondents often thought about local community issues. These factors may hinder community participation in ICM. With regard to how manageable (or practical) catchment management might be, there were a number of impediments to effectively managing land and water in the catchment identified including slow government strategies, slow reactions of government to

new problems, the catchment's large area, the cost of solutions, a lack of easy solutions, low trust of government programs, and insufficient understanding of relevant problems. It will be important for ICM to address these perceptions of impediments, perhaps by encouraging timely responses from government, encouraging financial support for ICM, developing and promoting solutions, encouraging improved formal and information communication between the government and the community, and improving understanding of land and water management problems.

5.2.4 Attitudes and resources of local constituency groups

An examination of documentation has shown that there has been a broadening of the focus of industry organisations (eg. CANEGROWERS, Herbert Pest and Productivity Board) in the catchment from an almost exclusive concern with productivity and efficiency issues and impacts at the inception of ICM in 1992 to a recognition and even promotion of the importance of natural resource management to the long term sustainability of the industry.

HRCCC members consistently identified rural producers, industry organisations, the Herbert River Improvement Trust and the Drainage Board as having an effective to very effective involvement in ICM. These groups also were reasonably active attendees at HRCCC meetings. In contrast, local environment organisations were represented by one member who was very effective when available to participate in meetings and highly respected for that contribution by other members. However, due to many other commitments the conservation representative has had a very low attendance rate and there was an apparent lack of an alternative representative to act as a proxy.

5.2.5 Support from politicians

Local government politicians have had an active and influential involvement with ICM process with 2 Councillors from the lower catchment and one other from the upper catchment regularly participating in the HRCCC. In addition, the lower catchment Mayor is now the Deputy Chair of the HRCCC. However State government and Federal government politicians have had little input or involvement such that HRCCC members identified them as having an ineffective to very ineffective involvement.

5.2.6 Media coverage and attention to NRM issues and ICM

The 1995 Community survey found that *The Herbert River Express,* the local newspaper for the lower Herbert catchment was used more frequently than any other source of information (60%) on catchment issues, including friends and colleagues (54%) and personal experience (39%). In the lower catchment it was the source of information for 84% of those surveyed.

An assessment of the representation of natural resource management issues in general, and integrated catchment management in particular, as they were presented by the *Herbert River Express* from 1990 to 1998 found that natural resource management issues became increasingly prominent in the *Herbert River Express* with 1995-96 and 1996-97 exhibiting the highest levels of prominence. The river/stream/water management theme comprised 36% of all natural resource management articles, while political controversies comprised 20% of the articles and pest/feral species 15%. The occurrence of these articles in the *Herbert River Express* clearly reflects that the Herbert River Catchment Coordinating Committee (HRCCC) has a profile in the lower catchment community. However, the analysis does indicate a lag in the time between the inception of ICM in the Herbert River catchment in March 1993 and the HRCCC developing a profile in the community and also possibly influencing the presentation of natural resource management issues in the community. For example, over

the eight year time frame studied, 1996-97 and 1997-98 were the years where river, stream and water management issues were the most prominent.

Although the actual number of articles on river, stream and water management issues appearing each year peaked in 1995-96 there is a tendency for the prominence of these issues to increase over time. This suggests an increasing community interest in, or focus, on river/stream and water management issues. The *Herbert River Express* also provided information on the role and function of the HRCCC and at times emphasised the importance of community involvement in natural resource decision making.

5.3 Adequacy of Policy Frameworks and Institutional Arrangements for ICM at State and Local Catchment Levels

5.3.1 Adequacy and effectiveness of policies, plans and decision rules of ICM and other responsible agencies/groups for NRM

The ICM Policy

The integrated management of land and water in Queensland is addressed through the Integrated Catchment Management Policy (1991) and the emerging system of regional resource management strategies promoted through DNR's community resource management program. A substantial source of funding for these programs is the National Landcare Program (NLP) and, more recently, the Natural Heritage Trust (NHT). There is no legislative basis for integrated resource management in Queensland to compare with the NSW Total Catchment Act or the Victorian Catchment Management Act and little statutory guidance for management of steep lands, floodplains, riparian zones and other key landscapes for ICM.

The implementation of ICM in Queensland is based on the establishment of Catchment Coordinating Committees (CCC). A CCC comprises representatives of the major sectors of the community and government that are involved in, or influenced by the management of land and water resources in the catchment. While considerable progress has been achieved in some catchments and in some regions, the depth, coverage, and effectiveness of the ICM in Queensland is very patchy. Specifically, there are as yet no regional resource management plans to guide ICM activities and only a minority of river basins covered by Integrated Catchment Management (ICM) plans. The consequence is that at this time there is no statutory or policy framework to guide landholder and local resource management plans with respect to water, vegetation and land management. There is no set of priorities or codes of practice for on-ground works, vegetation management, soil conservation, riparian zones and other key areas.

Implementation of strategies for resource management by individual ICM organisations in Queensland requires the voluntary cooperation of the community, local government and government agencies. The ICM organisation does not have the authority to legislate or pass laws to regulate resource use. The organisation is only able to influence the regulation of resource use through an organisation, such as local government, which does have this authority. Alternatively, where regulations are not enforceable, for example on freehold land, the voluntary support of the community may be the only alternative.

Since the inception of ICM in Queensland implementation has been hindered by the inability of catchment management groups to influence land use planning and management. Traditionally ICM principles and catchment management issues have not been incorporated into or addressed by local planning schemes. A recent legislative approach towards promoting ecologically sustainable development in Queensland, the *Integrated Planning Act*

(1997), does not specifically identify a role for ICM organisations in the planning and management of natural resources. The *IPA* allows local government to require landholders wishing to conduct intensive agricultural activities, such as cane farming, to obtain it's approval. While this mechanism could provide benefits, it appears to be focused on development control rather than strategic planning. Indeed, the intent of the Integrated Development Approval System within IPA appears to be primarily focused on streamlining decision-making processes, rather than enhancing their effectiveness.

The HRCCC
The approach to selection of members/stakeholder representatives on the HRCCC has been to ask for a nomination from the organisation concerned. Representatives have tended to be community leaders or 'committee people' who are often already over-committed. There is some concern among HRCCC members that there are no clear rules for managing the HRCCC's representational structure and processes (eg. use of proxies, reviewing membership, election of office bearers). To-date the approach has been largely an ad hoc process that may in time reflect on its credibility.

Land use planning in the Herbert Catchment
Clearing of native vegetation (particularly land close to stream and watercourses) remains one of the most contentious issues impinging on land and water resources management in the Herbert River catchment. Much current decision-making in relation to the granting of caneland assignment occurs in the absence of clearly agreed catchment based plans for land, water and vegetation resources. For the period 1993-96, 525 applications for caneland assignment covering an approximate area of15,013ha were submitted to the Victoria and Macknade Local Boards for approval. Of these, 12,165ha were awarded, representing an 81% approval rate. Over 70% (8,655ha) of the awards granted were on land that both the Local Cane Assignment Boards and Environmental Advisory Committee (EAC) deemed suitable. About 7% (741ha) was granted on land that both groups perceived as unsuitable and another 20% (2,768ha) was granted on land over which there was clear disagreement between the Local Boards and EAC over drainage and habitat issues.

As a step towards addressing these issues, a recent development in 1998 in the lower Herbert catchment is the process that requires farmers opening up new areas for intensive agriculture or seeking a change of use will require Hinchinbrook Shire Council approval (for conditions) under the new Shire Plan. This process seeks advice from a range of responsible agencies including ICM in the decision-making process. Although local government in the lower catchment now does have enormous scope to achieving catchment management objectives, it is limited by the fact that it can only implement these strategies when a development application is triggered by the planning scheme. The regulation of new developments through the planning process will not effectively deal with existing resource management problems because planning controls have little power to control existing unsustainable land uses or minor variations in those uses. Ultimately this development requires the Council to have both the technical capacity and political will to implement their statutory powers. Therefore to effectively achieve ICM, planning schemes and development assessment need to be integrated with other forms of institutional arrangements to deal with existing use rights.

5.3.2 Clarity and consistency of roles and objectives of ICM and other responsible agencies/groups for NRM

The ICM Program in Principle
Queensland's ICM program has very broad, and from a community point of view, somewhat nebulous goals. The stated purpose of ICM as outlined in the Queensland ICM Strategy

(QDPI 1991), is to integrate the management of land, water and related biological resources in order to achieve the sustainable and balanced use of these resources. The fundamental assumptions that underpin this policy are that the objective of ICM will be achieved by:

- generating a better understanding of ecosystem interactions at a catchment scale by the community and Government; and, thereby
- moving towards common or agreed goals through development of a catchment management strategy; and
- facilitating co-ordination and co-operation within and between Government agencies and the Community to enable the prioritisation of actions; and
- joint or independent action to seek solutions to problems.

The strategy also differentiated clear roles for the community, and local, state and federal governments. As such, the role of the community in ICM was identified as:

- Establishing and supporting Catchment Committees as needed to address land and water issues.
- Identifying interrelated land and water issues that should be addressed, and contributing to the development of solutions.
- Participating in the development of catchment management strategies.
- Influencing the community and individuals through local action groups to achieve results on the ground;
- Promoting within the local community the concepts and principles of sustainable and balanced use of land and water resources; and
- Contributing funds to develop and implement catchment management strategies.

The role of local government is identified as:

- Fostering community awareness and the formation of Catchment Groups;
- Contributing technical and financial support to Catchment Groups and Committees, on a voluntary basis and as resources permit;
- Participating in the development of catchment management strategies; and
- Contributing voluntarily to the implementation of catchment management strategies by considering incorporating relevant parts of these strategies in local authority plans, by-laws and administrative procedures and in their own field activities

The roles of the State Government is identified as:

- Fostering community awareness and the provision of educational material and services;
- Participating in the development of catchment management strategies;
- Contributing technical and financial support to Catchment Coordinating Committees as resources permit;
- Establishing policies, institutional arrangements and necessary legislation to facilitate the implementation of integrated catchment management;
- Contributing to the implementation of catchment management strategies by considering the incorporation of relevant parts of these strategies in appropriate legislation, regulations and administrative procedures, and in the management of public land and water resources and the provision of infrastructure and services;
- Developing State-side catchment management strategies and programs and monitoring their progress; and
- Ensuring interdepartmental coordination of land and water resource programs.

The roles of the Commonwealth Government is identified as:

- Participating in the development of catchment management strategies
- Adopting catchment management strategies on land used or managed by the Commonwealth Government or its agencies
- Providing financial support to priority catchment projects where national interests apply

- Providing taxation and other financial incentives for expenditure on land and water conservation

ICM in Practice
The State-wide survey of Catchment Coordinators and Chairs revealed, however, that although there is general agreement on the ultimate purpose of ICM and stakeholder roles, there is a wide spread of opinions as to the purpose and operation of CCC among the various individuals and catchments in the State. This is not to be perceived as a deficiency of the program, given that it is intended to be community based. Over the ten years of the ICM initiative in Queensland it has been surprisingly robust. While it has evolved, its essential philosophies and implementation have remained constant.

In the Herbert River catchment, there was considerable uncertainty initially amongst HRCCC members on the roles and objectives of the HRCCC and ICM in general. It took over 3 years before a draft Catchment Management Strategy (CMS) was developed that identified a clear set of objectives for ICM in the Herbert for the first time. These objectives are:

- Co-ordinate government agencies and the community to pursue common goals
- Seek community involvement in catchment management
- Reflect the requirements of the wider community within the Catchment
- Identify and rectify natural resource degradation
- Promote ways to prevent and reduce natural resource degradation
- Promote the wise use of all natural resources within the Catchment
- Identify key indicators of biodiversity and monitor as a measure of catchment health
- Encourage the retention of significant natural habitats within the Catchment.

These objectives of the HRCCC are caste in general terms, which encompass both its role as a coordinator between the catchment community and government agencies as well as its role as a monitor of catchment health.

5.3.3 Adequacy of financial resources for ICM

Financial resources for a program with such ambitious goals as the ICM policy have been erratic and low. A key source of funds has been the NLP, without which ICM would struggle to survive. CCCs are required to find funding on their own initiative rather than use established revenue sources as do most public programs. DNR provides significant levels of funding, especially for start-up, the employment of Coordinators and related administrative costs. At present however CCC have no revenue raising capacities and there is a lack of confidence in government funding for implementation, which is of particular concern given that once CCCs have been established and created strategies, their requirement for funds for on-ground works will increase their financial requirements. Planning is inexpensive relative to action.

Although seed money provided by the lead state agency for ICM has been pivotal to the successful formation of the HRCCC and a catalyst for it to leverage other sources of funding (eg. NLP/NHT), the short term nature of funding and political cycles has not been conducive to long term environmental/sustainable development solutions. In addition, much of the funding is administratively burdensome to apply for and to manage and takes up a lot of the HRCCC's resources (eg. the Catchment Coordinators time). The extent and speed with which the HRCCC can implement its strategy is largely determined by the level of funding that it can attract.

5.3.4 Coordination among ICM and other responsible agencies/groups for NRM

ICM at the state level
DNR is the lead agency for ICM in Queensland which was perceived by most Chairs and Catchment Coordinators in the state-wide surveys in 1995 and 1997 to be a successful partnership between DNR and the rural land owner interests and not much more than that. There was a widely held view that local governments, both politically and at officer level have not been involved effectively in the ICM process. Involvement of other key state agencies such as Lands and Environment is less applauded.

In Queensland in general most CCCs have not so far had effective involvement from local governments nor from key agencies with statutory resources and management responsibilities. As the coordinating process for mainstream decisions affecting natural resources, ICM have not yet been universally successful. Lack of co-ordination between state agencies has been a major obstacle for ICM. There is no whole of government or even whole of DNR commitment evident. For example, the Water Infrastructure Taskforce kargely ignored ICM, as has the Water Allocation Management Planning (WAMP) process and the Sugar Infrastructure Planning (SSIP) initiative.

ICM in the Herbert River catchment
Effective state government involvement is critical to the success of ICM in the Herbert through the provision of financial resources, technical support, and its power to endorse the Catchment Management Strategy. An endorsed strategy is the basis for leveraging funding for projects. However, a high turnover has occurred in state-agency personnel at regional/catchment and state policy levels relevant to ICM, which has meant a loss of expertise on what is essentially an experimental policy process. This poses particular challenges for ICM groups like the HRCCC in terms of maintaining effective networks, the loss of corporate memory on previous decisions and what needs to happen with regard to a particular ICM initiative.

There have been significant changes in the system of organisational linkages on NRM in the Herbert River catchment since the inception of ICM:

- Increased number of linkages (both regulatory and non-regulatory) between (a) local government and related statutory bodies and industry and other community organisations in the Herbert catchment and (b) these Herbert River organisations and state and federal agencies.
- The emergence of a number of successful coordinative, collaborative and/or joint funding initiatives for NRM purposes (eg. the Herbert Mapping Project and the establishment of the HRCCC in 1993) which are now the catalyst for further collaborative ventures relevant to catchment management (eg. the Herbert Resources Information Centre or HRIC).

Within this system, the HRCCC however is moving towards being a legitimate coordinative and informative forum on NRM (at least within the lower catchment) for facilitating information exchange and more inclusive debate on NRM issues with a level of legitimacy that had not existed before in the catchment.

5.3.5 Commitment and skill of staff in ICM and other responsible agencies/groups for NRM

Commitment
One of the big challenges for ICM is keeping up the momentum in a process where tangible outcomes are slow to emerge and may well be attributed to others influenced by ICM rather

than the ICM process itself. A strong, active, credible and enduring Chair has been essential for driving the ICM process in the Herbert and progressing issues. The HRCCC has also been fortunate in having only two Catchment Coordinators in its lifetime – both being very capable and the first being there for 4 years. This situation is in sharp contrast to many ICM initiatives in Queensland where, in the 2-year period 1995 to 1997, there was less than 25% of both Catchment Coordinators and Chairs being retained.

Participants of a community forum held in 1995 in the catchment identified Government as being the hardest to get on-side and committed to ICM. Besides providing continuity in support through providing resources (eg. funds, personnel, technical advice) to effect action, a key requirement from government for successful ICM is the commitment of top officials to ensure effective participation by agencies as well as the continuity of political commitment (ie. of all tiers of government).

Qualities of ICM personnel

In 1998, based on their experience in ICM, HRCCC members identified the important qualities of a Catchment Committee member as: open-minded with a broad vision (including benefit of the community at heart, recognises needs of others, sees other point of view, prepared to compromise, able to give a little); genuinely concerned about NRM/ICM issues; good communication skills and can contribute to group discussion and take information back to their own stakeholder group; understands and is prepared to put forward the views of own interest group; good interpersonal skills (including willingness to listen to others views); vast local experience and aware of what is going on in the catchment; progressive attitude (including willingness to accept change, learn things all the time); and with available time to commit to ICM.

Members also identified a number of important qualities of a Catchment Coordinator as: experience with and knowledge of NRM issues and agricultural systems (ie. technical skills, understanding across disciplines, problem solving, eye for myths and legends); good communicator; highly developed interpersonal skills and able to handle a diverse group of people; broad minded with an ability to look at the big picture; tactful; confident and prepared to stand up and be accounted for; good conflict resolution skills; and a good listener.

5.3.6 Opportunities for formal access by wider community

The state ICM program is community based and, at least formally, provides adequate opportunity for involvement by all in the community. This has mostly been achieved through representation of groups of specific interests including industry and conservation. The pattern of actual access differs widely between regions.

However, there is a lack of a clear mechanism for initiating involvement in ICM outside the formal representative structure of the HRCCC. Importantly, through this formal mechanism a sub-committee of the HRCCC for the upper catchment involving 16 representatives of a broad range of stakeholders from the community, industry and government was formally formed in December 1998 to discuss and raise issues of particular relevance to the upper catchment. Community members in the upper catchment felt that they were not equally represented on the HRCCC (only one representative), there was a predominant focus of the HRCCC on issues affecting the lower floodplain and that there were logistical difficulties relating to the long distance between the upper and lower catchments to attend meetings (ie. a 4-5 hour drive). This new group is also facilitated by the HRCCC's Coordinator and regularly reports to the HRCCC. The upper catchment also maintains a representative on the HRCCC.

5.4 Adequacy and Equity of the Herbert River ICM Processes

5.4.1 Knowledge and expectations of the process by stakeholders

The 1995 and 1998 Community surveys showed that awareness levels of ICM, the HRCCC and its main purpose were relatively high (42%, 42% and 39% respectively). These could be improved, particularly in urban areas and the upper catchment. Detailed awareness of ICM's effectiveness however was low. Nevertheless Herbert community priorities for the role of ICM were identified in 1998 as:

- working closely with local government;
- encouraging joint projects;
- raising local awareness; gaining better understanding of environmental problems;
- developing solutions for these problems; and
- encouraging research.

Within the HRCCC there has been a clear improvement in member's awareness of catchment issues and expectations of ICM. Initially, the HRCCC had a focus on undertaking on-ground activities and works. Now members see their role as being more strategic and influential on others to undertake projects and catchment management planning processes.

5.4.2 Degree of coordination of resources to address catchment issues

Coordination of government resources to address issues of community conflict relating to land and water resources management from a whole of government approach has consistently been seen as a major blockage to an effective ICM process. Experience with major resource management issues with significant social conflict in the Herbert River catchment supports this concern (eg. the failure for over 5 years to reach agreement on the Sugar Industry Infrastructure Package with the local sugar industry bodies; Mahogany Glider conflict at Pomona; and fish kills controversy).

The HRCCC has adopted a lead role as the key broker in the catchment for external funding of community projects to address natural resource management problems in the catchment. For example, the HRCCC acted as the broker and coordinator for all new proposals from the catchment submitted for federal government funding through the National Heritage Trust initiative. This is providing the catalyst for community activity in federal and state-funded natural resource management initiatives in a more strategic way than in the past.

The 1998 Community survey identified that residents in the catchment considered coordination of efforts by ICM and local government as extremely important, ie local government planning taking ICM into account and a local government role in ICM. While Government agencies were perceived to often give conflicting information on land and water management issues. It can be difficult for community members to obtain information from government agencies and also a lack of internal communication often leads to mixed messages emanating from the Government to the community.

The Communication study found that a matrix of contacts existed between key stakeholders of ICM in the Herbert River catchment. In particular, there was direct contact and therefore linkages between all major groups of stakeholders. Therefore the basis for a communication network was present, although the strength of links was variable. Most communication was categorised as "mutual" which indicated that the informal contacts made during meetings and other gatherings are important to the functioning of ICM. The predominant reasons

supplied by respondents for their communication, and the primary contacts associated with those reasons, were:

- policy/planning/decision making with local government and Brisbane state government;
- environmental issues with local government;
- research/project work with the HRCCC; and
- follow up on catchment/strategy issues with the HRCCC.

5.4.3 Degree of motivation, commitment, cooperation and support for the process

State-level

CCCs have to contend with low awareness in the general public about resources management issues and a general resistance to external intervention. A surprising, consistent and very significant result from the state-wide survey of Chairs and Catchment Coordinators was the universal view that there is too much government regulation. People in rural Australia resent government controls on land use whether they arise from World Heritage listing and conservation generally, tree clearing regulations, water and land management regulations, changes to land tenure and land rights laws. There is a clear message here that landholders in particular will resist any solution to ICM problems that involve state and national government regulations.

Perhaps for the reason that ICM requires a complex process of learning, there was a disturbing low level of satisfaction with progress on ICM amongst the respondents at the state level (especially the Coordinators). Less than half the coordinators in 1995 were satisfied with progress in their CCC and three were unsatisfied, one to the point of resigning over it. The Chairs were generally more satisfied with progress, and while none was actually dissatisfied, almost half were ambivalent. Although satisfaction levels and support improved during the period 1995-98, they remained relatively low.

Most Chairs and Catchment Coordinators believed that support from the general public was low due largely to the public's low level of awareness about natural resource management issues. Importantly only 35% of Coordinators are satisfied with the acceptance of their CCCs by other government agencies. Chairs were more positive on this point. A wide range of factors generate support from industry and community organisations, especially the efforts of the CCC Chairs. Respondents however were commonly unhappy with political support and of the acceptance of local government at both the agency and political levels. As in many other results of the survey there are regular exceptions to common patterns. Other community groups rating as important include Landcare groups, Recreational fishing, Commercial Fisherman's Association, Aboriginal Council, Sugar Industry (Mills), Tourism and environmental organisations.

Clearly and not surprisingly, the dominant effective partnership is between the CCCs, the DPI (now DNR) and rural producer groups. Coordinators were not in general impressed with the involvement of the Departments of Lands, Local Government and Planning or Environment.

The Herbert Catchment

The membership of the HRCCC has ranged from between a total of 13 and 17 representatives since it was established in 1993. There has been varied commitment to the ICM process by these representatives over time (ie 1993-98) as reflected in attendance at monthly meetings (eg. about 9 members on average attend each meeting). The representatives of the sugar industry/agencies, local government, upper catchment and

Landcare have been the most consistent participants, while the Conservation representative, local Development Bureau and a local community group had the lowest involvement.

The time commitment of HRCCC members to ICM matters has increased between 1995 and 1998. Until 1997, the majority of members (over 70%) spent less than 10 hours per month on ICM matters but, by 1998, nearly 50% of members identified a commitment of more than 16 hours per month to ICM.

HRCCC member's motivation for involvement in ICM was identified in 1997 as being personally rewarding (eg. because they could contribute to the community), they cared about the environment, and that they could meet other members of the community who could influence resource management decision-making. However, in some instances (eg. contentious or 'hot' issues), some members have appeared to be protecting their own sectoral or personal interests rather than acting for the betterment of the overall catchment community and the sustainability of resource use. Most members have become positive over time (1995-98) about the HRCCC's achievements and the group's overall direction. They also perceive an improvement in the level of community support for ICM from a low to a moderate level. However, there are some concerns with the slow rate of progress and in particular the slowness of the overall process in general.

Local government involvement has been perceived by the HRCCC to be of critical importance to the success of ICM in the Herbert, and that, effectively, ICM could not really function well without that involvement.

At the Herbert catchment community level, the majority of residents surveyed in 1998 who were aware of the HRCCC supported its general direction and effectiveness and were satisfied with the speed of its progress. Personal benefits of involvement in group activities were perceived by 31%, preparedness of respondents to become involved in land and water issues was around 40%, preparedness to assist in local projects was around 42% and intentions to become involved were around 22%. The level of involvement in local community groups or associations was 44% in the 1995 survey and 32% in 1998. Most respondents agreed there was an urgent need to address environmental problems, signifying the basis for a high degree of motivation to deal with problems. Time was an important factor preventing involvement in local community issues for 36% of respondents. While support for ICM was implicit in the high degree of support shown for all of the proposed activities of ICM.

5.4.4 Efficiency and effectiveness of process

HRCCC Achievements

The major achievements of the Herbert River ICM process as identified by HRCCC members can be summarised as:

- Providing a forum that brings very different people in the catchment together to exchange ideas and providing a catalyst for change;
- Developing a Herbert River Catchment Management Strategy (CMS);
- Supporting a range of projects on natural resource management;
- Raising community awareness of catchment issues; and
- Gaining legitimacy as an influential group on NRM in the catchment.

The present value of the costs associated with the establishment and on-going administration of the HRCCC over a period of 20 years is estimated to be approximately $974,000. To offset this cost, the HRCCC has undertaken a number of specific activities in the catchment. These activities have been funded from both the public purse as well as from the catchment

community. They relate to: (i) management of riparian vegetation, (ii) preservation of natural habitats, (iii) management of drainage problems, (iv) management of wetlands, (v) management of acid sulfate soils, (vi) strategic river bank protection and (vii) the stabilisation of relict mining dams. These activities have the potential to significantly improve or preserve the condition of natural resources in the catchment.

Catchment Management Strategy
Due to a lack of continuity and security of funding for ICM, HRCCC activities and progress has been largely opportunistic and dictated by state and federal government political imperatives and opportunities, funding options and technical understanding rather than by the priorities identified in the Herbert Catchment Management Strategy (CMS). Thus, for example, action has often been dictated by NHT funding priorities and opportunities as expressed by the Regional Advisory Panel rather than the priority needs expressed by the HRCCC. This has meant that the HRCCC has been fairly reactive in its approach in implementing the CMS (rather than setting its own agenda), and that it is tending to follow a circuitous course towards reaching its stated goals.

The HRCCC released a draft Herbert River Catchment Management Strategy in May 1996 for public comment that was important to HRCCC members because (a) it provided a future direction to the group and a guide for future actions (e.g. identified issues, prioritised needs, identified stakeholders and their roles, provided a reference point to start from); and (b) it helped to get resources and support for ICM in the Herbert (e.g. funding for Catchment Coordinator and natural resource projects, and gaining in principle commitment of State Government to undertake projects). The Catchment Management Strategy development process proved to be valuable to the HRCCC members involved because (a) the process was seen to be inclusive and transparent within the Committee, (b) it raised awareness of issues and others viewpoints within the HRCCC membership, (c) it identified areas of agreement, and (d) helped to focus the HRCCC and establish an overall direction.

The issues relating to the development process for the catchment strategy are the lack of resolution on some key issues, speculation whether it will assist in resolving resource management conflicts in the catchment, and the apparent failure of the strategy to have a significant impact on what the Committee was actually doing to-date.

Progress
The HRCCC in general takes a consensual approach to decision making or at least an approach based on a process that seeks consensus. However, this has meant that on some issues in the catchment, the HRCCC has taken 'minimal' decisions rather than perhaps what might be called 'better' decisions for the catchment. In addition, this approach has kept some more contentious but critical problems from being addressed by ICM (eg. drainage coordination).

From 1995 to 1998 there has been a general improvement in the overall level of satisfaction of HRCCC members with progress. However they identified a number of ways that could improve their performance (including the level of stakeholder group involvement in the HRCCC) by:

- Raising the profile of ICM and the HRCCC in the community through more targeted publicity and promotion of the HRCCC and its activities;
- Ensuring the security of tenure for a Catchment Coordinator and the adequacy of funding for HRCCC activities;
- Maintaining legitimacy through broad stakeholder representation on the HRCCC (eg. direct involvement of local business through the Chamber of Commerce; more active

involvement of environment interests; representation of government technical expertise from the EPA and DNR);
- Greater use of proxies by representatives;
- A more proactive (versus opportunistic) approach; and
- More effective government agency involvement in the ICM process (including government agencies being required to consult with the HRCCC on all their programs in the catchment).

The HRCCC is constrained in undertaking its roles both financially, in terms of funding to carry out specific activities, as well as institutionally, in terms of its legislative or statutory power to regulate resource management. In particular in 1998, HRCCC members considered that the implementation of ICM in the Herbert River catchment was difficult because of the large size of the catchment, the lack of financial resources within the community (particularly in the upper catchment), the lack of cooperation between State government agencies, and the lack of coordination between state government agencies in addressing issues.

Communication
Communication on NRM relies predominantly on existing social networks. Local media is also a highly important source of information for a community.

In the communication study, with the exception of local landholders, most perceived their communications in relation to ICM to be satisfactory. Satisfaction was highest, however, for communication with the HRCCC and local government, which indicates a greater satisfaction when communication was with local bodies. In general, outcomes from communication were very positive, the most commonly identified being progress on issue, understanding of issues, information exchange, resolution of issues/decision, gained information, changed their outlook, specific action taken; and coordinate/collaborate.

Information needs
In principle, in order to be successful, an ICM initiative has massive information needs from biophysical through socio-economic to procedural. However in practice in the Herbert River ICM process, most information sharing, management and analysis has been informal and verbal through Committee meetings, presentations by researchers and special interest groups and so on. The Catchment Co-ordinator did circulate information to HRCCC members and their has been exchange of information between members at meetings, but most data access was reactive. Information was mainly pushed out to the community via the media. Inadequate access to biophysical and socio-economic information was not perceived to overly constrain the HRCCC's activities, although inadequate procedural information probably did.

The HRCCC continues to see the value of information and push for support for information-based programs. Thus, the HRCCC played a role in the establishment of the Herbert Resource Information Centre (HRIC) but has, in practice, itself made little use directly of the resources available through the HRIC. Local knowledge and expertise is a primary source of information applied within the ICM process. This is consistent with the nature and intent of ICM. Major ICM-based initiatives in the formal collection, collation and management of information relevant to the ICM process seem both inappropriate and unrealistic.

Importantly, the specific information needs facing the ICM initiative in the Herbert have been unpredictable, or at least difficult to predict. Thus, the Committee's information requirements have been context specific in response to changing priorities and circumstances

in the catchment. Furthermore, the information requirements have changed with the state of development of the ICM initiative and the maturity of the processes underpinning it. The HRCCC therefore has had to be adaptive and responsive and, despite the strategic nature of the Catchment Management Strategy does not have the resources or mandate to plan major initiatives, whether on-ground or in relation to the design, collation and management of key natural resource management data. As a consequence, ICM in the Herbert has relied predominately on the corporate knowledge and expertise of members of the HRCCC and opportunities to access additional expertise from others on a needs basis – including researchers and State Government resource managers.

5.4.5 Equity and procedural justice and perceptions of trust in process

Difficulties of ICM

In the state-wide survey, Coordinators believe that some of the most significant difficulties for ICM are due to the wide variety of beliefs amongst CCC members; a perception that the program has been forced on the catchment by the State Government in communities without financial resources to respond, and a lack of trust in the public in government sponsored initiatives. The Chairs hold similar views differing significantly as a group only in relation to the significance of the wide variety of beliefs and values of CCC members and to a lesser extent on the difficulties posed by the large size of catchments. Both groups believe that the CCCs have the important groups represented. There are some potentially fatal problems identified here, although many can be overcome in time as the ICM process matures and achieves ownership and clearer common perceptions.

In the Herbert Community survey in 1998, some of the major difficulties in managing land and water were seen to be caused by slow government strategies, slow reactions of government to new problems, and a low trust of government programs. Importantly, respondents did not find government strategies to be highly useful to them on a personal level. Many respondents felt the government needed to give more resources to voluntary groups and give incentives for landholders to address environmental issues.

In the Herbert River catchment, there has been a clear shift of opinion by HRCCC members over time (1995-1998) from agreement to disagreement on whether the ICM implementation process was difficult because of:

- the public's lack of trust in state/local government-sponsored initiatives;
- the absence of a single acute resource management problem (eg. of the magnitude of salinity); and
- the wide variety of values and beliefs among HRCCC members seriously detracted from an effective level of cooperation developing; or

In 1998 they also clearly disagreed that ICM was difficult because of a community perception that ICM has been forced on the catchment by the state government. These changes suggest both an increase in the confidence of HRCCC members in the ICM approach and a greater acceptance/tolerance of the diversity of views amongst members.

There is also a clear perception within the HRCCC of the importance of procedural fairness (eg. in land allocation and planning decisions) and the need for better incentives for landholders and greater resourcing of community groups for catchment management.

Overall HRCCC members considered that all parties (ie. all three tiers of government, industry and individual farmers) should contribute to catchment management. However on average members felt that the Commonwealth and State Governments should contribute considerably more than other parties (ie 30% each), local government (17%) marginally more

than industry (14%) with individual farmers contributing the least (10%). The community survey revealed a very similar order and distribution of contributions, except that it was perceived that federal government should contribute more (ie. 34%) than state government (27%). In sum, the overall system was perceived to be reasonably fair and there was an overall preference from all stakeholders for a partnership approach between government, industry and the community rather than responsibility going primarily to government or the community.

All of the potential benefits resulting from investment in ICM activities are not equitably distributed among those incurring the cost and those who do not contribute to the cost can not realistically be excluded from enjoying the benefits. In effect, the positive externalities resulting from on-farm investment in improving the condition of the environment cannot be internalised. In an economic climate where the financial viability of farmers is generally deteriorating, the ability, and therefore the willingness, of farmers to invest in improved resource management is likely to be considerably reduced.

For the successful implementation of a number of activities undertaken by the HRCCC, notably management of riparian vegetation, management of acid sulfate soils and management of wetlands, private property owners would incur considerable financial expense, but many of the benefits accrue to the community in general. Specifically the *potential costs* of the activities undertaken by the HRCCC are incurred by both individual landowners (eg. opportunity cost of land, restoration or remediation works, materials and construction costs, in-kind contributions of time and equipment) and the catchment community (eg. cost of reparation or remedial works, construction costs, wages and publicisation). Similarly *potential benefits* will accrue to both landowners (eg. avoided costs of lost production, aesthetic attraction of improved habitat, reduced production costs, improved water supply) and the catchment community (eg. improved downstream water quality, retention and improvement of natural habitats, reduced social conflicts, reduced litigation and transaction costs, aesthetic benefits, avoided costs of resource degradation and damage to infrastructure).

5.4.6 Influence of ICM in the catchment

Community Involvement

For the major natural resource management activities in the catchment (ie. land use planning, environmental protection, land clearing guidelines drainage coordination), HRCCC members consider that that there should be much greater community influence in decision-making than what occurs at present. However, they also consider that the level of community involvement/public participation in decision-making needs to vary depending on the particular issue of concern between 'Consulting', 'Involving', and 'Shared planning and decision making'. Importantly, they were not in support of the community or the government alone making decisions on these issues. Rather decision making should be a partnership between government, industry and the community.

The ICM process has contributed to increased community awareness and involvement in natural resource management issues in the catchment. In particular, the presence of the HRCCC and its activities has helped to focus community attention on natural resource management issues. However, to-date it has not been possible to assess the extent this awareness has been translated into better land management practices by landowners.

Local Government Planning

The active involvement of local government in the HRCCC emerged as a key strategy for the HRCCC to influence decision-making processes in the Herbert particularly relating to land

development planning. Local government is an important information source for the ICM process, it recognises HRCCC with its broad stakeholder representation as a legitimate referral and advisory group in the catchment, it is actively seeking HRCCC's advice on catchment issues, and it is seen as an important mechanism for providing ICM with "teeth for implementation".

ICM has had a substantial influence on local government in a relatively short period of time. Some of these changes include an improved awareness of ICM, better coordination between authorities in extending the reach of town planning to achieve ICM strategies as well as the actual implementation of ICM in the local planning scheme. Positive benefits also include improved communication between local government and previously unconnected stakeholder groups to provide a wider range of perspectives on resource management issues. Now local authorities in the lower Herbert are regulating land uses to achieve catchment management objectives. The upper catchment is significantly behind the lower catchment in terms of the understanding of planning and ICM issues, open communication between stakeholder groups and level of commitment to resource management.

Communication

In the Communication study involving key stakeholders of ICM in the Herbert, influence related to how much the communication was thought to have changed the outlook of those involved. Respondents reported the greatest change in outlook (for themselves and the contact) in communications with the HRCCC and with people on an individual basis. This is an important result to utilise in situations where attitude change is seen to be important. The main ways in which *respondents* reported that *their outlook had changed* were: gaining greater awareness, understanding or knowledge or to share what is happening and ideas. Areas in which *respondents* felt the *outlook of contacts had change*d were: understanding/knowledge; greater awareness; and acceptance of ICM.

The Media

The dominant community values regarding natural resource management and integrated catchment management as presented in the local newspaper for the lower catchment, the Herbert River Express, were life support values. The sample of articles exhibited no intrinsic values held about river/stream water management issues in the Herbert River Express. Life support values were found in 65% of the articles, economic or utilitarian values in 26% and aesthetic values in the remaining 9%. These life support values focus on issues of flood mitigation, water course management and ensuring the viability of the sugar industry, but more in terms of the way of life it represents. That is, the identity of the district as a sugar cane production area is strong.

The term *'Integrated Catchment Management* 'specifically appears from mid 1996 and is stressed as an important issue for the community. The HRCCC is portrayed as a contributor to achieving the goals of productivity, development and sustainability of the local community. The media representation of the HRCCC is positive and is clearly linked with integrated catchment management in almost all articles involving the HRCCC. Extrinsic, 'life support' values were the predominant values presented in natural resource management issues in *The Herbert River Express*. The community's identity and well being is dependent on the health and sustainability of their natural resources, and is clearly evident from the manner in which the local newspaper presents issues.

5.4.7 Agreed responsibilities and roles

The Catchment Coordinating Committee
In 1998, HRCCC members prioritised the roles for ICM in the Herbert River catchment (in priority order from very high to moderate) as:

- Encourage Local Government to take an active role in environmental management issues
- Encourage joint projects between community, industry and state and local government
- Provide a continuing source of advice to local government on catchment issues
- Encourage discussion between community interest groups on environmental issues
- Raise the level of local awareness and knowledge of environmental issues on the catchment
- Encourage coordination of state government programs
- Encourage research
- Develop solutions for, and better understanding of, environmental problems in the Herbert catchment.
- Undertake specific on-ground projects with other bodies.

Respondents reported a wide range of activities reflecting largely the age and maturity of the CCCs. Some have been in operation effectively since 1988, whereas some are still in the process of being formed. A progression of activities can be recognised from organisational activities - public awareness and involvement - issues generation - catchment planning - technical studies. The range of activities are all envisaged in the Queensland ICM Policy which now requires the preparation of catchment strategies before funding is provided for projects (QDPI 1991)

Perhaps the most interesting feature of these results is the wide spread of opinions as to the purpose and operation of CCC among the various individuals and catchments in the State. Coordinators for example are not in clear agreement as to what they and their CCCs should do - some believe that Coordinators and CCCs should coordinate activities and give advice to landowners, others do not. Significant differences in opinion exist as to whether the objectives of the local ICM programs are clear to all members and to the level of participation of their CCC members in meetings. They too do not always agree as to whether the CCC should give advice to landholders.

There has been a significant increase in the number and diversity of projects engaged in by the HRCCC - from a tin mining dam inventory in 1995 to include by 1999 a joint project with the HRIT on bank stabilisation, the owl nesting box program, a Catchment Atlas, several restoration and revegetation projects, riparian vegetation mapping study, weed control activities, a riparian "community" forum, acid sulphate soils awareness, and a cooperative project to link ICM and local government planning.

While the majority of members agreed that an HRCCC member's role is to represent the resource management views of their constituent group at meetings, there was a divergence of opinion on whether an HRCCC member's role is also to provide either their personal views on resource management issues or a catchment-wide perspective of natural resource management issues at CCC meetings.

The reliance on local expertise and knowledge has clear implications for the management of ICM to ensure its effective contribution to improved natural resource management including:

- the HRCCC needs to provide not only for effective representation of key stakeholder groups but also to provide as broad a base of expertise locally available as can be achieved.
- The Catchment Coordinator must have a key role to play in providing a stream of information to Committee members so that they can continue to expand their expertise in relation to ICM relevant issues.
- Relevant State agencies and other key stakeholder groups have a clear responsibility for effective communication of available information to members of the CCC.

Local Government
Since the inception of ICM in the Herbert catchment, a significant increase has occurred in the role and responsibility of local government in catchment management and planning. This has emerged through (a) an influential role based on active membership on the HRCCC and (b) regulatory and statutory processes (including major changes to the Hinchinbrook Shires Planning Scheme and HRIT activities).

Industry
The industry must take a leadership role if the importance placed on the environment and sustainability is to be realised. Present Conditions of Assignment suggest that failure to comply with restrictions may see the award revoked. This places increased responsibility for enforcement on the Local Board (Cane Production Board). These are new roles for these organisations. Leadership by the Local Board (Cane Production Board), CANEGROWERS and mills can establish an expectation that compliance is expected and required by all farmers. This type of widely based, voluntary action could engender very strong public support. ICM clearly has a role to play here. In its absence, public support will be nurtured through compliance and enforcement. The recommended audit should provide insight into both voluntary compliance and enforcement measures. Those findings will reflect on the leadership qualities of the sugar industry, and identify the need for evolutionary and revolutionary change in its management of natural resources.

The Community
Members clearly feel that the community also had a responsibility regarding land and water management and that ICM should remain a voluntary activity by community members. Similarly, many community members felt that individual landholders had a role to play in land and water management and that there were ways they and their local communities could assist. To do this, they saw the need for support from the government in terms of resources and incentives. Overall, there was a high sense of self responsibility for dealing with land and water management issues.

5.4.8 Integration (of processes in structure and context)

The system of organisational structures and linkages on natural resource management in the Herbert River Catchment has evolved to be more coordinated and more inclusive of key stakeholder groups since the establishment of the HRCCC in 1993. Significantly, the HRCCC is providing a key integrating and informing functional role on NRM within this system. In particular, CCC meetings provide a forum for networking and responding to community needs, a central 'pool' of information on the catchment, and a link between local government, state government agencies and various industry and community interest groups that did not exist before ICM.

Despite the need for ICM to integrate across government agencies the state-wide survey of Catchment Corrdinators and Chairs revealed there is a clear absence of a "whole of government" approach, commitment or involvement in ICM. State politicians seem to ignore ICM and there has been ineffective, even counter productive involvement of some

state agencies. While there was no reported hostility from politicians, agency staff and community groups, it seems that CCCs must create these supporting links themselves with little support from outside.

Similarly, concern was continually expressed by some HRCCC members of the on-going failure of State Government agencies to effectively use their statutory powers and authority to substantively address land and water development and management through a whole of government approach within the catchment (eg. land conversion from grazing to intensive agriculture, caneland expansion through tree clearing, and construction of levees on the floodplain). State agencies continue to make decisions on NRM issues in the catchment independently of each other and local interest groups and often fail to advise or consult local agencies or groups on new programs or activities to be commenced in the catchment. For example, some important catchment initiatives (eg. Water Infrastructure package) have 'by-passed' ICM.. In particular, the apparent lack of sharing of information between agencies has led to contradictory or conflicting information being presented to the community by different government agencies with regard to important issues in the Herbert. This situation has often exacerbated the community conflict.

There is a strong and complementary relationship between Landcare and ICM in the Herbert River catchment. The Catchment Coordinator also acts as the Landcare coordinator and has encouraged the re-establishment of a group in the lower catchment.

On the basis that establishing effective communications on ICM is a fundamental element of systems implementation in ICM, understanding the communication network is essential. Most communications amongst stakeholders of ICM in the Herbert were found to be *mutual* (through a mutual contact, meeting or other event) which indicates the importance of mutual or informal ways of meeting to the functioning of ICM.

5.5 Methods for Supporting ICM

In the course of the evaluation of the ICM process in the Herbert River Catchment, a range of different methods for supporting ICM implementation processes were identified and trialed. These methods and their potential role in ICM are briefly outlined below.

Evaluating ICM Policy Initiatives
The challenge to create policy processes, institutional arrangements and NRM practices that can contribute towards achieving sustainable and equitable resource use outcomes requires rigorous evaluation as part of the change process. Monitoring and evaluation is fundamental to identifying change, supporting an adaptive approach that is flexible enough to meet the challenge of this change, and enabling learning at individual, community, institutional and policy levels. Natural resource management policy and planning initiatives need to be evaluated as a system that links the initiative's objectives and rationale to performance 'on the ground'. The integrated systems evaluation strategy developed by the project provides:

- a basis for an integrated evaluation of the different perspectives (i.e. social, economic, environmental, policy and institutional) on the performance of the policy process;
- a framework for guiding its implementation; and
- a rigorous basis for synthesising findings (Bellamy *et al.* 1999a, 1999b).

Catchment Atlas
The Herbert River Catchment Atlas (Johnson and Murray 1997) provided essential natural resource information for supporting and promoting ICM in the Herbert River Catchment. The Atlas has been distributed widely by the Herbert Catchment Coordinating Committee and used as an important means of raising awareness of catchment stakeholders (eg. high

school children, local government and cane farmers) of the natural resources and related issues of the catchment.

Assessing land use change

ICM processes frequently are required to deal with intractable issues that are embedded in past land use decision making behaviour and land management practices. In facilitating an effective ICM process, Catchment Committees and supporting government and industry agencies should place a priority on the collection of essential natural resource use data to understand past and present resource use. In particular, a focus on providing data that enables ICM groups to understand the spatial and temporal distribution of key indicators such as land use change and agrochemical usage is essential. Doing this helps to raise awareness of catchment resources and the potential implications of land management practices, and thus informs the debate on the nature and extent of both future resources use and the level of behavioural change required to meet these aspirations. It has a valuable bi-product of providing a vehicle for cooperation as was the case with the HRIC.

Assessing local knowledge

Investigation of changes in local knowledge over time provide a powerful tool for evaluating some of the key impacts of an ICM process (Walker and Meesham 1999). In particular, the assessment of local knowledge provides an effective means of identifying gaps in local understanding in relation to management options and in evaluating fundamental assumptions that underpin local management practices and may thereby provide an appropriate basis for prioritising research. An approach based on 'landscape literacy' allowed the characterisation of resource user perceptions and to determine significant differences amongst stakeholders to the principles underpinning ICM.

Institutional analysis

Regular monitoring of the evolving legislative, administrative and financial arrangements for ICM and related policy areas (including natural resource, environmental, planning legislation and programs at the local, state and Commonwealth level) developed an understanding of the broader policy, administrative and financial context impinging on the Herbert ICM process. The Herbert is not an island. While local commitment drove the HRCCC, without local and state government support little would probably have been achieved. Queensland's ICM policy remained unchanged for a decade, but erratic finances, advent of the project funding opportunities of the NHT, emergence of improved conservation and environmental programs all played a critical role in what happened in one catchment.

Assessing organisational linkages

A broad range of community, industry and government organisations with some level of responsibility or an interest in resource use management and planning function in catchments or at a regional level. The system of organisational structures and linkages is a critical mechanism for facilitating the exchange of information and supporting a coordinated and inclusive approach to catchment management decision-making (Bellamy and Horsley 1999). An assessment of the change in the system of organisational structures and linkages on natural resource management provided an indicator of progress on ICM and a basis for monitoring a key factor underlying the effectiveness and fairness of the outcomes of the process.

Monitoring community attitudes and values

Attitudinal surveys of catchment residents extend social profiles beyond a demographic focus to perceptions, a better understanding of tractability, identifying how effective ICM is perceived to be, and identifying priorities for investigation (ie. where to focus effort in regard to specific issues, such as opportunities for use of the media). The community survey

examined landholder's behaviours and attitudes toward land and water management in the Herbert River catchment, and provided an understanding of social factors that might influence the implementation of ICM in the Herbert catchment (McCreddin and Syme 1999a, 199b).

Assessing communication networks

The effectiveness of communications provides an important measure of whether coordination is happening, and also identifies where there are gaps in the system and the effectiveness of specific/different linkages on ICM. Measuring this effectiveness should be a routine part of any ICM evaluation, particularly in the early stages. A simple questionnaire investigation provided a methodological basis on which to evaluate the adequacy of communications at a system level for ICM (McCreddin *et al.* 1999). The study also demonstrated the feasibility of monitoring communication networks and their adequacy over time.

Media representation of NRM

The use of a media as an unobtrusive source of data for research on the social context is becoming more popular as the data is becoming more readily available in 'on-line' databases. The analysis of newspaper coverage provides a useful and unobtrusive means of gauging community values about natural resource management issues (Cottrell and Rowbotham 1999). The method of content analysis that focuses on the article as the unit of analysis allowed a greater consideration of the broader social context within which the issues occur.

Economic assessment of ICM

Cost-benefit analysis (CBA) could provide a consistent and reliable evaluation of the ICM organisation that addressed the social costs and social benefits arising from the implementation of the policy initiative although formidable problems of measuring intangible benefits make the ideal difficult to achieve. To undertake a CBA, a number of simplifying assumptions are required including those concerning the causal relationship between the activities of the ICM initiative and potential improvement in the condition of natural resources and about the shifting baselines for almost all variables – economic, environmental and social. While acknowledging the problems and limitations underlying CBA, it provides valuable information for an ICM organisation to guide the ICM implementation process regarding the efficiency of investment as well as the distribution of the costs and benefits from its activities (Robinson *et al.* 1998, 1999). These contributions relate to the resource management questions, such as the value of riparian zones or clean water and to the more obscure question as to the efficiency of Catchment Coordinating Committee processes themselves. For example, does the relatively small cash outlay on ICM, plus the larger in-kind contributions of members generate real benefits in resource use?

6. FACTORS INFLUENCING THE SUCCESS OF ICM IN THE HERBERT RIVER CATCHMENT

6.1 Importance of Context

Within the Herbert River catchment community, established social networks and interactions, societal values, legal policy frameworks and historical influences have shaped the human association with the natural resource environment and will inevitably continue to influence that association and pattern of behaviour in the future. At the time of inception of ICM in the Herbert River Catchment in 1992 there was a low level of awareness of natural resource management issues in industry, local government and the general Herbert catchment community except for the compelling issue of flooding and drainage. Linkages on natural resource management between state government, local government and industry organisations were non-existent. In general, there was even a lack of cooperation within and between government agencies or sections of departments and ICM was seen as an initiative of the Resource Management section of the Department of Primary Industries rather than a whole of government initiative. There was low industry awareness and commitment to the environment and resource management beyond immediate production impacts and a lack of incentives for industry to develop environmental objectives. In addition, understanding of the resources in the catchment was fragmented across a myriad of agencies with relevant technical information not widely shared or available in an accessible form to key stakeholders and decision-makers for addressing catchment issues.

Since the establishment of the HRCCC in 1993, ICM has been only one of many changes occurring in the Herbert catchment. The social, economic, institutional, technological and environmental context has evolved independently. Some of these external influences on the ICM process and catchment issues include an increasing commitment by state and federal governments to devolve responsibility for natural resource management to the local level, a sugar industry environmental audit, the introduction of the *Integrated Planning Act*, the establishment of the Herbert Resources Information Centre (HRIC), a State of the Rivers study of the catchment, the Mahogany glider controversy at Pomona, several highly publicised fish kills in floodplain rivers, and in general growing community awareness of natural resource management across the country. The tractability of catchment issues therefore has changed markedly during the life of the HRCCC.

The implementation of the ICM process in the Herbert River Catchment is context sensitive and a wide range of environmental, economic, social, policy/institutional and technological factors have influenced its implementation and impact (Bellamy *et al.* 1999a). Based on the evaluation of the Herbert ICM process presented in Section 5 of this report, the next section identifies the environmental, economic, social, institutional and technological factors that fostered and hindered the implementation of ICM in the Herbert River catchment.

6.2 Factors Fostering the ICM Process in the Herbert River Catchment

6.2.1 NRM Issue Characterisation in the Catchment

- Lack of accessible information and technical understanding of some of the key issues is not seen as an inhibiting factor in the Herbert River catchment. There are clear enough technical solutions to many of the natural resources management problems in the Herbert River catchment in some cases for decades and longer (eg. floodplain management, soil erosion control and acid sulfate soils). In addition there has been an emergence of a number of collaborative ventures between local government, industry and state and federal government agencies to improve the capture of relevant data on

NRM issues (eg. Herbert Mapping Project and a Catchment Atlas) and provide locally accessible mechanisms for integrating data and information delivery or service provision (ie. Herbert Resource Information Centre).

- Understanding the history of land use change within the catchment helped in understanding the causes of some issues, to identify the target/client group and helped also to target strategies to resolve the problem.
- Accessibility and availability of the local knowledge and expertise on catchment issues from a diversity of catchment stakeholder groups/interests represented on the HRCCC has been critical to successful progress in the ICM process.
- Successful ICM requires a high degree of community awareness that there are important environmental problems that require timely action. Although awareness of ICM in the Herbert community is comparatively modest, it is clearly improving from a low base.
- A high level of support for community responsibility was evident within the Herbert River community by general agreement that many environmental problems come from the way individuals manage their properties. This is an advantage for ICM in gaining community participation but it will be very important for ICM to recognise the need for behavioural change at property level when working with the community and developing policies.

6.2.2 Implementational Context of the Herbert River ICM Process

- The inception of ICM in the Herbert was a voluntary process that was actively negotiated by key actors in the catchment in local government and industry organisations. As such it has attained a certain degree of credibility within the catchment because it has not been seen to have been forced on them by government or other 'outsiders'.
- The social context in which an ICM initiative operates can have an important influence on its progress. Importantly how resource management issues and ICM processes in particular are presented in the local media can reflect, and in turn, influence a community's values on these issues. The local newspaper for the lower catchment community has increased its presentation of natural resource management issues (ie. in terms of the number of published articles on NRM and the prominence of articles) since 1995. It has also identified the ICM process to the Herbert community and emphasised the importance of community involvement in natural resource management decision-making.
- There has been a broadening of the focus of local industry organisations in the catchment from an almost exclusive concern with productivity and efficiency issues and impacts at the inception of ICM in 1992 to a recognition and even promotion of the importance of natural resource management to the long term sustainability of the industry.
- Involvement in ICM is facilitated by an appreciation of personal benefits from becoming involved in group activities to help manage land and water. This was demonstrated by positive attitudes towards group involvement in the Herbert and the reported group activities of a substantial proportion of the community.

6.2.3 Policy Frameworks and Institutional Frameworks for ICM processes

- The long term consistency of the goals for ICM and commitment of its primary promoter, the Queensland Department of Natural Resources, has contributed to the survival and success of ICM in Queensland. A critical factor is the level of commitment through funding and staffing. ICM has survived using a mixture of state program and core funds and, most importantly through the National Landcare Program and its successor, the Natural Heritage Trust. Most significantly, the host Department, DPI

then DNR (from 1995), provide in-kind support centrally and in the regions in the form of staff time and operational expenses.

- At the State level, acceptance of the need for better coordination of government programs has assisted ICM. This has occurred through the acceptance of the need to develop regional resource management strategies (few have been finalised at time of writing), the increasing adoption of the *Integrated Planning Act 1997* as a framework for local and regional integration of planning and development assessment and, less tangibly, the expanded understanding in State Government of the demands of integration to achieve sustainable development.
- The ICM program in Queensland has been experimental, evolutionary and incremental. The early pilot studies informed the expansion and maturing process to the point that over 35 catchments are now formally included in the program. Catchment Coordinating Committees are formally endorsed by the (now) Landcare and Catchment Management Council. There is a growing group of experienced facilitators and catchment coordinators who contributed to this effort. Since 1995, the Queensland ICM program has organised a number of conferences and forums – especially targeted at the chairs of committees and the catchment coordinators with first hand experience of the operation of the program. They reviewed achievements and shared experiences as a learning opportunity for those catchments representatives and facilitators without the same level of experience.
- State seed money for the HRCCC (eg. for organisational start-up and development, capacity building, general operational costs, and leveraging other sources of funding for undertaking projects) was crucial to making the local/community side of the partnership work.
- Project funding successes (e.g. NLP/NHT), the appointment of an innovative and active Chair of the HRCCC, development of strong linkages with Local Government and the Herbert River Improvement Trust (HRIT), collaborative projects with other local stakeholder/interest groups, improvement in general in the cooperation amongst collaborating government agencies on ICM, and the appointment of additional DNR extension staff in the catchment are key factors raising the profile of ICM in the community and gaining a certain degree of confidence in the process and credibility amongst stakeholder groups.
- Skilled committed and long term staffing of the HRCCC has been critical to an effective and influential ICM process. In particular, a well funded Catchment Coordinator was essential to "drive" the process and perform administrative and other "burn-out" producing tasks (eg. communication/media, grant writing, coordination of activities).
- The HRCCC's representational structure and the perceived inclusiveness of the key catchment stakeholders on the committee has been important to ICM gaining credibility with other groups and processes in the catchment. In providing a representative community forum, the HRCCC has facilitated (a) exchange of information between stakeholder organisations on NRM issues, (b) the development of an appreciation of other's viewpoints, and (c) a more informed debate on catchment issues.
- There is a strong and complementary relationship between Landcare and ICM in the Herbert River catchment. The Catchment Coordinator also acts as the Landcare coordinator and has encouraged the re-establishment of a group in the lower catchment.

6.2.4 ICM Processes

- Increasing community awareness, concern and commitment to improving natural resource and environmental conditions is a major challenge for ICM in the Herbert River catchment. The acuteness or perceived social importance of the resource management problems and the ability to link these problems to ICM related solutions

(eg. habitat protection, water quality) have helped ICM gain a certain degree of legitimacy in the community.

- There has been a clear improvement in HRCCC member's awareness of catchment issues and expectations of ICM. Initially, the HRCCC had a focus on undertaking on-ground activities and works. Now members see their role as being more strategic and influential on others to undertake projects and catchment management planning processes.
- Achieving a truly representative ICM process is in part dependent on the identification of an appropriate "scale" for the ICM initiative, ie. one that is relevant to the key catchment management problems and meaningful to the local "community of interest". With a clearly differentiated upper and lower catchment context (socially, topographically and economically) in the Herbert River catchment, the formation of a new sub-committee in the upper catchment provides the basis for a more inclusive and integrated approach to catchment problems that was not perceived to be the case with one initial lower catchment dominated HRCCC.
- HRCCC meetings have provided an effective on-going forum for networking and responding to community needs in the catchment. Importantly they provide a central 'pool' of information to address issues, and they operate as a link between local government, state government agencies and various catchment stakeholders groups for NRM.
- The emphasis of the ICM process on fostering a partnership approach between government and the community is seen as one of its key strengths. Many of the HRCCC members were not in favour of an approach to NRM issues and planning based on the community alone making the decision. Concern was expressed that decisions would be based on the vested interests of particular dominant stakeholder groups rather than for the benefit of the catchment community as a whole.
- There is strong support within the Herbert community for a close a relationship between local government and ICM. This has been established by the HRCCC.
- ICM has had a substantial influence on local government planning in a relatively short period of time in the lower catchment. Importantly, a partnership has formed between the HRCCC and local government with local government taking greater responsibility for the implementation of ICM principles and strategies. This partnership is the result of improved communication between the catchment committee and local government, a better understanding of the principles and objectives of ICM within local government and because of an improved recognition of the role of local government in the management of natural resources by the HRCCC. Importantly, local government involvement has been of critical importance to the success of ICM in the Herbert. Effectively, ICM could not really have had the impact that it has without this strong partnership with local government.
- It is important that the community understands and supports what ICM is trying to achieve. Community perceptions of the main purpose of ICM appear to match closely with HRCCC objectives and their priority activities.
- Particularly in its initial stages, ICM may be more process than product and therefore may lack tangible outcomes for a considerable time. Focussed high profile activities that are small, topical, measurable and have visible outcomes (eg. owl nesting boxes, Catchment Atlas) have provided a win-win illustration of the importance of NRM in the community and providing clear evidence of progress on ICM in the catchment. They have also been important in raising community awareness of the ICM process and fostering on-going commitment of HRCCC members to a slow evolving process.
- The HRCCC developed a lead role as the key broker in the catchment for external funding of community projects to address natural resource management problems in the catchment (eg. NHT). This has provided the catalyst for community activity in

federal and state-funded natural resource management initiatives in a more strategic way than in the past.

- An inclusive and participative approach to developing the Herbert River Catchment Management Strategy substantially raised awareness of issues and others viewpoints within the HRCCC, it identified that there were substantial areas of common agreement amongst stakeholders on many key issues where there was a clear divergence of opinion and helped to establish an overall direction for the group.
- The improvement in the system of organisational networks and formal linkages in the catchment on NRM has provided opportunities for more coordinated and inclusive collaborative projects and ventures on NRM in which ICM has been a key player. These linkages have been fundamental in helping the ICM process have an influential role in catchment management and planning processes.
- Effective linkages and communication network among catchment stakeholders provide opportunities for improved coordination of resources. Existing communication networks among Herbert catchment stakeholders are providing for mutual benefits (such as information exchange, progress or ensuing action on the issue of communication, better understanding of issues) and mutual influence (eg. changed views, acknowledgment of problems, increased awareness of problems, sharing of ideas, increased acceptance and awareness of icm).
- The capacity and a willingness within an ICM organisation to collaborate with other groups, agencies or individual experts with particular understanding of the issues is essential for raising awareness of ICM issues and precipitating appropriate action. This appears to be occurring to an acceptable extent in the Herbert River ICM context.

6.3 Factors Hindering the ICM Process in the Herbert River Catchment

6.3.1 NRM Issue Characterisation in the Catchment

- ICM in the Herbert River catchment has been required to deal with intractable issues that are embedded in past land use and resource management decision making behaviour and established ways of doing things that were based to a large extent on:
  - a history of 'ignorance' of the incremental, cumulative and insidious nature of environmental degradation (eg. as exemplified in the Herbert River catchment by extensive land clearing of lowland forest and coastal wetland vegetation for agricultural development); and
  - a past developmental ethos actively promoted by governments and rural industry alike.
- Technical issues have been a hindrance in the case of some emergent problems in the Herbert catchment. For example, biodiversity conservation and nutrient enrichment of waterways are not so well defined in technical terms, and the HRCCC has experienced difficulty focusing its priorities and activities on these issues. They need research information to gain a greater understanding of the processes involved and to demonstrate the necessity and effectiveness of technological solutions.
- Understanding of cause-effect relationships and 'solutions' to major issues in the Herbert River catchment have varied along a scale of 'speculative' (eg. fish kills) to 'uncontested' (eg. acid sulfate soils). The lack of technically uncontested 'solutions' for highly sensitive issues in the catchment at times has led to substantial community conflict and lack of confidence in government, research and other relevant agencies and therefore has inhibited progress on these issues.
- Feelings of personal and community control are also related to feelings of tractability of the problem. All possible impediments to managing land and water as presented in the questionnaires in the Herbert were perceived to exist at least to some extent. Greatest

impediments were seen to be with government, in particular a lack of responsiveness and low trust in government programs.
- The key catchment issues are perceived by HRCCC members to be difficult for ICM to address because of (a) 'institutional failure' (eg. slow government responses and strategies, departmental conflicts, lack of government commitment to a 'whole of government' approach) and (b) economic issues (eg. high costs of solutions and lack of financial capacity in the community).
- Rural producers/land managers (particularly on the lower floodplain) are the principal responsible groups requiring change in behaviour to a more precautionary approach, in particular in regard to land clearing and nutrient enrichment of waterways. However, long term solutions are frequently not in a landowners self-interest financially to undertake.

6.3.2 Implementational Context of the Herbert River ICM Process

- The lower Herbert catchment is topographically, hydrologically, socially and politically 'divorced' from the upper catchment. This means that at the catchment scale inclusiveness of all interests, integrated solutions, and communication are major challenges for a whole of catchment ICM process.
- At the inception of ICM in the Herbert in 1992, a broad range of community, industry and local and state government organisations with some level of responsibility or an interest in resource use management and planning were present in the Herbert River Catchment. However, there was a clear lack of integration or formal linkages between these organisations on natural resource management that would support an integrated approach to the management of the land and water resources of the catchment.
- Successful ICM requires a high degree of community awareness that there are important environmental problems that require timely action. Those who were unaware of ICM and other related strategies on the catchment may be wary of these programs.
- A high personal sense of control in dealing with environmental problems, or a belief that individuals can help motivate the community to improve the environment will promote ICM. Unfortunately in the Herbert a large percentage of the community felt they had a low influence over what happens in their community.
- Government strategies are not perceived to be highly useful to many community members at a personal level and therefore not seen to be highly relevant at that scale.
- The effectiveness of communication of existing information between state and other relevant bodies is critical to informing the ICM process. At the inception of ICM in 1992, there was a lack of both formal linkages between organisations on natural resource management and a capacity to share information.
- Despite the need for ICM to integrate across government agencies there is a clear absence of a "whole of government" approach, commitment or involvement in ICM. State politicians seem to ignore ICM and there has been ineffective, even counter productive involvement of some state agencies on some contentious issues.

6.3.3 Policy Frameworks and Institutional Frameworks for ICM processes

- There has been an increasing commitment within federal and state governments to devolve responsibility for natural resource management to the local level without a concomitant devolution of resources to local authorities to do so. Initially, there was a lack of capacity (ie. knowledge, resources, skills) in local government in the Herbert River catchment to implement natural resource management objectives.
- The frequent lack of effective cost-sharing and other incentive systems to encourage and support changes in land manager behaviour, and in some cases reparation of

ecosystems, is a major hindrance to ICM in the Herbert in addressing key issues such as riparian vegetation clearance and nutrient enrichment of waterways.

- The relatively erratic and low level of funding available to ICM has been a major hindrance to ICM. It is still a marginal program, compared say with infrastructure development, health care or other social services. It receives some regular annual support from DNR budgets but uncertain and short term project funding from this source and from the NHT has not allowed any certainty of program development and employment in the process. This is especially an issue for a program that is intrinsically evolutionary and dependent on awareness, planning and action cycles that take longer than a few years to establish. In particular in the Herbert catchment, the lack of continuity and security of funding for a Catchment Coordinator has been a major concern to members and at times has inhibited progress on ICM.
- Inadequate resources for an ICM initiative and lack of a mandate to plan major initiatives has meant that ICM activities (eg. awareness raising and on-ground action) have been largely opportunistic and often dictated by political imperatives and opportunities, funding options and existing technical understanding rather than the priorities identified in the Herbert Catchment Management Strategy.
- ICM is a essentially an experimental program with participants on a steep learning curve. There was therefore considerable uncertainty and disagreement initially amongst HRCCC members on the roles and objectives of the HRCCC and ICM in general. It took over 3 years before a draft Catchment Management Strategy (CMS) was developed that identified a clear set of objectives for ICM in the Herbert for the first time.
- Moving from identifying and prioritising issues and developing a catchment strategy to precipitating action on that strategy has been a major challenge for the HRCCC. Guidelines that identify practical options or strategies for addressing specific natural resource issues on the ground have generally been lacking.
- There has been a high turnover in state-agency personnel at regional/catchment and state policy levels relevant to ICM, which has meant a loss of expertise on what is essentially an experimental policy process. This has posed particular challenges for the HRCCC in terms of maintaining effective networks, the loss of corporate memory on previous decisions and what needs to happen next.
- Many existing regulatory mechanisms for resource use and management focus on development control rather than strategic integrated planning and therefore have provided only limited opportunity for ICM to influence decision-making (eg. the granting of cane assignment). In addition there was poor integration of land use and management planning processes (such as the caneland assignment process with Local Government planning schemes). Through the new Integrated Planning Act, the new Hinchinbrook Shire Planning Scheme will address this issue but only for new development applications or changes of existing right of use. Government authorities still have limited ability to control potentially harmful land management practices particularly on freehold land. These issues mean that there is a potential for high transaction costs in the negotiation of the appropriate management of riparian areas and coastal wetlands with relevant authorities and individual land owners.
- Lack of an open and accountable process of cane assignment so that all parties with an interest can understand the assumptions and processes leading to decisions being made has fostered considerable social conflict in relation to the granting of caneland assignment.
- There is a lack of agreed catchment based management plans for land, water and vegetation resources for the catchment that can be used in the assessment of cumulative or potential downstream impacts of development proposals and caneland assignment applications.

6.3.4 ICM Processes

- Coordination of information flow from state government agencies was considered to be low in relation to environmental topics or ICM related matters.
- Lack of coordination of government resources to address issues of community conflict relating to land and water resources management from a whole of government approach has consistently been seen as a major blockage to an effective ICM process in the Herbert.
- A major challenge for an ICM organisation like the HRCCC in progressing action on issues is how to deal with a range of conflicts that exist between catchment stakeholders. Such conflicts existed in the Herbert between different state government agencies and even sections within a department in providing contradictory or conflicting information, within the catchment community about development (eg. growers, conservationists), in relation to individual versus community rights, and among experts about biophysical processes (eg. fish kills) or which mechanisms to use (eg. statutory).
- Although there has been consensus amongst stakeholders in identifying the key catchment issues, much greater difficulty and even strong conflict occurred in gaining agreement on the prioritisation of issues and the best ways or strategies for the ICM initiative to address them. This is complicated further by the situation that many representatives on the HRCCC frequently wear several 'hats' or roles during their engagement with particular catchment issues.
- The approach to selection of members/stakeholder representatives on the HRCCC has been to ask for a nomination from the organisation concerned. Representatives have tended to be community leaders or 'committee people' who have "too many hats" and are often already over-committed. Loss of motivation and burnout are a high risk amongst members. Also unless there are clear rules and strategies agreed upon regarding election of office bearers and renewal of representatives periodically there may be stagnation in the ICM implementation process and even dissatisfaction amongst members.
- The HRCCC mostly takes a consensual approach to decision making or at least an approach based on a process that seeks consensus. However, this has meant that on some issues in the catchment, the HRCCC has taken 'minimal' decisions rather than perhaps what might be called 'better' decisions for the catchment. In addition, this approach has contributed to some more contentious but critical problems from being addressed by ICM (eg. drainage coordination).
- In relation to some contentious or 'hot' issues arising, some HRCCC members have appeared to be protecting their own sectoral or personal interests rather than acting for the betterment of the overall catchment community and the sustainability of resource use.
- All of the potential benefits resulting from investment in ICM activities are not equitably distributed among those incurring the cost and those who do not contribute to the cost can not realistically be excluded from enjoying the benefits. In effect, the positive externalities resulting from on-farm investment in improving the condition of the environment cannot be internalised. In an economic climate where the financial viability of farmers is generally deteriorating, the ability, and therefore the willingness, of farmers to invest in improved resource management is likely to be considerably reduced.
- Obviously programs which are perceived to be well resourced both in terms of money and time are likely to be successful. Even though people thought current financial contributions from locals and government sources to be relatively equitable the surveys demonstrated worry about local people lacking money to spend on solutions. There was also concern arising from lack of finances about an inability for landholders to plan more than a year ahead. Reservations were expressed about government willingness to spend money on solutions in the longer term. In addition there was a perceived need

for more government resources for voluntary groups and better incentives for landholders to address environmental issues/problems in the future. Finally, over a third of respondents felt that they had little time to become involved in local community issues.

- Communication issues and related problems identified by Herbert stakeholders which inhibit an effective ICM process include:
  - Difficulties in getting acknowledgment of problems by all stakeholders;
  - Perceptions that issues are too politicised and too big to deal with and that there is lack of resourcing and true commitment to ICM both within government and the community;
  - Difficulty some stakeholders have in explaining concepts of ICM to others;
  - The assumption by many stakeholders that they are influencing others outlooks much more than they may be in reality.
- The specific information needs facing the ICM initiative in the Herbert have been unpredictable, or at least difficult to predict. The HRCCC therefore has had to be adaptive and responsive and, despite the strategic nature of the Catchment Management Strategy does not have the resources or mandate to plan major initiatives, whether on-ground or in relation to the design, collation and management of key natural resource management data. As a consequence, ICM in the Herbert has had to rely predominately on the corporate knowledge and expertise of members of the HRCCC and opportunities to access additional expertise from others on a needs basis – including researchers and State Government resource managers.

7. ROLE OF ICM IN NATURAL RESOURCE USE MANAGEMENT AND PLANNING

7.1 A Process of Influence

Although the Herbert River ICM process is only one case study of the ICM policy initiative in Queensland, fortuitously it is an exemplary one. It is a process that has continued to slowly evolve in a context of substantial change in regard to community values and expectations of natural resource management and planning within the catchment. However, it is a process that at times has been inhibited by a considerable degree of uncertainty and confusion on the intent of the process and on what was required or expected of those involved. It has also been subject to internal and external conflicts between its diverse stakeholders that at times have constrained progress, as has indifference, inertia, self-interest and even gate-keeping by key participants and proponents on some issues. This is not surprising given the complexity of the issues being addressed and the inherent multi-stakeholder and multi-objective nature of the ICM policy initiative. Significantly, ICM has had a substantial influence on NRM in the catchment, but there is still a long way to go to ensure a sustainable future for the Herbert River catchment.

The process by which ICM has influenced NRM in the Herbert River catchment is shown simplistically in Figure 1. Given that actual NRM decisions are mostly made by individual landowners and public agencies, ICM has only an indirect role in NRM. It achieves its core objectives primarily by influencing the behaviour of these decision-makers. To do so it has had to change values and attitudes of those with statutory and other rights and powers over natural resources. That process is one of social learning, awareness raising and political influence, operating in part by affecting the whole community's awareness and supporting the incorporation of ICM principles and objectives in resource management and planning processes occurring in the catchment.

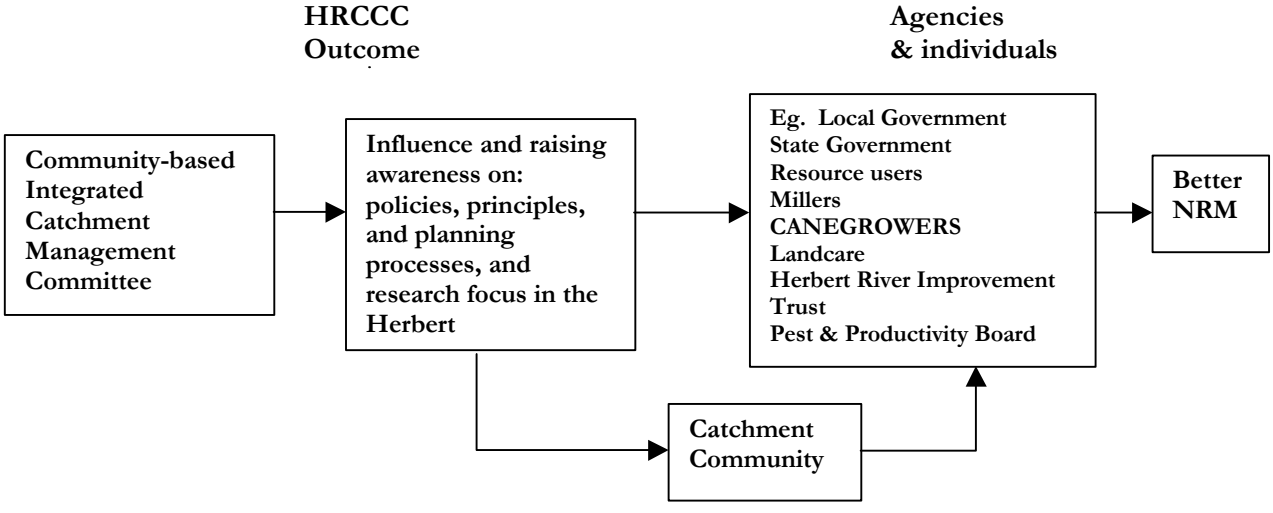


Figure 1. The ICM Process of influence on NRM in the Herbert River catchment

The Queensland Government's ICM policy initiative triggered this process in the Herbert River catchment by funding the HRCCC as a catalytic group. In Queensland, the ICM policy relies on community-level processes to promote the ICM principles in the local community and industry as well as local government without any statutory powers and only limited finances. In this context, the HRCCC has certainly succeeded in raising community and industry awareness of NRM issues, had noticeable success influencing land use planning

and development assessment at local government level, and was a voice for an integrated approach to Coastal Zone management and planning, integrated pest management and sugar industry expansion in the catchment. The HRCCC was also the driving force and principal broker negotiating funding for NRM research and resource management projects undertaken by other agencies and groups in the catchment such as Landcare, local government the Herbert River Improvement Trust and the Herbert Resources Information Centre.

7.2 Principles for the Role of Community-based Catchment Management Initiatives

The experience of the Herbert River Catchment ICM process revealed a number of fundamental principles relating to community-based catchment management policy initiatives. In particular form our perspective, a successful ICM process requires ICM to have the following roles:

- *To be a process of influence.* As a multi-stakeholder mechanism for community participation in natural resource management, ICM should not be seen as a vehicle for radical shifts in power relations within the community, but rather a vehicle for influencing policy agendas and the system of planning processes on NRM within government (local, state and federal), industry and the broader catchment community.
- *To support community learning.* ICM needs to be recognised as a program of community learning that requires a significant period of time before substantial on-ground results can be expected. Community learning at all levels, including the State level, implies:
  - the parallel increase in awareness of the significance of long term resource management problems;
  - appreciation of the need for integrated as opposed to piecemeal approaches;
  - maturing of community cooperation to address the problems;
  - creation of plans and actions that are agreed by the community;
  - political support; and
  - eventually substantial on-ground change.

  This process can easily stall and even reverse at any time along the path.
- *To be a partnership between government, industry and the community.* The ICM initiative relies on existing authorities and various programs and planning processes of state and local governments and private and non-government sectoral activities to implement their plans and achieve their objectives. ICM requires a partnership approach between different levels of government (particularly local government), industry, landholders and the broader community. There is a responsibility for landholders to do things on the ground, which is widely supported by the community and needs to be recognised and promoted in this approach. At the same time, both incentives for their efforts and resources for voluntary groups need to be provided by government rather than through regulation alone. An important way to implement this will be joint on-ground projects. This includes ensuring consistency of the information that is provided for the community from government. In doing so, there needs to be agreement on the exact roles of community and government, ie. clear roles will need to be established at the commencement of any activity.
- *To ensure legitimate representation.* For the partnership to work and gain credibility within the catchment community, representation in the ICM process must be legitimate, inclusive and accountable. Representatives must keep their constituents informed of the ICM process, interact actively with their constituents to understand their perspectives, and represent their constituency's interests to the partnership.
- *To provide a community forum for coordination of effort, networking and social learning.* Community-based ICM meetings can provide an effective and legitimate community forum for networking, both within the community and between government and the community,

as well as a vehicle for the exchange of information and more informed and inclusive discussion on NRM issues and planning processes that links state government, local government and various key catchment stakeholder groups. Decision-making in this forum needs therefore to be based on negotiated accommodation of explicitly stated interests and social learning of new shared perspectives rather than entrenched positions.

- *To build trust and effective interactions amongst stakeholders.* The success of ICM in precipitating action on catchment issues depends on the willingness of the participating individuals to build trust, deal sensitively with conflicts in the catchment community and work on maintaining productive interactions within the context of workable institutional arrangements. In this, local leaders play a substantially influential role.
- *To ensure fairness of process.* A key determinant of broader community acceptance of decision-making on catchment issues and related planning outcomes is the perceived fairness of NRM process and procedures and relatedly the fairness of outcomes that people receive. An ICM process can foster fairness through: (a) establishing a legitimate system of representation for the ICM initiative (eg. ensuring inclusiveness of membership and the supporting representatives to adequately represent their group's interests in the ICM process), (b) working towards the development of acceptable cost-sharing arrangements for NRM infrastructure and on-ground works and (c) establishing a decision-making approach for ICM that is based on a process that seeks consensus amongst stakeholders, while respecting and accommodating on-going differences.
- *To identify and broker project funding opportunities*. ICM needs to develop a lead role as coordinator and the principal broker in the catchment for external funding of community projects to address natural resource management problems in the catchment (eg. NHT).
- *To provide an influential voice on NRM at the regional level.* An ICM initiative has a key role of linking NRM principles and objectives into regional processes such as regional economic development, regional planning, cultural heritage and conservation management programs and processes.
- *To demand long term government agency commitment to the process.* The success of ICM is in part dependent on government agencies resolving bureaucratic gridlock among the array of fragmented but inter-dependent agency-based policies, plans and programs and (b) ensuring long term agency commitment to the ICM process (ie. clear upper management commitment within government agencies, political support, financial and administrative resources, establishment of workable institutional arrangements).
- *To provide a vehicle for integrating information relevant to NRM.* The two primary sources of information for the ICM process are local knowledge and expertise and existing technical information held by state and other relevant bodies. ICM meetings provide a central pooling of local knowledge through the wide diversity of stakeholder representatives involved in the ICM decision-making processes and related activities. Agencies are also repositories of technical information on the catchment but this information is fragmented and needs to be "shared" with other agencies and local interest groups. A key role of ICM is to foster the capture of relevant data on NRM issues and the development of locally accessible mechanisms for integrating data and delivering information.

Finally ICM implementation is acutely context-dependent. Established social networks and interactions, fundamental social values, institutional frameworks, historical problems and past actions and experiences have influenced and will continue to shape the current human association with the natural resource environment in a catchment. An ICM process therefore needs to recognise these and work towards achieving a sustainable future for the catchment by influencing existing networks, value systems and institutional frameworks rather than creating a new set of structural arrangements.

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9. APPENDIX 1
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1. ANALYSIS OF RESOURCE USE IN THE HERBERT RIVER CATCHMENT

OBJECTIVE

This project activity aimed to quantify and document the natural resource context and aspects of the evolution of natural resource use and management in the Herbert River catchment. It focused on two key activities:

1. Integrating existing natural resource information into a form easily accessible to catchment stakeholders.
2. Quantifying changes over time in two key indicators of the resource use context, namely:
   - Land cover and land use change; and
   - Inputs of agrochemicals.

RELATIONSHIP TO OVERALL PROJECT STRUCTURE

This component provides key data on the historical context in which natural resource management has evolved in the Herbert River catchment and thus contributes to an understanding of the factors that influence the success of the ICM. In particular it examines aspects of the following specific elements of the evaluation framework:

Natural Resource Management Issue Characterisation

- Evolution of NRM in the catchment
- Extent of behavioural change required

METHODS

The analysis of resource use in the Herbert River catchment was addressed through three different approaches:

(i) *Spatial and temporal analysis of land cover and land use in the Herbert River catchment.* This involved the visually interpretation of the land cover of the lower Herbert River catchment from scanned and rectified 1:25,000 aerial photography acquired for 1943, 1961, 1970, 1977, 1988 and 1992 and 1:10,000 digital orthophotography acquired in 1993, 1994 and 1995. Land cover boundaries were then mapped onto a geo-referenced digital base in ARCINFO GIS. The classification drew on previous vegetation and soil surveys. Validation of 1996 mapping units and boundaries was conducted by vehicle and foot traverse. Approximately 150 sites were visited during inspections. Classification of units and boundaries not inspected was completed by extrapolation from equivalent photographic units. Data on land use was obtained from the Bureau of Census and Statistics (pre-1972) and the Australian Bureau of Statistics (ABS), and was cross-referenced with the land cover data. These data were augmented (particularly for the pre-1948 period) from records held by the two local sugar mills and the Queensland Department of Primary Industries.

(ii) *Preparation of a Herbert River Catchment Atlas.* This involved the thematic compilation of data relating to soils, ground and surface water hydrology, climate, geology, land use, demography and vegetation from a range of local, state and federal government agencies. The Atlas is available digitally (CD-Rom and Web-site access) and as a hard copy publication.

(iii) *Spatial and temporal analysis of nutrient and pesticide usage in the Herbert River catchment.* Quantities of pesticide used in infrastructure maintenance pest and weed control on government and leasehold lands, and government forestry plantations were obtained from historical records maintained by the relevant state or local government agency. Data for fertiliser and insecticide usage in the sugar industry was obtained from historical records held by the Herbert Cane Protection and Productivity Board. Fertiliser and pesticide usage for crops other than sugarcane was estimated by combining data collected at 4 levels:

- statistical divisions and local government boundaries;
- the original sales areas of chemical companies (these correspond in the Herbert River catchment to the sugar mill areas);
- individual dealer records for sales districts of fertiliser companies; and
- semi-structured interviews with individual agricultural producers.

Nutrient and chemical allocations were developed on a crop basis (i.e. the known area of each crop multiplied by the rate of usage), and then summed for the catchment over time. Allocations of sales area data to the catchment were confirmed in discussions with industry staff.

KEY FINDINGS

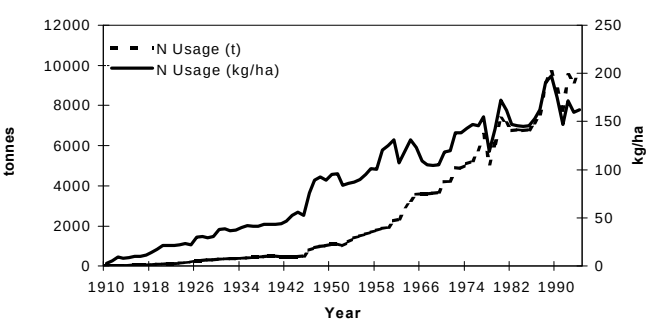
Evolution of Natural Resource Use and Management in the Herbert River Catchment

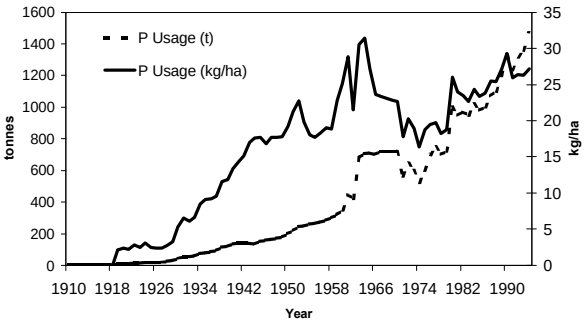
Land cover and land use

- Land cover and land use in the Herbert River catchment has changed substantially since European settlement, particularly in the lower catchment. Prior to European settlement in the 1860's, the area was dominated by open grassland, rainforest patterns, mangrove patterns, Eucalypt woodlands and *Melaleuca* communities. However, by the 1940's large losses of rainforest patterns and *Melaleuca* dominated patterns had occurred and much of the native grassland had been converted either to grazing or sugarcane. Land cover remained relatively stable throughout the 1960's and early 1970's. However, the period between 1977 and 1996 saw a rapid expansion in the area of land under sugarcane from 27000 ha in 1977 to approximately 65000 ha in 1996. The consequences of this expansion have been:
  - a decrease of approximately 65% in the area of *Melaleuca* dominated patterns;
  - a 60 % decrease in the area of beachside vegetation;
  - a 20% decrease in the area of Eucalypt woodland; and
  - a 10% decrease in the areas of rainforest patterns when compared to pre-European estimates.
- The area of mangrove communities and open water has remained relatively stable since 1943, while the area of sugarcane has more than tripled between 1943 and 1996. As expected the area of urban and industrial land cover has increased since European settlement, however the total area alienated is small within the context of total catchment area (ie <1%). In contrast, land cover and land use (predominantly extensive grazing of unimproved pastures) in the upper catchment has remained relatively constant over this time.

Nutrient Usage.

- Total fertiliser N and P use in the catchment has increased with time, however it is important that these increases are placed in the context of changes in land use. The total area of rural land fertilised is approximately 7.5% of the total catchment area, with the majority of this (ie. 6.5% of the total area fertilised) for sugarcane cultivation. As the area of sugarcane cultivated has continued to increase, N fertiliser inputs (kg ha^{-1}) increased with time, reaching a peak in the late 1980's. Early indications are that this trend may be declining as sales of fertiliser post 1990 have declined and current Bureau of Sugar Experimental Stations (BSES) fertiliser recommendations for the Herbert River district advocate reduced rates of N.
- P fertiliser inputs (kg ha^{-1}) have increased over time as the area of cultivated land has increased, although both rates and total use declined for a period in the 1970's coinciding with the removal of the government fertiliser subsidy and the energy crisis.





- Inputs of N and P to improved pastures increased dramatically during the 1980's, however their relative contribution to total catchment inputs was small. Subsequent conversion of pastures to sugar cane meant that the area of this land type fertilised has declined to negligible levels by 1998. The area of exotic pine plantations has increased since their establishment in the 1970's,

although additions of N and P (kg ha^{-1}) have decreased since the late 1980's. The area of horticulture and small crops in the catchment has varied with time, although N and P usage (kg ha^{-1}) has remained relatively stable.

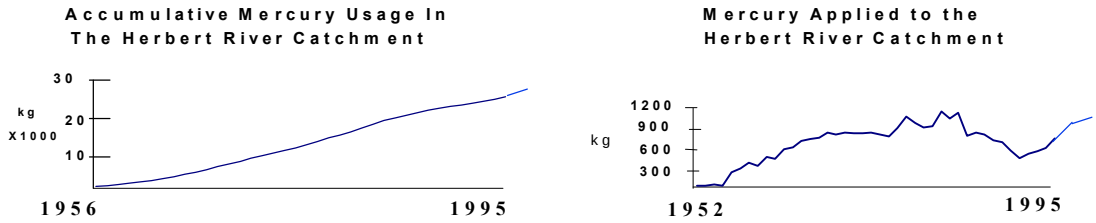
Pesticide Usage.

- A large number of agrochemicals have been applied in the Herbert River catchment since European settlement. In 1995 approximately 7% of the total catchment area was receiving pesticide applications, with approximately 95% of total applications (by volume) occurring in cane growing areas of the lower catchment. With an increasing land area under sugarcane and other crops, total agrochemical use in the catchment has increased with time and it provides a potential source of contaminants to the adjacent water of the Great Barrier Reef Marine Park (GBRMP).
- Significant quantities of organochlorine pesticide have been applied in the catchment. In general these chemicals are highly persistent, sorb strongly to particulate matter, are toxic to aquatic and marine organisms and have a tendency to bioaccumulate. While many of these were withdrawn from usage in the late 1980's and early 1990's, their fate in aquatic and marine environments of the Herbert River and adjacent GBRMP are unknown.
- Large volumes of the organophospate insecticide Chlorpyrifos continue to be applied in the catchment. Chlorpyrifos has become the dominant chemical for control of cane grubs in the sugar industry. Recent increases in total volumes correspond closely in relative magnitude to the increasing area of sugarcane production. Given the significant impact that cane grub damage has on the sugar industry, this trend is likely to continue unless an effective substitute can be found. Chlorpyrifos is persistent but effectively immobile in the soil, hence it poses little threat to ground water. However it does have the potential to contaminate aquatic and marine environments, particularly where soil erosion occurs.
- The volume of the herbicides Atrazine, Diuron and 2-4,D applied in the Herbert also increased rapidly between 1985 and 1995. Very little is known of the residual behaviour of Diuron and 2-4,D under north Australian conditions and no information is available in terms of their persistence in ground or surface waters in these areas. Diuron is persistent but not highly mobile while 2-4,D is less persistent but more mobile. Given the large volumes applied of both Diuron and 2-4,D, they do have ecotoxicological potential. Atrazine, which is both highly persistent and mobile, has been detected in ground water in the Burdekin River delta and similarly, has a high ecotox potential.
- Usage of Azole group fungicides has increased rapidly since 1982 as cane growers used these products as a substitute to Mercury based fungicides. However, the small volumes used mean that a low ecotoxicological potential exists. Large volumes of methoxymethlymercury chloride (MEMC) have been applied in the catchment since 1953. MEMC has the longest continuous record of known pesticide application in the Herbert catchment. Farmers perceptions of the greater efficacy of MEMC in comparison to Azole group fungicides has meant that its use has increased in the 1990's following a period of declining use in the 1980's. The environmental fate of MEMC is not well documented in the literature, however recent studies have shown a close correspondence between known history of MEMC application, and its subsequent appearance in the Herbert River estuary and associated coastal embayments of the GBRMP.

Extent of Behavioural Change

- The results of these studies demonstrate the magnitude of the tasks facing planners and natural resource managers in the Herbert River catchment in relation to the extensive historical decline of riparian and wetland ecosystems and the rise in use of agrochemicals in the lower Herbert River catchment and their long term implications for the sustainability of coastal and marine ecosystems. It identifies rural producers/land managers (and in particular cane growers) as the responsible groups requiring change in behaviour to a more precautionary approach, in particular in regard to land clearing and chemical usage.
- It also identifies considerable challenges for an ICM process in dealing effectively with the issues of accountability and 'user-pays' in the context of an emerging public good issue arising from past land and water management practices (eg. land clearing and expansion of intensive agriculture by rural producers). These were encouraged and/or inadvertently promoted under a past development ethos by both government and industry alike without the full knowledge or

understanding of the environmental consequences.



METHODS FOR SUPPORTING ICM IMPLEMENTATION PROCESSES

- The *Herbert River Catchment Atlas* provided essential natural resource information for supporting and promoting ICM in the Herbert River Catchment. The Atlas has been distributed widely by the Herbert Catchment Coordinating Committee and used as an important means of raising awareness of catchment stakeholders (eg high school children and cane farmers) of the natural resources and related issues of the catchment.
- The methods used to assess spatial and temporal variation in land cover and land use practices have generic application to other catchments in Australia. They have been published in a number of forms. Their robustness, rigour and simplicity would enable their application by most ICM groups.

FACTORS THAT INFLUENCE THE SUCCESS OF ICM

- ICM processes frequently are required to deal with intractable issues that are embedded in past land use decision making behaviour and land management practices that they have had no opportunity to have influence over but which were based to a large extent on:
  - a history of 'ignorance' of the incremental, cumulative and insidious nature of environmental degradation (eg. as exemplified in the Herbert River catchment by land clearing of lowland forest and coastal wetland vegetation); and
  - a past developmental ethos actively promoted by governments and rural industry alike.
- The frequent lack of effective cost-sharing and other incentive systems to encourage and support changes in land manager behaviour, and in some cases reparation of ecosystems, is a major hindrance to the success of ICM processes.

RECOMMENDATIONS

- In facilitating an effective ICM process, Catchment Committees and supporting government and industry agencies should place a priority on the collection of key natural resource use data to understand past and present resource use. In particular, a focus on providing data that enables ICM groups to understand the spatial and temporal distribution of key indicators such as land use change and agrochemical usage is essential. In so doing this helps to raise awareness of catchment resources and the potential implications of land management practices, and thus informs the debate on the nature and extent of both future resources use and the level of behavioural change required to meet these aspirations.

PRINCIPAL RESEARCHER(S):

Andrew Johnson

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2. LOCAL KNOWLEDGE AND INTEGRATED CATCHMENT MANAGEMENT

OBJECTIVE

This project activity considers local understanding about catchment processes and its potential contribution to the progress of Integrated Catchment Management (ICM). The work specifically reports on some trial exercises undertaken with sugar producers and resource professionals:

- to investigate the potential role that local knowledge has in the context of ICM;
- to consider different approaches to local knowledge elicitation and analysis; and
- to investigate practical issues involved in the elicitation and analysis of local knowledge.

RELATIONSHIP TO OVERALL PROJECT STRUCTURE

This activity provides key data and insights on the social and technological contextual factors that influence the implementation of an ICM process. In particular, it examined aspects of the following particular elements o the evaluation framework :

NRM Issue Characterisation:

- Status of technical solutions
- Perspectives on natural resource use and management

METHODS

The methods for the project included three primary components:

(i) A Review of literature was undertaken to:

- Consider why local knowledge is relevant to ICM;
- Investigate the difference between 'indigenous knowledge', 'local knowledge' and 'land literacy'; and
- Investigate what would be required to implement a large scale local knowledge study.

(ii) Trial interviews conducted with individuals to investigate operational aspects of eliciting local knowledge.

These trials were designed to explore a range of approaches to eliciting technical knowledge relating to catchment management (with an initial focus on characterisation of the physical nature of issues/ problems) in order to scope out some of the operational issues that would be involved in the design of a large scale research project. The emphasis in ICM is on integration of issues such as water quality; water quantity (availability); drainage; flood protection; riparian zone management; habitat management and protection; soil erosion and sedimentation; and pest management. These trials reflected this diverse set of issues rather than treating them in isolation.

For the individual interviews, three techniques to knowledge elicitation, representation and analysis were investigated:

- questionnaire survey;
- semi-structured interview; and
- scenario-based approaches.

Two farmers, two researchers and one drainage engineer were interviewed. Each completed all three parts of the trial in a single interview of between one and one and a half hours.

(iii) Trial workshops to investigate differences between groups (eg. on the basis of age).

The use of small groups was investigated as a means of eliciting local knowledge using a number of different (but preferably related) scenario selection exercises that considered different management options in a fictitious catchment. Maps of the topography and hydrology of the hypothetical

catchment, current land use and tenure, soils and land use suitability for sugar cane were prepared to support the exercise, and a scenario description was also prepared. Two groups of 8 farmers each were approached, each representing different demographic characteristics and different levels of experience in sugar farming. The first consisted of farmers over 50 with more than 20 years cane farming experience. The second consisted of farmers under 40, all of whom were at least second-generation cane farmers.

KEY FINDINGS

This research activity focussed on an examination of the role of local knowledge as an input into the ICM process and the potential assessment of change in local knowledge as a means of tracking the impact of an ICM process. As such, local knowledge was identified as having the potential for a significant role in ICM, particularly in regard to:

- targeting research priorities;
- determining whether research programs are likely to be adopted by catchment communities;
- evaluating the impact of ICM implementation programs through tracking changes in perceptions and attitudes.

Status of Technical Solutions

- Assessment of local knowledge may provide an effective means of identifying key gaps in local understanding in relation to management options and in evaluating fundamental assumptions that underpin local management practice and may thereby provide an appropriate basis for prioritising research.

Perspectives on Natural Resource use and Management

Opinions in relation to key resource management issues and constraints are impacted significantly by understanding. As a consequence, investigation of local knowledge may provide key insights into differing values and opinions.

Methods

- The review of literature revealed that an approach termed 'landscape literacy' was most likely to be useful in the context of ICM. It allows researchers to characterise resource user perceptions and to determine significant differences to the principles underpinning ICM. This approach is also more suitable to tracking changes in resource user behaviour and attitudes providing a potential indicator of the success of ICM programs.
- The practical trials revealed some significant operational issues associated with knowledge elicitation and analysis. Principally, some participants were uncomfortable with certain aspects of interviews. In addition, many remained focussed at the level of their own farm, and had difficulty relating to hypothetical situations for the purposes of drawing out common themes amongst groups of participants.
- The two trial workshops resulted in considerable and heated discussion, thereby providing a considerable insight into farmers' perceptions of catchment scale issues. While the scenario provided a useful point of departure and reference for this discussion, it proved hard to keep the discussion focussed on the scenario, such that it proved impossible to get a clear justification for the group for selection of a particular scenario. It is anticipated that altering the scenario rules and moving towards a scenario selection and vote at the end of this workshop would mitigate this problem. On the basis of the trial only, it was difficult to clearly delineate differences between groups of farmers.
- In summary, efficient and effective formal approaches to eliciting and assessing local knowledge that would be operationally relevant to an ICM process have yet to be developed.

RECOMMENDATIONS

- Investigation of changes in local knowledge over time provide a powerful tool for evaluating some of the key impacts of an ICM process.
- Investigation of local knowledge may be achieved with a variety, and preferably a mix, of methods. The valuation of methods in this study reinforced the general observation that questionnaire based approaches to eliciting local knowledge are much more effective than semi-structured interview and scenario-based group workshop processes.
- The study revealed some convincing arguments for the inclusion of a local knowledge component in ICM implementation programs. It is recommended that a larger scale study be pursued to clarify details of how local knowledge can be incorporated into ICM strategies, and to develop methods for the analysis of 'landscape' literacy in the context of ICM

PRINCIPAL RESEARCHER(S):

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FURTHER READING

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3. INSTITUTIONAL ARRANGEMENTS FOR THE ICM PROGRAM IN QUEENSLAND

OBJECTIVE

As part of the state system of institutional arrangements for Integrated Catchment Management, and resource management more generally in Queensland, performance of a specific ICM initiative, such as the HRCCC, depends substantially on state structures, processes and support to that process. This project component therefore focussed on developing an understanding of the broader policy, administrative and financial context of ICM policy initiative at the state-level to provide:

- an understanding of the essential institutional context in which ICM in the Herbert River catchment has been conducted including legal, administrative and financial factors;
- key baselines for the assessment of the institutional factors that influence the success of an effective ICM process in the Herbert River catchment; and
- key information for the assessment of the technical needs for effective ICM.

RELATIONSHIP TO OVERALL PROJECT STRUCTURE

In relation to the evaluation framework of the research program, the institutional arrangements at the Statewide level are important as a baseline or contextual matrix for evaluating activities in the Herbert River catchment. In particular, it examined aspects of the following particular elements of the evaluation framework :

Adequacy of Policy Frameworks and Institutional Arrangements for ICM at state and local catchment levels

- Clarity and consistency of roles and objectives of ICM and other responsible agencies/groups for NRM
- Adequacy of financial resources for ICM
- Coordination among ICM and other responsible agencies/groups for NRM
- Adequacy and effectiveness of policies, plans and decision rules of ICM and other responsible agencies/groups for NRM
- Opportunities for formal access by wider community

Adequacy and Equity of the Herbert River ICM Processes

- Knowledge and expectations of the process by stakeholders (inside and outside the catchment)
- Degree of coordination of resources to address catchment issues
- Degree of motivation, commitment , cooperation and support for the process
- Efficiency and effectiveness of process
- Equity and procedural justice and perceptions of trust in the process (by those whose activities are affected).
- Influence of ICM on planning activities in the catchment
- Agreed responsibilities and roles of important individuals and agencies
- Integration - degree of incorporation of processes in structure and context.

METHODS

The assessment of the institutional arrangements for the ICM policy initiative in Queensland was addressed through two different approaches:

Statewide Survey of ICM Officials

A comprehensive mail-out survey of all ICM coordinators and CCC Chairpersons in the State was conducted in December 1995 and repeated in November 1997. The response rate for 1995 survey was excellent. All coordinators (14 at that time) and 78% of Chairs returned the survey in most cases with useful additional comments. The results are reported in McDonald and Shrubsole (1996).

The 1997 questionnaire was based on the one used in the 1995 survey with some additions and deletions. The response rate was modest , 61% of incumbent Coordinators (28) and 50% of Chairs (26). The results are reported in McDonald, Bellamy and Laredo (1998) which contains a full description of the survey and its results.

Regular Monitoring of Legislation and ICM Programs
Regular monitoring of the evolving legislative and administrative arrangements that affect ICM in the Herbert including natural resource, environmental, planning legislation and programs at the local, state and Commonwealth level that impinge on the Herbert. This was achieved by regular interviews with key government officials in Brisbane, Townsville and Ingham and by compiling documentary sources on legislation, programs, finance, etc. One of the team (G. McDonald) was appointed Chair of the Natural Heritage Trust Assessment Panel in 1998, which provided additional opportunity to observe NRM in Queensland close at hand.

KEY FINDINGS

Clarity and consistency of roles and objectives of ICM and other responsible agencies/groups for NRM

- Queenslands ICM program has very broad, and from a community point of view, somewhat nebulous goals. There is general agreement on the ultimate purpose of ICM, but also a wide spread of opinions as to the purpose and operation of CCC among the various individuals and catchments in the State. This is not to be perceived as a deficiency of the program, given that it is intended to be community based. Over the ten years of the ICM initiative in Queensland it has been surprisingly robust. While it has evolved, its essential philosophies and implementation have remained constant.

Adequacy and effectiveness of policies, plans and decision rules of ICM and other responsible agencies/groups for NRM

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- The integrated management of land and water in Queensland is addressed through the Integrated Catchment Policy (1991) and the emerging system of regional resource management strategies promoted through DNR's community resource management program. A substantial source of funding for these programs is the Natural Heritage Trust. There is no legislative basis for integrated resource management in Queensland to compare with the NSW Total Catchment Act or the Victorian Catchment Management Act and little statutory guidance for management of steep lands, floodplains, riparian zones and other key landscapes for ICM.
- While considerable progress has been achieved in some catchments and in some regions, the depth, coverage, and effectiveness of the Queensland integrated resource management system is very patchy. Specifically, there are as yet no regional resource management plans to guide ICM activities and only a minority of river basins covered by Integrated Catchment Management (ICM) plans.
- The consequence is that at this time there is no statutory or policy framework to guide landholder and local resource management plans with respect to water, vegetation and land management. There is no set of priorities or codes of practice for on-ground works, vegetation management, soil conservation, riparian zones and other key areas.

Coordination among ICM and other responsible agencies/groups for NRM

- DNR is the lead agency for ICM which was perceived by most respondents to be a successful partnership between DNR and the rural land owner interests and not much more than that. There was a widely held view that local governments, both politically and at officer level have not been involved effectively in the ICM process. Involvement of other key state agencies such as Lands and Environment is less applauded.
- CCCs have not so far had effective involvement from local governments nor from key agencies with statutory resources and management responsibilities but the problem is understood and action being taken (DNR 1996; Vella 1999). As coordinating focus for mainstream decisions affecting resources, ICM have not yet been universally successful.

Adequacy of financial resources for ICM

- Financial resources for a program with such ambitious goals has been erratic and low. A key source of funds has been the NLP, without which ICM would struggle to survive. CCCs are required to find funding on their own initiative rather than use established revenue sources as do most public programs. DNR provides significant levels of funding, especially for the employment of coordinators.
- At present CCC have no revenue raising capacities and there is a lack of confidence in government funding for implementation, which is of particular concern given that once CCCs have been established and created strategies, their requirement for funds for on-ground works will increase their financial requirements. Planning is inexpensive relative to action.

Opportunities for formal access by wider community in ICM at state level

- The state ICM program is community based and, at least formally, provides adequate opportunity for involvement by all in the community. This has mostly been achieved through representation of groups of specific interests including industry and conservation. The pattern of actual access differs widely between regions.

Degree of motivation, commitment, cooperation and support for the process

- CCCs have to contend with low awareness in the general public about resources management issues and a general resistance to external intervention. A surprising, consistent and very significant result from the survey was respondents universal view that there is too much government regulation. People in rural Australia resent government controls on land use whether they arise from World Heritage listing and conservation generally, tree clearing regulations, water and land management regulations, changes to land tenure and land rights laws. There is a clear message here that landholders in particular will resist any solution to ICM problems that involve state and national government regulations.
- Perhaps for the reason that ICM requires a complex process of learning, there was a disturbing low level of satisfaction amongst the respondents at the state level (especially the Coordinators). Less than half the coordinators in 1995 were satisfied with progress in their CCC and three were unsatisfied, one to the point of resigning over it. The Chairs were generally more satisfied with progress, and while none was actually dissatisfied, almost half were ambivalent. Satisfaction levels and support improved during the period 1995-98.
- Most respondents believed that support from the general public was low due largely to the public's low level of awareness about natural resource management issues. Only 35% of Coordinators are satisfied with the acceptance of their CCCs by other government agencies. Chairs are more positive on this point.
- A wide range of factors generate support from industry and community organisations, especially the efforts of the CCC Chairs. Again both groups of respondents were commonly unhappy with political support and of the acceptance of local government at both the agency and political levels. As in many other results of the survey there are regular exceptions to common patterns. Other community groups rating as important include Landcare groups, Recreational fishing, Commercial Fisherman's Association, Aboriginal. Council, Sugar Industry (Mills), Tourism. Environmental organisations considered to be valuable for CCC groups included ACF, QCC, Regional Environmental Council, Marine Conservation Society (although there was ambivalence on this, some respondents believed that these groups were obstructionist).
- Clearly and not surprisingly, the dominant effective partnership is between the CCCs, the DPI (now DNR) and rural producer groups. There was less agreement between the Chairs and Coordinators on the effectiveness of the involvement of local government and even some ambivalence on the involvement of others such as the Department of the Environment. Coordinators did not in general seem impressed with the involvement of Lands and Local Government.

Agreed responsibilities and roles of important individuals and agencies

- Respondents reported a wide range of activities reflecting largely the age and maturity of the CCCs. Some have been in operation effectively since 1988, whereas some are still in the process of being formed. A progression of activities can be recognised from organisational activities - public awareness and involvement - issues generation - catchment planning - technical studies. The range of activities are all envisaged in the Queensland ICM Policy which now requires the preparation of catchment strategies before funding is provided for projects (Queensland Department of Primary Industries, 1991)
- Perhaps the most interesting feature of these results is the wide spread of opinions as to the purpose and operation of CCC among the various individuals and catchments in the State. Coordinators for example are not in clear agreement as to what they and their CCCs should do - some believe that Coordinators and CCCs should coordinate activities and give advice to landowners, others do not. Significant differences in opinion exist as to whether the objectives of the local ICM programs are clear to all members and to the level of participation of their CCC members in meetings. They too do not always agree as to whether the CCC should give advice to landholders.

Equity and procedural justice and perceptions of trust in process by those affected

- Coordinators believe that some of the most significant difficulties are due to the wide variety of beliefs amongst CCC members, a view not so strongly held by Chairs; a perception that the program has been forced on the catchment by the State Government in communities without finical resources to respond, and a lack of trust in the public in government sponsored initiatives. The Chairs hold similar views differing significantly as a group only in relation to the significance of the wide variety of beliefs and values of CCC members and to a lesser extent on the difficulties posed by the large size of catchments. Both groups believe that the CCCs have the important groups represented. There are some potentially fatal problems identified here, although many can be overcome in time as the ICM process matures and achieves ownership and clearer common perceptions.

Integration – the degree of incorporation of processes in structure and context

- Despite the need for ICM to integrate across government agencies there is a clear absence of a "whole of government" approach, commitment or involvement in ICM. State politicians seemed to ignore ICM and there was ineffective, even counter productive involvement of some state agencies. While there was no reported hostility from politicians, agency staff and community groups, it seems that CCCs must create these supporting links themselves with little support from outside.

Conclusions

It is crucial to the evaluation of the ICM process to identify what is *the problem* and how it affects the implementation process. From a *technical* point of view resource management is finding effective mechanisms to address specific well defined problems such as soil erosion, flooding, nutrient enrichment, unreliable water supplies, loss of biodiversity. The solutions are defined in terms of land management practices, engineering structures, input usage and similar hard technological matters. From a *socio-economic* point of view, resources management is a matter of designing and implementing socially acceptable and effective solutions and preventative actions to these same problems through awareness raising and education, economic, administrative and legal measures

All the respondents acknowledged the difficulty of promoting a program with relatively few immediate benefits but often with immediate cost implications for land holders. This problem is intrinsic to ICM, and can only be alleviated by a change in ethics in the community as a whole. It would be assisted by technical and economic data that demonstrated the severity of the problems and reality of the long term benefits. Those catchments with more apparent and visible resource issues (such as water shortages or acute soil erosion) will have a better chance of focussing

community attention.

The Queensland ICM program is part of the struggle to move from sectoral approaches to resources management to an integrated whole of landscape approach. The survey revealed that the biggest obstacle to ICM is the *process* within the community and within government to redress and prevent resource management problems - political and social processes to apply technological solutions. Not surprisingly, this change of philosophy is accompanied by uncertainty and resistance especially when the way forward is not signposted. As yet there is no well tested solution to this problem as a guide to action, although significant progress is being made with regional plans and better integration of local governments.

The move towards an integrated approach to natural resources management has come at a time when community expectations about environment and resources issues have increased. In some cases these changes have been rapid and the shift in resource management and economic goals magnifies the extent of attitude and behaviour change required. For example, twenty years ago, farmers were encouraged to develop natural resources such as irrigation, tree clearing for grazing, clearing and drainage for agriculture. Recently, they have been asked to revise their practices substantially. These changing requirements for resource management have been isolated to a considerable extent from the economic development decision making process although there are promising signs that the merger of resource and environmental issues with economic development issues is beginning to occur in rural areas of the State. For example decisions on water resources development, agricultural expansion, water control, use rights and land tenure, resources extraction are becoming the concern of ICM groups. In order to do this successfully, further changes will be required by the major players in natural resources management. At present the ICM program is largely limited in scope to a relationship between farmers and the Department of Natural resources (formerly Primary Industries). Sustainable development requires a whole of government and a whole of community approach to decision about resources and economic issues.

The Queensland ICM program has been active only since 1990. Consequently a major constraint to any evaluation is the relatively short period of time that CCCs have been in existence and the limited opportunities they have to bring about change. A progression of activities was recognised from organisational activities - public awareness and involvement - issues generation - catchment planning - technical studies - implementation. Judging from the diversity of responses, it requires approximately five years before a CCC will reach maturity along this spectrum. A considerable amount of time is taken establishing the CCC, creating some coherence amongst its members, learning the challenges and opportunities and having the platform for planning and implementation.

FACTORS THAT INFLUENCE THE SUCCESS OF ICM

- The long term consistency of the goals for ICM and the commitment of its primary promoter, the Queensland Department of Natural Resources, are the most important factors influencing the success of ICM in Queensland.
- The relatively erratic and low level of funding available to ICM has been a major hindrance to ICM. It is still a marginal program, compared say with infrastructure development or health care. It receives some regular annual support from DNR budgets but uncertain and short term project funding from this source and from the NHT has not allowed any certainty of program development and employment in the process. This is especially an issue for a program which is intrinsically evolutionary and dependent on awareness, planning and action cycles that take longer than a few years to establish.
- Critical to the survival and success of any program is the level of commitment through funding and staffing. ICM has survived using a mixture of state program and core funds and, most importantly through the National Landcare Program and its successor, the Natural Heritage Trust. It is difficult to define accurately just what resources have been available for the ICM program and the Catchment Committees. Most significantly, the host Department, DPI then DNR (from 1995), provide in-kind support centrally and in the regions in the form of staff time and operational expenses. Because catchment related research, planning and implementation

support are closely interconnected with many programs. Disentangling specific ICM related expenditures (eg river improvement, water allocation) is difficult and conceptually dangerous.

- The ICM program in Queensland has been experimental, evolutionary and incremental. The early pilot studies informed the expansion and maturing process to the point that over 35 catchments are now formally included in the program. Catchment Coordinating Committees are formally endorsed by the (now) Landcare and Catchment Management Council. There is a growing group of experienced facilitators and catchment coordinators who contributed to this effort. Since 1995, the Queensland ICM program has organised a number of conferences and forums – especially targeted at the chairs of committees and the catchment coordinators with first hand experience of the operation of the program. They reviewed achievements and shared experiences as a learning opportunity for those catchments representatives and facilitators without the same level of experience.
- This developmental process has depended on improved understanding of community-based processes, acceptance and adoption of the need for strategies to guide catchment action, and more recently scaling up to the regional level in the form of regional NRM strategies.
- Increasing community awareness, concern and commitment to improving natural resource and environmental conditions in their areas is a major factor promoting ICM. The acuteness of the resource management problems and the ability to link these problems to ICM related solutions, (eg water quality) helps ICM gain legitimacy in the community.
- Technical issues have been a hindrance in the case of some issues but not others. The research revealed that there are clear enough technical solutions to many of the natural resources management problems in Queensland in some cases for decades and longer - eg floodplain management, soil erosion control, groundwater depletion and acidification. The proposed technical solutions have been similar in each case, but the resources management problem still exists. Other emergent problems, such as biodiversity conservation and nutrient enrichment of waterways are not so well defined in technical terms, and ICM groups where these are key issues have greater difficulty focusing their priorities and activities. They need research information to gain a greater understanding of the processes involved and to demonstrate the necessity and effectiveness of technological solutions.
- The lack of support from State politicians for ICM has been a major hindrance to ICM. This is slowly changing. Also the relationship with local government, though highly variable, is improving to the benefit of ICM in the long term.
- There was wide agreement about the supportive role of the media and of the essential role that the CCCs, its Chairs and Coordinators play in gaining support from the stakeholders. Clearly, the ability of these people is critical to the success of individual ICM programs. The study could not assess these abilities and what skills are essential, personal or technical.
- At the State level, acceptance of the need for better coordination of government programs has assisted ICM. This has occurred through the acceptance of the need to develop regional resource management strategies (few have been finalised at time of writing), the increasing adoption of the *Integrated Planning Act 1997* as a framework for local and regional integration of planning and development assessment and, less tangibly, the expanded understanding in State Government of the demands of integration to achieve sustainable development.

RECOMMENDATIONS

- That ICM be recognised as a program of community learning and that it requires a significant period of time before substantial on-ground results can be expected. Community learning at all levels, including the State level, implies the parallel increase in awareness of the significance of long term resource management problems, appreciation of the need for integrated as opposed to piecemeal approaches, maturing of community cooperation to address the problems, creation of plans and actions that are agreed by the community, political support and eventually substantial on-ground change. This process can easily stall and even reverse at any time along the path.
- The regional resource management and integrated catchment management strategies prepared under the DNR's community resource management program be strengthened by a statutory basis and coordinated with the regional planning process under the Integrated Planing Act 1997 and other resource management legislation. More specifically the regional resource management plans and the regional conservation strategies could become the formal agreed strategies for that

component of regional plans. Such a development would bring Queensland into line with Victoria and with emerging trends in NSW.

- Accompanying the need for a firmer statutory basis for ICM in local and regional planning is the need for more reliable financial support. At the State level ICM finance has come from a mixture of source including state and NHT funds. Coordinators and CCCs live with uncertainty and short time horizons. This is not conducive to commitment and effective staffing nor to long term incentives for successful CCCs. (This is not a recommendation that funding be guaranteed but that a more stable source of funding be provided to staff CCCs and to allow reasonable expectations of competitive project support – say as applies to RITs, local roads etc.

PRINCIPAL RESEARCHER(S):

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4. MONITORING THE IMPLEMENTATION OF ICM IN THE HERBERT RIVER CATCHMENT

OBJECTIVE

Monitoring and evaluation are fundamental to identifying change and enabling learning (eg. at individual, community, institutional and policy levels). As part of the development of an understanding of both the factors that foster and hinder community-based ICM policy initiatives and their likely impact, this project activity focussed on monitoring and evaluating the context, practice and progress of the ICM process in the Herbert River Catchment to provide:

- an understanding of the essential social and institutional context in which ICM in the Herbert River catchment has been conducted;
- key baselines for the assessment of the social and institutional factors that influence the success of an effective ICM process in the Herbert River catchment; and
- key information for the assessment of the technical needs for effective ICM.

RELATIONSHIP TO OVERALL PROJECT STRUCTURE

In relation to the research project's evaluation framework, an assessment was made of the historical context of resource use in the catchment, the local institutional arrangements, and implementation process for the ICM initiative in the Herbert River catchment to identify (a) the social and institutional factors that influence an ICM process and (b) what might be realistically expected of the ICM process. In particular, this component examined aspects of the following particular elements of the evaluation framework:

Characterisation of NRM Issues in the Catchment

- Diversity of stakeholder knowledge, attitudes and values on natural resource use and management

Implementation Context for the ICM Policy Initiative in the Herbert River Catchment

- Rationale and motivation for the commencement and on-going development of the Herbert River ICM initiative
- Socio-economic conditions and use of technology
- Community attitudes and support for ICM
- Attitudes and resources of local constituency groups
- Support from politicians

Adequacy of Policy Frameworks and Institutional Arrangements for ICM at state and local catchment levels

- Clarity and consistency of roles and objectives of ICM and other responsible agencies/groups for NRM
- Coordination among ICM and other responsible agencies/groups for NRM
- Adequacy and effectiveness of policies, plans and decision rules of ICM and other responsible agencies/groups for NRM
- Commitment and skill of staff in ICM and other responsible agencies/groups for NRM
- Opportunities for formal access by wider community

Adequacy and Equity of the Herbert River ICM Processes

- Degree of coordination of resources to address catchment issues
- Degree of motivation, commitment , cooperation and support for the process
- Efficiency and effectiveness of process
- Agreed influence (eg. of ICM initiative in the catchment)
- Agreed responsibilities and roles of important individuals and agencies
- Integration – degree of incorporation of processes in structure and context

METHODS

The assessment of the social and institutional context, local institutional arrangements and the implementation process for the ICM policy initiative in the Herbert River catchment was

addressed through multiple methods:

(i) Bench-marking attitudes, values and behaviour through semi-structured interviews of HRCCC members in 1995, 1997 and 1998. The questionnaires covered members' views on the nature and tractability of catchment management issues, roles and responsibilities of CCCs, HRCCC activities and achievements, Herbert River Catchment Management Strategy –development process and influence, the ICM program in Queensland - suitability and needs, public awareness, community support and involvement in ICM, stakeholder/sector involvement and influence in the ICM process, information needs and use, factors influencing ICM implementation, personal demands and motivation, and personal background information, group/organisational involvement (McDonald and Shrubsole 1996; Shrubsole 1996; Bellamy *et al.* 1998, 1999).

(ii) Catchment stakeholder workshop to benchmark attitudes and values on natural resource issues and ICM in 1995 (Bellamy *et al.* 1995).

(iii) Interactive annual forums with HRCCC members as a group to interactively discuss issues arising in the ICM process..

(iv) On-going monitoring and analysis of documentation relevant to the ICM process including consultancy reports, HRCCC meeting minutes, stakeholder organisation annual reports (eg. McDonald and Bellamy 1997; Bellamy and Johnson 1997; Bellamy and Horsley 1999).

(v) Review of ICM and Local Government Planning schemes based on review of legislation, consultancy reports and documentation on institutional and administrative arrangements as well as semi-structured interviews with key informants in the Herbert River catchment (Vella 1997, 1999).

(vi) Mapping of change in the system of organisational structures and linkages on NRM in the Herbert catchment from 1993 to 1998 based on interviews of key informants and a review of organisational documentation including annual reports (Bellamy and Horsley 1999).

(vii) Development of a catchment socio-demographic profile through the analysis of ABS Census data for 1991 and 1996 for the catchment.

KEY FINDINGS

Rationale and motivation for the commencement and on-going development of the Herbert River ICM initiative

- There is a prominent history of flooding and drainage issues in the catchment, which has created significant social conflict over a long timeframe. Previous local and state government responses were to undertake 5 major technical studies since the late 1970s. However, there was concern within the local catchment community that (a) despite the major public and private investment in these studies, government had failed to achieve on-ground outcomes on drainage management, and (b) the local community needed a greater influence on decision-making on these issues. To this end, prominent actors in the catchment from the sugar industry and local government lobbied the State Government for the initiation of an ICM process in the catchment in 1992.
- The HRCCC has a representational structure. The steering committee set up in July 1992 identified key stakeholder organisations in the Herbert with a responsibility or interest in natural resource management in the catchment and in February 1993 invited them to nominate representatives for the HRCCC. Since then the HRCCC has opportunistically invited additional stakeholder groups to participate in the HRCCC as they saw fit. The number of members on the HRCCC therefore has fluctuated between 13 and 17 members since it was formally established in March 1993. Current representation on the HRCCC is diverse involving local industry (sugar, cattle, fishing, horticulture), local government and other statutory bodies, conservation and community interests. However, the HRCCC has been dominated by the lower catchment with only one representative from the upper catchment. State government had not been formally represented until 1999 with the appointment of a representative from the EPA for the first time. Informally DNR officers have provided technical advice on a regular basis.
- HRCCC membership has been remarkably stable with approx. 60% of current members (1999) being the original foundation members. All members are active community leaders who belong to a wide range of different organisations in the catchment holding executive and other leadership positions. They therefore have multiple allegiances and interests.

Socio-economic conditions and use of technology

- The lower Herbert catchment is topographically, hydrologically, socially and politically 'divorced' from the upper catchment. This means that at the catchment scale inclusiveness of all interests, integrated solutions, and communication are major challenges for a whole of catchment ICM process.
- Lack of relevant information is not perceived by HRCCC members as a constraint for ICM in the Herbert. Since 1995, there has been an emergence in the catchment of a number of collaborative ventures between local government, industry and state and federal government agencies to improve the capture of relevant data on NRM issues (eg. Herbert Mapping Project and a Catchment Atlas) and provide locally accessible mechanisms for integrating data and information delivery or service provision (ie. Herbert Resource Information Centre).

Diversity of stakeholder knowledge, attitudes and values on natural resource use and management

- In 1997, the HRCCC identified that managing land and water resources in the Herbert was perceived to be difficult because of (a) 'institutional failure' (eg. slow government responses and strategies, departmental conflicts, lack of government commitment to a 'whole of government' approach) and (b) economic issues (eg. high costs of solutions and lack of financial capacity in the community).
- HRCCC member's views on the key catchment resource management issues have evolved since 1995 and are now more strategic and inclusive in scope. Rural drainage, flooding, river management and sugar industry expansion and related land clearing have remained key issues in the catchment. Since 1997, emerging issues are water quality (particularly relating to fish kills), riparian vegetation and wetlands management, integrated pest and weed management, a coordinated approach to land use planning and resource management in the catchment. With closer linkages developed with the upper catchment community since 1998 grazing land degradation/erosion and water availability are also identified as key issues of concern.
- The focus of the issues identified by the new upper catchment sub-committee of the HRCCC formed in early 1999 largely related to specific "on-site" land and water management issues (eg. grazing land degradation, soil erosion). This contrasts with the current views of the lower catchment-dominated HRCCC, which is now more focussed on broader planning and public good issues (eg. land use planning, coordinated drainage, riparian and wetland management).
- Although there is good agreement among HRCCC members on the key catchment resource management issues, individual stakeholder/member understanding of those issues and in particular the diagnosis of their causes and possible solutions can vary significantly. This means that identifying mechanisms and strategies to address these issues needs to be a participatory process involving all stakeholders and to take account of the decision context. (eg. the level of problem/technical complexity and the intensity of community conflict associated with the decision). In 1998, members identified that three catchment issues - water quality (particularly relating to fish kills), waterways management and flooding, and floodplain drainage coordination – had both a high to very high degree of technical complexity and a high to very high intensity of community conflict. While industry expansion, land/vegetation clearing and land use planning had a moderate level of technical complexity but a high to very high intensity of community conflict in the decision context. In contrast, riparian management and wetland degradation have a low to moderate level of technical complexity and a moderate intensity of conflict. The participatory approach for dealing with these issues needs to be selected with close consideration to the particular decision context.

Community attitudes and support for ICM

- Over the period 1995-98, HRCCC members considered that the rural community's *awareness* on natural resource issues and the HRCCC organisation itself had improved substantially largely due to the occurrence of specific well publicised or controversial issues/events (such as land conversion from cattle-to-cane, land clearing for cane land expansion, owl boxes activity, fish kills in the river, damming of streams and acid sulfate soils).

Attitudes and resources of local constituency groups

- There has been a broadening of the focus of industry organisations in the catchment from an almost exclusive concern with productivity and efficiency issues and impacts at the inception of ICM in 1992 to a recognition and even promotion of the importance of natural resource management to the long term sustainability of the industry.

Support from politicians

- Local government politicians have had an active and influential involvement with ICM process with 2 Councillors regularly participating in the HRCCC and the lower catchment Mayor being the Deputy Chair of the HRCCC. However State government and Federal government politicians have had little input or involvement such that HRCCC members identified them as having an ineffective to very ineffective involvement.

Adequacy and effectiveness of policies, plans and decision rules of ICM and other responsible agencies/groups for NRM

- The HRCCC released a draft Herbert River Catchment Management Strategy in May 1996 for public comment that was important to HRCCC members because (a) it provided a future direction to the group and a guide for future actions (e.g. identified issues, prioritised needs, identified stakeholders and their roles, provided a reference point to start from); and (b) it helped to get resources and support for ICM in the Herbert (e.g. funding for Catchment Coordinator and natural resource projects, and gaining in principle commitment of State Government to undertake projects).
- Since the inception of ICM in Queensland implementation has been hindered by the inability of catchment management groups to influence land use planning and management. Traditionally ICM principles and catchment management issues have not been incorporated into or addressed by local planning schemes. A recent development (1998) in the lower Herbert catchment is the process that requires farmers opening up new areas for intensive agriculture or requiring a change of use will require Hinchinbrook Shire Council approval (for conditions) under the new Shire Plan. This process seeks advice from a range of responsible agencies including ICM in the decision-making process. Ultimately this development requires the Council to have both the technical capacity and political will to implement their statutory powers.
- While local government in the lower catchment does have enormous scope in achieving catchment management objectives, it is limited by the fact that it can only implement these strategies when a development application is triggered by the planning scheme. The regulation of new developments through the planning process will not effectively deal with existing resource management problems because planning controls have little power to control existing unsustainable land uses or minor variations in those uses. Therefore to effectively achieve ICM, planning schemes and development assessment may need to be integrated with other forms of institutional arrangements to deal with existing use rights.
- The approach to selection of members/stakeholder representatives on the HRCCC has been to ask for a nomination from the organisation concerned. Representatives have tended to be community leaders or 'committee people' who are often already over-committed.
- There is some concern among HRCCC members that there are no clear rules for managing the HRCCC's representational structure and processes (eg. use of proxies, reviewing membership, election of office bearers). To-date the approach has been largely an ad hoc process that may in time reflect on its credibility.

Coordination among ICM and other responsible agencies/groups for NRM

- The HRCCC has emerged as a coordinative and informative forum (particularly within the lower catchment) for facilitating information exchange and more inclusive debate on NRM issues with a level of legitimacy that had not existed before in the catchment.
- There have been significant changes in the system of organisational linkages on NRM in the catchment since the inception of ICM. (1) Increased number of linkages (both regulatory and

non-regulatory) between (a) local government and related statutory bodies and industry and other community organisations in the Herbert catchment and (b) these Herbert River organisations and state and federal agencies. (2) the emergence of a number of successful coordinative, collaborative and/or joint funding initiatives for NRM purposes (eg. the Herbert Mapping Project and the establishment of the HRCCC in 1993) which are now the catalyst for further collaborative ventures relevant to catchment management (eg. the Herbert Resources Information Centre or HRIC).

- A high turnover has occurred in state-agency personnel at regional/catchment and state policy levels relevant to ICM, which has meant a loss of expertise on what is essentially an experimental policy process. This poses particular challenges for ICM groups like the HRCCC in terms of maintaining effective networks, the loss of corporate memory on previous decisions and what needs to happen with regard to a particular ICM initiative.
- Effective state government involvement is critical to the success of ICM in the Herbert through the provision of financial resources, technical support, and its power to endorse the Catchment Management Strategy.

Clarity and consistency of roles and objectives of ICM and other responsible agencies/groups for NRM

- Initially there was considerable uncertainty amongst HRCCC members on the roles and objectives of the HRCCC and ICM in general. It took over 3 years before a draft Catchment Management Strategy (CMS) was developed that identified HRCCC objectives for the first time and indicated a degree of consensus on issues and respect for others views within the HRCCC.
- In 1997, The HRCCC launched a draft Herbert River Catchment Management Strategy for public comment which formally identified a clear set of objectives for ICM in the Herbert for the first time:
  - Co-ordinate government agencies and the community to pursue common goals
  - Seek community involvement in catchment management
  - Reflect the requirements of the wider community within the Catchment
  - Identify and rectify natural resource degradation
  - Promote ways to prevent and reduce natural resource degradation
  - Promote the wise use of all natural resources within the Catchment
  - Identify key indicators of biodiversity and monitor as a measure of catchment health
  - Encourage the retention of significant natural habitats within the Catchment.

Adequacy of financial resources for ICM

- Although seed money provided by the lead state agency for ICM has been pivotal to the successful formation of the HRCCC and a catalyst for it to leverage other sources of funding (eg. NLP/NHT), the short term nature of funding and political cycles is not conducive to long term environmental/sustainable development solutions. In addition, much of the funding is administratively burdensome to apply for and to manage and takes up a lot of the HRCCC's resources (eg. the Catchment Coordinators time).

Commitment and skill of staff in ICM and other responsible agencies/groups for NRM

- One of the big challenges for ICM is keeping up the momentum in a process where tangible outcomes are slow to emerge and may well be attributed to others influenced by the ICM process. A strong, active and credible Chair has been essential for driving the ICM process in the Herbert and progressing issues.
- Participants of a community forum held in 1995 in the catchment identified Government as being the hardest to get on-side and committed to ICM. Besides providing continuity in support through providing resources (eg. funds, personnel, technical advice) to effect action, a key requirement from government for successful ICM is the commitment of top officials to ensure real participation by agencies as well as the continuity of political commitment (ie. at all tiers of government).
- In 1998, members identified the important qualities of a Catchment Committee member as: open-minded with a broad vision (including benefit of the community at heart, recognises needs

of others, sees other point of view, prepared to compromise, able to give a little); genuinely concerned about NRM/ICM issues; good communication skills and can contribute to group discussion and take information back to their own stakeholder group; understands and is prepared to put forward the views of own interest group; good interpersonal skills (including willingness to listen to others views); vast local experience and aware of what is going on in the catchment; progressive attitude (including willingness to accept change, learn things all the time); and with available time to commit to ICM.

- Members also identified the a number of important qualities of a Catchment Coordinator as: experience with and knowledge of NRM issues and agricultural systems (ie. technical skills, understanding across disciplines, problem solving, eye for myths and legends); good communicator; highly developed interpersonal skills and able to handle a diverse group of people; broad minded with an ability to look at the big picture; tactful; confident and prepared to stand up and be accounted for; good conflict resolution skills; and a good listener.

Opportunities for formal access by wider community

- Although ICM is a community-based process, there is a lack of a clear mechanism for initiating involvement in ICM outside the formal representative structure of the HRCCC. Importantly, through this formal mechanism a sub-committee of the HRCCC involving 16 representatives of a broad range of stakeholders from the community, industry and government was formally formed for the upper catchment in December 1998 to discuss and raise issues of particular relevance to the upper catchment. Community members in the upper catchment felt that they were not equally represented on the HRCCC (only one representative), there was a predominant focus of the HRCCC on issues affecting the lower floodplain and that there were logistical difficulties relating to the long distance between the upper and lower catchments to attend meetings (ie. a 4-5 hour drive). This new group is also facilitated by the HRCCC's Coordinator and regularly reports to the HRCCC.

Degree of coordination of resources to address catchment issues

- Coordination of government resources to address issues of community conflict relating to land and water resources management from a whole of government approach has consistently been seen as a major blockage to an effective ICM process and experience with major resource management issues with significant social conflict in the catchment supports this concern (eg. the failure for over 5 years to reach agreement on the Sugar Industry Infrastructure Package with the local sugar industry bodies; Mahogany Glider conflict at Pomona; and fish kills controversy).
- The HRCCC has adopted a lead role as the key broker in the catchment for external funding of community projects to address natural resource management problems in the catchment. For example, the HRCCC acted as the broker and coordinator for all new proposals from the catchment submitted for federal government funding through the new National Heritage Trust initiative. This is providing the catalyst for community activity in federal and state-funded natural resource management initiatives in a more strategic way than in the past.

Degree of motivation, commitment, cooperation and support for the process

- The membership of the HRCCC has ranged from between a total of 13 and 17 representatives since it was established in 1993. There has been varied commitment to the ICM process by these representatives over time (ie 1993-98) as reflected in attendance at monthly meetings (eg. about 9 members on average attend each meeting). The representatives of the sugar industry/agencies, local government, upper catchment and Landcare have been the most consistent participants, while the Conservation representative, local Development Bureau and a local community had the lowest involvement.
- The time commitment of HRCCC members to ICM matters has increased between 1995 and 1998. Until 1997, the majority of members (over 70%) spent 10 hours or less per month on ICM matters but, by 1998, nearly 50% of members reported committing more than 16 hours per month to ICM.
- HRCCC member's motivation for involvement in ICM was identified in 1997 as being personally rewarding (eg. because they could contribute to the community), they cared about the

environment, and that they could meet other members of the community who could influence resource management decision-making. However, in some instances (eg. contentious or 'hot' issues), some members have appeared to be protecting their own sectoral or personal interests rather than acting for the betterment of the overall catchment community and the sustainability of resource use.

- Most members have become positive over time (1995-98) about the HRCCC's achievements and the group's overall direction. They also perceive an improvement in the level of community support for ICM from a low to a moderate level. However, there are some concerns with the rate of progress and the slowness of the overall process in general.
- Local government involvement has been perceived by the HRCCC to be of critical importance to the success of ICM in the Herbert, and that, effectively, ICM could not really function well without that involvement.

Efficiency and effectiveness of process

- Due to a lack of continuity and security of funding for ICM, HRCCC activities and progress has been driven opportunistically by state and federal government funding processes and schemes rather than by the priorities identified in the Herbert Catchment Management Strategy (CMS). This has meant that the HRCCC has been fairly reactive in its approach in implementing the CMS (rather than setting own agenda), and that it is tending to follow a circuitous course towards reaching its stated goals.
- The major achievements of the Herbert River ICM process are summarised as:
  - Providing a forum that brings very different people in the catchment together to exchange ideas and providing a catalyst for change;
  - Supporting a range of projects on natural resource management;
  - Raising community awareness of catchment RM issues; and
  - Gaining legitimacy as an influential group on NRM in the catchment.
- The HRCCC in general takes a consensual approach to decision making or at least an approach based on a process that seeks consensus. However, this has meant that on some issues in the catchment, the HRCCC has taken 'minimal' decisions rather than perhaps what might be called 'better' decisions for the catchment. In addition, this approach has kept some more contentious but critical problems from being addressed by ICM (eg. drainage coordination).
- From 1995 to 1998 there has been a general improvement in the overall level of satisfaction of HRCCC members with progress. However they identified a number of ways that could improve their performance (including the level of stakeholder group involvement in the HRCCC) by:
  - Raising the profile of ICM and the HRCCC in the community through more targeted publicity and promotion of the HRCCC and its activities;
  - Ensuring the security of tenure for a Catchment Coordinator and the adequacy of funding for HRCCC activities;
  - Maintaining legitimacy through broad stakeholder representation on the HRCCC (eg. direct involvement of local business through the Chamber of Commerce; more active involvement of environment interests; representation of government technical expertise from the EPA and DNR);
  - Greater use of proxies by representatives;
  - A more proactive (versus opportunistic) approach; and
  - More effective government agency involvement in the ICM process (including government agencies being required to consult with the HRCCC on all their programs in the catchment).
- The Catchment Management Strategy development process proved to be valuable to the HRCCC members involved because (a) the process was seen to be inclusive and transparent within the Committee, (b) it raised awareness of issues and others viewpoints within the HRCCC membership, (c) it identified areas of agreement, and (d) helped to focus the HRCCC and establish an overall direction.
- The issues relating to the development process for the catchment strategy are the lack of resolution on some key issues, speculation whether it will assist in resolving resource management conflicts in the catchment, and the apparent failure of the strategy to have a significant impact on what the Committee was actually doing.
- In 1998, HRCCC members considered that the implementation of ICM in the Herbert River catchment was difficult because of the large size of the catchment, the lack of financial resources

within the community in the upper catchment, the lack of cooperation between State government agencies, and the lack of coordination between state government agencies in addressing issues.

Agreed Influence of ICM in the catchment

- The system of organisational structures and linkages on natural resource management in the Herbert River Catchment has evolved to be more coordinated and more inclusive of key stakeholder groups since the establishment of the HRCCC in 1993. Significantly, the HRCCC is providing a key integrating and informing functional role on NRM within this system.
- Overall HRCCC members considered that for major natural resource management activities in the catchment (ie. land use planning, environmental protection, land clearing guidelines drainage coordination) that there should be much greater community influence in decision-making than what occurs at present. However, they also in general considered that the level of community involvement/public participation in decision-making needs to vary depending on the particular issue of concern between 'Consulting', 'Involving', and 'Shared planning and decision making'. Importantly, they were not in support of the community alone making decisions on these issues.
- The active involvement of local government in the HRCCC emerged as a key strategy for the HRCCC to influence decision-making processes in the Herbert particularly relating to land development planning. Local government is an important information source for the ICM process, it recognised HRCCC with its broad stakeholder representation as a legitimate referral and advisory group in the catchment, it is actively seeking HRCCC's advice on issues, and it is seen as an important mechanism for providing ICM with "teeth for implementation".
- Integrated catchment management has had a substantial influence on local government in a relatively short period of time. Some of these changes include an improved awareness of ICM, better coordination between authorities in extending the reach of town planning to achieve ICM strategies as well as the actual implementation of ICM in the local planning scheme. Positive benefits also include improved communication between local government and previously unconnected stakeholder groups to provide a wider range of perspectives on resource management issues. Now local authorities in the lower Herbert are regulating land uses to achieve catchment management objectives. The upper catchment is significantly behind the lower catchment in terms of the understanding of planning and ICM issues, open communication between stakeholder groups and level of commitment to resource management.
- The ICM process has contributed to increased community awareness and involvement in natural resource management issues in the catchment. In particular, the presence of the HRCCC and its activities has helped to focus community attention on natural resource management issues. However, to-date it has been difficult to assess the extent this awareness has been translated into better land management practices by land owners.

Agreed responsibilities and roles

- In 1998, HRCCC members prioritised the roles for ICM in the Herbert as:
  - Encourage Local Government to take an active role in environmental management issues
  - Encourage joint projects between community, industry and state and local government
  - Provide a continuing source of advice to local government on catchment issues
  - Encourage discussion between community interest groups on environmental issues
  - Raise the level of local awareness and knowledge of environmental issues on the catchment
  - Encourage coordination of state government programs
  - Encourage research
  - Develop solutions for, and better understanding of, environmental problems in the Herbert catchment.
  - Undertake specific on-ground projects with other bodies.
- Since the inception of ICM in the Herbert catchment, a significant increase has occurred in the role and responsibility of local government in catchment management and planning. This has emerged through (a) an influential role based on active membership on the HRCCC and (b) regulatory and statutory processes (including major changes to the Hinchinbrook Shires Planning Scheme and HRIT activities).
- While the majority of members agreed that an HRCCC member's role is to represent the

resource management views of their constituent group at meetings, there was a divergence of opinion on whether an HRCCC member's role is to provide either their personal views on resource management issues or a catchment-wide perspective of natural resource management issues at CCC meetings.

- Members clearly feel that the community also had a responsibility regarding land and water management and that ICM should remain a voluntary activity by community members.
- There has been a significant increase in the number and diversity of projects engaged in by the HRCCC - from a tin mining dam inventory in 1995 to include by 1999 a joint project with the HRIT on bank stabilisation, the owl nesting box program, a Catchment Atlas, several restoration and revegetation projects, riparian vegetation mapping study, weed control activities, a riparian "community" forum, acid sulphate soils awareness, and a cooperative project to link ICM and local government planning.

Integration – the degree of incorporation of processes in structure and context

- Concern was continually expressed by some HRCCC members of the on-going failure of State Government agencies to effectively use their statutory powers and authority to substantively address land and water development and management through a whole of government approach within the catchment (eg. land conversion from grazing to intensive agriculture, caneland expansion through tree clearing, and construction of levees on the floodplain). State agencies continue to make decisions on NRM issues in the catchment independently of each other and local interest groups. In particular, the apparent lack of sharing of information between agencies has led to contradictory or conflicting information being presented to the community by different government agencies with regard to important issues in the Herbert. This situation has often exacerbated the community conflict.
- Government agencies have often failed to consult local agencies or groups on new programs or activities to be commenced in the catchment. For example, some important initiatives have 'by-passed' ICM (eg. Water Infrastructure package).
- There is a strong and complementary relationship between Landcare and ICM in the Herbert River catchment. The Catchment Coordinator also acts as the Landcare coordinator and has encouraged the re-establishment of a group in the lower catchment.

Equity and procedural justice and perceptions of trust in process

- Overall members considered that all parties (ie. all three tiers of government, industry and individual farmers) should contribute to catchment management. However on average members felt that the Commonwealth and State Governments should contribute considerably more than other parties (ie 30% each) with individual farmers contributing the least (10%).
- There was clear perception within the HRCCC of the importance of procedural fairness (eg. in land allocation and planning decisions) and the need for better incentives for landholders and greater resourcing of community groups for catchment management.
- In 1998, most members considered that ICM was *not made difficult* because of:
  - The public's general lack of trust in government-sponsored initiatives;
  - The wide variety of values and beliefs among HRCCC members seriously detracting from an effective level of cooperation developing among them; or
  - A community perception that ICM has been forced on the catchment by the state government.
- Significantly, there has been a clear shift of opinion by members over time (1995-1998) from agreement to disagreement on whether the ICM implementation process was difficult because of:
  - the public's lack of trust in state/local government-sponsored initiatives;
  - the absence of a single acute resource management problem (eg. of the magnitude of salinity); and
  - the wide variety of values and beliefs among HRCCC members seriously detracted from an effective level of cooperation developing,

These changes suggest both an increase in the confidence of HRCCC members in the ICM approach and a greater acceptance/tolerance of the diversity of views amongst members.

FACTORS THAT INFLUENCE THE SUCCESS OF ICM

Establishing confidence and credibility in the process

- The inception of ICM in the Herbert was a voluntary process that was actively negotiated by key actors in the catchment in local government and industry organisations. As such it has attained a certain degree of credibility within the catchment because it has not been seen to have been forced on them by government or other 'outsiders'.
- The HRCCC has a representational structure and the perceived inclusiveness of the key catchment stakeholders on the committee has been important to its credibility with other groups and processes in the catchment. In providing a truly representative community forum a CCC can facilitate (a) exchange of information between stakeholder organisations on NRM issues, (b) the development of an appreciation of other viewpoints, and (c) a more informed debate on catchment issues.
- Achieving a truly representative ICM process is in part dependent on the identification of an appropriate "scale of catchment" for the ICM initiative, ie. one that is relevant to the key catchment management problems and meaningful to the "community of interest". With a clearly differentiated upper and lower catchment context (socially, topographically and economically) in the Herbert River catchment, the formation of a new sub-committee in the upper catchment provides the basis for a more inclusive and integrated approach to catchment problems that was not perceived to be the case with one initial lower catchment dominated HRCCC.
- Project funding successes (e.g. NLP/NHT), the appointment of an innovative and active Chair of the HRCCC, development of strong linkages with Local Government and the Herbert River Improvement Trust (HRIT), collaborative projects with other local stakeholder/interest groups, improvement in general in the cooperation amongst collaborating government agencies on ICM, and the appointment of additional DNR extension staff in the catchment are key factors raising the profile of ICM in the community and gaining a certain degree of confidence in the process and credibility amongst stakeholder groups.
- Understanding of cause-effect relationships and 'solutions' to major issues in the Herbert River catchment have varied along a scale of 'speculative' (eg. fish kills) to 'uncontested' (eg. acid sulfate soils). The lack of technically uncontested 'solutions' for highly sensitive issues in the catchment at times has led to substantial community conflict and lack of confidence in government, research and other relevant agencies and therefore has inhibited progress on these issues.

Creating awareness of issues and the ICM process

- Particular in its initial stages, ICM may be more process than product and therefore may lack tangible outcomes for a considerable time. Focussed high profile activities that are small, topical, measurable and have visible outcomes (eg. owl nesting boxes, Catchment Atlas) have provided a win-win illustration of progress. They have also been important in raising community awareness of the ICM process and fostering on-going commitment of HRCCC members to a slow evolving process.
- An inclusive and participative approach to developing a Catchment Management Strategy substantially raised awareness of issues and others viewpoints within the HRCCC, it identified that there were substantial areas of common agreement amongst stakeholders on so key issues, and thus helped to establish an overall direction for the group.

Precipitating action

- The success of ICM in precipitating action on catchment issues depends on the willingness of the participating individuals to build trust, resolve/deal with conflicts in the catchment community and work on maintaining productive interactions within the context of workable institutional arrangements.
- Understanding the history of land use change within the catchment helped in understanding the causes of some issues, to identify the target/client group and helped also to target strategies to resolve the problem.
- Moving from identifying and prioritising issues and developing a catchment strategy to precipitating action on that strategy has been a major challenge for the HRCCC. Guidelines that identify practical options or strategies for helping the CCC address specific natural resource

issues on the ground have generally been lacking.

Acting to resolve conflict

- A major challenge for an ICM organisation like the HRCCC in progressing action on issues is how to deal with a range of conflicts that exist between catchment stakeholders. Such conflicts existed in the Herbert between different state government agencies and even sections within a department in providing contradictory or conflicting information, within the catchment community about development (eg. growers, conservationists), in relation to individual versus community rights, and among experts about biophysical processes (eg. fish kills) or which mechanisms to use (eg. statutory).
- Although there may be consensus amongst stakeholders in identifying the key catchment issues, much greater difficulty and even strong conflict may occur in gaining agreement on the prioritisation of issues and the best ways or strategies for the ICM initiative to address them. This may be even more complicated by the common situation that representatives on the CCC frequently wear several 'hats' or roles during their engagement with particular catchment issues.

Ensuring continuity

- HRCCC meetings have provided an effective on-going forum for networking and responding to community needs by providing a central "pool' of information to be available to address business, and operating as a link between local government, state government agencies and various catchment stakeholders groups for NRM.
- State seed money for ICM is crucial to making the local/community side of the partnership work (eg. for organisational start-up and development, capacity building and general operational costs, and leveraging other sources of funding for undertaking projects).
- A well funded Catchment Coordinator was essential to "drive" the process and perform administrative and other "burn-out" producing tasks (eg. communication/media, grant writing, coordination of activities). The lack of continuity and security of funding for a Catchment Coordinator has been a major concern to members and at times has inhibited progress on ICM.

Maintaining commitment to the process

- CCC members are frequently active and committed community leaders or 'committee people' who may have "too many hats". Loss of motivation and burnout are a high risk amongst members.
- The approach to selection of members/stakeholder representatives on the HRCCC has been to ask for a nomination from the organisation concerned. Representatives have tended to be community leaders or 'committee people' who are often already over-committed. Also unless there are clear rules and strategies agreed upon regarding election of office bearers and renewal of representatives periodically there may be stagnation in the ICM implementation process and even dissatisfaction amongst members.

Establishing an influential role

- The emphasis of the ICM process on fostering a partnership approach between government and the community is seen as one of its key strengths. Many of the HRCCC members were not in favour of an approach to NRM issues and planning based on the community alone making the decision. Concern was expressed that decisions would be based on the vested interests of particular dominant catchment stakeholder groups rather than for the benefit of the catchment community as a whole.
- ICM has had a substantial influence on local government planning in a relatively short period of time in the lower catchment. Importantly, a partnerships has formed between the HRCCC and local government with local government taking greater responsibility for the implementation of ICM principles and strategies. This partnership is the result of improved communication between catchment committee and local government, a better understanding of the principles and objectives of ICM within local government and because of an improved recognition of the role of local government in the management of natural resources by the HRCCC. Importantly, local government involvement has been of critical importance to the success of ICM in the Herbert. Effectively, ICM could not really have had the impact that it has without this strong partnership with local government.
- The improvement in the system of organisational networks and formal linkages has provided

opportunities for more coordinated and inclusive collaborative projects and ventures on NRM in which ICM has been a key player. These linkages have been fundamental in helping the ICM process take an influential role in catchment management.

RECOMMENDATIONS

- The ICM process provides a multi-stakeholder mechanism for community participation in ESD that should not be seen as a vehicle for radical shifts in power relations within the community but a vehicle for influencing policy agendas on NRM.
- Established social networks and interactions, fundamental social values, legal/institutional frameworks and historical influences have shaped the current human association with the natural resource environment in the Herbert and will continue to influence the pattern in future. An ICM process needs to recognise these and work towards achieving ESD by influencing existing networks, value systems and institutional frameworks rather than creating a new set of structures and processes.
- In choosing the method of community engagement and a strategy for action for a particular catchment problem, attention needs to be given to the decision context relating to that problem (ie the level of technical complexity and the intensity of community conflict associated with the decision).
- Local government has enormous scope in achieving catchment management objectives through the incorporation of ICM principles into planning schemes. However local government land use planning is not the answer alone. It is limited in that it can only implement these strategies in Queensland when a development application is triggered by the planning scheme. Therefore to effectively achieve integrated catchment management, planning schemes and development assessment will need to be integrated with other land management arrangements that can deal more effectively with existing unsustainable use rights.
- Government agencies need to resolve bureaucratic gridlock and ensure long term agency commitment to the ICM process. The complex and often confusing array of Acts, programs, and policies that impact on resource management at the local, watershed, state and national levels need to be rationalised to ensure a truly integrated approach to catchment management. Examples of were this could occur through legislation at a State level in Queensland include the River Improvement Trust Act, Water Resources Act, Nature Conservation Act, Environmental Protection Act and the Land Act.
- Government agencies and other technical advisers or experts need to be careful not to push highly speculative solutions that may create greater social conflict and loss of trust in policy processes.
- An ICM process needs to establish clear and agreed ground rules on how the CCC will operate (ie. purpose, structure, composition, process). Some of the key questions that need to be addressed are:
  - What is the appropriate scope and scale of the ICM initiative – this requires defining the community of interest.
  - Who should be involved – this raises the issues of inclusiveness vs effective group size
  - How representatives are to be selected.
  - How office bearers are to be appointed and for how long
  - How decision will be made (eg. by vote or consensual decision)
  - What is the role of a representatives (eg. protecting own or sectoral interests, communication needs)
  - Ensuring legitimacy of representativeness (eg. use of proxies, review of membership).
- CCC members are frequently active and committed community leaders or 'committee people' who may have "too many hats". Efficient use of proxies and turn over of representatives are essential for an inclusive, enthusiastic and actively influential ICM process.

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FURTHER READING

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5. ANALYSIS OF THE SUGAR CANE ASSIGNMENT PROCESS IN THE HERBERT RIVER CATCHMENT

OBJECTIVE

Since the early 1990s, significant expansion in both growing area and milling capacity has occurred in the Australian sugar industry and in the Herbert River catchment in particular. Knowledge about the nature and processes that operate within the sugar industry are central in understanding both problems and solutions. The institutional arrangements that are often perceived to be part of the problem, as well as a part of the solution, are generally poorly understood.

The cane land allocation process arguably has the greatest influence on the use of natural resources in the lower Herbert River catchment. ICM has traditionally played a minor role in the cane land allocation process, however changes in sugar industry policy and increasing capacity within ICM groups represent an opportunity for this situation to change. As a contribution to the assessment of the institutional factors that influence the success of an effective ICM process, this Activity aims to evaluate the cane land allocation process in the Herbert River catchment in relation to its compliance with the objectives of ICM.

RELATIONSHIP TO OVERALL PROJECT STRUCTURE

This component contributes to the identification and assessment of factors that influence the success of an ICM implementation process. In particular it examines aspects of the following specific elements of the evaluation framework:

NRM Issue Characterisation

- Evolution of NRM in the catchment
- Extent of behavioural change required

Institutional Structures for ICM

- Policies, plans and decision rules of implementing agencies
- Coordination among implementing agencies

Analysis of Process

- Efficiency and effectiveness of process
- Equity and procedural justice
- Integration (degree of incorporation of process in structure and context)
- Agreed responsibilities and roles

METHODS

This activity involved a detailed evaluation of the cane land allocation process in terms of efficiency, equity and performance in relation to the objectives of Integrated Catchment Management in the lower Herbert River catchment during the period 1993-1996.. This analysis was addressed through five different methodological approaches:

(i) Review of written records of applications for assignment;
(ii) Analysis of spatial data on the biophysical and land use characteristics of the lower Herbert River district (see Activity 1 of this study);
(iii) A statistical analysis of the relationship between the granting or rejection of assignment applications and key biophysical, economic and social parameters;
(iv) A geo-statistical analysis of the relationship between the granting or rejection of assignment applications and key locational parameters; and
(v) Semi-structured interviews with key sugar industry and government respondents at local and state levels.

KEY FINDINGS

Evolution of NRM in ihe catchment

- During the study period, 525 applications for assignment, covering an approximate area of 16,000 ha, were submitted to the Victoria and Macknade Local Boards for approval. It was feasible to link information from complete application forms with a companion spatial database for 472 applications (89.9%) of the total application pool. These applications encompassed an area of 15,013ha or about 94% of the total 15,994ha area applied for. During the study period, 472 applications were spatially represented and comprised an area of 15,013ha. From this total, 355 (75%) applicants were awarded their entire request, 92 (20%) were awarded less than their request, and 22 (5%) were denied. Of the 15,013ha applied for, 12,165ha were awarded, representing an 81% approval rate. 1,962ha were not awarded on the basis of an applicant being granted less than 100% of their request. In addition, 887ha were denied an award. All applications that were denied occurred in 1996 and represented an area of 2,736ha. Since the 1996 application pool contains applications that were denied, the analysis pays particular attention to it.
- Over 70% (8,655ha) of the awards granted during the study period occurred on land that both the Local Cane Assignment Boards and Environmental Advisory Committee (EAC) were deemed suitable by both bodies. About 7% (741ha) was granted on land that both groups perceived as unsuitable. Of concern is the 2,768ha of development that occurred in the area of disagreement. This represented about 20% of development during the entire study period. More importantly, in 1996, over 1,400ha of the total assignment of 3,601.5ha (38.8%) were located in this region. In the absence of an open and transparent decision-making process and effective conflict resolution mechanisms, cane expansion in these areas may alarm government officials (and interested members of the public) who are concerned with drainage and habitat issues. It is these considerations that the Local Boards and EAC disagree on.

Extent of behavioural change required

- These data and development patterns raise concerns about how effectively the sugarcane assignment process supports the objectives of ESD in general and ICM in particular. Changes to existing institutional arrangements are required if sustainable development is to be achieved.

Policies, plans and decision rules of implementing agencies

- Many of the recent changes, such as regulations under the *Fisheries Protection Act 1994* and the development of Codes of Practice and Environmental Protection Policies, are focused at the operational level of planning. However, they are often perceived as reactive rather than proactive. Their frequent use, particularly on newly assigned lands has prompted the question; "Why was this land assigned in the first place"? *Environmental Protection Policies* and *Codes of Practice* are an important part of the solution that ensures that an appropriate "duty of care" is achieved. However, they are only part of a package that must also incorporate strategic and normative level responses.
- There have been a number of advances at normative and strategic levels. All levels of government have supported the need for ecologically sustainable development with legislation and/or strategic planning initiatives. For example, in the Herbert District, the draft Cardwell/Hinchinbrook Coastal Management Plan aims to provide legislative support for ESD initiatives. Similar activities are underway in other cane growing catchments. It is also likely that catchment management strategies developed by Integrated Catchment Management groups will have a very significant influence on land use planning and development in local government areas in the future. The intent is to implement many of the provisions contained in these documents in local government Strategic Plans. This first step has happened in the lower Herbert River catchment with the incorporation of ICM principles in the new planning scheme (see Vella 1999).
- Much current decision-making in relation to the granting of "assignment" occurs in the absence of agreed catchment based plans for land, water and vegetation resources. Hence it is extremely

difficult to assess cumulative or potential downstream impacts of assignment applications/proposals.

- Clearing of native vegetation (particularly land close to stream and watercourses) remains one of the most contentious issues impinging on cane expansion activities. A number of options are available to the sugar industry:
  - Motivational and voluntary incentives including activities such as ICM must be a core mechanism for improved natural resource management eg. to reduce the clearing of valued habitats.
  - Although some protection for natural resources is currently afforded by planning controls embedded within a number of State *Acts,* problems exist in areas subject to the provisions of the *Water Resources Act 1989*, or on land with freehold tenure. An increasing regulatory role for Local Government (eg through the invocation of planning controls if consent is required for subdivision, zone change and drainage development) provides some opportunity for improved natural resource management. Some of these issues are presently being addressed in the planning schemes of Hinchinbrook Shire in the lower Herbert catchment and the HRCCC has had an important influence in this development (see Vella 1999).
- The introduction of the *Integrated Planning Act 1997* (IPA) and the reformulation of many Queensland local government Strategic Plans are fundamental guides for future resource management activities. The *IPA* allows local government to require landholders wishing to conduct intensive agricultural activities, such as cane farming, to obtain it's approval. While this mechanism could provide benefits, it appears to be focused on development control rather than strategic planning. Indeed, the intent of the Integrated Development Approval System within IPA appears to be primarily focused on streamlining decision-making processes, rather than enhancing their effectiveness.

Coordination among Responsible agencies

- The establishment of an EAC provides a mechanism for more formal communication between Local Boards and those government, industry and community representatives who have an interest in natural resource issues. However, this mechanism has many shortcomings. Members of an EAC can feel betrayed and frustrated when their recommendations are not acted upon, because there is an ineffective two-way process of communication. In cases where there are differences of opinion between the EAC and the Local Board, the latter is under no obligation to inform the former of why it rejected its recommendation. These differences of opinion can occur at two levels and pertain to: (i) areas that are suitable for cane expansion; and (ii) individual applications. A one-way exchange of information is supported through the present referral process.

Integration

- The essence of balanced decision making is to integrate economic, social and environmental considerations. Current assignment mechanisms provide very limited opportunity to support balanced decision making. Formation of an EAC and the development of the conditions of assignment reflect Local Boards' primary responses to the requirement that it and the Queensland Sugar Corporation are satisfied that assigned land is "prepared and used for the growing of sugar cane without undue damage to the environment". In practice, EAC's provide only modest opportunities to significantly influence decision-making. If decisions are to be more balanced, there is a need for the cane allocation process to introduce environmental and social issues earlier in the cane assignment process and to have the "assignment" process underpinned by a strategic planning outcome which represents the views of both sugar industry and non sugar industry stakeholders.

Equity and procedural justice

- More needs to be done to support the application of the precautionary principle through transferring more responsibility to proponents. Issues related to the management of Mahogany Glider habitat and acid sulphate soils in the Herbert River Catchment, for example, have

demonstrated the challenges of moving the management system towards the precautionary principle. Mechanisms need to be developed that place more responsibility on applicants and Local Boards for determining the nature and extent of threatening activities before the review of an individual application. In response, action will be required of CANEGROWERS, mills, and the BSES to determine: (i) the need for industry sponsored collection of essential data which further the existing information base; and (ii) the need for and basis of cost-sharing arrangements which support appropriate analysis during the application process.

Efficiency and effectiveness of process

- Effective responses to the changes, uncertainties, complexities and conflicts that will continue to be part of the sugar industry's future lie in innovative administrative mechanisms, planning initiatives, and scientific research. Thus, there are conceptual and practical shortcomings in present responses that suggest the need for changes to the cane land allocation process. While the industry is currently in a phase of reduced expansions, it needs to be adequately prepared for future expansions when economic conditions become more favourable. We argue that ESD in the sugar industry requires a better integration of economic, social and environmental considerations. ICM can play a key role in supporting the achievement of this goal.

Agreed Responsibilities and Roles

- The industry must take a leadership role if the importance placed on the environment and sustainability is to be realised. Present Conditions of Assignment suggest that failure to comply with restrictions may see the award revoked. This places increased responsibility for enforcement on the Local Board (Cane Production Board). These are new roles for these organisations. Leadership by the Local Board (Cane Production Board), CANEGROWERS and mills can establish an expectation that compliance is expected and required by all farmers. This type of widely based, voluntary action could engender very strong public support. ICM clearly has a role to play here. In its absence, public support will be nurtured through compliance and enforcement. The recommended audit should provide insight into both voluntary compliance and enforcement measures. Those findings will reflect on the leadership qualities of the sugar industry, and identify the need for evolutionary and revolutionary change in its management of natural resources.

FACTORS THAT INFLUENCE THE SUCCESS OF ICM

- ICM has had limited opportunity for influence on decision-making on the granting of cane assignment in the past.
- The focus of many existing regulatory mechanisms on development control rather than strategic integrated planning.
- Lack of an open and accountable process of cane assignment so that all parties with an interest can understand the assumptions and processes leading to decisions being made.
- Poor integration of the caneland assignment process with other land use and management planning processes, especially Local Government planning schemes.
- Lack of agreed catchment based management plans for land, water and vegetation resources that can be used in the assessment of cumulative or potential downstream impacts of assignment applications/proposals.
- Lack of time to undertake an effective open and accountable process that is effectively informed by appropriate and available information.
- Historical socio-cultural context in the catchment with established ways of doing things and a past history of encouragement by both government and industry alike of a development ethos in ignorance of the incremental and cumulative impacts of environmental degradation.

RECOMMENDATIONS

- The policy environment for ESD will continue to respond to changing political, economic, social and environmental considerations. While the manner in which resources are managed will vary, public expectations for, and support of, effective environmental management policies will

remain. In this regard, the principles for ESD will form the basis for the development of new and improved initiatives. ICM needs to take a key role in influencing these developments.

- The challenge for the sugar industry is to embrace, rather than resist, the inevitable trend toward greater public intervention in its affairs. In response, government must provide a stable environment in which locally relevant decision-making can occur and in which appropriate and viable monitoring, cost-sharing and regulatory arrangements can be supported. The Australian sugar industry must continue to develop its own capacity to plan for expansion (and contraction). Such planning must be a continuous activity rather than a single exercise. Further, the industry must develop its own strategic view on where and how sugarcane will be grown – both at regional and whole of industry levels. This view will need to be based on the best available scientific information and full utilisation of the products of its substantial investment in environmental R&D.
- In facing the significant challenges of balancing the dual goals of economic efficiency and environmental conservation in relation to cane expansion, the sugar industry in collaboration with ICM, can reflect on its own experience and that of other agricultural industries and move to a sustainable future by playing a key role in jointly:
  - *Developing structures and related processes and procedures that foster cooperation* between the industry and other industry, community groups and government organisations and paves the way for more equitable decision making and more sustainable natural resource outcomes on the ground;
  - *Ensuring open and accountable decision-making processes on caneland allocation* so that all parties with an interest can understand the assumptions and processes leading to a assignment recommendation or proposal and provide appropriate advice; and
  - *Supporting the integration* of resource management principles (including Codes of Practice for Sustainable Cane Growing) into Local Government planning schemes and decision-making processes.

PRINCIPAL RESEARCHER(S):

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6. COMMUNITY SURVEY

OBJECTIVE

The goals for managing catchment land and water resources need to be informed by the views and behaviours of those - whether seen as individuals or group and community members - within the catchment. The aims of the Community Survey Component therefore were as follows.

- To examine, longitudinally, landholders' behaviours and attitudes towards land and water management in the Herbert River Catchment.
- To provide an understanding of social factors that might influence the implementation of ICM in the Herbert.
- To provide an understanding of whether and how such factors vary according to where people live and what their interests are.

RELATIONSHIP TO OVERALL PROJECT STRUCTURE

This component will provide key baselines for the assessment of factors that hinder or foster an effective ICM process in the Herbert River catchment, and in particular examine aspects of the following specific elements of the evaluation framework:

Analysis of Processes:

- Knowledge and expectations of ICM
- Responsibilities and roles in ICM
- Degree of motivation, commitment and support
- Coordination of resources
- Equity and procedural justice/trust in the process

Context of ICM

- Attitudes of constituents
- Community support
- Socio-economic conditions

METHODS

This project component was designed as a longitudinal study of the attitudes and behaviour of Herbert River catchment residents based on 2 mail-out surveys. The sampling framework for these two surveys was stratified on geographic location - upper or lower catchment and rural or urban. In both surveys initially 800 people were phoned to ask their willingness to participate in the survey. There were 477 respondents to the initial baseline survey conducted in 1995 and 401 respondents to the second survey in 1998. The second survey included 44% repeat respondents.

KEY FINDINGS

Knowledge and expectations of ICM

- Awareness levels of ICM, the HRCCC and its main purpose were relatively high (42%, 42% and 39% respectively). These could be improved, particularly in urban areas and the upper catchment. Detailed awareness of their effectiveness was low.
- Priorities for ICM were considered to be: working closely with local government; encouraging joint projects; raising local awareness; gaining better understanding of environmental problems; developing solutions for these problems; and encouraging research.

Responsibilities and roles

- There was a high sense of self-responsibility for dealing with land and water management issues.
- Many community members felt that individual landholders had a role to play in land and water management and that there were ways they and their local communities could assist. To do this, they saw the need for support from the government in terms of resources and incentives.

Degree of motivation, commitment and support

- The majority of those who were aware of the HRCCC supported its general direction and effectiveness and were satisfied with the speed of its progress.
- Personal benefits of involvement in group activities were perceived by 31%, preparedness of respondents to become involved in land and water issues was around 40%, preparedness to assist in local projects was around 42% and intentions to become involved were around 22%.
- The level of involvement in local community groups or associations was 44% in the 1995 survey and 32% in 1998.
- Most respondents agreed there was an urgent need to address environmental problems, signifying the basis for a high degree of motivation to deal with problems.
- Time was an important factor preventing involvement in local community issues for 36% of respondents. A finding of the urban catchment management study (Nancarrow *et al.* 1998) was that people have commitments which impact on their time available for voluntary work.
- Support for ICM was implicit in the high degree of support shown for all of the proposed activities of ICM.

Coordination of resources

- Coordination of efforts by ICM and local government was seen to be extremely important, ie local government planning taking ICM into account and a local government role in ICM.
- Government agencies were perceived to often give conflicting information on land and water management issues, similar to the finding by Nancarrow at al (1998) that it can be difficult for community members to obtain information from government agencies and that a lack of internal communication often leads to mixed messages emanating from the Government to the community.
- Encouragement of joint projects was seen to be one of the main priorities for ICM.

Equity and procedural justice/trust in the process

- Funding contributions to ICM made by the three levels of government, industry and farmers were perceived to be relatively equitable.
- Respondents did not find government strategies to be highly useful to them on a personal level.
- Many respondents felt the government needed to give more resources to voluntary groups and give incentives for landholders to address environmental issues.
- Some of the major difficulties in managing land and water were seen to be caused by slow government strategies, slow reactions of government to new problems, and a low trust of government programs.
- There were split opinions regarding government and community roles in catchment management (eg whether or not: catchment management should be funded and run by the government; ICM should remain a voluntary activity; the government expects too much from local communities in catchment management; and programs like ICM interfere with people's rights to make their own decisions).

Attitudes of constituents to resource use issues and management

- People were generally satisfied with many aspects of living in the Herbert River catchment and perceived many advantages of living in the area. The majority of respondents would therefore possibly not support any changes threatening these aspects of their community.
- The most important issues identified by respondents were: unemployment; a lack of opportunities for young people; and a lack of diversity in industry. Further issues related to land and water management and included: clearing of marginal land; flooding; drainage; water quantity issues (ie. lack of water); fishing issues; the impact of weather and changing weather conditions on primary industry; and environmental issues.
- The awareness within the community of land and water problems and the perception that these issues are important, both personally and on a catchment scale, signifies general support for ICM to tackle land and water management on a number of fronts. However, land and water

management issues were not uppermost in people's minds which suggests that there needs to be awareness and acknowledgment by ICM that while people may support land and water management of various kinds, their first priorities lie with 'life issues'.

- While there was community interest in issues for the Herbert, the influence people felt was not particularly high, it appeared that there may be some conflict and not all respondents often thought about local community issues. These factors may hinder community participation in ICM.
- With regard to how manageable (or practical) catchment management might be, there were a number of impediments to effectively managing land and water in the catchment identified:
  - slow government strategies;
  - slow reactions of government to new problems;
  - the catchment's large area;
  - the cost of solutions;
  - a lack of easy solutions;
  - low trust of government programs; and
  - insufficient understanding of relevant problems.
- It will be important for ICM to address these perceptions of impediments, perhaps by:
  - encouraging timely responses from government;
  - encouraging financial support for ICM;
  - developing and promoting solutions;
  - encouraging improved formal and information communication between the government and the community; and
  - improving understanding of land and water management problems.

Community Support

- ICM activities were all seen as of moderate to high importance which suggests there is considerable support for ICM in the community. Community perceptions of the priority responsibilities for ICM were:
  - encouraging joint projects between government, industry and research;
  - raising local awareness of natural resource management;
  - gaining a better understanding of environmental problems;
  - developing solutions for environmental problems;
  - encouraging research; and
  - communicating on this work to the community.

Socio-economic conditions

- A lack of financial resources in the community were considered an issue for both solutions to natural resource problems and for personal planning.
- The largest impacts on the Herbert were seen to be from a loss of farm productivity, higher taxes, and higher production costs.

FACTORS THAT INFLUENCE THE SUCCESS OF ICM

This social research has demonstrated a number of factors which are crucial in positively or negatively motivating community involvement in ICM as summarised below.

Awareness

- Successful ICM requires a high degree of community awareness that there are important environmental problems that require timely action. Awareness of ICM in the Herbert was comparatively modest from the surveys. Those who were unaware of ICM and other related strategies on the catchment may be wary of these programs.

Control and Tractability

- A high personal sense of control in dealing with environmental problems, or a belief that individuals can help motivate the community to improve the environment will promote ICM. Unfortunately in the Herbert a large percentage of respondents felt they had a low influence over what happens in their community.
- Feelings of personal and community control are also related to feelings of tractability of the problem. All possible impediments to managing land and water as presented in the questionnaires in the Herbert were perceived to exist at least to some extent. Greatest impediments were seen to be with government: a lack of responsiveness and low trust in government programs.

Responsibility

- High level of support for community responsibility was shown by general agreement that many environmental problems come from the way individuals manage their properties. This is an advantage for ICM in gaining community participation but it will be very important for ICM to recognise the need for behavioural change at property level when working with the community and developing policies.

Perceived Personal Benefits

- Involvement in ICM is facilitated by an appreciation of personal benefits from becoming involved in group activities to help manage land and water. This was demonstrated by positive attitudes towards group involvement in the Herbert and the reported group activities of a substantial proportion of the community. Unfortunately, Government strategies were not perceived to be highly useful to respondents at a personal level and therefore not seen to be highly relevant at that scale.

Support for the Activities of the Catchment Coordinating Committee

- It is important that the community understands and supports what is trying to be achieved. The surveys showed that community perceptions of the main purpose of ICM matched closely with HRCCC objectives and their priority activities.

Coordination of ICM with Local and State Government Functions

- There was strong community support for a close a relationship between local government and ICM. This has already been established by the HRCCC. Unfortunately coordination of information flow from state government agencies was considered to be low in relation to environmental topics or ICM related matters.

Resources

- Obviously programs which are perceived to be well resourced both in terms of money and time are likely to be successful. Even though people thought current financial contributions from locals and government sources to be relatively equitable the surveys demonstrated worry about local people lacking money to spend on solutions. There was also concern arising from lack of finances about an inability for landholders to plan more than a year ahead. Reservations were expressed about government willingness to spend money on solutions in the longer term. In addition there was a perceived need for more government resources for voluntary groups and better incentives for landholders to address environmental issues/problems in the future.
- Finally, over a third of respondents felt that they had little time to become involved in local community issues.

RECOMMENDATIONS

Communication with the community

- The widespread community recognition of the importance, urgency and impacts of land and water issues can be exploited. Communication with the community can therefore focus instead on those issues where there was low awareness and a desire to know more, including possible solutions for environmental problems and ensuring there is something provided that the community can start working with immediately. Concentrating on solutions and actions can help to prevent a negative "doom and gloom" image sometimes perceived.
- Information and education should use the results showing which dimensions heighten the likelihood of participating and be presented with the local community in mind, responding to community needs and interests. Therefore, it will be important to emphasise those issues shown to increase intentions to participate by: encouraging an interest in local community issues; demonstrating the importance of land degradation to individuals; emphasising that the size of the Herbert does not make land and water management too difficult; and explaining in which ways government strategies are useful to individuals.

Working with the community

- In working with the community, it will be important to understand and acknowledge the historical issues that have been frustrating for the community in order to move forward in working with the community, gaining support and involvement. Related to this is the need to address the lack of influence felt by the community by showing that they have influence and demonstrating the ways in which they can influence land and water management. An important first step will be to respond to the issues in the community survey.
- Recognise money constraints and the limitations on people's time to become involved in local land and water management activities and promote solutions and activities for the broader community that can save them time or take very little extra time or effort.
- Use a partnership approach, between ICM, different levels of government (particularly local government), industry, landholders and the broader community. There is a responsibility for landholders to do things on the ground, which is widely supported by the community and needs to be recognised in this approach. At the same time, incentives for their efforts and resources for voluntary groups need to be provided by government rather than regulation. An important way to implement this will be joint on-ground projects. This includes ensuring consistency of the information that is provided for the community from government. In doing so, as there is little agreement on the exact roles of community and government, clear roles will need to be established at the commencement of any work. It was found in a National Review of Whole Catchment Management that giving groups more autonomy acts to increase motivation and a positive outlook (Syme et al. 1993).
- The perceived impediments to managing land and water need to be addressed by: speeding up government responses and strategies and communicating regularly about what is happening. This will assist in improving relations with the community and heightening trust in government. In addition, promote solutions to problems and, if possible, low cost solutions; clearly explain how the difficulties arising from the large area of the catchment are being addressed.
- Acknowledge the importance of employment and financial issues in working with the community and assist in the issues of financial management and productivity and start to identify, and publicise, employment opportunities in the solutions that are developed for land and water management. ICM therefore needs to include market and productivity issues as well as environmental issues to ensure relevance.

Research methods

- This relates not so much to the development of methods but to the value of attitudinal surveys to ICM. This type of survey extends social profiles beyond a demographic focus to:
  - perceptions;
  - a better understanding of tractability;
  - how effective ICM is perceived to be;

- identifying priorities for investigation, ie where to focus efforts in regard to specific issues, eg opportunities for use of the media).

PRINCIPAL RESEARCHER(S):

Geoff Syme, Janet McCreddin and James Butterworth

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7. ORGANISATIONAL COMMUNICATION AMONG ICM STAKEHOLDERS

OBJECTIVE

Whatever the precise aims of Integrated Catchment Management (ICM), success by definition depends on coordination of inputs from the multiple stakeholders and communication of the interpretation of these inputs between all parties. Effective communication both within and between stakeholder organisations is a prerequisite for trust to be developed and integration to occur. To-date, however, very little research has been conducted on how to measure the degree of communication between stakeholders of ICM and the effectiveness of the communication.

The principal objectives of this pilot study were:

- to develop and test a simple tool or approach for measuring the quantity, and various characteristics, of communication occurring on ICM and environmental issues among ICM stakeholders; and
- to shed some insights on the effectiveness of the organisational communication network on ICM in the Herbert Catchment in particular.

For the purposes of this study, communications include:

- formal (eg. a letter or e-mail) or informal (eg. a conversation or meeting at a social occasion);
- for one particular reason or for a number of reasons;
- personal (ie. individuals representing themselves) or official (ie. individuals representing their organisation); or
- 'one off' or a 'group' of communications with the same contact.

RELATIONSHIP TO OVERALL PROJECT STRUCTURE

This component contributes to the assessment of factors that hinder or foster an effective ICM process in the Herbert River catchment and, in particular, examines aspects of the following elements of the evaluation framework:

Analysis of Process

- Coordination of resources
- Influence
- Systems implementation
- Effectiveness of process

Context of ICM

- Attitudes of constituency groups

METHODS

A pilot study was conducted to measure communications about ICM and environmental issues between all significant stakeholder groups of the Herbert River ICM process. This was done to establish whether an effective communication system had been attained.

Stakeholders included:

- State Public Servants (Brisbane);
- State Public Servants (Regional);
- Regional participants in ICM in nearby catchments;
- Researchers
- HRCCC
- Landholders (not HRCCC)
- Prominent local people.

Across these groups, a total of 80 people were contacted to ask if they would participate in this pilot study and 60 agreed. In less organised categories of people respondents were gathered in a "snowball" sampling manner. Those who agreed to participate were interviewed by telephone using

a questionnaire to measure the following aspects of communication:

- frequency of communication with contacts over the past year;
- the topics of communication;
- who initiated the contact;
- whether respondents represented themselves or an organisation;
- the outcomes;
- the degree of satisfaction with the communication;
- any resultant change in the respondent's outlook; and
- the respondent's opinion about resultant change in the contact's outlook.

KEY FINDINGS

Coordination of resources

A matrix of contacts revealed that that there was direct contact and therefore linkages between all major groups of stakeholders. Therefore the basis for a communication network was present, although the strength of links was variable. Most communication was categorised as "mutual" which indicated that the informal contacts made during meetings and other gatherings are important to the functioning of ICM.

The predominant reasons supplied by respondents for their communication, and the primary contacts associated with those reasons, were:

- policy/planning/decision making with local government and Brisbane state government;
- environmental issues with local government;
- research/project work with the HRCCC; and
- follow up on catchment/strategy issues with the HRCCC.

Influence

Influence in this study related to how much the communication was thought to have changed the outlook of those involved.

There was a tendency for respondents to report that they had influenced the outlook of others more than others had influenced them. This may be true but the result may have more to do with the tendency people have to describe their own activities more positively than they describe others, in other words, 'self-others biasing' (Kurman & Eshel, 1998).

Respondents reported the most change in outlook (for themselves and the contact) in communications with the HRCCC and with people on an individual basis. This is an important result to utilise in situations where attitude change is seen to be important.

The main ways in which *respondents* reported that *their outlook had changed* were: gaining greater awareness, understanding or knowledge or to share what is happening and ideas. Areas in which *respondents* felt the *outlook of contacts had change*d were: understanding/knowledge; greater awareness; and acceptance of ICM.

Systems Implementation

On the basis that establishing effective communications on ICM is a fundamental element of systems implementation in ICM, understanding the communication network is essential. In this study therefore, 'contacts' were categorised into *outward* (the respondent initiated the communication), *mutual* (through a mutual contact, meeting or other event) and *inward* (the contact initiated communication with the respondent). Most communications were found to be "mutual" which indicates the importance of mutual or informal ways of meeting to the functioning of ICM.

Respondents reported having initiated the communication (outward communication) more than contacts initiated the communication (inward communication). As noted above this may be due to

self-others biasing.

Effectiveness of process

In the communication study, effectiveness of process was looked at in terms of the outcomes of the communication as well as perceived satisfaction with the communication event. In general, outcomes from communication were very positive, the most commonly identified being:

- progress;
- understanding of issues;
- information exchange;
- resolution of issues/decision;
- gained information;
- changed their outlook;
- specific action taken; and
- coordinate/collaborate.

With the exception of local landholders, most perceived their communications in relation to ICM to be satisfactory. Satisfaction was highest, however, for communication with the HRCCC and local government, which indicates a greater satisfaction when communication was with local bodies.

Attitudes of constituency groups

Major concerns for those involved in ICM were:

- the environment in general;
- ineffective decision making processes and communication;
- water quality; and
- flooding, drainage and their management.

For those not involved in ICM, however, flooding, drainage and their management were of greatest concern.

Methods

- The simple questionnaire investigation provided a methodological basis on which to evaluate the adequacy of communications at a system level for ICM. The study also demonstrated the feasibility of monitoring communication networks and their adequacy over time.
- To improve this research face-to-face rather than telephone interviewing should be adopted to ensure greater rapport and information exchange between the researcher and the interviewee.
- The pilot questionnaire took some time to complete for more "central" stakeholders in the ICM process because of their large number of pertinent communications. Efforts should be made to streamline the measurement of communications for these individuals by identifying major strengths and weaknesses rather than attempting to enumerate individual communications.

FACTORS THAT INFLUENCE THE SUCCESS OF ICM

- The existing linkages and communication network among stakeholders of a catchment provide opportunities for improved coordination of resources (such as information, knowledge, and understanding of issues) particularly through mutual or informal contact.
- Effective communication networks among catchment stakeholders provide for mutual benefits (such as information exchange, progress or ensuing action on the issue of communication, better understanding of issues) and mutual influence (eg. changed views, acknowledgment of problems, increased awareness of problems, sharing of ideas, increased acceptance and awareness of ICM). These outcomes seem to be occurring to an acceptable extent in the Herbert situation.
- Communication issues and related problems which may inhibit an effective ICM process include:
  - Difficulties in getting acknowledgment of problems by all stakeholders;
  - Perceptions that issues are too politicised and too big to deal with and that there is lack of

resourcing and true commitment to ICM both within government and the community;
- Difficulty some stakeholders have in explaining concepts of ICM to others;
- The assumption by many stakeholders that they are influencing others outlooks much more than they may be in reality.

RECOMMENDATIONS

Implementing an ICM initiative

- The effectiveness of communications provides an important measure of whether coordination is happening, and also identifies where there are gaps in the system and the effectiveness of specific/different linkages on ICM. Measuring this effectiveness should be a routine part of any ICM evaluation, particularly in the early stages.
- Communication between groups and individuals are potentially an important means of influence in terms of changing outlook of others on ICM or environmental issues. In particular communication is effective in increasing awareness and gaining understanding and knowledge. Nevertheless, there should be caution in assuming how much perceived influence people are having on others, and it is therefore important for ICM to evaluate this.
- The importance of 'mutual' communication should be recognised. Opportunities should be created for mutual and informal contact and information exchange. If considered successful, such contacts are likely to be self-perpetuating.
- An effective overall system of communication on ICM across all stakeholder groups should be designed to facilitate significant outcomes including:
  - *mutual benefits* (such as information exchange, progress or ensuing action on the issue of communication, better understanding of issues).
  - *mutual influence* or changed outlook (including changed views, acknowledgment of problems, increased awareness of problems, sharing of ideas, increased acceptance and awareness of ICM).

Methods for ICM Evaluation

- The simple questionnaire investigation demonstrated the feasibility of monitoring communication networks and their adequacy over time. As such it provides a mechanism for measuring an indicator of the transaction costs or communication "effort" required to keep a system such as ICM operating. This questionnaire should be applied both during the development of ICM and from time to time during it mature operating phase.

PRINCIPAL RESEARCHER(S):

Geoff Syme and Janet McCreddin

FURTHER READING

McCreddin, J.A., Syme, G.J. & Porter, N.B. 1999. *Integrated Catchment Management Communication Study: The Herbert River Catchment, Queensland.* CSIRO Land and Water Consultancy Report No. 99-18.

8. MEDIA STUDY

OBJECTIVE

This project activity focuses on how natural resource management issues in general and integrated catchment management in particular were presented in the media. In a survey of the catchment conducted by Butterworth *et al.* (1997) various media were found to be important sources of information about land and water resource issues. *The Herbert River Express,* the local newspaper for the lower Herbert catchment was used more frequently than any other source of information (60%), including friends and colleagues (54%) and personal experience (39%). In the lower catchment it was the source of information for 84% of those surveyed.

This component therefore focussed on a content analysis of the *Herbert River Express* as a key source of information for the loer Herbert River catchment community. Specifically, it involved an assessment of the representation of natural resource management issues in general, and integrated catchment management in particular, as they were presented by the *Herbert River Express* over the time frame of July 1990 to June 1998 to provide an overview of:

- Changes in emphasis on natural resource management issues over an eight year time frame;
- Changes in emphasis on Integrated Catchment Management issues over an eight year time frame; and
- The dominant community values regarding natural resource management and Integrated Catchment Management as presented in a local newspaper.

RELATIONSHIP TO OVERALL PROJECT STRUCTURE

This component contributes to the assessment of the social context in which the ICM process in the Herbert River catchment occurs as well as the assessment of factors that influence the success of the ICM process in the Herbert River catchment. In particular it examines aspects of the following specific elements of the evaluation framework:

Context of ICM

- Media coverage and attention

Analysis of Process

- Influence

METHODS

A quantitative and qualitative analysis was made of articles and Letters to the Editor covering natural resource management issues published in the *Herbert River Express* from 1990-1998. Because this newspaper is not available on line or on microfiche, it was necessary to physically handle each issue of the newspaper to assess the content. Conducting only a quantitative analysis of these issues would have provided a limited view of the social context in which integrated catchment management was occurring. Whilst a qualitative analysis is time consuming, it provides a more detailed understanding of the nature of community values held about natural resource management. The quantitative analysis used Gregory and Williams (1981) point score framework and the qualitative analysis was based on extrinsic (ie. economic, life support and aesthetic) and intrinsic (ie. moral/spiritual) values after Xu and Bengston (1997) and Callicott (1989).

The aim was to examine articles on environmental and natural resource management issues in *The Herbert River Express* to provide a view of local perspectives on integrated catchment management in particular. *The Herbert River Express* is a paid tabloid with a circulation of approximately 3,200 and published three times a week.

KEY FINDINGS

Media Coverage/Attention

- Over the eight year time frame of 1990-1998 natural resource management issues were increasingly prominent in the *Herbert River Express* with 1995-96 and 1996-97 exhibiting the highest levels of prominence. Themes identified within natural resource management issues included: sugar industry; forestry industry; tourism industry; waste management; land resources; fisheries; pest/feral species; world heritage; river/stream/water management; soil conservation; flora/fauna issues; government initiatives; and other. River/stream/water management issues were the most prominent over time comprising 36% of all natural resource management articles. Political controversies comprised 20% of the articles and pest/feral species 15%.
- The occurrence of articles in the *Herbert River Express* clearly reflects that the Herbert River Catchment Coordinating Committee (HRCCC) has a profile in the lower catchment community. However, the analysis does indicate a lag in the time between the inception of ICM in the Herbert River catchment in March 1993 and the HRCCC developing a profile in the community and also possibly influencing the presentation of natural resource management issues in the community. For example, over the eight year time frame, 1996-97 and 1997-98 were the years where river, stream and water management issues were the most prominent.
- Although the actual number of articles on river, stream and water management issues appearing each year peaked in 1995-96 there is a tendency for the prominence of these issues to increase over time. This suggests an increasing community interest in, or focus, on river/stream and water management issues. The *Herbert River Express* also provided information on the role and function of the HRCCC and at times emphasised the importance of community involvement in natural resource decision making.

Influence

- The dominant community values regarding natural resource management and integrated catchment management as presented in the local newspaper were life support values. The sample of articles exhibited no intrinsic values held about river/stream water management issues in the Herbert River Express. Life support values were found in 65% of the articles, economic or utilitarian values in 26% and aesthetic values in the remaining 9%. These life support values focus on issues of flood mitigation, water course management and ensuring the viability of the sugar industry, but more in terms of the way of life it represents. That is, the identity of the district as a sugar cane production area is strong.
- The term 'Integrated *Catchment Management* 'specifically appears from mid 1996 and is stressed as an important issue for the community. The HRCCC is portrayed as a contributor to achieving the goals of productivity, development and sustainability of the local community. The media representation of the HRCCC is positive and is clearly linked with integrated catchment management in almost all articles involving the HRCCC.
- Extrinsic, '*life* support' values were the predominant values presented in natural resource management issues in *The Herbert River Express*. This seems fitting as the community in the Herbert River region is agriculturally based and located on a flood plain. The community's identity and well being is dependent on the health and sustainability of their natural resources, and is clearly evident from the manner in which the local newspaper presents issues. Intrinsic values were not apparent.
- An *important* issue is that it seems that *The Herbert River Express* editorial policy appears to operate in a manner that excludes views that do not adhere to the dominant social values locally. However, once an item is accepted for publication there appears to be so little editorial interference that the material can be accepted as representing the dominant values held.

Research Methods

- The use of a media as an unobtrusive source of data for research on the social context is becoming more popular as the data is becoming more readily available in 'on-line' data bases. For national media this provides a useful perspective on changing attitudes to environmental issues (Bengston *et. al.*, 1999). On the basis of the results of this research we suggest that despite

the difficulties of data collection and analysis, local newspapers such as *The Herbert River Express* are rich sources of data for social context on resource management issues.

- There are two main methods used to conduct content analyses of media. There are those which focus on individual words, a method primarily employed by social psychologists. We found that the method which focuses on the article as the unit of analysis allowed a greater consideration of the broader social context within which the issues occur. In the context of this study we felt the latter approach more appropriate. There are other research contexts in which the former approach is more appropriate, particularly where the data are already 'on-line'.

FACTORS THAT INFLUENCE THE SUCCESS OF ICM

- The social context in which an ICM initiative operates may have an important influence on its progress. How resource management issues and ICM processes in particular are presented in the local media may reflect, and in turn, influence a community's values on these issues.

RECOMMENDATIONS

- The number and frequency of articles on natural resource management issues and ICM in particular show that local media such as local newspapers can contribute to community discourse on natural resource management issues and can be exploited to bring attention to an ICM approach within a catchment community.
- Analysis of newspaper coverage provides a useful and unobtrusive means of gauging community values about natural resource management issues. In future studies of these issues newspaper coverage might be a useful starting point for assessing community values and attitudes.

PRINCIPAL RESEARCHER(S):

Alison Cottrell and Katherine Rowbotham

FURTHER READING

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Gregory, K.J. and Williams R.F. 1981. Physical Geography from the Newspaper. *Geography* 66: 45-52.

Xu, Z. & Bengston, D. N. 1997, 'Trends in national forest values among forestry professionals, environmentalists and the news media, 1982 –1993', *Society and Natural Resources,* 10 : 43-59.

9. AN ECONOMIC EVALUATION OF ICM IN THE HERBERT RIVER CATCHMENT

OBJECTIVE

The role of ICM organisations is to provide a vehicle for the implementation of natural resource management in an integrated way at a catchment scale. The objectives of this project activity were:

- To identify an appropriate methodology for the economic evaluation of ICM organisation in the Herbert River catchment (ie. Herbert River Catchment Coordinating Committee or HRCCC)
- To establish the economic context for the ICM organisation in the Herbert, and
- To undertake an economic evaluation of the Herbert River ICM organisation to provide information to decision-makers about the efficiency of public sector investment in these organisations and about the possible distribution of identified costs and benefits.

RELATIONSHIP TO OVERALL PROJECT STRUCTURE

This component contributes to the identification and assessment of (a) the implementation context of the ICM process in the Herbert River catchment, (b) factors that influence the success of that process from achieving stated objectives, and (c) potential impacts of an ICM initiative. In particular it examines aspects of the following specific elements of the evaluation framework:

Implementation Context of ICM

- Socio-economic conditions

Adequacy of Policy Frameworks and Institutional Arrangements for ICM

- Adequacy and effectiveness of policies, plans and decision rules of ICM and other responsible agencies/groups for NRM
- Adequacy of financial resources for ICM

Analysis of Process

- Efficiency and effectiveness of process
- Equity and procedural justice

METHOD

The economic evaluation of the ICM organisation in the Herbert River catchment had three methodological components:

(i) A review of the literature to identify economic evaluation techniques that would be appropriate to evaluate ICM organisations and to identify their strengths and weaknesses.

(ii) An economic profile of the sub-regional economy was developed using land-use data, historical employment data as well input-output techniques.

(iii) An economic evaluation of the HRCCC was undertaken based on a cost-benefit analysis using an outcome-scenario approach (Robinson *et al.* 1998). Initially, the costs associated with establishing and administering the organisation were estimated. A number of the activities undertaken by the HRCCC to implement its stated strategy were then evaluated to determine whether the potential benefits associated with these activities would meet the costs of the organisation.

KEY FINDINGS

Implementation Context for ICM Initiative

- The economy of the lower catchment is heavily dependent on the sugar industry and the economy of the upper catchment is dependent on the cattle industry. The economic impact of these industries on the regional economy of North Queensland shows that, together, these industries make a significant contribution (both direct and flow-on effects) to gross output and employment in the region:
  - *Output*: the sugar industry of the lower Herbert River catchment contributed to over $354m of output in the regional economy, including $206m of output from sugar production and a

further $148m in flow-on impacts from other industries in the region. The cattle industry in the upper Herbert River catchment contributed $16m in output to the regional economy, including $13m in output from Cattle production and a further $3m in flow-on impacts.

- *Regional employment*: the sugar industry of the lower Herbert River catchment provided employment for over 3,300 people in the Northern statistical division in 1995. Over 1,300 of these people are estimated to be employed directly in the production of sugar with a further 1,936 people employed in industries supporting the sugar industry. The cattle industry in the upper Herbert River catchment is estimated to provide employment for 170 people, which includes 120 people employed directly in cattle production and a further 49 in support industries.

- The economic sustainability of these industries therefore is critical to the regional economy.
- The financial viability of cane farmers in the future is not optimistic. The possibility of reduced financial viability could result in reluctance, on the part of farmers, to engage in farm management practices which, though regarded as improving the state of the environment, would not directly improve the financial status of individual framers.

Adequacy and effectiveness of policies, plans and decision rules of ICM and other responsible agencies/groups for NRM

- Implementation of strategies for resource management by individual ICM organisations in Queensland requires the voluntary cooperation of the community, local government and government agencies. The ICM organisation does not have the authority to legislate or pass laws to regulate resource use. The organisation is only able to influence the regulation of resource use through an organisation, such as local government, which does have this authority. Alternatively, where regulations are not enforceable, for example on freehold land, the voluntary support of the community may be the only alternative.
- A more recent legislative approach towards promoting ecologically sustainable development in Queensland, the *Integrated Planning Act* (1997), does not specifically identify a role for ICM organisations in the planning and management of natural resources.

Adequacy of financial resources for ICM

- The HRCCC is financially constrained. Apart from the catchment coordinator, who has been funded through the federal government's National Landcare Program (NLP) and supported in terms of administrative and office accommodation by the Department of Natural Resources (DNR), the organisation is staffed and supported by local stakeholder bodies such as the local council and sugar industry bodies. No formal cost-sharing of resource management activities is in place.
- For the most part, HRCCC activities, including data collection research activities as well as specific projects and programs, are funded by grants from state and federal governments as well as industry support organisations which are awarded through a competitive bidding process. The extent and speed with which the organisation can implement its strategy is largely determined by the level of funding it can attract.

Efficiency and effectiveness of process

- The objectives of the HRCCC are caste in general terms which encompass both its role as a coordinator between the catchment community and government agencies as well as its role as a monitor of catchment health. The HRCCC is constrained in undertaking these roles both financially, in terms of funding to carry out specific activities, as well as institutionally, in terms of its legislative or statutory power to regulate resource management.
- The present value of the costs associated with the establishment and on-going administration of the HRCCC over a period of 20 years is estimated to be approximately $974,000. To offset this cost, the HRCCC has undertaken a number of specific activities in the catchment. These activities have been funded from both the public purse as well as from the catchment community. They relate to: (i) management of riparian vegetation, (ii) preservation of natural habitats, (iii) management of drainage problems, (iv) management of wetlands, (v) management

of acid sulfate soils, (vi) strategic river bank protection and (vii) the stabilisation of relict mining dams.

- The activities undertaken by the HRCCC have the potential to significantly improve or preserve the condition of natural resources in the catchment. The *potential costs* of these activities are incurred by both individual landowners (eg. opportunity cost of land, restoration or remediation works, materials and construction costs, in-kind contributions of time and equipment) and the catchment community (eg. cost of reparation or remedial works, construction costs, wages and publicisation). Similarly *potential benefits* will accrue to both landowners (eg. avoided costs of lost production, aesthetic attraction of improved habitat, reduced production costs, improved water supply) and the catchment community (eg. improved downstream water quality, retention and improvement of natural habitats, reduced social conflicts, reduced litigation and transaction costs, aesthetic benefits, avoided costs of resource degradation and damage to infrastructure).

Equity and procedural justice

- For the successful implementation of a number of activities undertaken by the HRCCC, notably management of riparian vegetation, management of acid sulfate soils and management of wetlands, private property owners would incur considerable financial expense, but many of the benefits accrue to the community in general.
- All of the potential benefits resulting from investment in ICM activities are not equitably distributed among farmers incurring the cost and those who do not contribute to the cost can not realistically be excluded from enjoying the benefits. In effect, the positive externalities resulting from on-farm investment in improving the condition of the environment cannot be internalised. In an economic climate where the financial viability of farmers is generally deteriorating, the ability, and therefore the willingness, of farmers to invest in improved resource management is likely to be considerably reduced.

Methods for Supporting ICM Processes

- Economic evaluations are not routinely undertaken for natural resource management policy initiatives, and where they have been undertaken they do not generally address the social costs and social benefits arising from the implementation of the policy initiative. In addition, there is no consistent methodology for measuring and valuing a change in the condition of natural resources.
- Cost-benefit analysis has the potential to provide a consistent and reliable evaluation of an ICM organisation. To undertake a CBA of the HRCCC, a number of simplifying assumptions were required including those concerning the causal relationship between the activities of the HRCCC and potential improvement in the condition of natural resources.
- Insufficient data was available to provide an estimated NPV of the investment in the HRCCC, that is to establish, measure and value causal relationships between the condition of the natural resources in the catchment and the activities of the HRCCC. In particular, there was: (i) limited data available to identify the "without project" scenario; (ii) lack of on-going data collection to determine any improvements in the condition of the natural resources in the catchment and (iii) limited data to enable credible valuation of any deterioration in the condition of the environment or of the benefits resulting from improvements in the condition of the environment.

RECOMMENDATIONS

- Because ICM organisations in Queensland cannot rely on the legislature to introduce and enforce property rights which would be environmentally appropriate, informal and frequently less reliable methods to encourage the adoption of norms of good behaviour need to be adopted. Implementation of strategies for resource management by individual ICM organisations therefore requires the voluntary cooperation of the community, local government and government agencies.
- Community-based organisations, which rely on the voluntary cooperation of individual resource managers, may need to consider the financial viability of managers and offer financial incentives to improve the effectiveness of their strategies. Specifically, ICM organisations will need to address the problem of encouraging farmers to take on farm management practices that could

result in improvements to the land and water resources when to do so could result in a shortfall in their income and limited personal benefits. Educating farmers is not necessarily going to result in a change in behaviour. Financial incentives may need to be introduced if a change in attitude is going to lead to a change in behaviour that will result in an improvement in the condition of natural resources.

- While acknowledging the problems and limitations underlying cost benefit analysis (CBA), CBA can provide valuable information for an ICM organisations that can guide the ICM implementation process regarding the efficiency of its investments as well as the distribution of the costs and benefits resulting from its activities. To facilitate such evaluations, indicators measuring the condition of natural resources need to be identified and monitored to enable substantiation of claims of natural resource improvement.

PRINCIPAL RESEARCHER(S):

Jackie Robinson, Geoff McDonald and Jenny Bellamy

FURTHER READING

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Robinson, J.J., Bellamy, J., and McDonald, G., 1999, Economic Evaluation of the Herbert River ICM Organisation, CSIRO, Tropical Agriculture, Brisbane. (Also this publication Vol. 6, Ch. 2, pp. 27-86).

10. INFORMATION NEEDS FOR ICM

OBJECTIVE

The purpose of this activity was to explore key issues and considerations for planning and managing information needs and provision to support community-based approaches to integrated resource management through case study investigation of ICM in Queensland, and the Herbert River ICM process in particular.

In particular, the activity aimed to review information needs associated with the following four tasks and to make recommendations on their management:

- Developing a catchment management strategy that identifies and prioritises land and water management issues and develops recommendations;
- Raising awareness of catchment issues;
- Influencing resource managers' activities, including precipitating/catalysing action; and
- Implementing an effective ICM program.

RELATIONSHIP TO OVERALL PROJECT STRUCTURE

This activity contributed to the identification and assessment of the implementation context of the ICM process in the Herbert River catchment and factors that influence the success of that process. In particular it examines aspects of the following specific elements of the evaluation framework:

Implementation Context for the ICM Policy Initiative in the Herbert River Catchment

- Socio-economic condition and use of technology

Adequacy and Equity of the Herbert River ICM Processes

- Efficiency and effectiveness of process
- Agreed responsibilities and roles

METHOD

(i) Collation and review of multiple data sources:

- Policy documentation on ICM;
- Lead agency documentation supplied to a Catchment Coordinating Committee (CCC);
- R&D findings and related documents from the CTC7 research project;
- Minutes of HRCCC meetings;
- Targeted semi-structured interviews with three key informants in the Herbert River ICM process;
- On-going interviews and discussions with key informant/participants of ICM; and
- The collective experience of the research team.

(ii) Data analysis using qualitative assessment techniques

Information that was asserted or predicted to be relevant in the various documents available to an ICM CCC was compared to evidence for what information was actually used in the context of the Herbert initiative for each of the four tasks identified (ie. catchment strategy development, awareness raising, influencing resource managers and precipitating action and running an effective ICM program). Explanations for, and the implications of, the difference between the two were then explored.

KEY FINDINGS

Socio-economic condition and use of technology

- Given the consensus that the HRCCC has a primary role in awareness raising, improving communication on catchment management issues and lobbying for action, it is not surprising

that the HRCCC has not made extensive use of Information Technology in its own right. Nevertheless, the availability to other stakeholders of technologies to underpin resource management has been important to the HRCCC, which has, therefore, fostered the further adoption of such technologies. The most significant example of this in the Herbert has been the HRCCC's support for the establishment of the Herbert Resource Information Centre, a collaborative GIS venture for the management and use of spatial resource data for the catchment. The HRCCC is not a partner to the HRIC per se (the HRIC is a joint venture between Hinchinbrook Shire Council, CSR Ltd., the Herbert Cane Protection and Productivity Board, CANEGROWERS Herbert River District, CSIRO and the Queensland Department of Natural Resources), nor is it a significant user of the HRIC's data sets or services. Nevertheless, the HRCCC has had a role to play in facilitating and encouraging the use of those data and services by resource managers and planners.

- The HRCCC was also instrumental in bringing about the Herbert River Catchment Atlas in collaboration with CSIRO and the Herbert River CANEGROWERS. The Atlas was created by CSIRO and was extensively used in the development of the Catchment Management Strategy. The HRCCC has been instrumental in the broad dissemination of the Atlas, partricularly to schools, TAFE and for other awareness raising and educational purposes."

Efficiency and effectiveness of process

- In principle, in order to be successful, an ICM initiative has massive information needs from biophysical through socio-economic to procedural. However in practice in the Herbert River ICM process, most information sharing, management and analysis has been informal and verbal through Committee meetings, presentations by researchers and special interest groups and so on. The Catchment Co-ordinator did circulate information to HRCCC members and their has been exchange of information between members at meetings, but most data access was reactive. Information was mainly pushed out to the community via the media. Inadequate access to biophysical and socio-economic information was not perceived to overly constrain the HRCCC's activities, although inadequate procedural information probably did.
- The HRCCC continues to see the value of information and push for support for information-based programs. Thus, the HRCCC played a role in the establishment of the Herbert Resource Information Centre (HRIC) but has, in practice, itself made little use directly of the resources available through the HRIC.
- The specific information needs facing the ICM initiative in the Herbert have been unpredictable, or at least difficult to predict. Thus, the Committee's information requirements have been context specific in response to changing priorities and circumstances in the catchment. Furthermore, the information requirements have changed with the state of development of the ICM initiative and the maturity of the processes underpinning it.
- The specific awareness raising initiatives and involvement in instigating on-ground management that the HRCC has been involved in has been largely opportunistic and dictated by political imperatives and opportunities, funding options and technical understanding. Thus, for example, action has often been dictated by NHT funding priorities and opportunities as expressed by the Regional Advisory Panel rather than the priority needs expressed by the HRCCC.
- The HRCCC has had to be adaptive and responsive and, despite the strategic nature of the Catchment Management Strategy does not have the resources or mandate to plan major initiatives, whether on-ground or in relation to the design, collation and management of key natural resource management data. As a consequence, ICM in the Herbert has relied predominately on the corporate knowledge and expertise of members of the HRCCC and opportunities to access additional expertise from others on a needs basis – including researchers and State Government resource managers.
- Local knowledge and expertise is a primary source of information applied within the ICM process. This is consistent with the nature and intent of ICM. Major ICM-based initiatives in the formal collection, collation and management of information relevant to the ICM process seem both inappropriate and unrealistic.

Agreed responsibilities and roles

- The reliance on local expertise and knowledge has clear implications for the management of

ICM to ensure its effective contribution to improved natural resource management including:

- the HRCCC needs to provide not only for effective representation of key stakeholder groups but also to provide as broad a base of expertise locally available as can be achieved.
- the Catchment Coordinator must have a key role to play in providing a stream of information to Committee members so that they can continue to expand their expertise in relation to ICM relevant issues.
- Relevant State agencies and other key stakeholder groups have a clear responsibility for effective communication of available information to members of the CCC.

FACTORS THAT INFLUENCE THE SUCCESS OF ICM

- Inadequate resources for an ICM initiative and lack of a mandate to plan major initiatives may mean that ICM activities (eg. awareness raising and on-ground action) will be largely opportunistic and often dictated by political imperatives and opportunities, funding options and existing technical understanding.
- Accessibility and availability of the local knowledge and expertise on catchment issues from as broad a range as possible of catchment stakeholder groups/interests is critical to a successful ICM process.
- Informal and verbal communication through social networks and existing institutional arrangements are critical for information sharing and analysis within the ICM process.
- Inadequate procedural information may constrain the focus and diversity of the activities of an ICM process
- Given that formal collection, collation and management of information relevant to an ICM process may be both inappropriate and unrealistic for a specific ICM initiative, the effectiveness of communication of existing information between state and other relevant bodies is critical.
- Capacity and a willingness within an ICM organisation to collaborate with other groups, agencies or individual experts with particular understanding of the issues may be essential for raising awareness of ICM issues and precipitating appropriate action.
- Adequacy of the skills and commitment of the staff ICM groups and other relevant agencies are critical to an effective and influential ICM process.

RECOMMENDATIONS

Planning Information Needs in Support of an ICM Process

- The specific information provisions required in order for ICM to contribute to the solution of problems are diverse from biophysical through socio-economic to procedural; variable with the stage of implementation of the ICM process; and in any specific instance, context specific; and unpredictable in response to changing circumstances and priorities in the catchment including political imperitives and opportunities, funding options and technical understanding.
- Information needs associated with an ICM initiative can be usefully considered and managed in relation to the following discrete tasks: developing a Catchment Management Strategy; raising awareness of ICM and issues that ICM is tackling; influencing and precipitating action and planning by others; and managing an effective ICM program.
- Local corporate knowledge and expertise is likely to be a primary source of information applied within the ICM process. It is imperative that the ICM committee provides not only for effective representation of key stakeholder groups but also provides as broad a base of expertise locally available as can be achieved.
- The Catchment Co-ordinator must have a key role to play in providing a stream of information to Committee members so that they can continue to expand their expertise in relation to ICM relevant issues.
- Major ICM based initiatives in the formal collection, collation and management of information relevant to the ICM process may be both inappropriate and unrealistic for a community-based ICM group to undertake. However it is imperative that effective communication of information is possible between relevant State agencies and other key stakeholder groups and members of the CCC.

Developing a Catchment Management Strategy

- Generically, the structure and content of the Catchment Management Strategy is dictated by State level policy. However, the local expertise of the members of the Catchment Coordinating Committee and other stakeholders consulted during the process of developing the Strategy need to be used to develop a Strategy within this general framework that meets local needs.
- The Strategy can not rely solely on local expertise. Extensive use of documented information and knowledge needs to be used to validate, 'reality check' and develop the structures and issues generated by the Catchment Coordinating Committee. This material should be properly referenced within the document.
- Because the Catchment Strategy is intended to be a living document, it is important that, as well as being referenced, the data and information that underpin the document are maintained by the Committee and that on-going process of continue to collection and collate key information continues so that future versions of the document can reflect an increasing documented resource base.

Raising Awareness of ICM

- Awareness raising is likely to be more productive in relation to issues that are well understood scientifically rather than remaining fundamentally contentious.
- Awareness raising on issues is likely to be opportunistic, so information collection for awareness raising must be rapid and responsive to opportunities.
- Effective awareness raising depends on a reasonable knowledge of the current level of awareness in the community, on the sources of information most widely used by people in the area etc. Collection of this type of information may be a worthwhile investment for a CCC.

Influencing and Precipitating Action

- As with raising awareness, influencing resource managers and planning processes and precipitating on-ground action will fall into the broad strategic direction set by the Catchment Management strategy. However, it is likely to be opportunistic and therefore not easy to plan for in terms of information provision.
- The expertise of members of the Catchment Coordinating Committee is often critical in identifying opportunities for influencing resource managers and planning processes as well as precipitating action.
- Collaboration with other groups, agencies or individual experts with particular understanding of the issues involved is often the most expedient way of precipitating appropriate action.

Implementing an effective ICM program

- Implementing an effective ICM program places a number of information needs on the Catchment Coordinating Committee. However, most information sharing, management and analysis was informal and verbal through Committee meetings, presentations by researchers and special interest groups and so on
- The State level coordinators of ICM need to ensure a regular and consistent flow of information to local groups.
- The Catchment Coordinator and Committee Chair need to ensure close and effective communication with policy level people.
- The management skills of the Coordinator and Committee members is important - appropriate people should be picked on this basis and additional training may be merited.

PRINCIPAL RESEARCHER(S):

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FURTHER READING

Walker, D.H. and Bellamy, J., 1999, Information needs for Integrated Catchment Management: A case study of the Herbert River ICM process, CSIRO, Tropical Agriculture, Brisbane. (Also this publication Vol. 1, Ch. 4, pp. 199-226).

Chapter 4

Information Needs for Integrated Catchment Management: A Case Study of the Herbert River ICM Process

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1.0 INTRODUCTION

Integrated Catchment Management (ICM) is an example of the significant investments that are being made throughout Australia in approaches to natural resource management through the integration of community involvement, technical knowledge, and organisational structure and policy objectives. The purpose of this report is to explore key issues and considerations for planning and managing information needs and provision to support community-based approaches to integrated resource management through case study investigation of ICM in Queensland, and the Herbert River ICM process in particular. While based on an assessment in relation to ICM, the findings presented in this report are of direct relevance to other integrated resource management initiatives across Australia.

The report briefly considers the background to ICM in Queensland and identifies four fundamental tasks faced by an ICM initiative. In the subsequent sections, the information needs associated with each of these tasks is considered in some detail. Finally we draw together the material and make recommendations in relation to planning for the information needs associated with an ICM initiative.

1.1 BACKGROUND

ICM in Queensland is being implemented as a partnership between catchment communities (as represented by Catchment Coordinating Committees, CCCs) and the Queensland Government. It is a policy initiative based on voluntary participation from the community and does not have a statutory underpinning per se (see McDonald *et al.* 1999).

The key elements of this ICM policy initiative promoted in Queensland were (Rowland and Begbie 1997):

- *Voluntary program.* Participation in ICM was to be voluntary for both community and government.
- *Community based*, meaning that all structures were to have a majority of community members. Formation of catchment coordinating committees (CCCs) was dependent on interest from the community and other sectors.
- *Partnership* between the levels of government, industry and the community. All sectors and key stakeholders are to be involved. As the CCCs do not have statutory "teeth", implementation of strategies relies on negotiated and voluntary action by responsible agencies and individuals.
- *Processes* used by the committees in coordinating and integrating management of the catchment are to be *participative and consultative.*
- ICM is about taking a *strategic and planned* approach to tackling important issues. This should be a feature of the actions of all catchment management groups.

The implementation of ICM in Queensland is based on the establishment of Catchment Coordinating Committees. The Queensland Integrated Catchment management Strategy (QDPI 1991) identifies that:

> *Catchment Coordinating Committees are established to address complex catchment management issues that involve many community groups and government agencies. Catchment Coordinating Committees comprise representatives of the major sectors of the community and government that are involved in, or influenced by the management of land and water resources in the catchment. Their major roles are to provide a forum for community input and discussion, to prioritise the issues and to develop and promote the adoption of catchment management strategies.*

One of the seven principles espoused in the Queensland Integrated Catchment Management Strategy (QDPI, 1991) is that "*Land and water resource management decisions must be based on the best available information*." This principle is elaborated in the same document with the observation that "*Information on land and water resources, particularly on the interactions between these resources, is often deficient or not readily accessible. While additional information is often desired, management decisions will need to be made using available data to avoid unacceptable delays.*" (QDPI, 1991)

The stated purpose of ICM as outlined in the Queensland ICM Strategy (QDPI 1991), is to integrate the management of land, water and related biological resources in order to achieve the sustainable and balanced use of these resources. The "key elements" identified in the ICM Strategy are : awareness; community action; and Government action and support.

The fundamental assumptions that underpin the ICM policy are that the objectives ICM initiatives will be achieved by:

- generating a better understanding of ecosystem interactions at a catchment scale by the community and Government; and, thereby
- moving towards common or agreed goals through development of a catchment management strategy; and
- facilitating coordination and cooperation within and between Government agencies and the Community to enable the prioritisation of actions; and
- joint or independent action to seek solutions to problems.

In order for these objectives of awareness and action to be achieved, the ICM Catchment Coordinating Committees, facilitators and other managers also need to be able to manage a successful ICM program.

1.2 TASKS FOR ICM

On the basis of these observations on the background to ICM, we propose that an ICM initiative faces four fundamental tasks: the requirement to develop a catchment strategy; the need to raise awareness of catchment scale issues and solutions; the need to precipitate action to bring about solutions; and the need to run an effective program in order to achieve the first three objectives.

Each of these fundamental tasks imposes particular information needs on the ICM initiative. Furthermore, these information needs have to be addressed with due recognition of the participatory nature of the ICM process. The role of communication in ICM as a basis for seeking consensus and building the capacity of stakeholders to contribute to integrated resource management means that information needs cannot be addressed as a technical issue independently from participatory processes.

Task 1 : Develop a catchment management strategy that identifies and prioritises land and water management issues and develops recommendations.

As identified above, the Queensland ICM Strategy (DPI 1991) identifies the development and promotion of a catchment management strategy as a fundamental requirement placed on all ICM groups. The process of developing a strategy demands some element of resource audit, issue identification, issue prioritisation and the identification of targets and responsibilities for action. Fulfilling these requirements involves accessing or creating and then integrating diverse information from a range of sources.

Task 2 : Raising Awareness of Issues

ICM aims to raise awareness amongst all stakeholders about issues of land and water management at a catchment scale, and the interactions between them. The focus on awareness is justified in the Queensland ICM Strategy as follows.

> *"The sustainable and balanced use of land and water resources depends on landholders and other resource users, the community in general, and government agencies and authorities having a sound understanding of the interactions between land and water, and of the need for a coordinated catchment-wide approach for addressing issues affecting these resources. A good understanding of these principles will enable all people and organisations involved to identify the need to change existing practices and adopt practices best suited to their own situation, without damaging other parts of the ecosystem."* (QDPI, 1991)

Thus, one of the key functions of the Catchment Coordinating Committee is to raise awareness of issues across the community. Similarly, one of the key roles identified for the State Government in the Queensland ICM Strategy is "*Fostering community awareness and the provision of educational material and services*".

In many contexts, raising awareness is not simply a question of promulgating existing understanding. Issues at a catchment scale are often not well understood by any individual or group, thus the challenge may be to identify issues and seek consensus and then disseminate consensus to the broader community. This is a demanding process and will call on information and insight from a range of sources.

Task 3: Precipitating / catalysing action
It is implicit in the Queensland Integrated Catchment Management Strategy that ICM is intended as a means of raising awareness about the need to manage natural resources strategically across a catchment (as discussed above) and, thereby, enable appropriate action by appropriate stakeholders. Thus the 'Guidelines for the Formation of a Catchment Coordinating Committee' (DPI 1994) states that "*The CCC will initiate change in practices, procedures and policies through goodwill and influence on the relevant authorities and groups. The committee does not make decisions which are the statutory responsibility of other bodies. … The success of CCC depends on its ability to take a catchment perspective and to influence other bodies, rather than the exercise of power and statutory responsibility.*" (p.14). This places ICM in contrast with Landcare which often has a greater role in identifying and implementing specific solutions to particular resource management issues. This view is broadly consistent throughout the material on ICM, although in places it is implied that ICM is also aimed at directly tackling problems rather than facilitating their resolution.

For the purpose of this document, we have assumed that technical solutions to particular problems remains the domain of stakeholders in the ICM process (whether individual landholders, local government or State Government agencies) and that the role of ICM is to identify and raise awareness of issues and precipitate their resolution by resource managers. Thus the Queensland ICM Strategy document (QDPI, 1991) states that "*CCCs foster the voluntary implementation of catchment management strategies through existing government and community organisations*". Nevertheless, given the objective of seeking integrated solutions, an ICM initiative may have a significant role to play in facilitating information access for resource managers. Given that better outcomes stem from better understanding not just better information, the exchange of information cannot reasonably be seen independently from the provision of training and skills, which may therefore also be an appropriate role for ICM.

Task 4: Implementing an effective ICM program
Relationships, roles and personal skills are probably the most critical factor in achieving the effective collaboration and participation that underpins an effective ICM initiative. However, there are also a number of information requirements that relate to the CCC's fundamental role in influencing other bodies. These include information on the ICM policy and related policies and statutory arrangements, on the broader institutional environment, on the roles and relationships of key partners, the expectations of key partners and on the biophysical and socio- economic context. They will also include a range of information to enable those involved in implementing the initiative to track progress and modify actions accordingly, thus enabling the ICM policy and program to be effective as an adaptive learning process.

2.0 METHOD

In this report, we address the information needs associated with the fundamental tasks outlined above by considering experience in the Herbert ICM in relation to each task.

For each task, we identify what information was asserted or predicted to be relevant in the various documents available to an ICM CCC and compare this to evidence for what information was actually used in the context of the Herbert initiative. We then consider explanations for, and the implications of, the difference between the two.

Given the need to integrate information across a range of issues and domains and from a range of perspectives and stakeholders, it is reasonable to assume that ICM groups face challenges in collecting, storing and managing data. We therefore explore these processes for each of the tasks in relation to the Herbert experiences.

Given the participating and community-oriented nature of ICM, it is reasonable to suppose that knowledge and expertise held by members of the catchment community (termed here as local knowledge in contrast to professional knowledge) are critical in the ICM process. Furthermore, given the complex nature of some of the natural resource issues being tackled, it is reasonable to assume that research projects and resource use inventory and survey may be a key source of information. These two sources are therefore considered in relation to each of the four tasks.

2.1 DATA SOURCES

The data sources used are referenced throughout the report. In summary, they include:-

- Policy documentation on ICM;
- Documents provided by the lead agency to guide CCCs;
- R&D findings/documents from the CTC7 research project;
- HRCCC minutes;
- Targeted interviews with 3 key informants in the Herbert River ICM process;
- Participant observation, on-going interviews and discussions with key informants
- The collective experience of the research team.

3.0 EVALUATIVE CONTEXT: ICM IN THE HERBERT

ICM in the Herbert River catchment is a community-led and voluntary process in a formative stage initiated by key interests in the catchment. The impetus for the establishment of the Herbert River Catchment Coordinating Committee (HRCCC) in 1993 related to two key factors. Firstly, broad community-based concern over the ineffectiveness of fragmented government decision-making on river management issues, and the failure of past studies to move beyond the development of plans and lead to action on the ground to resolve these issues. Secondly, the perceived need within the catchment for more active and meaningful community involvement in decision-making on these issues, that is beyond a basic consultative approach (Bellamy et al. 1998, 1999).

The objectives of the ICM process in the Herbert Catchment have been identified by the HRCCC in its draft Catchment Management Strategy (HRCCC 1996, p.i) as:

- Co-ordinate government agencies and the community to pursue common goals
- Seek community involvement in catchment management
- Reflect the requirements of the wider community within the Catchment
- Identify and rectify natural resource degradation
- Promote ways to prevent and reduce natural resource degradation
- Promote the wise use of all natural resources within the Catchment
- Identify key indicators of biodiversity and monitor as a measure of catchment health
- Encourage the retention of significant natural habitats within the Catchment.

Although these broad objectives are couched in terms that suggest an overall policy framework for the catchment, ICM has no legislative jurisdiction in Queensland. Success therefore will depend to a considerable extent on the degree to which the Herbert ICM process can engage public and private interests in a substantive way to voluntarily effect required action.

The HRCCC involves representatives of a broad range of rural industry, community and local government and other statutory organisations that have an interest and/or role in natural resource management in the catchment (Bellamy *et al.* 1999). As such, the membership reflects the influential groups, power structures, and prominent community interests in the catchment. In 1998, the HRCCC had a local Chairman and 16 other members representing community, industry and local government and statutory bodies in the catchment. A full-time Catchment Coordinator facilitates the process. Nine of the current members (50%) have been involved with the HRCCC since its inception in March 1993. Most of the members are active community members with multiple sectoral interests or 'hats'. Eleven of the seventeen HRCCC members are either sugarcane farmers or employed within the sugar industry reflecting the economic, social and cultural importance of the sugar industry in the lower Herbert catchment community.

4.0 TASK 1: DEVELOPMENT OF A CATCHMENT MANAGEMENT STRATEGY

4.1 INTRODUCTION

All ICM initiatives in Queensland are required to develop a catchment management strategy. The same is true of many equivalent regional or catchment resource management initiatives in other States.

In the context of ICM in Queensland, a catchment management strategy "*should provide a framework or blueprint for resolving key issues of catchment wide importance in a catchment. It should be useful to groups and organisations within the catchment as well as to others outside (like funding bodies, State Government etc.) the catchment*" (Rowlands, 1995). Furthermore, "*Catchment management strategies provide a broad assessment of the priority land wand water issues in the catchment and contain recommended actions to address particular issues*" (DPI, 1991, p. 20).

Given the number of Catchment Management Strategies (CMS) or equivalent documents that have been developed by community groups in recent years or are under development, it is perhaps not surprising that an increasing number of documents have been generated to provide guidance for this process. These include:

- Catchment Management Strategies : Draft Notes Philip Rowland, 22 February 1995 – Maleny Forum
- Essential Characteristics of Regional and Catchment Management Strategies: Michael O'Brien: Queensland Department of Natural Resources, March 1999 - Draft document
- Australian Local Government Association. 1997. Regional Environmental Strategies: How to prepare and implement them;
- Greening Australia. 1997. Regional Strategy Checklist: Essential Characteristics of Natural Resources Management Strategies; and
- DNR. 1998. Interim Guidelines for the Development of Natural Resources and Biodiversity Conservation Regional Strategies

While the broad principles discussed in these documents have a good deal in common, the specifics of the recommended contents for Strategy documents vary. Table 1 presents a generic Strategy structure derived from Rowland (1995).

Table 1: Key components of a Catchment management strategy (After Rowland 1995)

Setting the Scene	Description of the physical, economic, biological and social attributes of the catchment and the use and management of natural resources in the catchment.
The Vision	A statement or series of statements describing a vision for the catchment or principles to guide use of resources that have broad stakeholder support.
Identifying Issues	Identification, analysis and ranking of the key natural resource management issues.
Outcomes	Statements of the proposed outcomes resulting from the implementation of the Strategy
Objectives	Specific, measurable, achievable, relevant and timely objectives to address each issue.
Strategies	Strategies to achieve the objectives. Major components of these strategies include: Activities to be carried out Organisations, government departments or agencies, local authorities and other key stakeholders that need to be involved. Resources (time, money, manpower) needed to carry out the activities
Performance Indicators	Attributes that should be measured or determined to assess progress toward the objectives.
Outputs	For example : Policies for use by local and state government, industry groups and other agencies. Guidelines for the use and management of natural resources in the catchment. Operational plans to redress or prevent degradation of loss of value with natural resources in the catchment. Institutional arrangements necessary to achieve better use and management of natural resources.
Implementation	Mechanisms and structures to be used in implementing the strategy.

Evaluation and Review	How the implementation of the strategy will be monitored so that appropriate changes can be made if necessary.

4.2 METHOD

In this section we assess information needs by comparing the guidelines and requirements provided to ICM initiatives by State Government with the practice as illustrated by the Herbert River case study. Given that information management and content is significantly impacted by the purpose for which the document is put together we first consider purpose. We then address processes for accessing and managing information before addressing the actual information content in the Strategy. In each case we compare:

- **Principles** - the direction provided by State Government;
- **Assessment Criteria** - the assessment criteria proposed by State Government for assessing Strategies (which therefore provide a measure of the Government's views on how principles should be operationalised); and
- **Practice** – from consideration of the Herbert case study.

This comparison provides insights into the information needs and challenges for ICM initiatives but is based on the assumption that the State Government policy, while evolving, has been broadly consistent over the life of the whole ICM Program and that the Herbert Catchment is an appropriate example of an ICM initiative that represents the best efforts of the Catchment Coordinating Committee. While at the time of writing the Herbert CMS has yet to be endorsed, it has received interim endorsement twice. Furthermore, continued funding support suggests continued State Government approval of process in the catchment.

4.3 THE PURPOSE OF THE CATCHMENT STRATEGY

The Catchment Management Strategy has two generic functions.

It fulfils a 'due process' requirement. ICM Catchment Strategies need to be endorsed by State Government in order to receive and maintain funding inputs and other support. As a consequence, criteria for assessing such strategies have been developed (see O'Brien 1999 for assessment criteria under development for use by the Queensland LCMC for the assessment of ICM Catchment Management Strategies).

As well as meeting the requirements for 'due procedure' the Strategy is clearly intended to provide a focus for the ICM initiative and a point of reference through its subsequent development.

These two generic functions are apparent in both principle and in practice, but with important differences in interpretation and application.

In Principle
In notes prepared for the Catchment Management Forum at Maleny in February 1995, Philip Rowland identified three basic purposes for Catchment Management Strategies:

- Formal recognition by State government (through Cabinet), local government and industry.
- Providing "*a clear message to these bodies [funding sources in Government and elsewhere] about what needs to be done*".
- A tool for local stakeholders by "Acting as a framework or blueprint for resolving key issues of *catchment wide* importance in a catchment".

The notes place considerable emphasis on following standard structures for Catchment Management Strategies in order to ensure that they are appropriate for endorsement and provide a sound basis for communication with Agencies beyond the catchment. Similarly notes on "*Essential characteristics of regional and catchment management strategies*" (O'Brien, 1999) state that "*A key element in the preparation and implementation of resource management strategies is the need to gain endorsement at a State Government level*".

These and similar documents contain limited discussion on the structure of the Strategy in relation to its role in local management of resource use strategies. Nevertheless, the emphasis on

standardisation is reflected in the stringent criteria for Strategy endorsement that have been developed (O'Brien, 1999) and the requirement to have a Strategy submitted and endorsed in order to continue to receive recognition and funding support.

In Practice
Surveys of HRCCC members in 1997 and 1999 (Bellamy & MacDonald, 1998; Bellamy et al., 1999) demonstrate that the Herbert River Catchment Coordinating Committee have similar views to those being presented by State Government. Most members agreed that the HRCCC prepared a catchment strategy to ensure future funding support and that it was the main driver for its preparation.

However, they also stated that the development of the strategy helped to focus the HRCCC, and that the catchment strategy would contribute to more effective resource management in the Herbert. However, there was a wide range of views amongst the members on whether the catchment strategy would assist in resolving resource management conflicts or whether the Catchment Management Strategy provides an effective blueprint for the HRCCC activities.
Importantly, the development of the Catchment Management Strategy is perceived by members to have been of value because of a number of qualities and outcomes of the development process that include:

1. *inclusive and transparent* to all members involved; bringing all viewpoints across organisations on issues together and out into the open.
2. *establishing a clear direction* for the HRCCC; helping to focus the HRCCC as an organisation and providing an overall vision for the catchment.
3. *raising awareness* of catchment issues; especially improving Committee member's awareness of issues as well as other stakeholder's viewpoints on those issues.
4. *highlighting areas of common ground*; by identifying areas of agreement across diverse sector groups on some catchment issues, it provided a basis for the Committee to move ahead and develop better natural resource management and planning projects.

4.4 ACCESSING AND MANAGING INFORMATION

The development of a catchment management strategy is a major undertaking for a CCC. The process of developing a strategy demands some element of catchment resource audit, issue identification, issue prioritisation and the identification of targets and responsibilities for action. Fulfilling these requirements involves some level of accessing or creating and then integrating diverse information from a range of sources.

In Principle
The ICM Program has specific expectations of the approaches to information collection, collation, integration and interpretation that underpin the Catchment Management Strategy development if it is to receive formal endorsement. Some of the criteria provided for CCCs to guide the development and assessment of their strategies (O'Brien, 1999) are presented in Box 1.

Meeting these criteria demands significant skills in terms of accessing and analysing quantitative data sources, literature review and community consultation. Development of the Catchment Management Strategy requires access to "historical" material in terms of grey literature in the form of previous reports and studies etc. as well as accessing the formal literature in relation to fundamental principles to resource management issues relevant to their catchments. They will also need significant skills and expertise to effectively access community perceptions, priorities and values.

In Practice
The HRCCC has been involved in developing a CMS twice, the initial CMS was developed and launched by the HRCCC in 1996. In 1998, a major revision was undertaken to obtain endorsement. While endorsement has been seen as a significant target, it has not been treated as the 'end of the road'. The Strategy has been envisaged as becoming an enduring 'living document'.

Box 1. Criteria for developing and accessing strategies (After O'Brien, 1999)

PRINCIPLES

Is the strategy consistent with the overarching principles of effective resource management (eg. ICM, ESD)?

STAKEHOLDERS

- Have all the relevant stakeholders been identified (eg. community interest groups, NGOs, Government agencies, Indigenous groups etc …)
- Was the stakeholder input reflective of the importance of developing a regional strategy?
- Have the responsibilities of the various stakeholder groups been clearly defined and endorsed (signed off) by them?
- Has a lead agent been identified and accepted by the stakeholders as responsible for coordinating and promoting the endorse strategy?
- Has the stakeholder involvement been consistent and facilitated through appropriate methods through all stages of the strategic plan (ie. planning, implementation, review phases)
- Do community members respect the creditability of organisations and agencies involved in the strategy?
- Have the stakeholder groups that already deal with particular issues (if they exist) been identified?

INFORMATION BASE

- Have information gaps been identified?
- Has the opportunity to fill information gaps by utilising the knowledge of stakeholders as a resource been investigated?
- Has the integrity of the various data sources for economic, social, cultural and ecolo9gical processes been documented?
- Has the current understanding of processes been documented?
- Is there confidence in the integrity of the information contained in the strategy, and in information used in its development?

SYSTEMATIC REGIONAL APPROACH

- Have external impacts or flow on effects resulting from the strategy been identified?
- Has compromise been made between the social, cultural, ecological and environmental objectives to ensure acceptance by the community?
- Does there need to be a systematic and systematic perspective of the region?
- Does the strategy focus on a variety of regional issues?

INTEGRATED

- Have all other plans and strategies (all scales) appropriate to the management of the region been identified and their role integrated into the strategy?
- Has the hierarchy of the related plans been identified? (consider the priority of implementing the strategy in relation to other regional plans)
- What are the existing priorities and strategies within the organisations that are required to support the implementation of the strategy?
- Have the constraints, difficulties and limitations in linking this strategy with other plans been identified?
- Have possible resolutions to these been suggested?
- Does the NRM strategy conform to the statutory plans used by local and state government when dealing with development pressures?

SCALE

- Does the strategy address the issues at an appropriate scale to ensure effective management?
- Have mechanisms been provided to address issues across legal boundaries?
- Has the future role of the strategy in the management of the region been identified?

GENERATION & EVALUATION OF OPTIONS

- Have a variety of options and alternatives for addressing issues been identified?
- Have the positives and negatives of each alternative been documented and evaluated?
- Have the costs and benefits of each option (as they relate to environmental, social and economic resources) been considered?
- Have options been prioritised in an appropriate yet flexible manner?

COMMUNITY CONSULTATION

- Has sufficient and effective consultation been carried out throughout the planning, implementation and evaluation stages?
- *Consider:* appropriate time and resources committed, suggestion and promotion of mechanisms to facilitate feedback throughout the life of strategy.
- Was the method of community consultation appropriate for the various stakeholder groups involved?
- *Consider*: education and literacy levels, knowledge of topics, facilitation and promotion method, potential conflicts, objectives of consultation made clear from onset, local relevance of issues, representatives for stakeholder groups communicated outcomes effectively
- To what degree have the consultation methods fostered an atmosphere of community ownership and commitment? (Reflected in the stakeholder signatures in the Endorsement Section and in acceptance of responsibilities for carrying out actions)
- Has justification been provided for those issues where public participation was not used?

Formal interviews and informal discussions with participants suggest that it was generally agreed that local knowledge was a key information source for catchment management strategy development. There was strong consensus and agreement within the HRCCC that local expertise was not often in

conflict. It was widely held that the expertise held by members of the Catchment Coordinating Committee (including their knowledge of, or involvement in, previous studies and reports) was the dominate information source. The Catchment Coordinator stated that formal and documented information had been relied on where available and interpreted in the light of local knowledge. Local knowledge had only been used in its own right where there was no documented information to be used instead.

The development of the first Catchment Management Strategy had little or no input from State Government. This was perceived to have been a deficiency and the second round development has included significant involvement from State Government agencies, representative bodies and local government. Anecdotal information and undocumented experience or expertise was only used in the Strategy if it was widely held (the same did not apply to technical documents from which data was included even if it was not supported by the committee members experience).

The Catchment Co-ordinator was active in seeking out published information of relevance to the development of the Strategy and circulating this material to Committee members. It was clear that for some areas (eg. the upper Herbert River Catchment) documented information was very sparse. For the lower Herbert there was more documentation to back up (or refute) local knowledge. The Catchment Co-ordinator reported some significant differences between local perspectives and documented technical information.

Some participants noted that it had became clear that the Strategy was really just a document to obtain Government funding and was therefore constrained by what government wanted, particularly during the second revision.

Prioritisation of issues and strategies was based entirely on Catchment Coordinating Committee consensus and discussion. There was limited if any 'reality checking' of the importance of issues or viability of strategies.

When asked how they would change the development of the strategy if they were tackling it again, the three key participants interviewed said that they would bring in more agencies and other perspectives earlier in the process. They also said that they would invest time in looking into research and experience beyond the catchment boundaries and interstate. The close to exclusive reliance on local expertise and research or other technical documentation specific to the catchment was clearly seen as a missed opportunity.

4.5 INFORMATION CONTENT FOR THE STRATEGY

In Princi ple
The proposed or required structure for a Catchment Management Strategy and the required contents (as expressed in the evaluative criteria, O'Brien, 1999 and Box 1) provide some clear guidance on the content required.

Context. Description of the physical, economic, biological and social attributes of the catchment and the use and management of natural resources in the catchment provides critical context for the remainder of the strategy. A comprehensive description of context at a catchment scale is a significant task. This process requires accessing previous documents, which may be out of date, may cover an overlapping but different physical area and may have a particular perspective that covering a particular issue requires. Furthermore, statistical data and other primary data such as State of the Environment reports and ABS population census data may need to be accessed and analysed.

Vision. The development of a vision statement that represents reasonable community consensus requires significant consultation and negotiation. Clearly, consideration of negotiation processes is beyond the scope of consideration of 'information needs', however, the consultation process is essentially a data gather exercise. This demands a clear identification of representatives of key stakeholder groups and the use of appropriate methods to support those groups in reaching their own consensus on their vision and articulating this to other groups as a basis for negotiating a community vision. Furthermore, given that endorsement of a Catchment Management Strategy by

the LCMC requires '*strong evidence of community input*' appropriate methods for recording these inputs and making them available for later consideration might be necessary.

Values. Development of the vision requires consideration of the social, economic, environmental and cultural values associated with the area. Some of these values will be directly quantifiable while others might only be measurable through surrogates and many might not realistically be described in anything other than qualitative terms. Furthermore, the values considered need to go beyond the immediate stakeholder groups and have some cognisance of the regional, state, national and international values associated with the area.

Key issues. Identifying key natural resource management issues facing a region with due recognition of their economic, cultural, environmental and social dimensions is a significant challenge. Issues need to be considered not only in their local context but also as they relate to state, national and international issues. Similarly, multiple timeframes need to be integrated. Achieving community consensus on the comparative priorities of these key issues is possibly harder still. Rowlands (1995) makes the point that scientific (qualitative and quantitative) as well as local knowledge should be used in the description and analysis of the issues. This is a big ask for Catchment Coordinating Committees.

Objectives & strategies Devising a set of objectives and strategies for the resolution of the key issues identified may be a relatively straight forward process. Nevertheless, objectives need to be based on Committee (and by implication community) consensus, be clearly communicated and demonstrably contribute to the achievement of the vision. They also need to be tractable and consistent with legislation, policy and other natural resource management frameworks. The strategies that underpin objectives also need to be technically feasible and tractable in terms of resource availability. They also need to demonstrably be an appropriate means of achieving the objective. Thus, as with any planning activity, the greatest challenge facing the Committee in drafting objectives and strategies is to be able to analysis their feasibility and tractability. This 'reality check' process demands considerably more information than drafting objectives and strategies in the first instance.

In Practice
In a broad sense, both the first and second editions of the Herbert Catchment Management Strategy cover the material proposed by the State level program.

It is clear from the Strategy and, in particular the use of specific figures on particular issues, that extensive use was made of published material. The Strategy itself contains reference to the meetings, field inspections, literature reviews and general contact with the community that underpinned the development of the Strategy.

The introductory section provides an excellent audit / situation statement with a significant use of figures. The Herbert River Catchment Atlas (Johnson *et al.*, 1999) was clearly a key document and receives its own section in the Introductory material. The only other specific references in the document are to DPI and DEH vegetation assessment and mapping and to the Nature Conservation (Wildlife) Regulation 1994. Similarly, the local statements of issues, values, strategies and so on are not referenced to source. This lack of referencing makes analysis of the use of information difficult. More significantly, it makes it difficult to judge the validity of the contents of the document. Furthermore, one of the Committee members pointed out during interview that a failure to reference adequately meant that the document could not practically be maintained as a 'living' or evolving document.

All three of the key participants in the development of the strategy who were interviewed argued that the key information gap they faced during the development of the document related to the spatial location and distribution of issues and resources. Specific issues included :

- the extent and significance of vegetation types;
- mahogany glider habitat;
- the extent of tree clearing in the upper catchment;
- up-to-date land use information;

- weed distribution;
- land use suitability;
- groundwater quality and quantity;
- water licensing and allocations.

4.6 CONCLUSIONS – INFORMATION NEEDS FOR STRATEGY DEVELOPMENT

This comparison of the information needs associated with the development of a Catchment Management Strategy in principle and practice raises a number of issues.

The development of a Catchment is a substantial and challenging task. It may often prove to be a significant test of the capacity of members of a Catchment Coordinating Committee to access, analyse and synthesis diverse data sources. Furthermore, it may frequently be constrained by the resources (in terms of direct funding, indirect support from external agencies and the voluntary time from CCC members) available.

These observations raise four issues of particularly note, as follows.

How much is enough?
The guidance provided to CCCs and the stringent assessment criteria applied in relation to endorsement provide a high standard for Catchment Management Strategies, as witnessed by the problems that many groups (including the Herbert) have had in receiving endorsement.

However, no information seems to be available on how much information analysis and synthesis is adequate to result in a Catchment Management Strategy that will adequately fulfil its role. This issue is complicated by the reality of the dual roles of a strategy - facilitating action within the catchment and receiving endorsement (and therefore further funding) from the State Government and by the level of consensus that is deemed to be necessary.

Responsibility for information provision
A catchment Management Strategy requires significant base information from biophysical to social. Much of this information is patchy, dispersed and difficult to access.

The CCC play a key role in accessing and integrating local expertise, values and knowledge but also have the primary responsibility for initiating and supporting approaches to collecting and collating base data. At the CCC Forum in Rockhampton in 1994 an expectation was clearly articulated that it was up to State and Federal Government to provide the information base required by the CCCs and Local Governments to prepare plans.

Maintaining the information base
This issue of responsibility for the management of the core information base is particularly significant given the need to maintain and update the information base that underpins the Catchment Management Strategy so that it remains a 'living document' which evolves to reflect changes in knowledge, understanding, attitudes and issues. This is a significant role for CCCs and one for which they may be poorly equipped.

Assessing tractability and feasibility
Little is said in the guidelines to CCCs about the information and analysis required to assess the tractability and feasibility of the objectives and strategies in the Catchment Management Strategies. This process of reality check is both demanding and important.

5.0 TASK 2: INFORMATION NEEDS FOR RAISING AWARENESS OF ISSUES

5.1 INTRODUCTION

HRCCC members stated during interview that one of the fundamental roles of an ICM initiative is raising awareness of issues in order to get others to act on them. This view is consistent with the ethos espoused in the Herbert Catchment Management Strategy that the intended role of the ICM initiative is to recommend actions and processes on the basis of issues identified and to be responsible for implementation through pushing adoption of its recommendations by the relevant management agencies and other stakeholders. Thus, one of the key outcomes of implementation of the strategy is identified as informed land holders.

It is clear from the material on the Herbert ICM process that in the first instance the challenge was to raise awareness amongst members of the HRCCC. Committee members represent a range of perspectives and interest groups. Committee members can, therefore, represent their constituents' interests to other stakeholders groups and can, in principle, raise awareness within their constituency of the issues of other groups. In order to implement substantial action, the CCC also needs to raise awareness of issues amongst key management agencies at the Federal, State and Local Government level, within industry and amongst landholders and the broader community.

In order to undertake these roles the CCC may need to tackle a number of issues such as:

- What appropriate information (i.e. of demonstrably local & personal relevance) is available for raising awareness on issues?
- What is the existing level of awareness?
- What is the necessary / desirable level of awareness?
- How are people likely to process and respond to issues?

These questions build on more generic issues relating to information management in ICM such as:

- What are the sources of information that people make use of?
- How do those sources present information?
- To what extent is the information from those sources trusted?
- How is the information from those sources used?
- How has local experience identified issues that require resolution?

5.2 CASE STUDIES

In order to address consideration of these and related issues in the Herbert ICM process the data sources used by the HRCCC to raise awareness were reviewed and assessed. This assessment focussed on the ICM initiative itself and four additional case studies:

- The management of acid sulfate soils within the Herbert River Catchment
- The assessment of the status of riparian vegetation within the Herbert River Catchment
- An inventory of the legacy of historic tin mining in the upper catchment
- A community oriented program to erect owl boxes for integrated pest management

As with the information used in developing the CMS, the information base used for raising awareness in the Herbert was a mixture of the 'corporate knowledge' of Committee members, documented information and other expert sources.

Raising awareness about the ICM initiative itself

At a workshop of key stakeholders in the ICM process held in 1995 (Bellamy et al., 1995) it was argued that in order to gain a long term commitment to the ICM process amongst the community, it was necessary to create a common and widespread understanding of the ICM conceptual process. At that stage (April 1995), it was argued by participants at the workshop that the development of the Catchment Management Strategy was a critical process in gaining community consensus on key issues and the role of ICM. The Catchment Management Strategy that was subsequently developed explicitly acknowledged this role and is being used to seek a consensus on key resource use issues amongst community leaders. The Community Surveys (Butterworth et al., 1998; McCreddin et al.,

1999) demonstrate that this broad community awareness of ICM through exposure to the Strategy has not yet been achieved in that there was limited awareness of ICM or the Strategy amongst the broader community.

Raising awareness about Acid Sulfate Soils
Acid sulfate soils have emerged as a potentially significant issue for the Herbert Catchment during the life of the ICM initiative. The HRCCC played a significant role in raising community awareness of this problem through the local media (Cottrell and Rowbotham 1999).

Several members of the HRCCC were aware of growing concern about acid sulfate soils in other sugar growing districts, particularly in NSW, through general media coverage and brochures and other literature prepared by the NSW Government. Subsequent developments of two low lying areas of land raised local concerns within State Government Departments and precipitated wider local interest. As a consequence, the HRCCC decided to take specific action in raising awareness. Through consultation with the Queensland Department of Natural Resources they established that acid sulfate soils were a particular issue at less than 3m AHD. The HRCCC then commissioned CSIRO to develop a map of land lower than 3m AHD in the catchment that was published with an accompanying article in the local press. This was perceived to have significantly broadened awareness of acid sulfate soils and their implications amongst the community.

Members of the HRCCC report that they found much of the information then available from Queensland State Government Departments to be vague and overly general. As a consequence the group relied heavily on the NSW literature that defines the problems and management requirements- but with some concern about its relevance to North Queensland. The ability to generate a map of local risk areas was critical to the success of awareness raising as it provided local context.

Raising awareness about ripari an vegetation
Riparian vegetation and its management has become a significant natural resource management issue in the Herbert over the course of the ICM initiative. Objectives, options and responabilities for management remain contentious. However, early in the life of the ICM initiative, the current state of riparian vegetation in the catchment was a major source of uncertainty.

The HRCCC supported student research work that mapped and assessed the state of riparian vegetation along major water courses in the lower catchment (Petroeschevsky, 1997). The HRCCC did not want botanical mapping or general level 'state of rivers' type assessments but needed information of relevance to land holders, allowing them to compare the state of their riparian vegetation to that of others. The inventory resulting from the student project was deemed to have fulfilled this role very well. The then Catchment Coordinator was of the opinion that it resulted in better and cheaper information than the State Government State of the Rivers report.

The exercise was reported as having been a very important catalyst in raising awareness of issues in relation to the state of riparian vegetation amongst members of the HRCCC. The data has been widely distributed. It is held by the Herbert Resource Information Centre (HRIC) and was, for some time, one of their most accessed data layers, having attracted broad interest including from Government departments and researchers. The data was a key input into the Joint Board Catchment Rehabilitation Plan for the Herbert River catchment and, in turn, also influenced the Herbert River Improvement Trust (HRIT) and the Hinchinbrook Shire Council's priorities.

Raising awareness about the impact of legacy tin mines
One of the enduring land and water management issues in terms of strength of feeling amongst community members prior to the establishment of the HRCCC was the impact of abandoned tin mines in the upper catchment. The dams were abandoned in the late 1980's and were regarded by Herberton Shire Council as a threat to the surrounding community and to the downstream quality of water in the Herbert River. Concern arose from the lack of maintenance of the earth-filled dams and the possible increasing risk of failure through erosion. The HRCCC's activities in addressing this issue are discussed in the next section, however, this action followed the building of a consensus amongst the HRCCC that this was an issue that merited HRCCC involvement. The HRCCC

therefore undertook a field visit to the upper catchment to view the sites. This proved to be a constructive means of building awareness and consensus among committee members.

Raising awareness about Owl boxes
One of the highest profile activities that the HRCCC has been involved in has been the promotion of owl nest boxes. Owl populations on the Ingham coastal lowlands have dropped noticeably over the last five years. Reduced populations have been attributed to the clearing of native vegetation to accommodate the expanding sugar industry resulting in the destruction of nesting habitats and hunting perches. In addition, the possibility of secondary poisoning linked to rat baits has been suggested (Robinson *et al.* 1999). Establishing nesting boxes and hunting perches for owls in cane growing areas increases the owls' hunting range and improves the chance of survival in a changed habitat. Robinson *et al.* (1999) reports that a single owl family can eat over 2,000 rats per year. Aside from the number of rats an owl family can physically remove from the environment, there is some potential for owls to disrupt the breeding cycle of rats, further reducing their population. Rat damage to cane in the Herbert River District has been estimated by the Herbert Cane Protection and Productivity Broad (HCPPB) to range from 28,265 tonnes in 1993 to 6,576 tonnes in 1997.

The owl nest box project is seen by HRCCC members as having been an important achievement that served in promoting principles of integrated pest management within the sugar industry, encouraging the retention of old growth trees in riparian areas and raising the profile of ICM in the catchment (through, for example, a Landline feature).

Interviews with HRCCC members reveal that this initiative came about as a consequence of a number of coincidental issues and triggers.

A local wildlife expert Mr John Young, ran an owl spotting tour that was attended by some HRCCC members and commented on the numbers of rats consumed by owls, the decline in owl numbers and the critical importance of nest sites in maintaining population levels. That damage has always been a significant issue for canegrowers and deregistering of key rodenticides at the time was forcing consideration of integrated approaches to pest management. Considerable work by the Bureau of Sugar Experiment Stations (BSES) rodent control research on habitat management was receiving attention. The HRCCC brought together this information and felt that promoting owl nest boxes was a potential win-win situation for the industry and environment that was unlikely to be contentious.

The expertise provided by John Young and the BSES researchers as well as information on the economic value of rat damage provided by the HCPPB provided the HRCCC with all the information they need to launch this simple but significant initiative.

5.3 INFORMATION NEEDS FOR RAISING AWARENESS – IMPLICATIONS FOR AN ICM PROGRAM

Focus on improving the flow of existing information – particularly within the CCC
During interviews with HRCCC members, it was argued that raising awareness was an issue of information flow between the HRCCC, agencies and the community and that, while as much information as could be available would be useful, the fundamental constraint on awareness raising was one of cooperation and information flow with management agencies and stakeholder groups rather than information gaps per se. Review of the case studies bears out that much of the awareness raising was indeed based on improving the flow of information. This was probably most clearly demonstrated in relation to awareness raising amongst the members of the HRCCC where discussions, presentations and field trips proved to be of considerable value.

Focus on awareness raising in relation to well understood issues on which there is broad technical consensus
Review of the case studies and other issues in which the HRCCC has become involved also demonstrates that issues that were well understood and on which there is broad consensus were a more effective basis for raising awareness than less well understood issues. Thus the HRCCC can claim a significant role in raising awareness about Acid Sulfate Soils and the decline in owl

populations but has had more trouble in dealing with the poorly understood and contentious fish kill issue.

6.0 TASK 3: INFORMATION NEEDS FOR PRECIPITATING ACTION

6.1 INTRODUCTION

As has been discussed, a consensus has emerged that the role of the HRCCC is to strategically precipitate action or influence planning by those with management responsibilities in Local and State Government, industry and amongst landholders on key natural resource management issues from the catchment perspective. Thus one of the foundations documents for the ICM program states that "*The CCC will initiate change in practices, procedures and policies through goodwill and influence on the relevant authorities and groups. The committee does not make decisions which are the statutory responsibility of other bodies. … The success of a CCC depends on its ability to take a catchment perspective and to influence other bodies, rather than exercise of power and statutory authority.*" (QDPI, 1994)

The HRCCC is faced with a variety of information and information management needs in precipitating or enabling appropriate and timely management intervention and adoption of appropriate practices and with influencing statutory planning processes. Can the specific information needs that might be associated with enabling action aimed at the resolution of resource management issues be predicted and, if so, at what stage? When surveyed in 1997, HRCCC members stated that catchment natural resources, land use, options for funding of ICM and other community activities, government policies and regulations on natural resources and related issues and government institutional arrangements for ICM, Landcare, natural resource management and related issues were the categories of information that were most useful in supporting the Herbert ICM program and its activities (Bellamy & Macdonald, 1998). When surveyed in 1998, most members disagreed that managing land and water resources in the Herbert was difficult because people on the catchment lacked access to information needed to respond to/deal with new catchment issues or problems. Members did not perceive a lack of relevant information as a significant constraint for ICM in the Herbert (Bellamy et al., 1999).

This section addresses these issues by looking at what was used by the HRCCC in practice and what the group would have liked to have used but did not have access to and comparing this to the early thinking on key issues. This comparison enabled consideration of the extent to which relevant issues might have been predicted. It is concluded that the specific information provisions required in order for ICM to contribute to the solution of problems are diverse; variable with the stage of implementation; in any specific instance, context specific; and unpredictable.

6.2 PREDICTING INFORMATION NEEDS FOR PRECIPITATING ACTION

The HRCCC raised four issues when it was formally recognised in March 1993:

1. River Management/River Improvement work
2. Need for improved Land Management/Land Use Planning
3. Mining Dams in the Herberton Shire
4. Drainage in the floodplain delta

At the Catchment Coordinating Committees Forum in Rockhampton in 1994, the HRCC identified the following as its key challenges over the next five years:

- To have direct consultation with the local authority(s) in the development of the Shire(s) Strategic Plan in coordination with the Department of Housing, Local Government and Planning
- To encourage the establishment of a Decision Support System (DSS) between industry, agriculture, local and state Government to better manage the catchment
- Industry endorsement of Property Management Planning consistent with Floodplain Management Guidelines.
- To address river Management Issues (Siltation, Water quality, River capacity) and liaise closely with, and assist the Herbert River Improvement Trust, in implementing the key recommendations of its Strategic Plan.

- To address Land Use Planning issues (Land utilisation, Land use plans, Land management plans) and work with local authorities and government departments to *effectively* use geographical data which is becoming available. Use land use planning to allocate appropriate land for cane expansion and other uses.
- To address Drainage issues (Water availability, drainage/irrigation, ground water, stream water, Coordinated drainage)

Concern over flooding has been a community issue in the lower catchment since the 1880s. However flood mitigation works and the development of uncoordinated drainage systems have been the cause of considerable community conflict. Between 1976 and 1993, there were a number of major studies commissioned by the Herbert River Improvement Trust (HRIT) and the Hinchinbrook Shire Council in collaboration with state government agencies that have examined water management related issues with respect to flooding management, rural drainage planning, and stream management planning. These technical studies focussed on "engineering-based" solutions.

In contrast, the most important resource management issues in the catchment identified by HRCCC members in 1995, 1997 and 1998 are compared in Table 1. In general, member's perspectives on catchment management issues broadened and became more strategic. Rural drainage, flooding, river management and sugar industry expansion and related land clearing have remained key issues for the HRCCC members across all surveys. However, since 1997 additional issues identified were water quality (particularly relating to fish kills, and stream sedimentation), riparian vegetation and wetlands management, pest and weed management, land use planning and a coordinated approach to catchment management. In 1998, with closer linkages to the upper catchment community, two further issues were also identified; grazing land degradation/erosion and water availability issues.

Importantly, perceived impacts of these issues have evolved from an initial focus in the technical studies on productivity and infrastructure impacts to encompass also loss of alternative use opportunities and environmental and ecological factors. Perceptions of the key mechanisms for resolution have also evolved from the initial focus on "engineering based" approaches to include policy incentives, individual action, the development of local industry codes of practice, and the use local government planning and development controls.

Table 1. Perceived Key Resource Management Issues by the HRCCC 1993-1998.

November 1995	November 1997	November 1998
Rural drainage	Rural drainage	Drainage coordination/ management
Stream bed/bank erosion	River management	on floodplains
Urban flooding		Waterways management and flooding
Allocation of sugar caneland	Caneland expansion	Sugar industry expansion
Land clearing		Land clearing
	Water quality	Water quality
	Riparian management	Riparian vegetation management
	Wetland degradation	Wetland degradation/ management
	Pest and weed management	Weed management
	Coordinated extension approach	
	Catchment planning	
		Land use planning, catchment management
		Grazing land degradation/erosion
		Water quantity/availability (upper)

In early 1999 a sub-committee of the HRCCC was formed in the upper catchment. This new group identified and prioritised the key issues for the upper catchment as detailed in Box 2. Although there are some commonalities with those issues identified by the formal HRCCC, the focus of the issues identified by the upper catchment sub-committee is quite different in that they are largely concerned with specific land and water management issues rather than including broader planning and public good issues.

Box 2. Key natural resource management issues for the upper catchment group

Weeds in general (ie. noxious weeds, ponded pastures, stream blockers)
Erosion (ie. cost effective measures)
Water conservation (ie. crop water requirements, changed water requirements (eg. for dairy, cane), best practices water harvesting, storage)
Water quality (ie. turbidity, chemical, sediment)
Land clearing (ie. best practice in native forest, management (fire, grazing, timber), potential cropping areas)
Soil fertility (ie. potential for cropping – forage and fruit, salinity, manganese, nitrification)
Wetland/wildlife preservation (ie. birds/maintenance of habitat (natural, artificial), feral animals)
Land subdivision (ie. more and larger approvals, water quality implications, licensing, multiplier effects of dams)
Creek and river restoration (ie. repair and cleaning)

A reasonable consistency in perception of key issues is apparent from this brief review. While these statements of key issues are generic, they arguably provide a reasonably solid basis for planning a program of information collection and collation. Some of the information that has been actually used is reviewed in the next section.

6.3 INFORMATION USED IN PRACTICE IN PRECIPITATING ACTION

Review of some of the activities that the HRCCC has been involved in in practice reveals that, the understanding, values and perceptions held by members of the HRCCC have proved to be a key information input into HRCCC activities designed to precipitate action. The HRCCC have, therefore, seemed to have had limited requirements for collating technical data beyond their existing expertise and have, instead, sought to involve the people with that expertise into the process, as illustrated in the following two case studies.

Stabilising tin mining remains

One of the early issues tackled by the HRCCC was an inventory and evaluation of abandoned tin mines on water quality downstream. The HRCCC targeted this issue in response to widespread community concern over many years of the impact on water quality, causing discolouration and possible impacts on the quality of drinking water extracted from the Herbert for the Ingham water supply. An HRCCC fieldtrip heightened awareness amongst committee members and lead to significant lobbying for action by HRCCC members from the lower catchment, principally directed at the HRCCC member from the upper catchment.

In response to the perceived issue, the Catchment Co-ordinator lobbied the State Government Mines Department to map and assess the old tin mining structures, particularly the dams associated with the mines. Following the inventory of major dam structures, material was sent to a dam safety engineer for assessment so that the extent of the problem, dams at risk and priorities for works could be identified. Funding applications had been knocked back for years but an HRCCC sponsored project with significant in-kind support from local lease holders, Shire Council and others was funded and remedial works were undertaken. This project was supported by NLP funding and was brokered in collaboration with State Government Department of Mining and Exploration and Herberton Shire Council. The project therefore resulted in on-ground remedial works. It also precipitated the development of an active Landcare group in the upper catchment which provided the impetus for the development of a Catchment Coordinating Committee in the upper catchment.

In this instance, the information required by the HRCCC was simply identification of the issue in the first instance. The Committee and Coordinator played an important facilitating role in bringing parties together and seeking funding but effectively out-sourced information requirements by contracting engineering consultants.

Influencing the modification of the Shire planning scheme

This initiative was part of a statewide project (Lusis, 1999). It was fortuitous that the Hinchinbrook Shire Council was undertaking a review of its planning scheme at this same time as the project team was looking for case studies. The HRCCC became involved in this project following an invitation

from the Mayor and came to contribute half of the members of the Committee. The HRCCC members played a key role in identifying and communicating issues and in driving much of the local project work. One of the aspects of the project was to locate key wetlands. This was of particular interest to the HRCCC and was facilitated by the mapping and analysis facilities offered by the Herbert Resource Information Centre. The project was not felt to have been information constrained.

The project itself lead to a significant change in the Shire strategic plan in that intensive agriculture was removed as an 'as of right' use such that proposed development of scheduled wetlands areas now trigger an impact assessment process.

Other initiatives

The same general observation that the HRCCC has relied predominantly on the expertise of members of the Committee applied to some of the more contentious and less productive issues that the HRCCC has been involved in. Thus the clearing of Pomona Station was a significant source of conflict within the community and at a State level. This conflict was reflected in a failure to reach agreement on action within the HRCCC. Members of the HRCCC have reported that they considered that there was enough information to know there was a problem, but not enough to precipitate a solution. Furthermore, access to information was reported as a problem as was the apparently conflicting advice coming from different agencies. As a consequence, personal opinions and local politics dominated the issue. Significant issues included :

- agreement on the definition of a water course and swamp or lake;
- basic inventory data about water resources in the area;
- understanding of mahogany glider habitat
- poor understanding of the legislation associated with these issues

The contrast between this issue and the two case studies outlined above clearly illustrates some of the limitations associated with relying predominately on expertise held within the Committee.

The Pomona issue did precipitate changes within the HRCCC specifically and in the catchment more broadly in seeking better ways to resolve resource use conflicts. Thus the HRCCC agreed that the issue had been exacerbated by inadequate basic information. However, instead of seeking to build the information base held by the Committee, the HRCCC successfully lobbied the Minister for a water resources extension officer to be based in the catchment, thereby extending the expertise available locally.

Other examples of significant differences of opinion on points of fact and interpretation of fact between members of the HRCCC are reported by key informants. These include views on the series of high profile fish kills that occurred in 1998 and on the SIIP (Sugar Industry Infrastructure Package) works in the Herbert

6.4 SUMMARY

In a general sense, perceptions of key natural resource management issues in the Herbert Catchment have been relatively stable over the life to date of the ICM initiative. In principle, this therefore provides a basis for planning the collection, collation and management of a range of base data for the catchment and research and other information pertinent to the key issues of concern. This has not happened and, in practice, reliance on the expertise of the members of the HRCCC and leveraging the expertise of other people where that expertise is inadequate has proved to be a reasonably effective approach to precipitating action. This approach has failed in relation to some poorly understood and highly contentious issues. However, in these circumstances the HRCCC has successfully sought to increase the level of expertise available locally through lobbying for additional state government staff and through promoting and encouraging research initiatives.

7.0 TASK 4: INFORMATION NEEDS FOR IMPLEMENTING AN EFFECTIVE ICM PROGRAM

In the introduction it was argued that one of the key information needs facing an ICM initiative related to design, implementation and management of a successful ICM program. In this section, the information needs facing a CCC in establishing and implementing an effective ICM program are reviewed. This information includes: contextual material, for example the State Government policy on ICM; implementational information such as legal requirements and funding options; and evaluative information (e.g. are the key stakeholder groups adequately involved in ICM). As with previous sections of this report, predicted needs and actual experience in the Herbert are compared and contrasted.

7.1 INFORMATION NEEDS THAT A CCC MIGHT BE EXPECTED TO HAVE IN ORDER TO MANAGE AN EFFECTIVE ICM PROCESS

Implementational information needs will clearly vary according to the stages of the ICM initiative. Much of the information provided by the State Government to guide the implementation of ICM process at a local level has been presented on a stage-by-stage basis and indeed has apparently evolved as ICM experience in Queensland evolves and pilot groups reach a new stage of development.

The information needs for implementation of an ICM program on the basis of stage in the process are summarised in Table 2.

Table 2. Information needs and information provision techniques for instigating and managing an ICM program (Adapted from QDPI 1994).

Stage	Objective	Information Needs	Suggested Techniques
Stimulate interest in a CCC	Stimulate interest in key issues associated with natural resources and Integrated Catchment Management as a way of tackling those issues	Overview of catchment issues, , techniques for stimulating interest in forming a CCC	Using media, video, clean up days, public/information meetings, issue scoping surveys, inviting speakers from other catchments or different interest sectors, leaflets etc.
Identify and inform key groups, organisations and individuals	membership will affect the credibility of the committee and *how* the committee is formed is also important.	local groups /organisations in catchment with interest / stake in NRM	personal contact, surveys, informed persons interviews, RRA.
Form a CCC steering group	Credibility and a community mandate	Relevant individuals, organisations and agencies; and how to communicate with the community	public workshops, focussed group workshops, nominations by interest groups)
The steering group in action	Obtain establishment grant, prepare brief *overview of important issues and problems*, inform community about ICM, determine *geographical area* of interest (may include adjacent catchments where inter-basin transfers etc); *become incorporated* (info on incorporation), determine size and composition of CCC.	Team / group management	
Form a CCC			
The CCC in action	Tasks: elect a chairperson, decision on incorporation, solicit support for the operation of CCC, obtain technical support (eg. from local govts, industry groups, unis, research orgs), apply for	Team / group management. Consensus building. Conflict resolution techniques. Financial management. Funding	

Stage	Objective	Information Needs	Suggested Techniques
	endorsement (to foster close relationship with govt and obtain establishment and operating grants), get started (eg. understand catchment including resources, changes occurring, key players; finalise major catch. Management issues, prepare an action plan, form subcommittees to oversee strategy devpt on major issues)	sources. Social / community networks. Information sources. Time management.	

As has been discussed previously, endorsement is a key step in the life of an ICM initiative. It gives a CCC formal recognition by Government under the Queensland Integrated Catchment Management (ICM) Strategy and provides access specific support available from the ICM initiative of the Queensland Government including public liability and personal accident insurance, operating grants and project grants (QDPI 1995). A number of guidelines are available to CCCs on the requirements for endorsement (see eg Box 3).

Box 3. Requirements for obtaining endorsement of a Catchment Management Strategy (QDPI 1995)

Catchment coordinating committees should have the following features to be eligible for endorsement under the Queensland ICM Strategy:

- They should cover an entire named river basin or a major sub-basin covering significant parts of at least two local government areas.
- Membership should reflect the interests of the major sectors of the community including:
- Local governments
- Key relevant primary industry organisations (for example, Canegrowers, Graingrowers, fruit and vegetable cooperatives, commercial fishing organisations)
- Landholders in proportion to the range of land uses in the catchment (for example, cane, fruit, hobby, urban, grazing)
- State Government agencies
- Community groups and organisations (for example landcare groups and service clubs)
- Recreation and conservation interests (including recreational fishing)
- Secondary industry (for example, millers, processors, light and heavy industry)
- Major stakeholders outside the catchment where relevant (for example the Great Barrier Reef Marine Park Authority, downstream users, out of catchment users,)
- Membership should be determined by open election or through nomination by community groups, agencies and the general public.
- Achievable objectives should be set that are consistent with the functions of a CCC as outlined in the *Queensland Integrated Catchment Management Strategy*.
- A whole catchment perspective should be taken rather than being restricted to a single issues such as soil erosion or stream bank revegetation
- A demonstrated ability to be accountable for the administration of funds and the management of projects is important. This can be indicated by the committee being incorporated and having an active executive.

7.2 ACTUAL EXPERIENCE OF THE HRCCC

Not withstanding the availability of guidelines such as those outlined in the previous section, one of the consistent themes from interviews with the participants in the Herbert initiative, the Mercure workshop (Bellamy et al., 1995) and the HRCCC surveys (Bellamy and Macdonald, 1998; Bellamy et al., 1999) was uncertainty about "*what the LCMC really want*" and doubts about continued support and resources from Government. This was closely related to continued uncertainty expressed about roles and responsibilities, lead agencies and co-ordination

Participants in the HRCCC spoke of inadequate communication with the LCMC but stated that where there was contact it was "patronising and dictatorial, but arbitrary". Some spoke of working in a policy and leadership vacuum. Furthermore, it was stated that many of the guidelines that were available simply stated what the Government wanted rather than helping the community to take a leadership role and achieve its ambitions.

In terms of tracking their own progress, some information had a significant impact on participants. Thus the survey of community views and perspectives (Butterworth et al., 1996, McCreddin et al., 1999) and HRCCC surveys (Bellamy and Macdonald, 1998; Bellamy et al., 1999) revealed a low awareness about ICM amongst the broader community and some internal problems within the Committee. The HRCCC were apparently initially surprised and defensive about both but subsequently took a proactive role in improving external communication and addressing Committee structure.

Participants reported that the key inputs into the ICM initiative in the Herbert were experience in other catchments and the experience of members of the committee. Both these inputs were critical in identifying and negotiating roles and realities for the HRCCC itself and members of the Committee. The process was therefore perceived as being only as good as the Committee, making appropriate representation critical. Thus, one key participant stated that "*A healthy committee with solid constitution and reasonable turn-over and involving [State Government] Departments has the information needed to develop a strategy. The committee can work out issues as well as anyone.*"

8.0 SUMMARY

In principle, in order to be successful an ICM initiative has massive information needs from biophysical through socio-economic to procedural. Our review of experience in the Herbert catchment however illustrates that most information sharing, management and analysis was informal and verbal through Committee meetings, presentations by researchers and special interest groups and so on. The Catchment Co-ordinator did circulate information to HRCCC members but most data access was reactive. Information was mainly pushed out to the community via the media. Inadequate access to biophysical and socio-economic information was nor perceived to overly constrained the HRCCC's activities, although inadequate procedural information probably did.

Despite these assertions, the HRCCC continues to see the value of information and push for support for information-based programs. Thus, the HRCCC played a role in the establishment of the Herbert Resource Information Centre (HRIC) but has, in practice, itself made little use directly of the resources available through the HRIC.

However, the specific information needs facing the ICM initiative in the Herbert have been unpredictable, or at least difficult to predict. Thus, the Committees information requirements have been context specific in response to changing prioritise and circumstances in the catchment. Furthermore, the information requirements have changed with the state of development of the ICM initiative and the maturity of the processes underpinning it.

The specific awareness raising initiatives and involvement in instigating on-ground management that the HRCC has been involved in has been opportunistic and dictated by political imperatives and opportunities, funding options and technical understanding. Thus, for example, action has often been dictated by NHT funding priorities and opportunities as expressed by the Regional Advisory Panel rather than the priority needs expressed by the HRCCC.

For all these reasons, the HRCCC has had to be adaptive and responsive and, despite the strategic nature of the Catchment Management Strategy does not have the resources or mandate to plan major initiatives, whether on-ground or in relation to the design, collation and management of key natural resource management data. As a consequence, ICM in the Herbert has relied predominately on the corporate knowledge and expertise of members of the HRCCC and opportunities to access additional expertise from others on a needs basis – including researchers and State Government resource managers.

In conclusion, local knowledge and expertise is a primary source of information applied within the ICM process. This is consistent with the nature and intent of ICM. Major ICM based initiatives in the formal collection, collation and management of information relevant to the ICM process seem both inappropriate and unrealistic. However, the reliance on local expertise and knowledge has implications for the management of ICM. It makes it imperative that the HRCCC provides not only

for effective representation of key stakeholder groups but also provides as broad a base of expertise locally available as can be achieved. Furthermore, the Catchment Coordinator must have a key role to play in providing a stream of information to Committee members so that they can continue to expand their expertise in relation to ICM relevant issues. The same responsibility applies to relevant State agencies and other key stakeholder groups – effective communication of information to members of the CCC will be critical for its effective contribution to improved natural resource management.

9.0 FACTORS THAT INFLUENCE THE SUCCESS OF ICM

- Inadequate resources for an ICM initiative and lack of a mandate to plan major initiatives may mean that ICM activities (eg. awareness raising and on-ground action) will be largely opportunistic and often dictated by political imperatives and opportunities, funding options and existing technical understanding.
- Accessibility and availability of the local knowledge and expertise on catchment issues from as broad a range as possible of catchment stakeholder groups/interests is critical to a successful ICM process.
- Informal and verbal communication through social networks and existing institutional arrangements are critical for information sharing and analysis within the ICM process.
- Inadequate procedural information may constrain the focus and diversity of the activities of an ICM process
- Given that formal collection, collation and management of information relevant to an ICM process may be both inappropriate and unrealistic for a specific ICM initiative, the effectiveness of communication of existing information between state and other relevant bodies is critical.
- Capacity and a willingness within an ICM organisation to collaborate with other groups, agencies or individual experts with particular understanding of the issues may be essential for raising awareness of ICM issues and precipitating appropriate action.
- Adequacy of the skills and commitment of the staff ICM groups and other relevant agencies are critical to an effective and influential ICM process.

10.0 RECOMMENDATIONS

10.1 PLANNING INFORMATION NEEDS IN SUPPORT OF AN ICM PROCESS

- The specific information provisions required in order for ICM to contribute to the solution of problems are diverse from biophysical through socio-economic to procedural; variable with the stage of implementation of the ICM process; and in any specific instance, context specific; and unpredictable in response to changing circumstances and priorities in the catchment including political imperitives and opportunities, funding options and technical understanding.
- Information needs associated with an ICM initiative can be usefully considered and managed in relation to the following discrete tasks: developing a Catchment Management Strategy; raising awareness of ICM and issues that ICM is tackling; influencing and precipitating action and planning by others; and managing an effective ICM program.
- Local corporate knowledge and expertise is likely to be a primary source of information applied within the ICM process. It is imperative that the ICM committee provides not only for effective representation of key stakeholder groups but also provides as broad a base of expertise locally available as can be achieved.
- The Catchment Co-ordinator must have a key role to play in providing a stream of information to Committee members so that they can continue to expand their expertise in relation to ICM relevant issues.
- Major ICM based initiatives in the formal collection, collation and management of information relevant to the ICM process may be both inappropriate and unrealistic for a community-based ICM group to undertake. However it is imperative that effective communication of information is possible between relevant State agencies and other key stakeholder groups and members of the CCC.

10.2 DEVELOPING A CATCHMENT MANAGEMENT STRATEGY

- Generically, the structure and content of the Catchment Management Strategy is dictated by State level policy. However, the local expertise of the members of the Catchment Coordinating Committee and other stakeholders consulted during the process of developing the Strategy need to be used to develop a Strategy within this general framework that meets local needs.
- The Strategy can not rely solely on local expertise. Extensive use of documented information and knowledge needs to be used to validate, 'reality check' and develop the structures and issues generated by the Catchment Coordinating Committee. This material should be properly referenced within the document.
- Because the Catchment Strategy is intended to be a living document, it is important that, as well as being referenced, the data and information that underpin the document are maintained by the Committee and that on-going process of continue to collection and collate key information continues so that future versions of the document can reflect an increasing documented resource base.

10.3 RAISING AWARENESS OF ICM

- Awareness raising is likely to be more productive in relation to issues that are well understood scientifically rather than remaining fundamentally contentious.
- Awareness raising on issues is likely to be opportunistic, so information collection for awareness raising must be rapid and responsive to opportunities.
- Effective awareness raising depends on a reasonable knowledge of the current level of awareness in the community, on the sources of information most widely used by people in the area etc. Collection of this type of information may be a worthwhile investment for a CCC.

10.4 INFLUENCING AND PRECIPITATING ACTION

- As with raising awareness, influencing resource managers and planning processes and precipitating on-ground action will fall into the broad strategic direction set by the Catchment Management strategy. However, it is likely to be opportunistic and therefore not easy to plan for in terms of information provision.
- The expertise of members of the Catchment Coordinating Committee is often critical in identifying opportunities for influencing resource managers and planning processes as well as precipitating action.
- Collaboration with other groups, agencies or individual experts with particular understanding of the issues involved is often the most expedient way of precipitating appropriate action.

10.5 IMPLEMENTING AN EFFECTIVE ICM PROGRAM

- Implementing an effective ICM program places a number of information needs on the Catchment Coordinating Committee. However, most information sharing, management and analysis was informal and verbal through Committee meetings, presentations by researchers and special interest groups and so on
- The State level coordinators of ICM need to ensure a regular and consistent flow of information to local groups.
- The Catchment Coordinator and Committee Chair need to ensure close and effective communication with policy level people.
- The management skills of the Coordinator and Committee members is important - appropriate people should be picked on this basis and additional training may be merited.

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Chapter 5

Planning and Implementing Integrated Catchment Management

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1. INTRODUCTION

Approaches to natural resource management based on the integration of community involvement, technical knowledge, and organisational structure and policy objectives are endorsed throughout Australia. All State Governments have adopted programs of integrated catchment management (ICM) under a variety of names and using a variety of policy and legislative frameworks. At present the application of ICM varies widely throughout Australia, with some states such as New South Wales having established legislation, whilst others such as Western Australia and Queensland have no generic legislative powers.

The fundamental challenge of these policy initiatives is to improve the way our natural resources are used and managed with a long-term perspective. However, the translation of the concept of an integrated approach to resource use and management at a catchment scale into practice is proving difficult. ICM is an evolving concept that lacks a well-defined body of guiding principles capable of general application.

This report identifies guiding principles for the role of community-based ICM, identifies factors that are likely to influence its success and makes recommendations on its planning and implementation. These principles and recommendations are based on a five-year study to investigate factors that influence the success of a community-based approach to ICM in the Herbert River Catchment of north Queensland[1]. Although many will not be necessarily surprising, their significance lies in that they are backed-up by comprehensive and rigorous interdisciplinary research (see 'Further Reading').

2. THE ROLE OF COMMUNITY-BASED ICM

2.1 To be a process of influence.

As a multi-stakeholder mechanism for community participation in natural resource management, ICM should not be seen as a vehicle for radical shifts in power relations within the community, but rather a vehicle for influencing policy agendas and the system of planning processes on NRM within government (local, state and federal), industry and the broader catchment community.

2.2 To support community learning.

ICM needs to be recognised as a program of community learning that requires a significant period of time before substantial on-ground results can be expected. Community learning at all levels, including the State level, implies:

- the parallel increase in awareness of the significance of long term resource management problems;
- appreciation of the need for integrated as opposed to piecemeal approaches;
- maturing of community cooperation to address the problems;
- creation of plans and actions that are agreed by the community;
- political support; and
- eventually, substantial on-ground change.

This process can easily stall and even reverse at any time along the path.

2.3 To be a partnership between government, industry and the community.

The ICM initiative relies on existing authorities and various programs and planning processes of state and local governments and private and non-government sectoral activities to implement their plans and achieve their objectives. ICM requires a

[1] LWRRDC R&D Project CTC7 – Evaluation of Integrated Catchment Management in a Wet Tropical Environment.

partnership approach between different levels of government (particularly local government), industry, landholders and the broader community. There is a responsibility for landholders to do things on the ground, which are widely supported by the community. At the same time, both incentives for their efforts and resources for voluntary groups need to be provided by government rather than through regulation alone. An important way to implement this will be joint on-ground projects. This includes ensuring consistency of the information that is provided for the community from government. In doing so, there needs to be agreement on the exact roles of community and government, ie. clear roles will need to be established at the commencement of any activity.

2.4 To ensure legitimate representation.

For the partnership to work and gain credibility within the catchment community, representation in the ICM process must be legitimate, inclusive and accountable. Representatives must keep their constituents informed of the ICM process, interact actively with their constituents to understand their perspectives, and adequately represent their constituency's interests to the partnership.

2.5 To provide a community forum for coordination of effort, networking and social learning.

Community-based ICM meetings can provide an effective and legitimate community forum for networking, both within the community and between government and the community, as well as a vehicle for the exchange of information and more informed and inclusive discussion on NRM issues and planning processes that links state government, local government and various key catchment stakeholder groups. Decision-making in this forum needs therefore to be based on negotiated accommodation of explicitly stated interests and social learning of new shared perspectives rather than entrenched positions.

2.6 To build trust and effective interactions amongst stakeholders.

The success of ICM in precipitating action on catchment issues depends on the willingness of the participating individuals to build trust, deal sensitively with conflicts in the catchment community and work on maintaining productive interactions within the context of workable institutional arrangements. In this, local leaders play a substantially influential role.

2.7 To ensure fairness of process.

A key determinant of broader community acceptance of decision-making on catchment issues and related planning outcomes is the perceived fairness of NRM process and procedures and relatedly the fairness of outcomes that people receive. An ICM process can foster fairness through: (a) establishing a legitimate system of representation for the ICM initiative (eg. ensuring inclusiveness of membership and the supporting representatives to adequately represent their group's interests in the ICM process), (b) working towards the development of acceptable cost-sharing arrangements for NRM infrastructure and on-ground works and (c) establishing a decision-making approach for ICM that is based on a process that seeks consensus amongst stakeholders, while respecting and accommodating on-going differences.

2.8 To identify and broker project funding opportunities.

ICM needs to develop a lead role as the principal broker in the catchment for external funding of community projects to address natural resource management problems in the catchment (eg. NHT). This role can provide the catalyst for community activity in federal and state-funded natural resource management initiatives in a more strategic way than in the past.

2.9 To provide an influential voice on NRM at the regional level.

An ICM initiative has a key role of linking NRM principles and objectives into regional processes such as regional economic development, regional planning, cultural heritage and conservation management programs and processes.

2.10 To demand long term government agency commitment to the process.

The success of ICM is in part dependent on government agencies resolving bureaucratic gridlock among the array of fragmented but inter-dependent agency-based policies, plans and programs and, in particular. ensuring long term agency commitment to the ICM process (ie. clear upper management commitment within government agencies, political support, financial and administrative resources, establishment of workable institutional arrangements).

2.11 To provide a vehicle for integrating information relevant to NRM.

The two primary sources of information for the ICM process are local knowledge and expertise and existing technical information held by state and other relevant bodies. ICM meetings provide a central pooling of local knowledge through the wide diversity of stakeholder representatives involved in the ICM decision-making processes and related activities. Agencies are also repositories of technical information on the catchment but this information is fragmented and needs to be "shared" with other agencies and local interest groups. A key role of ICM is to foster the capture of relevant data on NRM issues and the development of locally accessible mechanisms for integrating data and delivering information.

3. FACTORS THAT INFLUENCE ICM OUTCOMES

3.1 Characterisation of NRM Issues in the Catchment

Historical context and evolution of resource use

- The level of understanding relating to the history of land use change and resource use within the catchment that can help to identify the causes of some issues, to identify the target/client groups and to target strategies to resolve the problem.

Diversity of stakeholder knowledge, attitudes and values on natural resource use and management

- Degree of catchment community awareness of the importance of environmental problems and the need for behavioural change and timely action.
- Degree of recognition across stakeholder groups of community responsibility to address natural resource use and management problems.

Extent of problem recognition and acceptance of change required by different stakeholders

- The history of stakeholder 'ignorance' of the incremental, cumulative and insidious nature of environmental degradation in the catchment, as well as the existence of a past developmental ethos supported by both governments and rural industry that actively promoted land clearing and intensification of land use.

Scientific understanding, feasibility and acceptability of technical solutions to natural resource problems

- The availability and level of accessibility to all stakeholders of local knowledge, scientific data and technical understanding on natural resource issues in the catchment.

- The availability and acceptability to stakeholders of technical 'solutions' for sensitive issues in the catchment.

3.2 Local Attitudes, Values and Behaviours on NRM

Evolution of on-ground policy or program implementation

- The degree to which the catchment community perceived the ICM process as a voluntary one or one forced on the community by government.
- The degree of perceived personal and community control or influence on the management of land and water issues in the catchment.
- The appropriateness of the 'scale' of the ICM initiative to the local community, that is the degree of perceived relevance and meaningfulness of the catchment 'scale' to the local community of interest.

Socio-economic conditions and trends of context of implementation

- Stakeholder perceptions of the costs of solutions and the level of financial capacity within the catchment community to address natural resource issues.

Media coverage and attention

- The degree of coverage and the way in which resource management issues and an ICM initiative are presented in the local media.

Support from catchment community leaders

- The degree of support and promotion of natural resource management within local industry groups.
- The degree of support and promotion of natural resource management from politicians in local and state governments.

Attitudes and resources of local constituents

- The level and intensity of formal linkages and interaction between community, industry and government organisations with a responsibility or an interest in resource use management and planning within the catchment.
- The level of perceived personal and community benefit from becoming involved in NRM policy processes and related activities.
- Degree of perceived relevance of government strategies at a catchment scale and perceptions of their usefulness to community members at a personal level.

3.3 Adequacy of Policy Frameworks and Institutional Arrangements for ICM

Clarity and consistency of roles and objectives of the ICM initiative and other responsible groups

- The degree of consistency of the goals and objectives of an ICM policy initiative in the long term.
- Degree of integration of legislative frameworks on natural resource management across local, state and federal levels.
- The clarity of roles and responsibilities of implementing and other responsible bodies for ICM across stakeholder groups.

Coordination among implementing agencies and stakeholders on NRM

- The level of commitment of upper and other key management in state agencies to both ICM and a 'whole of government' approach, and their preparedness to commit resources to support the process in the long term.

- The degree of opportunity for those actively involved in the implementation of ICM to share knowledge experiences, and concerns relating to the process.
- The degree of support and closeness of the relationship between local government and ICM.
- The complementarity of the relationship between the ICM process and Landcare and the degree of coordination of their activities in the catchment.

Adequacy of financial resources for the policy initiative

- The level and security of government funding to support an ICM initiative (eg. for organisational start up, general operational costs, capacity building and leveraging other funding sources).

Commitment and skill of implementing staff

- The availability of a committed, skilled and well-funded catchment coordinator to drive the process and undertake a range of essential tasks.
- The level of commitment, amount of available time, and degree of strategic vision of the local chair of the ICM organisation.

Adequacy of policies, plans and decision rules of implementing agencies

- The degree to which the devolution of responsibilities for natural resource management to the local level is matched by a concomitant devolution of resources and capacity to local authorities.
- The degree of inclusiveness of the representation of interests on the ICM organisation.
- The availability and equity of cost-sharing and other incentive systems to encourage and support changes in land manager behaviour.
- The availability to the ICM organisation of guidelines and practical options for taking action on specific problems on the ground.
- The degree of focus of regulatory mechanisms on strategic integrated planning rather than development control.
- Availability of agreed management plans for land, water and vegetation resources in the catchment.

3.4 Sustainability and Equity of Processes for ICM

Knowledge and expectations of the process by stakeholders

- The degree and diversity of stakeholder awareness of catchment issues and their expectations of ICM.
- The community perception of the acuteness or perceived social importance of resource management problems and their ability to link these perceptions to ICM related solutions.
- The degree of matching of the views and understanding on the aims of ICM between the overall catchment community and those of the members of the ICM organisation.

Degree of coordination of resources to address catchment issues

- The degree of coordination of government resources and level and intensity of commitment to a whole of government approach across relevant agencies.
- The degree of contradiction and conflict in the flow of information and advice from different state government agencies.
- The effectiveness of communication networks between state agencies as well as between these agencies and other relevant organisations in the catchment.

Degree of motivation, commitment, cooperation and support for the process

- The capacity and willingness within an ICM organisation to collaborate with other groups and agencies or individual experts with a particular understanding of the issues.
- The degree of 'over-commitment' of key players, and the diversity and compatibility of the different 'hats' they wear.
- The degree of self-interest and gate-keeping by stakeholder representatives on the ICM organisation particularly regarding controversial or 'hot' issues for the catchment.
- Perceived degree of politicisation of natural resource management issues by the catchment community.

Efficiency and effectiveness of process

- The effectiveness of the ICM organisation in providing a representative community forum for informed debate on catchment issues, including linking state government, local government and other community groups, fostering the exchange of information amongst stakeholders, and the development of an appreciation of the nature and diversity of other stakeholder's viewpoints on particular issues.
- The degree to which the ICM initiative is perceived to be fostering a partnership approach between local government, state government and the community.
- The degree to which local government incorporates ICM principles into local government planning processes and takes responsibility for implementing them.
- The degree to which the ICM initiative is able to identify opportunities to undertake high profile activities that are topical, measurable and have visible outcomes to the catchment community in the short term.
- The frequency of turnover of staff and degree of retention of expertise on ICM within state agencies with roles and responsibilities relating to natural resource management in the catchment.
- Accessibility and availability of the local knowledge and expertise on catchment issues from a diversity of catchment stakeholder groups/interests to the ICM process.
- Timely targeting of appropriate inforamtion.

Perceptions of equity and procedural justice/trust in process

- The perceived inclusiveness of the selection process for stakeholder representation on the catchment committee and the adequacy of the rules and strategies underpinning this process.
- The perceived adequacy and fairness of the cost-sharing arrangements amongst potential beneficiaries of the investment in NRM activities in the catchment
- The degree of inclusiveness and level of participation of stakeholders in the development of the catchment management strategy.
- The degree of willingness and capacity of relevant government agencies and community organisations to share information.

4. RECOMMENDATIONS FOR PLANNING AND IMPLEMENTING ICM

4.1 Establishing Local Relevance

The implementation of an ICM initiative is inherently context sensitive and a wide range of environmental, economic, social, policy/institutional and technological factors will influence its implementation and impact. In any particular instance, the human association with the natural resource environment in a catchment is embedded in established social networks and interactions, fundamental social values, institutional frameworks, historical problems, past experiences and established ways of doing things and it will continue to be shaped by them in the future.

- ***Recommendation 1:***

  To ensure community acceptability and establish relevance to the local context, an ICM process should focus on achieving a sustainable future for the catchment by working with, influencing and improving the effectiveness of existing social networks and institutional frameworks rather than creating a completely new set of structural arrangements that supplant the old.

4.2 Establishing Supportive Institutional Arrangements

Although the development and implementation of strategies for catchment resource management should be encouraged through the voluntary cooperation of the community, industry groups, local government and state government agencies, the effective implementation of ICM objectives at the local level requires legislative support.

- ***Recommendation 2:***

  An ICM initiative needs to be initiated and its implementation supported as a voluntary partnership between the community and government. However its on-ground implementation also requires the balanced support of incentive systems (to encourage voluntary action in the community) and legislative backing (to enforce compliance where necessary).

Local government has substantial scope to achieve catchment management objectives through the incorporation of ICM principles into planning schemes. However local government land use planning is not the answer alone as it may only have powers to influence decision-making in limited situations (eg. to variations to existing use rights or new development applications).

- ***Recommendation 3:***

  ICM needs to foster strong linkages with and involvement of local government in the ICM process and to ensure the integration of ICM principles into local government planning schemes. However it also needs to support the integration of local government planning schemes and development assessment procedures with other resource management arrangements that may deal more effectively with existing use rights on both leasehold and freehold lands.

Although there has been an increasing commitment within federal and state governments to devolve responsibility for natural resource management to the local level, in general there has not been a concomitant devolution of resources to local authorities to support them doing so.

- ***Recommendation 4:***

  The ICM initiative itself, and state government in particular, need to actively address the lack of capacity (ie. knowledge, resources, skills) in local authorities to identify opportunities and to implement ICM objectives.

The common short-term nature of ICM funding and political cycles is not conducive to the development of long term sustainable solutions, or to the long-term commitment of staffing necessary for a successful ICM organisation. This is especially an issue for a program that is intrinsically evolutionary and dependent on awareness, planning and action cycles that take longer than a few years to establish. Importantly, once an ICM organisation is established and catchment management strategies developed, the requirement for funds for on-ground works will increase substantially as planning is inexpensive relative to action. There is also a risk that ICM activity and progress will be entirely opportunistic and dictated by state and federal government political imperatives and competitive funding opportunities rather than being directed by the community priorities identified in the catchment management strategy.

- ***Recommendation 5:***

  An ICM initiative requires adequacy and long term security of financial resources for both start-up and on-going operational support of the ICM organisation and to have reasonable expectations of competitive project support. The ICM organisation also needs to adopt a lead role as the key broker in the catchment for coordinating external funding of community projects to ensure that natural resource management problems in the catchment are addressed in a more strategic way.

Coordination of government resources to address issues of community conflict relating to land and water resources management from a whole of government approach within the catchment is essential to an effective ICM process. State agencies often make decisions on NRM issues independently of each other and local interest groups. In particular, a lack of sharing of information between agencies can lead to contradictory or conflicting information being presented to the community by different government agencies with regard to important catchment issues which exacerbates the community conflict. In addition, many existing regulatory mechanisms for resource use and management focus on development control rather than strategic integrated planning and therefore provided only limited opportunity for ICM to influence decision-making

- ***Recommendation 6:***

  The complex and often confusing array of Acts, programs, and policies that impact on resource management at the local, catchment, state and national levels require rationalisation to support a more strategic, integrated and coordinated approach to catchment management. In particular, a key requirement from government for successful ICM is the clear commitment of key officials to ensure effective participation, coordination of effort and consistency of advice by all relevant agencies as well as the continuity of political commitment (ie. all tiers of government) on a long-term basis.

ICM is promoted as a partnership approach to catchment management between government, industry and the community. However, specific roles and responsibilities for the different partners are frequently couched in very general terms, which may lead to confusion and slow progress or even in-action on important or challenging catchment strategies in some situations.

- ***Recommendation 7:***
  At the commencement of any work or activity of an ICM process, clear roles and responsibilities need to be negotiated and agreed upon between the responsible government, industry and community bodies.

4.3 Establishing Legitimacy

ICM as implemented in Australia is essentially an experimental program with participants on a steep learning curve. Community learning at all levels, including the State level, implies the parallel increase in awareness of the significance of long term resource management problems, appreciation of the need for integrated as opposed to piecemeal approaches, maturing of community cooperation to address the problems, political support, creation of agreed plans and actions and eventually substantial on-ground behavioural change. This process takes a long time to evolve and can easily stall and even reverse at any time along the path.

- ***Recommendation 8*:**
  ICM needs to be recognised, promoted and supported as a program of community learning that requires a significant period of time before substantial on-ground results can be expected.

Understanding of cause-effect relationships and 'solutions' to major issues in a catchment can vary along a scale of 'speculative' to 'uncontested'. The lack of technically uncontested 'solutions' for highly sensitive issues in a catchment can lead to substantial community conflict and lack of confidence in government, research and other relevant agencies.

- ***Recommendation 9*:**
  ICM needs to ensure Government agencies and other technical advisers or experts do not push highly speculative solutions that may create greater social conflict and loss of trust in policy processes. In particular, the resolution of sensitive issues requires clear local interpretation supported by appropriate and locally credible data.

The perceived level of openness and inclusiveness of the processes established for the management of the ICM organisation's representational structure (eg. election of office bearers, use of proxies, reviewing membership) will reflect on its credibility within the catchment community and government. In addition, ICM committee members are frequently active and committed community leaders who wear "too many hats" such that they may have difficulty in committing sufficient time to ICM activities.

- ***Recommendation 10*:**
  An ICM process needs to establish clear and agreed ground rules on how the ICM organisation will operate (ie. purpose, structure, composition, representative appointment process, decision-making rules, and roles and responsibilities). In particular, efficient use of proxies and turn over of representatives are essential for an inclusive, enthusiastic and actively influential ICM process.

Feelings of personal and community control are related to feelings of tractability of the NRM problem. The perceived impediments to effective ICM most commonly relate to feelings of personal or community control and include 'institutional failure' (eg. slow government responses and strategies, departmental conflicts, lack of government

commitment to a 'whole of government' approach) and economic issues (eg. high costs of solutions and lack of financial capacity in the community).

- ***Recommendation 11*:**
  The perceived impediments to managing land and water need to be addressed by speeding up government responses and strategies, promoting where possible low cost solutions to problems and ensuring regular communication with the community about what is happening. This will assist in improving relations with the community and heightening trust in government.

4.4 Creating Awareness of Issues and the ICM Process

ICM processes frequently are required to deal with intractable issues that are embedded in past land use decision making behaviour and land management practices. Successful ICM requires a high degree of community awareness that there are important environmental problems that require timely action. However, land and water management issues may not be uppermost in people's minds, first priorities frequently lie with 'life issues'. Awareness raising undertaken by an ICM initiative is likely to be more productive in relation to issues that are well understood scientifically and have local relevance rather than remaining fundamentally contentious.

- ***Recommendation 12*:**
  In facilitating an effective ICM process, ICM organisations and supporting government and industry agencies should place a priority on the collection of key natural resource use data to understand past and present resource use and management practices in the local catchment context. This information can inform the community debate on the nature and extent of both future resources use and the level of behavioural change required to meet these aspirations. The information can also be usefully presented as a catchment Atlas for broad distribution and use within the community. In addition, effective awareness raising requires a reasonable knowledge of the current level of awareness in the community on specific issues and on the sources of information most widely used by people in the catchment community. In particular, an ICM process can influence a community's awareness on natural resource issues and the ICM process itself through opportunistic use of high-profile political or controversial issues/events of local relevance.

4.5 Influencing and Precipitating Action

Although there may be good agreement among stakeholders on the key catchment resource management issues, for any particular issue individual stakeholder diagnosis of their causes and possible solutions may vary significantly. The success of ICM in precipitating action on catchment issues depends significantly on the choice of method of community engagement, which should be based on a clear understanding of the particular decision context of that issue.

- ***Recommendation 13*:**
  The success of ICM in precipitating action on catchment issues depends on the willingness of the participating individuals to build trust, deal sensitively with conflicts in the catchment community and work on maintaining productive interactions within the context of workable institutional arrangements. In particular, in choosing a method of

community engagement and a strategy for action for a particular catchment problem, clear understanding is required of the decision context relating to that problem, including the locally perceived mode of solution or level of technical complexity involved in resolving the problem and the nature and intensity of community conflict associated with the decision.

Raising awareness of issues amongst resource managers alone is not necessarily going to result in a change in management behaviour. Many long-term solutions to natural resource problems are frequently not in a landowners self-interest financially or social benefit to undertake. Specifically the costs of action are incurred by both individual landowners (eg. opportunity cost of land, restoration or remediation works, materials and construction costs, in-kind contributions of time and equipment) and the catchment community (eg. cost of reparation or remedial works, construction costs, wages and publicisation). Similarly the benefits will accrue to both landowners (eg. avoided costs of lost production, aesthetic attraction of improved habitat, reduced production costs, improved water supply) and the catchment community (eg. improved downstream water quality, retention and improvement of natural habitats, reduced social conflicts, reduced litigation and transaction costs, aesthetic benefits, avoided costs of resource degradation and damage to infrastructure). However, private property owners could incur considerable financial expense, but most benefits would accrue to the community in general.

- ***Recommendation 14*:**
  Many resource management issues require the political commitment and will of relevant local and state government agencies to effectively and consistently apply their relevant powers in land development decision-making and approval processes to ensure ICM principles are taken into account. However, effective and equitable cost-sharing and other incentive systems to encourage changes in land management behaviour need to be established to support these processes. In particular, an ICM process that relies on the voluntary cooperation of individual resource managers may need to offer financial incentives if a change in attitude is going to lead to a change in behaviour that will result in an improvement in sustainability of resource use.

Influencing resource managers and planning processes and precipitating on-ground action falls into the broad strategic direction set by the Catchment Management strategy. However, moving from identifying and prioritising issues and developing a catchment management strategy to precipitating action on those strategies is a major challenge for a community-based ICM process. In particular, due to the complexity of the problems being addressed and the limited resources available to ICM, the implementation is likely to be opportunistic and limited in terms of the locally available knowledge of the type of action or response required that is likely to be effective for catchment management. It may also be limited by the specific skills available to complete a desired action or response.

- ***Recommendation 15*:**
  The expertise of members of the ICM organisation is often critical in identifying opportunities for influencing resource managers and planning processes as well as precipitating action. Collaboration with other groups, agencies or individual experts with particular understanding of the issues involved is also often an expedient way of precipitating appropriate action. In addition, government agencies need to develop guidelines and advice

that identify practical on-ground options for a community to take action on specific types of issues. Government agencies also need to be aware of their own shortfalls in knowledge and respond to local knowledge where appropriate.

4.6 Gaining and Maintaining Commitment to the Process

One of the big challenges for ICM is keeping up the momentum in a process where tangible outcomes are slow to emerge and may well be attributed to others influenced by ICM rather than the ICM process itself. Representatives of ICM organisations are often community leaders who are often over-committed. Loss of motivation and burn out are therefore high potential risks amongst community participants.

- ***Recommendation 16*:**
  The management skills of key ICM personnel and office bearers are essential to a successful ICM process. In particular, an ICM initiative requires a credible and confident Catchment Coordinator who can "drive" the process and undertake essential and "burn-out" tasks. This requires a skilled person with experience and knowledge of NRM issues and agricultural systems, good communication skills, well developed interpersonal and conflict resolution skills for handling a diverse group of people, and who is sufficiently confident and prepared to stand up and be accounted for on catchment issues.

Although there may be community awareness and interest in catchment issues, the personal influence people feel they may have in addressing those issues may not be particularly high which can hinder community participation in ICM. A high personal sense of control in dealing with catchment issues, or a belief that individuals can help motivate the community to improve these problems will facilitate the promotion of ICM in the community and commitment to the process. In addition, government strategies are often not perceived to be highly useful to community members at the personal level and therefore not seen to be highly relevant at that scale.

- ***Recommendation 17*:**

  An ICM process needs to address the lack of influence felt by the community by showing that they have influence and demonstrating both the ways in which they can change land and water management and the relevance of catchment strategies at the farm or personal level.

4.7 Establishing an Influential Role

As a community-based process without statutory powers on natural resource use and management, an ICM initiative will rely largely on existing authorities and various programs and planning processes of state and local governments and private and non-government sectoral activities to implement its plans and achieve ICM objectives.

- ***Recommendation 18*:**
  As a multi-stakeholder mechanism for community participation in natural resource management, ICM should not be seen as a vehicle for radical shifts in power relations within the community, but rather a vehicle for influencing policy agendas and the system of planning processes on NRM within government (local, state and federal), industry and the broader catchment community.

Effective communication between groups and individuals is potentially an important means of influence in terms of changing outlook of others on ICM or environmental issues. In particular communication is effective in increasing awareness and gaining understanding and knowledge.

- ***Recommendation 19:***
  An effective overall system of communication on ICM across all stakeholder groups should be designed to facilitate significant outcomes including *mutual benefits* (such as information exchange, progress or ensuing action on the issue of communication, better understanding of issues), and *mutual influence* or changed outlook (including changed views, acknowledgment of problems, increased awareness of problems, sharing of ideas, increased acceptance and awareness of ICM). It should provide opportunities for both formal and informal exchanges between stakeholders.

A Catchment Management Strategy needs to be considered as a 'living document' that evolves as local community and technical understanding and relevant political imperatives change and develop over time. An endorsed catchment management strategy developed through a participatory process involving key stakeholders in the catchment provides the basis for developing both a shared vision of the catchment as well as leveraging funding support for the ICM organisation and related project activities. Generically, the general framework (ie. structure and content) of a Catchment Management Strategy however will be largely dictated by State level policy requirements.

- ***Recommendation 20*:**
  The local expertise of those stakeholders involved and consulted during the process of developing the strategy needs to be used to develop a strategy within the general framework required by government but that meets local needs. In addition, documented information and knowledge needs to be used to validate, 'reality check' and further develop the structures and issues generated by this participatory process. It is important also that the data and information that underpin the strategy document are maintained by the ICM organisation and that an on-going process of collection and integration of key information continues so that future versions of the strategy can reflect an increasing understanding of catchment management.

4.8 Communicating with the Community

Communication on NRM within a catchment community relies predominantly on existing social networks. However, local media can also provide a highly important source of information to the community.

- ***Recommendation 21:***
  Local media such as local newspapers can contribute to community discourse on natural resource management issues and can be exploited to bring attention to an ICM approach within a catchment community.

Community recognition of the importance, urgency and impacts of land and water issues can be exploited. Concentrating on solutions and actions can help to prevent a positively "doom and gloom" image sometimes perceived within a catchment community.

- ***Recommendation 22*:**
  When communicating with the catchment community, an ICM process should focus on those issues where there is low awareness and a desire to know more, including possible solutions for environmental problems and ensuring there is something provided that the community can start working with immediately. It may require systematic community investigation to identify those issues for all sectors.

4.9 Working with the Community

In working with the community, it is important to understand and acknowledge the historical issues that have been frustrating for the community in order to move forward, gaining support and involvement. In particular, an ICM process needs to acknowledge the importance of employment and financial issues.

- ***Recommendation 23*:**
  An ICM process needs to recognise money constraints and the limitations on people's time to become involved in local land and water management activities and promote solutions and activities for the broader community that can save them time or take very little extra time or effort. It also needs to assist in identifying and publicising employment opportunities in the solutions that are developed for land and water management.

ICM is promoted as a partnership approach between different levels of government (particularly local government), industry, landholders and the broader community. Implicit to this approach is a responsibility for landholders to do things on the ground, which is widely supported by the community.

- ***Recommendation 24*:**
  In a partnership approach to ICM, incentives for individual landholder efforts and resources for voluntary groups need to be provided by government rather than through regulation alone. An important way to implement this will be joint on-ground projects. This includes ensuring consistency of the information that is provided for the community from government to support these projects/activities. Giving the ICM group more autonomy will also act to increase motivation and a positive outlook.

4.10 Informing the ICM Implementation Process

The challenge to create policy processes, institutional arrangements and NRM practices that can contribute towards achieving sustainable and equitable resource use outcomes requires support from monitoring and evaluation of the progress and impact of the ICM policy initiative as part of the change process.

- ***Recommendation 25*:**
  Monitoring and evaluation of the progress and impact of an ICM policy initiative is fundamental to identifying change, supporting an adaptive approach that is flexible enough to meet the challenge of this change, and enabling learning at individual, community, institutional and policy levels. In particular, ICM initiatives need to be evaluated as a system that links the initiative's objectives and rationale to performance 'on the ground'.

Implementing an effective ICM program places a number of information needs on the ICM process. The specific information provisions required in order for ICM to contribute to the solution of problems are diverse from biophysical through socio-economic to procedural, variable with the stage of implementation of the ICM process, and in any specific instance, context specific. They are also likely to be unpredictable in response to changing circumstances and priorities in the catchment including political imperatives and opportunities, funding options and technical understanding.

- ***Recommendation 26*:**
  Major ICM based initiatives in the formal collection, collation and management of information relevant to the ICM process may be both inappropriate and unrealistic for a community-based ICM group to undertake. However it is imperative that effective communication of information is possible between relevant State agencies and other key stakeholder groups and members of the ICM organisation. Based on an adaptive and opportunistic approach, information needs for an ICM initiative can be usefully considered and managed in relation to four discrete tasks: developing a Catchment Management Strategy, raising awareness of ICM and the issues it is tackling, influencing and precipitating action and planning by others, and managing an effective ICM program.

Local corporate knowledge and expertise is likely to be a primary source of information applied within the ICM process. Accessibility and availability of the local knowledge and expertise on catchment issues can be provided through the diversity of catchment stakeholder groups/interests represented on the ICM organisation.

- ***Recommendation 27*:**
  An ICM organisation needs to provide not only for effective representation of key stakeholder groups but also as broad a base of expertise locally available as can be achieved. The Catchment Coordinator must have a key role to play in providing a stream of information to ICM members so that they can continue to expand their expertise in relation to ICM relevant issues.

A broad range of community, industry and government organisations with some level of responsibility or an interest in resource use management and planning function in catchments or at a regional level. The system of organisational structures and linkages is a critical mechanism for facilitating the exchange of information and supporting a coordinated and inclusive approach to catchment management decision-making.

- ***Recommendation 28*:**
  An assessment of the change in the system of organisational structures and formal and informal linkages on natural resource management can provide a key indicator of progress on ICM.

Landholder values, behaviours and attitudes toward land and water management in a catchment can provided an understanding of the social factors that influence the implementation of ICM initiative in a particular catchment.

- ***Recommendation 29*:**
  Attitudinal surveys of catchment residents extend social profiles beyond a demographic focus to perceptions. These include a better understanding of tractability, identifying how effective ICM is perceived to be, and defining priorities for investigation (ie. where to focus effort in regard to

specific issues, such as opportunities for use of the media). The analysis of newspaper coverage can also provide a useful and unobtrusive means of gauging community values about natural resource management issues.

The effectiveness of communications provides an important measure of whether coordination is happening, and also identifies where there are gaps in the system and the effectiveness of specific/different linkages on ICM.

- ***Recommendation 30*:**
  Measuring the effectiveness of communication networks should be a routine part of any ICM initiative, particularly in the early stages. As such it provides a mechanism for measuring an indicator of the transaction costs or communication "effort" required to keep a system such as ICM operating.

The assessment of local knowledge on NRM issues and processes provides an effective means of identifying key gaps in local understanding in relation to management options and in evaluating fundamental assumptions that underpin local management practice and may thereby provide an appropriate basis for prioritising research needs.

- ***Recommendation 31*:**
  Investigation of changes in local knowledge over time provide a powerful tool for evaluating some of the key impacts of an ICM process. In particular, an approach based on 'landscape literacy' can allow the characterisation of resource user perceptions and the determination of significant differences amongst stakeholders to the principles underpinning ICM.

Accountability of public expenditure is an increasingly important requirement of agencies that have been allocated public funding and/or have applied for public funding for the provision of a program or a public good. ICM organisations are developing into well-defined and well-organised community structures with financial resources for which they are required to be accountable.

- ***Recommendation 32*:**
  Cost benefit analysis (or similar) can provide valuable information for an ICM organisations that can guide the ICM implementation process regarding the efficiency of its investments as well as the distribution of the costs and benefits resulting from its activities. To facilitate such evaluations, indicators measuring the condition of natural resources need to be identified and monitored to enable substantiation of claims of natural resource improvement.

FURTHER READING

Evaluation of Integrated Catchment Management in a Wet Tropical Environment: Collected Papers of LWRRDC R&D Project CTC7. 7 volumes. Compiled by JA Bellamy (CSIRO Tropical Agriculture, December 1999).

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5 Ecologically Sustainable Development in a Global Economy: Environmental Management in the Sugarcane Assignment Process. Herbert River District, Queensland, Australia 1993-1996. Shrubsole, D., Johnson, A, with Murray A., Ebert S., Chalk, P., Jones, P. and Green, M. 167

6 Managing for Ecological Sustainability: Moving from Rhetoric to Practice in the Australian Sugar Industry. Johnson, A.K.L. and Bellamy, J.A. 279

7 Natural Resource Use and Management in the Australian Sugar Industry: Current Practice and Opportunities for Improved Policy, Planning and Management. Johnson, A.K.L., McDonald, G.T., Shrubsole, D.A. and Walker, D.H. 299

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2 A Survey of the Views of the Herbert River Catchment Coordinating Committee Members: November 1997/February 1998. An Interim Report. Bellamy, J.A., McDonald, G.T. and Laredo, L.A. 23

3 An Analysis of the Views of the Herbert River Catchment Coordinating Committee Members: November 1998 with Cross Comparisons from 1995 to 1998. Bellamy, J.A., McDonald, G.T. and Laredo, LA. 85

4 Organisational linkages on Natural Resource Management in the Herbert River Catchment, 1992-1998. Bellamy, J. and Horsley, D. 159

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EVALUATION OF INTEGRATED CATCHMENT MANAGEMENT IN A WET TROPICAL ENVIRONMENT: COLLECTED PAPERS OF LWRRDC R&D PROJECT CTC7

Compiled by Jennifer A. Bellamy

VOLUME 2

INSTITUTIONAL ARRANGEMENTS FOR ICM IN QUEENSLAND

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1999

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Chapter 1

What you told us: A Survey of the Views of Queensland ICM Chairs and Coordinators and Herbert River Catchment Coordinating Committee Members

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EXECUTIVE SUMMARY

This report describes the perceptions Chairmen and Coordinators 14 CCCs in Queensland, and members of the Herbert River Catchment Coordinating Committee towards the Queensland ICM program. It is based on the results of a mail questionnaire which was completed by all coordinators and 60% of chairs statewide and all but three members of the HRCCC.

The survey revealed many common attitudes but often a diversity between catchments and between Coordinators and Chairs in a given catchment. Key factors affecting this diversity included:

- the age of the CCC which conditions its maturity and opportunity to undertake planning, awareness raising and projects
- the environmental circumstance of the catchment - while many are costal rivers, there are also a number of inland rivers which have quite different resources and resource management issues
- the capabilities and effectiveness of the Coordinators and Chairs and the dynamics of the CCC

Some of the significant results include:

- disturbing low level of satisfaction amongst the respondents (especially their Coordinators)
- low and expected awareness in the general public about resources management issues
- widely held view that local governments, both politically and at officer level have not been involved effectively in the ICM process
- lack of support at the state political level
- ineffective involvement of some state agencies

On a positive note there was wide agreement about the supportive role of the media and of the essential role that the CCCs, its Chairs and Coordinators play in gaining support from the stakeholders. Respondents also believed that the DPI (now DNR) and rural producer groups were effectively involved in the process.

In terms of the general approach and institutional arrangements for ICM:

- diversity of views of members sometimes a significant problem with respect to the role of the CCC, its coordinator and whether it should for example be involved in giving advice to landholders, coordinate state government activities and have a regional development function.
- A significant obstacle for ICM is the resistance of many of the community and those in CCCs to state imposed programs which require community action without resources - a perception of force.

Significant findings from the HRCCC responses are:

The most important *resource management issues* were:

- rural drainage
- allocation of sugar caneland
- erosion
- urban flooding

The most important impacts of these resource management problems on the people of the catchment were:

- loss of confidence in government to manage resources effectively
- drinking water quality
- higher production costs
- higher taxes

These issues and impacts focus on government's role in resource management. The concern suggests that among other concerns, the HRCCC should consider how its activities will enhance present government performance.

HRCCC members perceived a strong level of support from the Queensland Department of Primary Industries, the Sugar Infrastructure Improvement Package (SIIP) program, and rural producers. Relatively less support was provided by Local Government, State Government Politicians, and the Department of Lands (now part of new Department of Natural Resources). The public was perceived to have:
(i) a low to moderate level of awareness about natural resource issues and associated impacts,
(ii) low to moderate level of support to solve natural resource issues; and
(iii) supported the local CCC program at a very low to moderate level.

These trends have implications for the extent and nature of partnerships which the HRCCC has developed.

Effective implementation of ICM in the Herbert River catchment is perceived to be aided primarily by:
- the role of the Chairman, Coordinator, and members,
- the representativeness of the membership of the wider catchment community, and
- the view that technical solutions can solve resource management problems in the catchment.

This finding has implications for the professional development and training of coordinators, chairs and members.

Effective implementation of ICM in the Herbert River Catchment is perceived to be hindered primarily by:
- poor understanding of problems
- lack of clear and immediate economic benefits
- high cost of solutions
- long timeframe to see benefits
- lack of trust in government sponsored programs
- public's lack of interest in community based activities
- lack of financial resources within the community
- large size of the Herbert River Catchment
- ICM lacks clear goals and objectives.

This finding has implications for:
- the feasibility of implementing community based initiatives like ICM,
- the need to raise the present level of community support for ICM,
- the need for cost sharing arrangements among governments, private industries, and
- individuals, and
- the need for visible commitment by state and local leaders to ICM.

PART 1 INTRODUCTION

This report describes the perception of Integrated Catchment Management (ICM) coordinators and chairs in Queensland, and the members of the Herbert River Catchment Coordinating Committee, to the following items:
(i) catchment issues,
(ii) resource management issues,
(iii) the level of support provided by other agencies and groups,
(iv) tractability of the issues,
(v) the institutional arrangements to deal with those issues, and
(vi) the process of ICM.
This introductory section provides background to the report, the focus, the approach taken, and the nature of the report itself.

1.1 Background

In 1994, the Division of Tropical Crops and Pastures of CSIRO received a five-year grant from LWRRDC (project CTC7) to assess the relative strengths and weaknesses of implementing Integrated Catchment Management (ICM) in the Herbert River Catchment. Specific research goals were to:

- develop a framework for evaluating the process of ICM implementation that was applicable to other catchment management programs in Australia;
- monitor and document the process of implementation of ICM in the Herbert River catchment and identify the social, economic and institutional factors that facilitated or hindered this process;
- evaluate the key impacts of the implementation process in terms of the attitude and behaviour changes in the community and changes in the severity or tractability of the resource use conflicts for the Herbert River catchment;
- assess the specific technical and related information needs that were relevant to an effective ICM implementation process in a wet tropical environment; and
- contribute to the development of more effective programs in Australia that implement production systems, conservation and land use planning programs based on the philosophy of ICM.

A number of activities have been associated with that research program. In the first year, the research team formulated an evaluation framework in order to organise the design, conduct and findings of subsequent activities (Bellamy *et al.*, 1995) (Figure 1). That framework focuses attention on four primary factors - the NRM context, the issue context, legislative aspects, and community processes.

This report is one aspect of the entire CSIRO DTCP research program, and been strongly influenced by the evaluation framework. The specific objectives of this report are, on both a state-wide basis and within the Herbert River Catchment Coordinating Committee:

- to identify the activities of Catchment Coordinating Committees, and how they are operating;
- to identify how well the CCCs are operating; and
- to identify economic, social and institutional factors which contribute and detract from effective implementation.

1.2 Research Framework

A range of technical, institutional, economic and social indices have been identified and incorporated as an integrated conceptual framework for observing change and evaluating the ICM implementation process. This framework combines aspects of the Mazmanian-Sabatier framework of policy implementation analysis described previously (Mazmanian and Sabatier 1991) with the criteria identified by the PRIME framework (Syme *et al.* 1994) from the social sciences, and environmental management and resource assessment techniques from the environmental sciences. The framework is illustrated in Figure 1.

1.3 Research Design and Approach

The study is based on a mail survey of two groups: (1) selected officials from all recognised ICM Committees and groups throughout the state; and (2) all members of the Herbert River Catchment Coordinating Committee (HRCCC). In addition to surveying these people, the study team interviewed the manager of the State ICM program on two occasions, reviewed all issues of *The Source*, other relevant publications on resource management initiatives in Queensland, and obtained some baseline data on the program from DNR files. This material was supplemented with a review of HRCCC meeting minutes and newspaper accounts, and interviews with selected HRCCC members, staff and local officials with other state and local government agencies.

The state-wide survey was limited to the coordinators and chairs of the 13 recognised CCCs and 1 Catchment Care Group operating in November 1995. The manager of the State ICM program provided the names of these individuals. Addresses for the HRCCC members were provided by the local coordinator.

The survey instruments were questionnaires designed to be readily completed by the respondents (Appendix 1 and 2). Conduct of the survey involved the following steps:

- the questionnaire was structured to follow the previously developed conceptual framework;
- pre-test of the questionnaire with the State ICM manager, the HRCCC Coordinator, and one other local ICM coordinator;
- a presentation at the November 1995 HRCCC meeting to outline the survey and request member support;
- mail out of the state-wide survey in November 1995, and the HRCCC survey in December 1995;
- mail our of reminder letters to non-respondents on December 15; and follow-up phone calls to non-respondents of the HRCCC survey in January 1996.

Formulation of the questionnaire considered both the evaluation framework (Figure 1) and pragmatic issues (*eg.*, ease of understanding). It contained a mixture of factual, scaled responses and open-ended questions on the following topics:

- biographical data on respondents: how long they had held current position, length of residency,
- the issues: what were the economic, social, and natural resource issues in the catchment; and what were specific resource management issues. and how tractable were they,
- attitudes to the support received from the public, government agencies, non-governmental organisations, and the clarity of their roles of ICM,
- overall strengths and difficulties,
- institutional arrangements and finance, and
- personal motivations for being a CCC member (on the HRCCC only).

PART 2 ICM IN QUEENSLAND: HISTORY AND INTENT

2.1 Integrated Catchment Management in Queensland

The quest for effective natural resource management has been the pursed by governments worldwide. Often, water has been a prime focus of attention because a catchment provides a natural system from which the interactions among people, water and related land resources can be considered, and the coordination of relevant public and private resource managers enhanced. To these ends, the State Government of Queensland, Australia released Integrated Catchment Management (ICM) in 1991 in order to:

> *integrate the management of land, water and related biological resources in order to achieve the sustainable and balanced use of these resources. It provides a framework for fostering cooperation and coordination between many landholders and other resource users, community groups and government agencies involved in the use and management of land and water resources* (Queensland, 1991, 1).

While it was recognised that other government initiatives such as the State Conservation Strategy, State-wide environmental programs (*eg.*, Landcare), and broad regional strategies such as the South East Queensland 2001 Growth Management Strategy and Coastal Protection Strategy would be important activities, ICM was perceived to be unique for two reasons. First, it was to involve all sectors of the community. Second, it was to be multiple, rather than single issue based.

ICM Principles

Five principles were to guide the ICM process. First, since land and water resources are basic and interactive parts of natural ecosystems, effective management was best achieved by using the catchment as the administrative unit. Second, since river catchments are continuously changing in response to natural processes and human activity, management strategies should anticipate, adapt, and respond to these changes. Third, decisions would be based on the best available information. Fourth, individual users and managers would be informed about water and land management issues and solutions. Fifth, ICM would provide for a "balance between economic development and conservation of land and water must be maintained" (Queensland, 1990, 1). By using these five principles to guide the formulation of catchment strategies, the following goals would achieved by promoting:

- community understanding, coordination and cooperation,
- common goals and community action, and
- economic and ecological sustainability.

Catchment Care Groups and Catchment Coordinating Committees were to be the driving forces behind ICM. Supported by QDPI which would provide information, education and training services about ICM, CCCs and CCCs were to provide the following functions:

- foster coordination between landholders, community action groups and government agencies in their land and water resource management activities;
- promote community understanding of the interactions between land, water and related biological resources and the value of a coordinated, catchment-wide approach for managing these resources;
- provide a forum for community and government discussions on catchment management issues for resolving conflicting demands on natural resources;
- identify and prioritise interrelated land and water resource issues in the catchment;
- develop catchment management strategies that address priority issues;
- promote and foster voluntary implementation of catchment management strategies by landholders and other resource users through community action groups and government agencies;
- provide advice and recommendations to landholders and other resource users, community action groups and government agencies on catchment management issues;

- monitor, review and report to Government and the community on progress and performance of catchment management strategies and activities [CCCs must report annually to Minister of DPI]; and
- recommend improvements in the administrative procedures and statutory requirements of government agencies to avoid duplication and conflicting requirements.

Implementation of ICM would foster a whole-of-government approach by providing a strategy which was consistent with policies and guidelines of all levels of government

ICM as a Process

ICM was to be a State-wide initiative. While the Queensland Department of Primary Industries (QDPI) would be the agency responsible for administering ICM, the important role of other agencies such as the Departments of Environment and Heritage (QDE), Lands (QDOL), and Housing and Local Government (QHLG) in supporting relevant aspects of ICM were recognised (Queensland, 1991). Collectively, State Government agencies would, within the scope of available resources, support and assist Catchment Care Groups (CCCs) and Catchment Coordinating Committees (CCCs). These two types of bodies would be formed in order to harness local and public agency involvement in order to formulate the catchment strategy document. CCCs would be less formal than CCCs and "link the activities of landholders, community action groups and government agencies" on relatively simple issues which involve a limited number of participants (Queensland, 1991, 2). Providing a forum for community discussion and fostering the cooperative development of solutions are the major roles of these groups. The initial intent was to form CCCs under legislation to address complex issues involving a large number of participants. In practice, legislation was never enacted because of a significant perception that ICM could result in another and unnecessary level of government. Instead, the level of support provided through QDPI has signalled the difference between CCGs and CCCs. The former has no catchment coordinator assigned to it and is ineligible for the $500.00 establishment grant. CCCs receive these types of support. Where a catchment was divided among several CCCs, Regional Catchment Coordinating Committees (RCCCs) could be formed to coordinate individual CCC activities. RCCCs are also eligible for the $500 establishment grant.

The State Government encouraged that CCGs and CCCs take a pragmatic approach which focused on "manageable and resolvable issues of high priority to the community rather than all issues" (Queensland, 1991, 20). When completed, the strategy would identify and describe major issues; describe relevant objectives, guidelines, policies and actions plans; identify mechanisms to achieve objectives; and provide appropriate monitoring and review mechanisms. Unless special legislation were passed, the requirements of the strategy would not be legally binding on any landowner or government agency.

ICM as a Product

The primary final product of the ICM process is a Catchment Strategy which prioritises catchment issues, and identifies appropriate implementation mechanisms. Three options for implementation were identified. The preferred choice would see the CCC seek the voluntary adoption of catchment management strategies by landholders and resource users, community action groups, and government agencies. Presumably, the strategy development process would educate resource managers about the need for of specified resource management activities. Where voluntary implementation was jeopardised, CCCs could request the appropriate state minister (*eg.*, QDPI, QDE, QDOL, QHLG) to have local and state agencies consider catchment management strategies in their routine operations. The final option would see the establishment of a catchment trust or similar statutory body for specified issues such as soil conservation, floodplain management, or river improvement. This issue was considered in the document 1994 document *The Sustainable Use and Management of Queensland's Natural Resources.*

The general intent of ICM may be summarised as follows. It is a voluntary approach which relies on local initiative to establish the need for the formation of a CCG or CCC. Both CCGs and CCCs and subsequent strategies lack legislative authority. Voluntary compliance by relevant private managers (landowners and corporate) and public agencies is the preferred method of implementation. Education of these managers through the exchange of information and the development of the Catchment Strategy is to facilitate the adoption of required actions. ICM Committees are to be composed of major stakeholders who have an interest or are influenced by significant resource management problems. Another dimension of this stakeholder approach, is the joint funding for relevant activities from both the State Government and relevant local participants. Catchment strategies are to focus on several important resource management issues operating on a catchment scale in order than an integrated consideration of problems and solutions is provided. While the state government has identified a number of requirements for all catchment strategies, local groups must seek their own approaches in the formulation of that document. Monitoring is to be an important element of all catchment strategies.

2.2 Forming and Operating a Catchment Coordinating Committee

The State Government identified ICM principles, processes and products. Local communities are to consider the need for ICM, and if appropriate, pursue the formation of catchment coordinating groups or committees. In this manner, ICM in Queensland should merge 'top down' and 'bottom-up' management. Both CCGs and CCCs are comprised of "representatives of the major sectors of the community and government which are involved in, or influenced by, the management of land and water resources in the catchment" (Queensland, 1991, 2). They are to work with state agencies and local groups in forming catchment strategies thus furthering the principle of partnership between state government and local government and groups.

CCGs and CCCs must encompass an administrative region of at least two local government areas and be catchment or sub-catchment based. The membership should "reflect the interests of the major sectors of the community" including local governments, key relevant primary industries, landholders in proportion to the range of land uses in the catchment, state government agencies, community groups and organisations, recreation and conservation interests, secondary interests, and major stakeholders outside the catchment (*eg.*, Great Barrier Reef Marine Park Authority, World Heritage Parks) (Queensland, 1995, 2). The membership should be determined by open election or through nomination by community groups, agencies, and the general public. Membership on RCCCs is drawn mainly from CCCs within the basin.

Once groups within a catchment have decided to form a CCC or CCG, they should apply for endorsement under the Queensland's ICM Strategy which provides them with access to operating and project funds, liability and accident insurance. Appropriate activities are funded from a number of sources. As the administering agency, QDPI provides seed funding for CCGs, CCCs and projects. A one-time $500 establishment grant is available to both CCCs and RCCCs. To cover the full costs of establishment, CCCs are to seek the financial and in-kind support from interested and member organisations. Operating grants are set at $2,000 per year for three years, and $1,000 afterwards. CCCs west of the Great Dividing Range and in the Fitzroy and Burdekin Districts are eligible for an increased level of grant up to $5,000 per year for three years, and $2,000 thereafter. Applications for additional project funding could also be submitted to funding agencies such as Landcare and LWRDCC, and other government and non-government agencies.

2.3 Review of State-wide ICM Activities (1991-1996)

By May 1993, 5 catchments - the Lockyer Valley, Johnstone River, Pioneer River, Mary River and Mitchell River - had been identified as pilot study areas. By October 1995, there were 13

CCCs and 1 CCG formed throughout the state, with most located along the eastern coastal catchments (Figure 1). There was initial concern that ICM and Land Care, which was launched in 1992 as a means of conserving natural resources and protecting the environment., would be seen as overlapping exercises. However, QDPI saw these initiatives as complementary.

> *ICM is about the 'big picture' or the condition of the whole catchment on a broad scale. Land Care deals mainly with localised issues on a property or small catchment scale...Both are flexible and can be moulded to suit the needs of the community* (*The Source*, April 1991, 8).

Several conferences such as the Downstream Effects of Agricultural Pollution (DEAP) have been held. The role of local government in ICM was highlighted in a 1994 study (QDPI *et al.*, 1994). A newsletter titled *The Source* provides information to all ICM members, coordinators, and interested participants. Between April 1992 and February 1996, 10 issues have been published.

The state government has also introduced a number of initiatives which influence the formulation and implementation of ICM strategies. These include the 1994 natural resource management discussion paper, environmental protection legislation, and reform and proposed reforms to the *Local Government (Environment and Protection) Act.*

As mentioned earlier, new legislation was initially considered as necessary to support ICM. In 1994, it became clear that this alternative would not be pursued. In a 1994 discussion paper titled *Sustainable Use and Management of Queenslands Natural Resources* the State Government identified its preference to amalgamate existing legislation within existing administrative arrangements, rather than create new agencies (QDPI, 1994). The overall objectives of the new framework are to "produce an integrated natural resource management (NRM) policy with non-regulatory strategies and a minimum of legislation," and to integrate the existing natural resource legislation administered by QDPI "to see an effective planning and management framework in place that provides for ecologically sustainable development for natural resources" (Queensland Department of Primary Industries, 1994).

Like implementation of ICM, the Queensland Government prefers voluntary compliance with its NRM requirements. However, if resource degradation was significant and effective community-based measures (*eg.*, ICM) were not forthcoming, QDPI could establish additional regulations and/or special statutory bodies under the NRM initiative. These would be in addition to and would probably supersede policies developed through the local planning and ICM process. If this situation is to be avoided, it is a community's interest to actively and effectively participate in the development and implementation of local plans, ICM strategies, and Codes of Practice. Non-involvement will detract from one's standing within the community, and contribute to the possible imposition of QDPI regulations and special statutory bodies. Local control would be reduced.

The need to reform existing legal arrangements within QDPI was also recognised in the discussion paper. Legislative options to overcome the "overly prescriptive", "highly variable" and "fragmented" nature of QDPI-administered Acts included: a single piece of legislation to replace the nine existing Acts and which incorporates Integrated Catchment Management (ICM); retention of the existing nine Acts with amendments, together with the preparation of an additional piece of legislation for ICM; preparation of umbrella legislation that sits across the existing Acts and that for ICM and; amalgamation of the existing Acts introduces three broad category Acts of Land, Forests and Water.

PART 3 STATE-WIDE FINDINGS

3.1 The Survey Respondents

Fourteen Coordinators (100%) and 11 (78%) Chairs responded to the questionnaire. All the responses were satisfactory, and most respondents provided significant additional written comments. In one case, Lake Baroon is a Catchment Coordinating Group and does not have a QDPI-supported coordinator. That respondent was treated as a chair for the purposes of data analysis.

All the ICM committees are quite young and most of the respondents were the initial appointees in their CCC although there has been some movement of coordinators.

Many of the coordinators were recent arrivals into the catchments as young professionals moving in to take up the newly created jobs although there are a couple of notable exceptions. Many of the Chairs are lifetime residents and most have lived in their catchments more than 15 years (60%). There are some relatively new arrivals amongst the Chairs (34%).

Table 1: The Survey Respondents

Catchment	*Respondents*	
Border Rivers Basin		Coordinator
Cardwell	Chair	Coordinator
Condamine		Coordinator
Dawson	Chair	Coordinator
Herbert River	Chair	Coordinator
Johnstone	Chair	Coordinator
Lake Baroon	Chair	not applicable
Lockyer		Coordinator
Maranoa-Balonne	Chair	Coordinator
Mary River	Chair	Coordinator
Mitchell River	Chair	Coordinator
Murray Darling	Chair	Coordinator
Pioneer		Coordinator
Russell-Mulgrave	Chair	Coordinator
Warrego-Paroo	Chair	Coordinator

3.2 The Activities and Progress of Catchment Groups

The major activities of the Queensland CCCs are summarised in Table 2 and in more detail in Table 3. There was a surprising difference in perception between coordinators and chairs as to whether the various activities above had been undertaken.

Table 2: Activities Undertaken by ICM groups in Queensland

Activity	*Yes*	*No*
Prepared a situation statement	5	9
Catchment strategy	11	3
Advice to Landholders	6	9
Conducted projects	9	5

Table 3: List of Activities Carried Out by ICM Groups in Queensland

General ICM Establishment Tasks	
Arranged meetings and presentations to Ministers.	Established a Catchment Centre and appointed a manager.
Landholders inventory.	Process of CCC formation is one of my major tasks at present
Community Education and Awareness	
Officer in place at the Catchment Centre.	Land management demonstration site Chillagoe.
Raise catchment and NRM awareness.	Roadside erosion control workshop.
Increase in awareness of committee members of the whole catchment	Arranged catchment seminar.
Carried out extensive consultation with the broad community.	Catchment seminar.
Fish breeding with school children, catchment care caravan.	Road signs, newspaper articles, newsletter, TV., radio
Cross section of communities viewpoints of necessary works.	Increased many people's level of awareness of "catchment"
Initiated a catchment-wide water watch program.	Involvement of local government
Land degradation workshop	Prepared education paper on catchment.
Produced 2 brochures	Public awareness of ICM
Planning	
A draft has been prepared for seven major issues	Catchment Strategy in draft form
Coordination of efforts across the basin.	Developing a Catchment Strategy
Draft only for catchment strategy/plan.	Developed a catchment strategy and implementation
Going back to the community with draft strategies and plans	Initiated appraisal planning study.
Land Use report (draft) - part of Water Quality project.	Ranked issues.
Series of position statements on key issues of community concern.	The catchment plan is almost ready for circulation
the Creek project is in draught	Working Groups (7) Issue based
Technical Work and Information Collection	
Commencing Flow Management Plan for basins.	Draft Strategy for Riverine Management issues
Fire Management Strategy.	Initiated water management planning project for basin
Principals and Guidelines for landuse	Existing Water Quality data collate/assess.
Water Quality Monitoring Program	Fertiliser Audit (draft) - part of Water Quality project,
Initiated study on soil type 1.	Nutrient Management Strategy due to commence (CMSS)
Pesticide Audit (draft) - part of Water Quality project,	Prepared paper on "Water Pricing Policy and Ownership",
Specific projects	
Assisted community groups and agencies to implement projects pertaining to catchment priorities.	Instigation of the DLP.
"river" Revival. Project	Voluntary Riverbank Restoration Grant Scheme.
	Prepared reports on status of stream banks, mangroves of area.

The wide range of activities reflects the age and maturity of the CCCs. Some have been in operation since 1988? whereas some are still in the process of being formed. The range of activities are all envisaged in the ICM Policy which now requires the preparation of catchment strategies before funding is provided for projects.

A progression of activities can be recognised from organisational activities - public awareness and involvement - issues generation - catchment planning - technical studies.

Table 4: Chairs and Coordinators' Level of Satisfaction with Progress in their ICM Program

Information supplied by	*Number of responses*	*Rating*					
		0	1*	2	3	4	5
Chair	11				4	6	1
Coordinator	13	1*		3	4	4	1

0 = no response, 1 = very unsatisfied, 2 = unsatisfied, 3 = neither satisfied nor unsatisfied, 4 = satisfied, 5 = very satisfied.

* One coordinator did not respond. No Coordinators or Chairs were very unsatisfied.

Less than half the coordinators were satisfied with progress in their CCC and three were unsatisfied, one to the point of resigning over it. The Chairs were generally more satisfied with progress, and while none was actually dissatisfied, almost half were ambivalent. The reasons for this disturbing low level of satisfaction are revealed in later discussion.

Table 5 shows the reasons given by Coordinators and Chairs for difficulty in implementing ICM in their catchment. The fundamental problem is that there are no apparent economic benefits for ICM in the short term. The time frame is long before benefits are seen. This in a context in which government agencies and landowners need to make changes to their practices to achieve coordination and to elevate resources management issues.

Table 5: The Reasons Implementing ICM is Difficult

Issues	*Coordinators ratings*					*Chairs ratings*				
	1	*2*	*3*	*4*	*5*	*1*	*2*	*3*	*4*	*5*
Resource management problems are not well understood		5	5	3			2		6	3
Technical solutions are not feasible	2	6	2	3		1	5	2	2	1
The impacts of mismanagement are long term and incremental	1	2		6	4		1	1	8	1
There is no single acute resource management issue within the catchment	2	4	2	1	4	2	2	1	5	1
The long time frame between implementing a solution and seeing the benefits		1	1	8	3		1		7	3
The high level of behavioural change required	1	1	2	7	2		3		6	2
The high cost of known solutions		2	1	6	4	1	2		5	3
The high level of change required from existing government agencies			4	5	4		1	1	5	4
The absence of clear and immediate economic benefits	1	1	1	7	3		1	1	5	4

1 = strongly disagree, 2 = disagree, 3 = neither, 4 = agree, 5 = strongly agree, 6 = NA/don't know

It is important to note that the reasons do not seem to be the lack of technical knowledge of solutions to address the problems. In all cases respondents believed that the problems were increasing in significance.

Coordinators made the following comments about current difficulties:

The decision of the Murray Darling Basin Ministerial Council to place an interim cap on all water diversions within the Murray Darling Basin required the CCC to be involved in negotiating Queensland's position re the "cap". The CCC initiated workshops to inform the catchment community about the Water Audit in the Basin and the Ministerial decision. The Goondiwindi Workshop provided a community response to Murray Darling Basin Mining. Council outlining this catchment's position and proposed action ie. development of a Flow Management Plan for the BR catchment (Qld and NSW). (2) Tree clearing guidelines. The CCC requested to be contact point in catchment. This was not to be the case. Community consultation on this issue has been nothing short of pathetic. Any decisions/actions etc. taken by CCC and other groups/departments etc. were overriding in this process.

The Council have introduced their Development Control Plan - many people are trying to come to terms with what it means for them - they tend to focus on Resource Management issues. Also the Sugar Industry Package is operating the area and it too focuses on Research Management issues - especially drainage

- Flooding incidences have decreased hence that issue is not as high on the agenda as it would normally be. Mahogany Glider habitat concerns have come to the forefront as they directly impact on cane expansion etc.

- Impacts of PEDA legislation. Impacts of EPA - Environment Protection Act. Impacts of infrastructure imposed by government with a disregard for Catchment Management Principals. Low ground water levels due to overuse and drought. Increasing urban sprawl and encroachment on agricultural land, sewage and waste disposal.

- The continuing drought has heightened awareness and involvement

Extractive industry review showed potential consumption sky marketing. CCC setup working group to formulate a policy approach. Followed this with setting up Reference Panel with DPI to review community responses on industry review. Council's management of rural subdivision spotlighted - CCC to lobby improved land capability studies, and amended DPI priorities for mapping. Riverbank erosion increased in importance as discussions and debate flourished on how to manage. CCC inserted Voluntary Riverbank Restoration Grant Scheme as a response.

· Change has occurred due to increased length of drought. CCC has responded by commissioning Water Management Project, but ultimately there are problems with over-allocation of water which the people who over allocated in the first place now need to redress. This, of course, requires admission that mistakes were made, and they are reluctant to do that. Also, that horrible word "compensation" keeps cropping up, acting as further impediment. Hence my non-answer to 11D.

· The placement of Government. Resource Management infrastructure has eg. ? have caused the committee to address a range of issues associated with the EIS process as well as evaluating the ICM works project

· Our CCC is fairly new. The beginning saw members who were in the main merely seat warmers, protecting sectional interests. I have drawn the members away from narrowly based interests to seeing themselves as the Catchment Management Authority. We believe that we have been managing this catchment from the beginning of recorded history and see no reason to change now! We know best! We will not accept government direction on how we run it, We will run it! We request government support for our (the community's) running of our own affairs. We don't want direction!

Changes are mainly introduced by external forces eg. Government - eg. tree clearing dispute, Murray Darling Basin Commission enforcing a moratorium on water licenses on our rivers. The CCC ensured general awareness of the problems and put forward position statements.

Chairs made these comments

The prolonged drought has focussed the catchment on water issues and alternative and effective water management strategies are being implemented. The threat to native state forests is now drawing attention to management of tree species. The structural unemployment is being exacerbated by the drought and means are being sought by us to address these three problems and wholistically.

· CCC still being formed

Change has occurred because of drought for past five years - has placed pressure on the resources particularly
water. Lately government actions concerns to tree clearing.

Councils like Mareeba Shire are having visionary exercises and starting to take a more holistic approach. (4d) Local consultation groups are being set up in the lower catchment by DPI production to help graziers tackle (?) some of their most immediate problems.

· NRM legislation - CCC involved in all resource management issues

· Some of the triggers for action are natural - especially drought. There is also a strong reaction from some respondents about the external direction and difficulties arising from the ICM initiative itself and from other proposed legislation such as PEDA, NRM.

3.3 The Issues

The issues seen as significant by the respondents naturally varied between regions. In all regions natural resource issues were approximately on par with social and economic issues. Most significantly both Chairs and coordinators believed that too much government regulation was the single most significant issue, exceeding all other issues. The most significant natural resource issue was water quantity, substantially higher than land degradation and water quality problems, although these too also were significant in most catchments.

Those issues rated highly and very highly by coordinators included economic sustainability, native and feral animal management and pests in national parks, creek bank erosion and siltation, groundwater salinity, land tenure and uncoordinated farm drainage and cross border coordination. Chairs rated only a few issues highly and very highly including rural residential development and storm water and native tree species management.

Table 6: The Significance of Social, Economic and Natural Resource Issues in Queensland Catchments

Issues	*Coordinators ratings*						*Chairs ratings*						
	1	2	3	4	5	6	0	1	2	3	4	5	6
Social Issues													
School	1	3	1	4	2	2			1	4	4	2	
Crime	2	6	4	1					5	5	1	1	
Unemployment		3	5	4	1				2	3	5	1	
Health care			7	3	1	2		1		4	5	1	
Economic Issues													
Land valuations		1	4	4	3	1			2	4	3	2	
High government spending		3	4	1	3	2		1	3	3	2	2	
High taxes		2	1	3	5	2	1		1	2	4	3	
Institutional Issues													
Too much Gov regulation		1	3	1	8				1	2	4	4	
Natural Resource Management Issues													
Agric land degradation problems			6	4	3				1	3	4	3	
Water quality problems		2	4	5	2				2	2	5	2	
Water quantity problems		2	2	1	8				1	3	3	4	
Nature conservation	1	2	4	3	3				1	6	3	1	

(0 = no response, 1 = very low, 2 = low, 3 = moderate, 4 = high, 5 = very high, 6 = NA/don't know.)

This question asked how the natural resource management issues were affecting the people in the catchment. These included loss of farm productivity and higher production costs. Chairs were particularly sensitive towards psychological impacts, emotional stress on individuals and a loss of confidence in government.

Some specific comments included: We fear abandonment of land to native claim and consequent bad management" and personal/family dislocation due to imposed infrastructure/compulsory acquisition" and concern about incapacity of government to make and carry out decisions"

Table 7: ICM Coordinators and Chairs Opinions on How Serious the Natural Resource Management Issues are in Queensland Catchments

Issue	*Coordinators ratings*							*Chairs ratings*						
	0	1	2	3	4	5	6	0	1	2	3	4	5	6
Land Degradation														
Cropland degradation		1	3	4	3	2				4	1	4	1	1
Grazing land degradation			3	3	3	5				4	2	3	2	
Soil salinity		5	6	2					4	5	1	1		
Weeds				2	4	7				1	3	6	1	
Insects and diseases of crops		3	1	3	6			1		1	4	4		1
Urban expansion onto farm lands		2	1	5		5			1	4	2	2	1	1
Allocation of cane land		1	2	1	3	1	5		1	2	1	2	1	4
Land clearing		1	2	2	3	5				2	2	3	4	
Water Quality Problems														
Surface water salinity		4	6	2	1				3	5	2			1
Wastewater management			4	4	3	2				3	5	2	1	
Surface water nutrient enrichment	1	1		5	5	1				3	4	3	1	
General surface water quality			2	5	4	2		2		2	3	4		
Groundwater quality			3	5	2	3				4	3	4		
Acid soils	1	5	2		5					6	4		1	
Stream and bed erosion			1	1	6	5				2	3	3	3	
Water Quantity Problems														
Water allocation and reliability		1		1	4	7		2		2	2	3	2	
Groundwater availability		1	1	3	4	4			1	4	1	4	1	
Rural flooding	1			6	2	4				1	2	7		1
Rural drainage		1	2	1	5	3	1			3	3	3	2	
Urban flooding		1	1	7	1	3			1	6	2	1	1	
Nature Conservation														
Management of forests and National Parks	1		2	5	3	2		1			3	2	5	
Water use conflicts		1		2	6	4		1	1	2	6			1
Dryland vegetation habitat loss		1	4	1	3	3	1			2	6	3		
Freshwater habitats			1	3	4	5				1	3	6		1
Coastal wetland habitat loss		1	1	2	1	3	5				3	2	2	4

Table 8: The Impacts of Natural Resource Issues on People in Catchments

Issue	*Coordinators ratings*							*Chairs ratings*						
	0	1	2	3	4	5	6	0	1	2	3	4	5	6
Aesthetic & Recreational Impacts														
Access to recreation		1	4	5	3				2	3	3	3		
Environmental amenities			1	5	4	3			1	1	4	4	1	
Loss of scenic values			2	6	4	1			1	5	3	2		
Life Support Impacts														
Drinking water quality		2	4	4	2	1			1	4	4	2		
Human health		2	4	2	3	2			1	3	2	5		
Fishery decline		1	3	3	3	3			1	2	1	5	1	1
Functional Resource Impacts														
High cost of water	1	3	5	1	1	1	1		2	4	3	2		
Loss of farm productivity			1	3	7	2					5	5	1	
Higher production costs		1		1	8	3					2	6	3	
Shortage of irrigation water		1		4	2	6			2	2	3	1	3	
Higher taxes			1	4	5	2	1				4	6		1
Social-Psychological Impacts														
Loss of independence to make (farm) decisions				5	2	4	2			2	3	5	1	
Emotional stress on individuals				2	7	2	2				4	5	1	1
Conflicts with other resource users		1	1	2	4	5				3	3	4		1
Loss of confidence in government...				3	3	6	1				3	6	2	

3.4 Attitudes and Support

Support from the Public

Table 9: Chairs and Coordinators' Opinion on the Level of Public Awareness about Natural Resource Issues and Impacts

Level	*Coordinators*	*Chairs*
Very high	0	0
High	4	1
Moderate	4	5
Low	5	5
Very low	0	1

Table 10: Chairs and Coordinators' Opinion on the Strength of Public Support to Solve Natural Resource Issues

Level	*Coordinators*	*Chairs*
Very high	2	0
High	2	1
Moderate	6	8
Low	3	2
Very low	0	0

A slight majority of all respondents believed that the public was moderately to highly aware of the resources management issues, including only 50% of Chairs who less sanguine overall than coordinators, a significant proportion of whom believe that the public had low to very low awareness. There is also significant diversity of views about the degree of public support (See table 11). Chairs are significantly less confident than coordinators in the degree of public support.

Table 11: Chairs and Coordinators' Views on the Degree of Public Support (pairs by catchment)

	Chairs					
	Level	Very low	Low	Moderate	High	Very high
Coordinators	Very high					
	High					
	Moderate					
	Low					
	Very low					

Coordinators generally believe that the most potent factors affecting the acceptance of ICM by the general public are the efforts of the CCC Chairs, members and the Coordinators themselves. Demonstration of positive outcomes and the support of industry and community groups were also seen to be important. Chairs share these views on the importance of the CCC itself but have a higher regard for the importance of state government activities. Support from local governments and from state politicians seemed to be unimportant for most coordinators and Chairs.

Table 12: The Significance of Various Items in Gaining Acceptance of ICM from the Public

	Coordinators ratings							*Chairs ratings*						
	0	1	2	3	4	5	6	0	1	2	3	4	5	6
The State's ICM policy statement		3	6	3	1				1	6	4			
Local government political support		1	6	2	3	1				5	1	2	3	
Local government agencies support		1	6	4	1	1				4	3	4		
State government political support		1	6	3	3					5	1	3	2	
State government agencies support			4	6	2	1					4	5	2	
Good financial resources of CCC		2	3	7	1				2		4	2	3	
Efforts of the CCC Chair				2	6	4	1				6	1	3	1
Efforts of the CCC Coordinator	1			3	4	3	2	1			2	5	3	
Positive outcomes....			4	2	4	3				2	3	3	3	
Support from industry and community			1	5	3	4				1	6	2	2	

(0 = no response, 1 = very low, 2 = low, 3 = moderate, 4 = high, 5 = very high, 6 = NA/don't know)

Comments made about the value of different activities include that the efforts of CCC members, (Rating 5), support from Landcare and production of plain English reports and statements, and that Quarries, industry, irrigators, were very low in supporting ICM work. One Chair argued that some Landcare groups lacked understanding of ICM.

Support from Government Agencies

Table 13: Coordinator and Chairs Opinion on How Effectively the Efforts of their CCC has been Accepted by other Government Agencies in the Catchment?

	Coordinators	*Chairs*
Very ineffectively	1	0
Ineffectively	2	0
Neutral	6	2
Effectively,	4	2
Very effectively,	1	4
NA/don't know)	0	1

Only 35% of Coordinators are satisfied with the acceptance of their CCCs by other government agencies. Chairs are more positive on this point.

Table 14: The Significance of Various Items been in Gaining Acceptance from other Government Agencies

Item	*Coordinators ratings*							*Chairs ratings*				
	1	2	3	4	5	6	1	2	3	4	5	6
The State's ICM policy statement	1	7	4	1				4	4	2	1	
Local government political support	3	4	4	2			1	3	3	2	2	
Local government agencies support	2	7	3		1		1	2	4	4		
State government political support	3	3	4	2	1			3	3	2	3	
State government agencies support	1	2	5	4	1			1	2	5	3	
Good financial resources of CCC	2	3	6	1		1	1	2	2	3	3	
Efforts of the CCC Chair	1	2	2	6	1	1		1	4	3	2	1
Efforts of the CCC Coordinator	1	1	2	5	2	2	1		4	4	2	
Positive outcomes of CCC activities		2	4	5	2			2	2	4	2	1
Support from industry and community	1	2	4	5	1			3	4	1	3	
Mining, Industry, Irrigators	1											

(0 = no response, 1 = very low, 2 = low, 3 = moderate, 4 = high, 5 = very high, 6 = NA/don't know)

Support from Local Industry and Community Organisations

Table 15: Coordinators and Chairs Opinion on How Effectively the Efforts of their CCC have been accepted by Local Industry and Community Organisations

	Coordinators	*Chairs*
Very ineffectively	1	0
Ineffectively	1	0
Neutral	5	3
Effectively,	5	5
Very effectively	1	1
NA/don't know)		1

Although 40% of respondents from the two groups are neutral as to the effectiveness of local industry and community organisations' support of the CCC, respondents are in general more satisfied with the acceptance of these groups and the difference between Coordinators' and Chairs' opinions are minor. Only one respondent believed it to be ineffective.

Table 16: The Significance of Various Items been in Gaining Acceptance from Industry and Community Organisations

Item	*Coordinators ratings*							*Chairs ratings*						
	0	1	2	3	4	5	6	0	1	2	3	4	5	6
The State's ICM policy statement		4	7	2					1	6	1	3		
Local government political support		2	6	2	2	1			1	4	1	5		
Local government agencies support		1	8	2	1	1			1	3	3	4		
State government political support		2	6	3		2				5		5	1	
State government agencies support		1	3	6	2	1				1	3	5	2	
Good financial resources of CCC		4	2	2	4	1			2		3	4	2	
Efforts of the CCC Chair		1	1	3	3	4	1			1	5	3	2	
Efforts of the CCC Coordinator		1	1	4	2	3	2				4	5	2	
Positive outcomes of CCC activities		1	1	5	2	4		1		2	4	2	2	
Support from industry and community		1	2	2	5	2	1			2	3	4	2	
Efforts of CCC members						1								
Mining, industry, irrigators		1												

(0 = no response, 1 = very low, 2 = low, 3 = moderate, 4 = high, 5 = very high, 6 = NA/don't know)

A wide range of factors generate support from industry and community organisations, especially the efforts of the CCC Chairs. Again both groups of respondents were commonly unhappy with political support and of the acceptance of local government at both the agency and political levels. As in many other results of the survey there are regular exceptions to common patterns. Other organisations considered to be valuable for CCC groups included ACF, QCC, Regional Environmental Council, Ecological Society, Marine Cons. Soc. of Aust. (although there was ambivalence on this some being obstructionist). Other community groups rating as important include Landcare groups, Recreational fishing, Commercial Fisherman's Assoc Aboriginal. Council , Sugar Industry (Mills), Tourism. One group mentioned that graziers were not helpful.

Table 17: The Effectiveness of Involvement of Various Rural industry Groups

Rural Industry Group	*Rating of Involvement*
Canegrowers	5, 5,4,5,5,5,4
Cattlemen's Union, UGA	4
Cotton growers	3, 4,
CU	4,4,3,1,4
CWA	3
Farmers and irrigators	6
Landcare	5
Landholders	4
QCFO	5
QDO	5, 4, 4
QFVG	4
QGGA	3, 4, 4,3
QPUG,	5, 4
Timber Industry.	4
UGA	3, 4, 4, 3,4, 4, 4, 3,3,4,1,4

(0 = no response, 1 = very ineffective, 2 = ineffective, 3 = neither, 4 = effective, 5 = very effective, 6 = NA/don't know)

Support from the Media

All groups use local newspapers as the most frequent form of media outlet. Worthy papers such as the Border News, Argus, Border Post, Macintyre News, Cairns Post, Innisfail Advocate, Tablelander, Central Telegraph, Chinchilla News, Star, Chronicle, Gympie Times, Sunshine Coast Daily, Maryborough Chronicle, Cairns Post, Pyramid News, Tully Times, were mentioned. ABC rural programs were mentioned by many respondents and a slightly lesser number mentioned local commercial radio. A few CCCs were able to use TV, one even place subsidised advertisements on regional TV.

Only one respondent believed the media to be ineffective in supporting the CCC. Eighty percent of Coordinators believed the media to be effective. One said the media were The Key!" and two others found the MDBC videos very valuable.

Table 18: The Effectiveness of Media

Rating	*Coordinators*	*Chairs*
No response	0	1
Very ineffectively	0	0
Ineffectively	0	1
Neither	3	4
Effectively,	8	5
Very effectively	2	0
Don't know	0	0

An overall summary of the importance of support from different groups is provided in Table . Clearly and not surprisingly, the dominant effective partnership is between the CCCs, the DPI and the rural producer groups. There was less agreement between the Coordinators and Chairs on the effectiveness of the involvement of local government and even some ambivalence on the involvement of others such as the DE. Coordinators did not in general seem impressed with the involvement of Lands and Local Government.

Table 19: The Effectiveness of Involvement in the CCC by Various Groups

Group	*Coordinators ratings*							*Chairs ratings*						
	0	1	2	3	4	5	6	0	1	2	3	4	5	6
Rural producers				3	7	3		1			1	8	1	
Local government politicians	1		3	4	3	2			1	2	2	5	1	
Local government administrators			3	5	3	2		1	1	2	3	2	2	
State government politicians			5	4	2	1	1	1	1	2	3	2	2	
DPI			1		6	6						4	7	
DEH		2	1	5	1	4				1	3	5	1	
Housing, Local Gov. and Planning		2	4	3	3	1			2	2	2	3		2
Department of Lands		2	2	5	2	2				1	4	4		2
Valley Trusts (or similar)	1	1		1	4		6	1	1		3	2		4
Drainage Board(s)		1		2	3		7		1		2	1	1	6
Media	5		1	4	2	1		2	1	2	2	3	1	

(0 = no response, 1 = very ineffective, 2 = ineffective, 3 = neither, 4 = effective, 5 = very effective, 6 = NA/don't know)

The views of the respondents about what could or should be done at state/local levels to improve the acceptance and involvement of relevant groups in your CCC process are summarised below:

Coordinators' comments

Advertise on a statewide basis on the Catchment concept and what local CCC groups are trying to achieve.

Locally we also need to advertise more our existence and the local issues we are trying to tackle.

Funding for implementing catchment strategies is vital. the community are more impressed with on-ground works than publication of reports, meetings etc.

A full scale ICM promotion program by State Government agencies.

Ministerial rockets required to ensure stronger commitment to ICM process from some State and Federal agencies, notably DEH and Wet Tropics Management Authority!

Better funding for Management Committee's expenses. If each Exec. member had access to a fax machine, for example, it makes it easier to share information/communicate.

A major state-wide promotion of ICM

Put a halt to new legislation. No more DRAFT POLICY OPTION PAPERS! Consultation Techniques of State Agencies to undergo major overhaul. Give the CCC more funding (subject to a catchment strategy).

Have Gov. commit itself to respond positively to CCC recommendations. Have Gov. Departments pay more than just lip service to ICM principles, and recognise CCCs.

We the CCC need to get runs on the board. To do that we need a more positive mind set amongst committee members, which needs to be encouraged at state/local levels.

The Government should change their attitude. It is believed that ICM is simply a taken gesture and not a serious consideration. The Gov. regularly undermines the community consultation process.

Chairs' comments

Some representation at state level. We have no say and no chance to answer unfair criticism.

More available funds, so that the community as a whole can see some useful work being completed instead of hearing of numerous studies being done with no effective follow-up work being obvious.

An ongoing programme of media releases and a public information programme highlighting the achievements and pointing out the benefits to individual stakeholder groups being involved, eg. be involved in forming the strategies and decisions before some bastard does it for you.

Support the process by allocation of funding (increasing it!) ICM won't solve all catchment management problems but it will help with many issues (eg. diffuse/ non-point pollutant loadings) not easily address

Involve ICM at the beginning of consultation and not at end as is the case at present and expect a rubber stamp.

Provide money for work on the ground.

Produce Catchment documentaries for TV presentation within catchments. We have to use the media of today and that is TV. I cannot stress this enough!

Little. Perhaps making public more aware of role and activities of CCC.

Apathy in this region is high. ICM is at a vulnerable stage within the community.

3.5 Institutional Arrangements and Finance

Table 20 provides results that probe more deeply into the difficulties within CCCs. Coordinators believe that some of the most important difficulties are due to the wide variety of beliefs amongst CCC members, a view not so strongly held by Chairs; a perception that the program has been forced on the catchment by the State in communities without finical resources to respond and a lack of trust in the public in government sponsored initiatives. The Coordinator do not agree in general that the CCCs do not have important groups represented. The Chairs hold similar views differing significantly as a group only in relation to the significance of the wide variety of beliefs and values of CCC members and to a lesser extent on the difficulties posed by the large size of catchments. There are some potentially fatal problems identified here, although many can be overcome as the ICM process matures and achieves ownership and clearer common perceptions.

Other reasons implementation is difficult and their ratings from **Coordinators** were:
- Very busy people on the Committee - there because they represent other groups
- Prodigious rainfall, short run-off, World Heritage, stupidity
- No single issue (problem) with NRM exists
- Perceived or real lack of Government. support

Table 20: The Reasons Implementation of ICM in CCCs is Difficult

Reason	*Coordinators ratings*						*Chairs ratings*					
	1	2	3	4	5	6	1	2	3	4	5	6
Large size of catchment or poor transportation links	1	5	2	4	1		1	3	1	1	4	1
Wide variety of values and beliefs among CCC members		2	1	8	2		1	4	2	2	2	
Media don't report resource issues accurately	1	6	6				1	5	4		1	
Important groups are not represented on the ICM committee	1	5	3	4			2	4	4	1		
Perception that ICM has been forced on the catchment by the state	1	4	3	3	2		2	5	1		3	
Lack of an effective level of interest by CCC members		3	5	5			1	4	2	2	1	
Public's lack of trust in state or local government sponsored initiatives		2	2	3	5	1		2	1	5	3	
Public's lack of interest in community type activities		3	1	8	1			3	1	6	1	
The lack of financial resources within the community	1		1	6	5			2	1	1	7	

(1 = strongly disagree, 2-disagree, 3 = neither, 4 = agree, 5 = strongly agree, 6 = NA/don't know)

Chairs comments

Lack of full coordination between government agencies

Lack of understanding of ICM in community

Table 21 reveals more detail on the operation of the CCCs themselves. Perhaps the most interesting feature of these results is the wide spread of opinions as to the purpose and operation of CCC among the various individuals and catchments in the State. Coordinators for example are not in clear agreement as to what they and their CCCs should do - some believe that Coordinators and CCCs should coordinate activities and give advice to landowners, other do not Chairs seem more consistent as a group in their beliefs about the role and purpose of CCCs and are in broad agreement with Coordinators on many issues. Significant differences in opinion exist as to whether the objectives of the local ICM programs are clear to all members and to the level of participation of their CCC members in meetings. They too do not always agree as to whether the CCC should give advice to landholders.

More NLP money is finding its way to on the ground activities. We have been very lucky with NLP funding in that we have received all the money we have applied for.

We have gained over $200,000 in funding from members and the Commonwealth Government.

Very little financial support from local or state government.

Successful applications for NLP and ICM works funding

The level of funding in my situation (Pumicestone Passage) is "unsecured". Initial NLP funding is only for 18 months until increased June 1996. it is difficult to interact with public when funding is precarious.

NLP funding made available for Catchment Centre Coordinator

MHW] (2) $140,000 Drought Landcare Program for Voluntary River Restoration Grant Scheme.

Increase in local government. input. Drought Landcare programme.

Drought Landcare Project started

DOL and DEH have increased support.
Lack of funds for new projects

Landcare is more active and the Wet Tropics Tree Planting Scheme has materially assisted our efforts.

Table 21: Coordinators and Chairs Opinions on the Role and Conduct of CCCs

Statements	*Coordinators*							*Chairs*						
	0	1	2	3	4	5	6	0	1	2	3	4	5	6
Purpose of ICM														
The objectives of the local ICM are very clear to all members	1		6	2	3	1				2	1	6	1	1
There is a strong consensus among CCC members concerning what the CCC should do	1		3	4	5					4	2	3	1	1
The CCC should coordinate state and local government resource management programs	2	1	3	1	3	3				3		4	3	1
The CCC should prioritise resource management problems in the catchment	1				6	6				1		5	4	1
The CCC should provide a forum for conflict resolution among resource users	1		1		6	5					3	4	3	1
The local ICM process has or will resolve resource conflicts in an open manner	1		1	1	6	4				1	2	2	3	3
The CCC should educate the public about the catchment's resource management problems and solutions	1				6	6					2	3	5	1
The CCC should provide a forum for information sharing within and between public and private resource managers	1				7	5					1	4	5	1
The CCC should prepare a strategic resource management plan	1			1	6	5					1	4	6	1
The CCC should facilitate the implementation of resource management initiatives noted in the strategic plan	1				6	6						5	5	1
The CCC should identify a common set of policies which will be implemented by relevant resource managers	1				6	6						5	5	1
The CCC should make private resource managers/owners more responsible for the impacts arising from their activities	1		3	4	1	3	1			1	3	4	2	1
The CCC should stimulate community or regional development	1		2	3	3	4				2	1	5	2	1
The CCC and its coordinator should provide advice to landholders	2	1	4		4	2		2	1	1	1	5		1
The local ICM process has or will resolve resource conflicts efficiently	1			7	4		1			1	2	5	1	2
Membership and Role														
The membership of the CCC effectively represents the interests of the catchment community	1			2	7	3						6	4	1
At CCC meetings, all CCC members participate actively	1	3	3	1	5							8	2	1
A CCC member's role is to provide their personal views on resource management issues at CCC meetings	1	3	3	1	5			2	2	2	1	2	1	1
A CCC member's role is to provide the views of their constituency group on resource management at CCC meetings	1	1		1	5	5		2		1		3	4	1
A CCC member's role is to provide a catchment wide perspective of natural resource management issues at CCC meetings	1		2	2	5	3		2			1	3	4	1
Performance														
The ICM process is very responsive to local needs	1		2	3	7					1	2	7		1
The CCC is solving the priority natural resource management problems in the catchment	1		4	3	4	1		1		2	3	3	1	

(1 = strongly disagree, 2-disagree, 3 = neither, 4 = agree, 5 = strongly agree, 6 = NA/don't know)

Changes that have occurred

Corporate support has decreased.

We never got any real support and only receive it when we go looking and asking for it!

We have no financial support from QDPI (except for NLP funding)

External project funds increased. Internal budget allocation decreased. Change in focus from planning to implementation and changed status of CCC. Funding for ongoing operations will

continue to decline (from DPI internal funds) while project funding from external sources expected to increase (hopefully) in the future.

Introduction of ICM grants

Table 22: Over the last 12 months, the level of financial and in kind support from QDPI has:

Catchment	*Rating*	*Changes that have occurred*
Border Rivers	Remained the same	
Cardwell	Remained the same	
Cardwell	Remained the same	
Condamine	Decreased	Corporate support has decreased
Dawson	Decreased	We never got any real support and only receive it when we go looking and asking for it!
Dawson	Decreased	We have no financial support from QDPI (except for NLP funding)
Herbert	Remained the same	
Herbert	Remained the same	
Johnstone	Increased	External project funds increased. Internal budget allocation decreased. Change in focus from planning to implementation and changed status of CCC. Funding for ongoing operations will continue to decline (from DPI internal funds) while project funding from external sources expected to increase (hopefully) in the future.
Johnstone	Increased	Introduction of ICM grants
Lake Baroon	Remained the same	
Lockyer	Remained the same	Not known, however, I am assuming it has basically remained the same.
Maranoa-Balonne	Remained the same	
Maranoa-Balonne	Remained the same	
Mary River	Decreased	Coordinators budget cut $50,000
Mitchell River	Increased	Resources through DPI for Salinity Project and through DME for Contain. minesite assessment. However, DME new say NAP funds are no longer available so what have they done with them! and are they fair dinkum about ICM.
Murray-Darling	Increased	Increased DPI commitment to Murray Darling NRMS programme
Murray-Darling	Increased	
Pioneer	Increased	ICM works funding $115,000
Russell-Mulgrave	Increased	We are starting to get serious and getting serious means spending more money - seed money! Now we need results money.
Russell-Mulgrave	Increased	Funding for coordinator to be employed three days a week instead of two.
Warrego-Paroo	Remained the same	
Warrego-Paroo	Increased	Funding for committee has increased.

Table 23: Changes in the level of financial and in kind in the past 12 months

Border Rivers Basin	*Remained the same*
Cardwell	Increased/ Remained the same
Condamine	Remained the same
Dawson	Remained the same/Increased
Herbert	Increased/Remained the same
Johnstone	Increased/Remained the same
Lake Baroon	Remained the same
Lockyer	Increased
Maranoa-Balonne	Remained the same/ Remained the same
Mary River	Increased/ Increased
Murray-Darling	Increased/Increased
Pioneer	Decreased
Russell-Mulgrave	Increased/ Remained the same
Warrego-Paroo	Remained the same/ Remained the same

Not known, however, I am assuming it has basically remained the same.

Coordinators budget cut $50,000

Resources through DPI for Salinity Project and through DME for Contain. minesite assessment. However, DME new say NAP funds are no longer available so what have they done with them! and are they fair dinkum about ICM.

Increased DPI commitment to Murray Darling NRMS programme

ICM works funding $115,000

We are starting to get serious and getting serious means spending more money - seed money!

Now we need results money.

Funding for coordinator to be employed three days a week instead of two.

Funding for committee has increased.

Table 24: How clear is the role(s) of the following groups in the local ICM process?

Group	*Coordinators ratings*							*Chairs ratings*						
	0	1	2	3	4	5	6	0	1	2	3	4	5	6
QDPI	1		1		4	7				1		5	8	
QDE	1	2		2	4	4			1	1	2	6	1	
Qld Dept. Lands	1	2	1	3	5	1			1	4	2	3	1	
Dept Housing, Local Government. & Planning	1	2	3	1	3	2	1	1	3	3	2	1	1	
Wet Tropics Management Agency	2		1	2	1	1	6	1	1	1	1	2		5
Great Barrier Reef Marine Park Auth.	2	1			4	1	5	1	1	1	1	2		5
River Improvement Trust	2		2		3	4	2			1		4	1	5
Drainage boards	2		2		4	1	4			1		4		6
Cane Assignment Committees	2		3	1	2	1	4	1		1		3		6
Local Government	1		3	1	4	4		1		1		6	3	
National Landcare Program	1	1			6	5				1	1	5	4	
For Industry, Environmental, Community and Other groups, see table below.														

(0 = no response, 1 = very unclear, 2 = unclear, 3 = neither, 4 = clear, 5 = very clear, 6 = NA/don't know)

3.6 Other Comments

Coordinator's comments

The Government, particularly DPI, provides considerable supportive rhetoric to ICM and CCCs, well in access of financial and acknowledgment support. The continued pressure on CCCs to progress ICM and develop management strategies to deal with the complex issues confronting them will take its toll on the volunteers. We need a champion in a position to fully support the community, with resources to back it and a willingness to adopt the ICM initiative throughout its structure, ie. the Government. Some of the committee members in the Qld section of the MURRAY DARLING BASIN feel they are being used (abused) to "rubber stamp" decisions of Government. to make those decisions more palatable to the tax payer. I personally feel that Government. (DPI) is trying to "push" the Committees "out there" to assist the Committees in creating their own identity. This is not what ICM is about. CCCs are a partnership. Government. should be open about its support and be seen to be functioning integrated with community. This is what ICM is about - providing avenues of communication between all stakeholders particularly Government/Community that existing communication networks do not allow. CCCs have not evolved sufficiently to operate 100% effectively or to understand where they sit in the big picture. Government. also needs to develop/evolve. Neither has a clear understanding of what each has to offer or is prepared to offer.

Substantially more funds are required to implement strategies. Implementation is what CCC members and coordinators work towards, however, there are no/limited funds available for on-ground works.

The concept of ICM is very good. As Scoot Sturgeons recently stated, the State Government is asking volunteers to do a huge job that requires super human feats. It appears to me that the government is asking private individuals to do all the work, then take all the credit and yet provide no financial support. ICM is a huge task. The money poured into the Johnstone River, a very small catchment, confirms these thoughts. How other catchments are meant to achieve these results with no support makes you really wonder!!

Could write a book about it. Just let me know what you want to know!

So far (as I have only been President for 3 months) I am concerned that the efforts of Sector Groups, particularly Landcare and Progress Associations, Industry Groups have major fears regarding the State and Federal Government's keened to overrule ICM principles with their own infrastructure agendas. This makes the whole process a bit of a joke. Examples are Eastlink Highway Bypasses, Railway access roads, other powerlines and roads. The Government is wasting its money putting it into ICM if it can be overruled/overshadowed by Government infrastructure. Infrastructure corridors should be put in place which respect the principles of ICM. I am sorry to have not provided this response sooner. If I have missed your deadline it is because I required some time to "settle into" my role as President in order to gauge my responses to the response form. Thank you for your attention to these matters.

I have left the job because of total lack of confidence in the process. ICM is being used as a smoke screen to pump up the agencies' need to be seen to be consulting the community. It is more like insulting the CCCs intelligence.

ICM in the Mary is plagued with apparent discontent in many parts of the community with existing LGA and State Agency response to issues. The CCC is seen as another potential source of help - this allows the CCC to be in touch with many issues but bogs it down and detracts from taking a strategic and catchment view of issues at times. There are many false expectations of the CCC, eg. it can make decisions and tell agencies what to do. When these expectations are not realised many people switch off and follow alternative methods to get what they want - this has implications for community support for the CCC (the no teeth! problem). Similarly, the empowering, facilitating, detailing, networking, influencing role is often seen as too slow to achieve the desired result in the time frames desired by some (yet some of the most enduring change in the last 3 years has come from this - its very subtle adherence [?] is often missed as an achievement.

I believe that the process as it currently stands will not survive. I think that the process would be more effectively served if Catchment Coordinators were appointed as Local Authority Natural. Res. liaison officers. That way they could act as conduits for info. flow between community groups and Local government. At the moment, we have CCCs deliberating on issues that many are unqualified or not interested in. The amount of skill and commitment available in catchments with large areas and small populations is also a worry. Last, but most importantly, many people in CCCs don't really believe that, when push comes to shove, Government. will really take notice of the CCCs, so they query their value. The action with the tree clearing guidelines confirmed their worst suspicions.

The lack of real State Government. commitment to the implementation of ICM strategies and funding and support of committees is holding back the implementation of ICM.

ICM in Western Queensland is still very new as compared to other catchments.

Chair's comments

The state government departments do not consult with us! Our correspondence and contacts go largely unanswered and our suggestions go unheeded. Our resources are used by QDPI without acknowledgment or payment despite repeated requests. I think we are one of the best structured and best managed ICM groups in Queensland (ask Neil McDonald at NLP) but the state government. don't want to know us!

The role of Catchment Coordinators is vital to developing an effective strategy and bringing the diverse stakeholder groups together. He/she should be a mature person with a wide knowledge and experience of the working of government and who has very good personal communication skills. If the best and most effective representatives are to be attracted to serve on CCCs, then need to be supported, resource wise, by a facility such as a Catchment Centre (for a group of catchments if necessary) to provide briefing, interpretations and back up support. An effective and ongoing media and public information programme is essential (using community media outlets with locally generated release) to effectively inform the Catchment Community on natural resource management

There appears to be a distinct lack of government policy about the direction ICM is to take in the community at this stage, with Departmental personnel at odds as to what they are prepared to accept from the committees and their role in the management of natural resources. Committees are feeling as though they are being used like pawns in a chess game. The amount of time and travel involved in the larger catchments is a burden on members as the amount of expenses reimbursed is not great from the limited funds available.

ICM should provide a framework for managing change throughout the State (NRM change). Current landholders cannot be expected to rectify the mistakes of generations without massive assistance from the general community. It is unrealistic to expect ICM, a voluntary group, to carrying the burden of enacting positive cultural change. Natural resource use changes must be sustainable. To be so they must also be profitable to landholders. More use must be made of practical landholders experience and observations instead of waiting for the results of expensive research. There needs to be an environmental cost charged into product prices so landholders can effect positive environmental procedures. Social and economic needs have to be kept to the fore in all NRM considerations.

ICM is a very worthy cause. However, I believe QDPI shoots itself in the foot with:

(1) Getting a coordinator to do more than one catchment

(2) Not funding coordinators on anything other than one year contracts making it difficult for them to get housing loans etc. --> low morale

(3) Getting coordinators to fill in holiday and leave for other departments in DPI and then not covering their job if they take leave

(4) Having non-sustainable policies such as irrigation water charges eg. Quota system - people should pay for what they use and if they use above sustainable level, penalty rates should apply.

(5) Having a wishy-washy relationship with local governments which tend to circumvent most legislation that deals with appropriate Natural Resource Management, ie. you cannot expect industries, groups and individuals to change their paradigms, when local councils ride roughshod over legislation to encourage development; eg. Eacham Shire Council forcing sewage on ratepayers after vote against because of financial hardship. Community consultation pah! and Mareeba Shires DCP fitting snugly around Mr Quaid's plans. Credibility for natural resource management is required and councils need to be made to come into line. Even with simple things like enforcing the requirement on landholders to remove noxious weeds. I suggest that, 2 or 3 Rural Councils are audited annually and if necessary held to account every year, until they get the picture.

3.7 Summary and Implications

The survey provided an insight into current attitudes of the two key groups the Coordinators and Chairs. These attitudes will surely change as a result of:

- changes in government policy and finance
- changes in the natural environment itself such as droughts
- most importantly in the CCCs themselves as they mature

The survey revealed some common attitudes but often a diversity between Coordinators and Chairs in a given catchment and between respondents from different catchments. Key factors affecting this diversity include:

- the age of the CCC which conditions its maturity and opportunity to undertake planning, awareness raising and projects
- the environmental circumstance of the catchment - while many are costal rivers, there are also a number of inland rivers which have quite different resources and resource management issues
- the capabilities and effectiveness of the Coordinators and Chairs and the dynamics of the CCC

Some of the significant results include:

- disturbing low level of satisfaction amongst the respondents (especially their Coordinators)
- low and expected awareness in the general public about resources management issues

- widely held view that local governments, both politically and at officer level have not been involved effectively in the ICM process
- lack of support at the state political level
- ineffective involvement of some state agencies

On a positive note there was wide agreement about the positive role of the media and of the essential role that the CCCs, its Chairs and Coordinators play in gaining support from the stakeholders. Respondents also believed that the DPI (now DNR) and rural producer groups were effectively involved in the process.

In terms of the general approach and institutional arrangements for ICM:

- diversity of views of members sometimes a significant problem with respect to the role of the CCC, its coordinator and whether it should for example be involved in giving advice to landholders, coordinate state government activities and have a regional development function.
- A significant obstacle for ICM is the resistance of many of the community and those in CCCs to state imposed programs which require community action without resources - a perception of force.

PART 4 THE HRCCC AND SURVEY RESULTS

4.1 Natural Resource Management Problem Definition

Evolution of HRCCC

Formed in March 1993, the HRCCC is the most recent attempt to address the resource management challenges of the Herbert River catchment. Previous studies include the:

1976 North Queensland Sugar Industry Drainage Study
1977 North Queensland Sugar Industry Flood Mitigation Study
1980 Herbert River Flood Management Study
1984 Herbert River Drainage Study
1993 Stream Management Plan Herbert River and District, and ongoing Sugar Infrastructure Improvement Package.

Continuing concerns for flooding and drainage prompted the need for the formation of the HRCCC. The 1991 flood caused a very significant reduction in sugar cane yield. Mining dams, some of which were abandoned in the late 1890s, pose a hazard to all downstream residents These and other resource issues provide for user conflicts, and impede economic and social development. Since the 1994 hiring of a full-time catchment coordinator, three types of activities characterise the HRCCC program.

The first concerns the formulation of the strategic plan. Given the numerous studies already conducted on the catchment and the 1993 completion of the Stream Management Plan, there was a belief that the HRCCC should implement its recommendations rather than develop a new strategy. While this is a legitimate view, the HRCCC should differ from previous studies in the following ways. First, it examines the entire catchment rather than the lower portion. Second, it addresses a broad range of resource issues, rather than specific concerns. Finally, it promotes ongoing dialogue among a range of interests from all parts of the catchment, rather than terminating at the completion of its strategic plan. These characteristics are very consistent with the general ICM principles noted in Section 2.

In developing the strategy, the HRCCC formed a number of subcommittees which drafted discussion papers on land, water, stream and habitat management. Items were clarified and incorporated into a single document (the Herbert River Catchment Management Strategy (Draft)) which will be circulated among relevant agencies, non-governmental organisations, and private interests for comment. Based on this input, the draft will be revised and finalised. The strategy should represent a significant departure from the sectoral approaches of the past to an integrated package required to deal effectively with the realities of the present.

Obtaining funding and implementing projects is the second type of activity. In August 1993 the HRCCC requested information from the Department of Minerals and Energy about the rehabilitation requirements which would be placed on new mine owners on mining bases in the Herberton Shire. This was followed by an inventory of dams in the Nanyetta Creek catchment. Other projects completed by October 1994 include: the rehabilitation of a 1 ha property adjoining Palm Creek (in cooperation with CSR Ltd.), the control of slumping on the lower Herbert (in cooperation with Herbert River Improvement Trust and James Cook University), and the control of water hyacinth along Palm Creek. The three schools in the Palm Creek planted the trees which had been purchased by the HRCCC. Funding was sought and received from the National Landcare Program (NLP). Most of these projects involved the participation of other groups which is very consistent with the community-oriented intent of ICM. These types of activities demonstrate the means and benefits of community-based activities, and enhance the HRCCC's public profile.

The third type of activity relates to the HRCCC's role as a referral agency. Hinchinbrook Shire and State agencies such as the former Department of Lands, and Primary Industries circulated subdivision, drainage and other relevant applications to the HRCCC for comment. It has been involved in the drainage planning in the Cattle Creek catchment, and the Sugar Infrastructure Improvement Package. The HRCCC has also provided some farm and drainage management advice to individual landowners on an *ad hoc* basis.

The Pomona case study illustrates some of the difficulties associated with dealing with resource conflicts. In 1995, cane assignment was granted in an area known as Pomona land holding. During land clearing, the area was found to be an important habitat for an endangered species, the Mahogany Glider (QDE, 1995)A conservation order was placed on the site, and later a draft conservation plan was prepared. There was a significant level of uncertainty and conflict among industry, government and non-government participants concerning this development. At present, a drainage permit under the *Water Resources Act 1989* has been applied for by the proponents, and is under review by the Queensland Department of Natural Resources (DNR)

The HRCCC held a site tour and issued a press release which noted the need for sustainable development on floodplains. It maintained that a Code of Practice should be developed. Until that code is completed, landowners were asked to plan their developments more effectively, and seek government advice.

Several HRCCC members reflected on this experience. While there is a consensus that the Pomona subdivision raised public awareness about environmental issues, the role of the HRCCC suggests significant differences of opinion. Some members suggested that it created friction between landowners and government agencies." The following comments were also offered:

- Pomona subdivision - HRCCC responded with inspections and some publicity. No further action taken and in hindsight was a lost opportunity.
- The HRCCC sat on fence and failed to comment (deliberately) on gross environmental vandalism in clearing creek beds and banks on Pomona Station. Even the council is now complaining about failure to observe 10m buffer on creek but still ICM holds the "must be polite" line.
- The HRCCC has made very broad comments condemning expansion in Pomona, the group could have been more forceful in their statements but have taken a "political approach."

There is a diversity opinion among HRCCC members concerning this and many other resource issues. This should be expected given its membership. It also suggests that early deliberations and successes may focus on process issues, such as establishing a basis for discussion, rather than tangible agreements on directions and priorities.

The Pomona case illustrates some of the difficulties in moving toward integrated approaches. Some of the drainage problems associated with that area have technical solutions. However, it is relatively more difficult to appropriately balance these solutions with sugar cane development with ensuring that biodiversity considerations, downstream landowner interests and water quality aspects. ICM in Queensland is to provide a more balanced approach which in the Herbert River should be facilitated by the HRCCC's strategic plan.

4.2 Context of ICM in the Herbert River Catchment

Recent Evolution of ICM in the Catchment

The importance of obtaining community involvement in the local program was mentioned frequently as the HRCCC's as noted in the following comments:

Cross Section of communities viewpoints of necessary works. Trying to coordinate natural resources activity in the Herbert Catchment.

The level of awareness of ICM to Canegrowers has been slow. Formation of the group went well. The formation of a strategic plan has been slow. The ICM group did become involved with issues as they arose, but had no policy at that stage. This is being addressed now.

Too early to tell.
People from significant backgrounds starting to talk and share ideas. This has proven to be a slow process.

Works on the mining sites in the upper catchment.

The only achievement I see is the controlling of the mining operations in the Herberton area. This has caused major siltation in the Herbert River. This siltation has caused very dirty water for the residents of the Hinchinbrook Shire. I feel there are too many meetings, too much talking - more positive decision making required.

Formulation of a management strategy. Formulation of Upper Catchment subcommittee.

Coordination of the mapping of total catchment and drawing up of catchment management plan.

Bringing together different group problems and trying to solve them.

The comments above focus on the HRCCC as a process. Progress has been tentative and hesitant, and members indicate a moderate level of satisfaction with progress to date (Table 4.1). This is not surprising given the absence of many tangible achievements at the time the survey was undertaken. The preceding comments also suggest that the process has been more difficult and slower than members anticipated. There is no single correct approach to doing ICM. When the transition is made from HRCCC as a process to HRCCC as a product, higher levels of satisfaction could be anticipated. The need for ICM is reflected by the perception that resource management issues have increased in importance over the last 12 months (Table 4.2).

The HRCCC offers both a need and opportunity to demonstrate one possible integrated approach to water and related resource management. This survey represents a benchmark against which the development of the HRCCC program can be measured.

Table 4.1: How satisfied are you with progress in the CCC.

	1	2	3	4	5
HRCCC	1	1	3	5	1

0 = no response, 1 = very unsatisfied, 2 = unsatisfied, 3 = neither satisfied nor unsatisfied, 4 = satisfied, 5 = very satisfied

Table 4.2: In the last 12 months, the importance of resource management issues has:

Catchment	Increased	Stayed the Same	Decreased	No response
Herbert	8	2	1	

General Issues in the Herbert River Catchment

The most important local issues were perceived to be (Table 4.3) too much government regulation, land valuation, unemployment, water quantity issues, nature conservation, agricultural land degradation, crime

There is reasonable parity among all issues - no single issue is perceived to dominate the region. Instead, there are multiple, yet interdependent issues. For instance, too much government regulation and land valuation can be considered as 'institutional or governance issues' which are likely long-term and chronic problems

However, it is unclear whether government is part of the problem rather than a symptom of other problems. If the HRCCC's forthcoming strategy is to effectively address this institutional issue, it must conduct socioeconomic and policy related studies to complement the biophysical inventories and analyses which tend to dominate resource planning activities. By understanding present management practices, the HRCCC can consider how government regulation can be reduced while maintaining or enhancing outcomes.

Table 4.3: In your opinion, what is the significance of the following issues in your catchment?

HERBERT	0	1	2	3	4	5	6
Social issues							
Schools			3	2	4	2	
Crime			1	2	5	2	1
Unemployment				2	7	1	1
Health care			1	4	4	1	1
Economic issues							
Land valuation				1	5	5	
High government spending	1	2	1	2	2	1	2
High taxes			1	3	3	4	
Institutional issues							
Too much government regulation				2	2	7	
Natural resource management issues							
Agric. land degradation. problems			1	5	1	4	
Water quality problems			3	3	1	4	
Water quantity problems			1	4	2	4	
Nature conservation			1	3	4	3	

0 = no response, 1 = very low, 2 = low, 3 = moderate, 4 = high, 5 = very high, 6 = NA/don't know

4.3 Resource Management Issues in the Herbert River Catchment

The most important resource management issues in the catchment were perceived to be (Table 4.4) - rural drainage, allocation of sugar caneland, stream bed and bank erosion, urban flooding, land clearing

Table 4.4: In your opinion, what is the significance of the following issues in your catchment:

Affects the catchment	0	1	2	3	4	5	6
Agricultural and degradation problems							
Crop land degradation		2	3	3	2	1	
Grazing land degradation		1	1	4	3		2
Soil salinity		3	2	1	2		3
Weeds				4	7		
Insects and disease on crops			3	2	4	2	
Urban expansion onto farm lands		4		2	3	1	1
Allocation of caneland			2		5	4	
Land clearing			1	3	3	3	1
Water quality problems							
Surface water salinity		2	3		3	1	2
Wastewater management		4	1	2	3	1	
Surface water nutrient enrichment		2	3	1	3		2
Pesticides in waterways		3		5	1		2
Groundwater quality		1	1	4	3	1	1
Acid soils		2	3	4	1		1
Stream bed and bank erosion			1	1	7	2	
Water quantity problems							
Surface water availability		2	1	3	2	2	1
Groundwater availability		2		2	5	1	1
Rural flooding and water....		1	1	2	6	1	
Rural drainage				1	7	3	
Urban flooding		1			8	2	
Nature conservation							
State forests and National Parks		2		6	1	1	1
Instream and outstream water use conflicts		2	1	4		2	2
Dryland veg. habitat loss		2	3	3	3		
Freshwater habitat. loss....		2	2	2	3	1	1
Coastal wetland habitat. loss		2	2	1	4	1	1
Barriers to fish migration		2		3	4		2
Other/s							
Lack of water storage infrastructure				1			

0 = no response, 1 = very low, 2 = low, 3 = moderate, 4 = high, 5 = very high, 6 = NA/don't know

Rural drainage was perceived to be the most significant natural resource issue, and supports the view that water quantity problems were the most important general resource issue confronting people in the catchment. It was closely followed by the remaining issues. Rural drainage, flooding and erosion represent longstanding issues in the lower Herbert River catchment. Caneland allocation and land clearing reflect more recent concerns. Other emerging issues which were mentioned frequently during interviews with local and state government officials include acid sulphate soils. This item received a very modest ranking from members. Upstream water issues such as water availability were viewed as low to moderate in significance.

The previously mentioned socioeconomic and policy studies should likely focus on rural drainage and caneland allocation. When completed, the HRCCC can determine the role it and other relevant interests should play in improving current practice.

Impacts of Resource Management Problems

The four most important impacts of these resource management problems on the people of the catchment were perceived to be (Table 4.5) loss of confidence in government to manage resources effectively, drinking water quality, higher production costs, higher taxes

These issues and impacts focus on government s role in resource management. The concern suggests that among other concerns, the HRCCC should consider how effectively its forthcoming strategy and activities will enhance present government performance

Table 4.5: What is the significance of the impact of these natural resource issues on people in the catchment, the following rankings were presented:

HERBERT							
Catchment	0	1	2	3	4	5	6
Aesthetic and Recreational Impacts							
Access to recreation		1	2	1	3	3	1
Environmental amenities		1	1	2	4	3	
Loss of scenic values		1	6	2	1	1	
Environmental and Life Support Impacts							
Drinking water quality				3	4	4	
Human health		1	2	3	2	2	1
Fishery decline		1	1	3	5	1	
Functional Resource Impacts							
High cost of water		1	1	4	2	2	1
Loss of farm productivity		1	1	3	4	2	
Higher production costs			1	2	5	3	
Shortage of irrigation water		2	3		5	1	
Higher taxes			1	3	5	2	
Social-Psychological Impacts							
Loss of independence to make (farm) decisions		1	3	3	3	1	
Emotional stress on individuals			1	4	2	3	1
Conflicts with other resource users			2	6	2	1	
Loss of confidence in government's ability to manage natural resources			2	1	3	5	

0 = no response, 1 = very low, 2 = low, 3 = moderate, 4 = high, 5 = very high, 6 = NA/don't know.

Support from Constituent Groups

Since ICM is to foster coordination between landholders, community action groups and government agencies in their land and water resource management activities, a series a questions concerned the perceived level of support and how this support was earned (Tables 4.6-4.18).

HRCCC members perceived a strong level of support from the Queensland Department of Primary Industries, the Sugar Infrastructure Improvement Package (SIIP) program, and rural producers. Relatively less support was provided by Local Government, State Government Politicians, and the Department of Lands (now part of new Department of Natural Resources)The public was perceived to have: (i) a low to moderate level of awareness about natural resource issues and associated impacts, (ii) low to moderate level of support to solve natural resource issues; and (iii) supported the local CCC program at a very low to moderate level.

These trends have implications for the extent and nature of partnerships which the HRCCC has developed. Implementation of ICM is to foster whole-of-government approach to water and land management. Given that many important agencies are participating ineffectively in the HRCCC process, this goal may be difficult to achieve. The perceived level of public support suggests that promoting community understanding of integrated resource management could also impair effective implementation of ICM. However, the HRCCC is aware of these potential shortcomings and can be addressed during the catchment strategy information process.

4.4 Institutional Structure for ICM

Effective implementation of ICM in the Herbert River Catchment is perceived to be hindered primarily by (Tables 4.19-23), poor understanding of problems (Table 4.19), lack of clear and immediate economic benefits (Table 4.19), high cost of solutions (Table 4.19), long time frame to see benefits (Table 4.19), lack of trust in government-sponsored programs (Table 4.20), public s lack of interest in community-based activities (Table 4.20), lack of financial resources within the community (Table 4.20), large size of the Herbert River Catchment (Table 4.20), ICM lacks clear goals and objectives. (Table 4.21), lack of consensus by HRCCC on objectives (Table 4.21).

While members believed that technical solutions could solve many resource problems in the catchment, many factors detract from their feasibility (Table 4.19)In the absence of adequate funding arrangements among senior and local governments, private interests, NGOs and property owners, the adequacy of any technical solution must be questioned. The poor understanding of resource problems seems to contradict the confidence placed in technical solutions, and reflects the reality of uncertainty often associated with all approaches to resource management

If technical solutions are beyond the financial capacity of the catchment community, behavioural solutions might be sought. However, members questioned the public's willingness to adopt community-based initiatives (like ICM) and it lacked confidence in government-sponsored initiatives. The HRCCC should consider how effectively its public information program and forthcoming strategy address these catchment-based shortcomings. Behavioural change by all resource managers is likely required to effectively solve the catchment's priority problems. Part of this change can be fostered through a visible commitment by state and local leaders to ICM.

Factors Assisting the Effective Implementation of ICM

Effective implementation of ICM in the Herbert River catchment is perceived to be aided primarily by (Tables 4.19-4.23) the role of the Chairman, Coordinator, and members (Tables 4.9 and 4.14), the representativeness of the membership of the wider catchment community (Table 4.22), and the view that technical solutions can solve resource management problems in the catchment (Table 4.19).

Clearly, members generally value the contribution which they make, and in particular the efforts made by the Chair and Coordinator. This belief is very appropriate given the voluntary nature of ICM. However, given the significance of these people, it is unclear how the state has supported the professional development of any of these individuals. While the State Government has allowed catchment committees to utilise their own means to produce the catchment strategy, it has not demonstrated clear leadership in facilitating an effective exchange of information among groups and provided for skill development. These items deserve effective action in the immediate future.

While HRCCC members believe they effectively represent the catchment community, one member was concerned that it was speaking "too much behind closed doors and not informing the public." This raises issues concerning how HRCCC members provide feedback to their constituent groups. However, the relationship between representative and constituent group is tenuous because, according to one member, "too many of the members of the CCC, have affiliations to too many other organisations. Some have 6 to 8 organisation involvements."

4.5 Summary and Implications

Integrated Catchment Management is a resource policy initiative for redressing the fragmented responses of the past and solve some of the complex problems of the present. While it is still too early to determine the efficacy of the approach, there appears to be considerable merit. The HRCCC has sustained its multi-stakeholder membership for over two years and the forthcoming release of the catchment strategy provide many challenges.

The importance of local leadership, particularly from the Chair, coordinator and members are perceived as extremely important in establishing credibility among other private and public resource managers. However, there are few opportunities for these individuals to obtain the skills, and systematically exchange experiences with other CCCs.

Some obstacles to effective implementation are perceived to be outside the influence of the catchment. These include the lack of clear and immediate benefits, and the high cost of solutions. Issues which the HRCCC can influence concern the perceptions that: (i) there is a lack of trust in government initiatives; (ii) there is a lack of interest in community activities; and (iii) there is a lack of clear goals regarding ICM objectives. Changing general public and specific resource manager attitudes and behaviours is a considerable challenge, but one which must be met if effective implementation is to be realised. The consultations which will occur after the release of the HRCCC strategy will be critical in determining the ultimate success and failure of the program

If and when that strategy is adopted, it will be years before the benefits of any HRCCC initiatives are realised. Consequently, the ultimate performance should be monitored over a long time frame. That performance will ultimately be measured through the reduction in resource conflicts and the improved well being of residents within the catchment.

Table 4.6: What is the level of public awareness about these natural resource issues and associated impacts?

Catchment	No response	Very low	Low	Low to Mod.	Moderate	Mod. to High	High	Very High
Herbert River			5	1	4			1

Table 4.7: What do you consider to be the strength of public support to solve these natural resource issues in your catchment?

Catchment	No response	Very low	Low	Moderate	High	Very High
Herbert River			6	4		

Table 4.8: What level of public support do you believe your CCC has?

Catchment	Very low	Low	Low to Mod	Moderate	High	Very high
Herbert	2	2		6	1	

Table 4.9: How significant have the following items been in gaining acceptance from the public?

HERBERT	0	1	2	3	4	5	6
The State Government's ICM policy statement		2	2	6			1
Local government political support			4	4	3		
Local government agencies support			3	5	3		
State government political support			3	7	1		
State government agencies support			1	4	6		
Good financial resources of CCC			5	2	3		1
Efforts of the CCC Chair		1	2	4	4		
Efforts of the CCC Coordinator				4	6	1	
Positive outcomes associated with CCC activities			3	4	4		
Support from relevant industry and community groups	1		2	5	3		

(0 = no response, 1 = very low, 2 = low, 3 = moderate, 4 = high, 5 = very high, 6 = NA/don't know)

Table 4.10: How effectively have the efforts of your CCC group been accepted by other government agencies within the Herbert?

Catchment	Very ineffectively	Ineffectively	Neither	Effectively	Effectively to very effectively	Very Effectively
Herbert			2	8		1

Table 4.11: How significant have the following items been in gaining acceptance from other agencies?

HERBERT	0	1	2	3	4	5	6
The State Government's ICM policy statement			4	2	4		
Local government political support			4	3	4		
Local government agencies support			3	2	5		1
State government political support			1	9	1		
State government agencies support				5	6		
Good financial resources of CCC			5	4	2		
Efforts of the CCC Chair			4	4	3		
Efforts of the CCC Coordinator				3	8		
Positive outcomes associated with CCC activities			2	4	4		
Support from relevant industry and community groups				7	4		

(0 = no response, 1 = very low, 2 = low, 3 = moderate, 4 = high, 5 = very high, 6 = NA/don't know)

Table 4.12: How effectively have the efforts of your CCC been accepted by relevant local industry and community organisations?

Catchment	Very ineffectively	Ineffectively	Neither	Effectively	Effectively to very effectively	Very Effectively
Herbert		1	2	8		

Table 4.13: How significant have the following items been in gaining acceptance from relevant industry and community organisations?

HERBERT	0	1	2	3	4	5	6
The State Government's ICM policy statement			4	2	4		1
Local government political support			3	5	3		
Local government agencies support			2	5	3	1	
State government political support			4	5	2		
State government agencies support				5	6		
Good financial resources of CCC			3	5	2		1
Efforts of the CCC Chair			2	3	6		
Efforts of the CCC Coordinator				3	5	3	
Positive outcomes associated with CCC activities			2	2	7		
Support from relevant industry and community groups		1	1	3	5	1	

(0 = no response, 1 = very low, 2 = low, 3 = moderate, 4 = high, 5 = very high, 6 = NA/don't know)

Table 4.14: How effective has the involvement of the following groups been to the CCC?

HERBERT	0	1	2	3	4	5	6
Rural producers			1	1	7	2	
Local government politicians			3	1	6	1	
Local government administrators			3	2	5	1	
State government politicians			4	5	1	1	
State government agencies:							
DPI				1	5	5	
DEH			2	2	5	1	
Housing, Local Government. & Planning			3	4	2		2
Dept of Lands			2	4	5		
Valley Trusts (or similar)	1		2	1	6		1
Drainage Board/s			1	2	7	1	
Sugar Industry Infrastructure Package Program			1	2	4	4	

0 = no response, 1 = very ineffective, 2 = ineffective, 3 = neither, 4 = effective, 5 = very effective, 6 = NA/don't know)

Table 4.15: How clear to you is the role(s) of the following groups in the local ICM process?

HERBERT	0	1	2	3	4	5	6
QDPI			1	1	7	2	
QDE			3		8		
Qld Dept. Lands		1	3	1	6		
Dept Housing, Local Government. & Planning		1	3	1	5		1
Wet Tropics Management Agency			2	4	4		
Great Barrier Reef Marine Park Auth.			2	1	7	1	
River Improvement Trust			2	2	5	2	
Drainage boards			2	2	5	2	
Cane Assignment Committees		2	1	1	5	2	
Local Government			2	1	6	2	
National Landcare Program				3	5	2	1
Industry Groups (total)	2		1		5	3	
Sugar						2	
CSR					3		
Canegrowers			1				
CU					1		
Other community groups (total)	9		1		1		
Development. Bureau					1		
Environmental groups (total)	5		1		2	2	1
WPS					1	1	
Other/s (Nil listed)							

0 = no response, 1 = very unclear, 2 = unclear, 3 = neither, 4 = clear, 5 = very clear, 6 = NA/don't know

Table 4.16: Over the last 12 months, the level of financial and in kind support from QDPI has:

Catchment	No response	Decreased	Decreased - Remained the Same	Remained the Same	Increased
Herbert	2			2	3
					4

Changes that have occurred:

Herbert

- Don't know if there has been any changes
- More DPI personnel available for advice; some increased special purpose funding; support for a student to work in the catchment.

Table 4.17: Over the last 12 months, the level of financial and in kind support from other state and local agencies, and other external funding organisations (eg. National Landcare Program) has:

Catchment	No response	Decreased	Remained the Same	Increased
Herbert	2		6	3

Changes that have occurred:

Herbert

- As above - I am not aware of the detailed breakdown of contributions.
- Approval of funding for a Landcare project.

Table 4.18: How effectively do you believe the news media presents your CCC's position on an issue?

Catchment	Very ineffectively	Ineffectively	Neither	Effectively	Very Effectively
Herbert	2	2	2	4	1

What could or should be done at state/local levels to improve the acceptance and involvement of relevant groups in the Herbert River CCC process?

Herbert River
More public news items. School promotions. Industry promotions at grower level.

More available funds, so that the community as a whole can see some useful work being completed instead of hearing of numerous studies being done with no effective follow-up work being obvious.

Continue to support with financial and technical back up

I think the CCC has to prove its credibility.

Greater public consultation and "listening" to public opinion

Increase public awareness of issues eg. organised articles in paper exploring issues to raise awareness. Can be difficult to manage when local "experts" get wound up.

Recognise the role of the CCC through legislation (The Chair believes the CCC is simply an advisory group).

The first thing that should be done is change the structure of the present CCC committee. There are members in it who do not have the confidence of the community at large. Their trust is gone and new faces and new ideas must be implemented. Many of the members have their fixed views which are not acceptable to the community. The next question has some clues.

Greater involvement of local council - information swapping and cooperation prior to action by council. Use of CCC as database and advisory agency - high level of local knowledge on varied topics in group.

Much more media publicity on CCC objectives and achievements. More funding for specific projects.

Increase the public's awareness of CCC.

Table 4.19: Tractability of the Issues: The implementation of ICM in your catchment is difficult because:

HERBERT	0	1	2	3	4	5	6
11a Resource management problems are not well understood			1		8	2	
11b Technical solutions are not feasible			7		1	1	2
11c The impacts of mismanagement are long term and incremental			1	1	7	2	
11d There is no single acute resource management issue within the catchment			5		5	1	
11e The high level of behavioural change required			1		6	4	
11f The long time frame between implementing a solution and seeing the benefits			2		5	4	
11g The high cost of known solutions			2		7	2	
11h The high level of change required from existing government agencies			1	1	6	3	
11i The absence of clear and immediate economic benefits					8	3	

Table 4.20: Institutional Arrangements and Finance. The implementation of ICM in your catchment is difficult because:

HERBERT	Strongly disagree (1)	Disagree (2)	Neither (3)	Agree (4)	Strongly Agree (5)	NA/don't know (6)
22a Large size of catchment (or poor transportation links between parts of catchment)			1	10		
22b Wide variety of values and beliefs among CCC members		3		5	3	
22c Media don't report resource issues accurately		4	1	4	2	
22d Some important constituency groups are not represented on the ICM committee		9	1		1	
22e Perception that ICM has been forced on the catchment by the state government	1	5	2	1	1	1
22f Lack of an effective level of interest by CCC members	1	4	3	2	1	
22g Public's lack of trust in state/local government-sponsored initiatives		2	1	5	3	
22h Public's lack of interest in community type activities		2	1	5	3	
22i The lack of financial resources within the community		2	1	5	3	

Other/s:

- Lacks specificity and "teeth" to solve public issues - Rating 4 (Agree)
- Ecology vs. development and expansion; downstream effects ignored by upstream development - Rating 5 (Strongly agree)

Table 4.21: HRCCC Process: Rate your level of agreement with the following statements concerning the operations of the CCC

HERBERT	1	2	3	4	5	6
23a The objectives of the local ICM are very clear to all members	1	5		4	1	
23b There is a strong consensus among CCC members concerning what the CCC should do	1	6		3	1	
23c The CCC should coordinate state and local government resource management programs			2	8	1	
23d The CCC should prioritise resource management problems in the catchment		1		7	3	
23e The CCC should provide a forum for conflict resolution among resource users		1	2	6	2	
23f The local ICM process has or will resolve resource conflicts in an open manner	1	1	4	4	1	
23g The CCC should educate the public about the catchment's resource management problems and solutions			1	6	4	
23h The CCC should provide a forum for information sharing within and between public and private resource managers			1	3	7	
23I The CCC should prepare a strategic resource management plan				5	6	
23j The CCC should facilitate the implementation of resource management initiatives noted in the strategic plan				7	4	
23k The CCC should identify a common set of policies which will be implemented by relevant resource managers within the catchment				7	4	
23l The CCC should make private resource managers/owners more responsible for the impacts arising from their activities		2	1	5	3	
23m The CCC should stimulate community or regional development		3	2	4	2	
23n The CCC should be providing individuals with technical advice on solutions to natural resource issues	1	1	1	4	4	
23o The activities of our CCC have been effectively coordinated with the activities of other state and local government agencies		3	1	6	1	
23p The membership of the CCC effectively represents the interests of the catchment community		1	1	8	1	
23q At CCC meetings, all CCC members participate actively		2	2	7		
23r The local ICM process has or will resolve resource conflicts effectively		3	5	3		
23s The local ICM process has or will resolve resource conflicts efficiently	1	2	5	3		
23t The ICM process is very responsive to local needs		1	2	8		
23u The CCC is solving the priority natural resource management problems in the catchment	1	1	2	6		1

1 = strongly disagree, 2 = disagree, 3 = neither, 4 = agree, 5 = strongly agree, 6 = NA/don't know

Personal Motivations

Table 4.22: Average hours per month devoted to ICM:

Catchment	Position	Hours/mth
Herbert	Chair	15
Herbert	Member	15
Herbert	Member	10
Herbert	Member	6
Herbert	Member	6
Herbert	Member	6
Herbert	Member	6
Herbert	Member	5
Herbert	Member	4
Herbert	Member	4
Herbert	Member	3

Table 4.23: Identify your level of agreement with the following statements:

HERBERT	Strongly disagree (1)	Disagree (2)	Neither (3)	Agree (4)	Strongly Agree (5)
28a The amount of time I devote to ICM significantly interferes with my own business/job requirements	1	4	2	4	
28b The amount of time I devote to ICM significantly interferes with my family commitments	1	6	1	3	
28c My involvement with the CCC causes significant out-of-pocket expenses	1	4	5	1	
28d I find being a member of the CCC personally rewarding because I can contribute to the community			3	7	1
28e I find being a member of the CCC personally rewarding because I care about natural resource management				8	3
28f I find being a member of the CCC personally rewarding because I can meet other members of the community who can influence resource management decision making				9	2
28g I find being a member of the CCC frustrating	1	3	2	3	2
28h I see my role in the CCC as a short-term commitment	1	6	1	3	
28i A CCC's member's role is to provide their personal views on resource management issues at CCC meetings		3	2	6	
28j A CCC member's role is to represent the resource management views of their constituency group at CCC meetings					8
28k A CCC member's role is to provide a catchment-wide perspective of natural resource management issues at CCC meetings.				3	6

Question 29 Further comments

A possible problem associated with ICM in the Herbert River District is that it is virtually a single industry catchment - this gives the sugar and allied industries a fair bit of punch. My personal opinion (possibly cynical) is that certain issues - expansion, drainage, wet land reclamation, river improvement???, use of pesticides and herbicides - may not be consistent with the ideal of ecologically sustainable development. To varying degrees, these practices can be detrimental to natural flora and fauna, also downstream users of the catchment and adjacent lands and waters.

If ICM is to succeed, I repeat that a new concept of information and advice must be found. The present views of "so called elected people" eg. Hinchinbrook Council, Canegrowers representatives, CSR and a few other organisations, must be got rid of. Unbiased people who will adopt common sense and reasoning and have a knowledge of all existing problems must be considered quickly. The above-named organisations do not know the trust of the community

and I fear that if the present scenario continues, ICM will fail. People want action not to be asked to go to meetings continually. There have been millions of dollars already wasted. Let's be constructive and not destructive

Comments on pages 2 and 3: We are being strangled by Bureaucrats who don't know the "grass roots" of problems. Over budgeting and serious lack of communication with the public.

The issues of Riparian Vegetation on existing cane land is a major issue with the potential of causing anxiety if not managed carefully. The issue of river management that is sand bars, instream vegetation and levies that can be rationalised has to be resolved. The level of meeting attendance is a problem and does effect continuity of the decision making process. The lack of a street frontage office I think effects our ICM public accessibility. There would be extra costs with it but it should be looked at.

Changes that have occurred:
Pomona subdivision - CCC responded with inspections and some publicity. No further action taken and in hindsight a lost opportunity. Erosion control works in Herbert River at Long Pocket region and was successful in funding. Cattle Creek drainage - to be dealt with in 1996. Trebonne Creek drainage - to be dealt with in 1996.

Mahogany glider conservation plan - response in progress

Main issue is Mahogany Glider habitat conservation is all out clearing for cane expansion. CCC sat on fence and failed to comment (deliberately) on gross environmental vandalism in clearing creek beds and banks on Pomona Station. Even the council is now complaining about failure to observe 10m buffer on creek but still ICM holds the "must be polite" line.

The CCC has made very broad comments condemning expansion in Pomona, the group could have been more forceful in their statements but have taken a "political approach."

It is my opinion that the CCC is speaking too much behind closed doors and not informing the public for support etc. Too many of the members of the CCC, have affiliations to too many other organisations. Some have 6 to 8 organisation involvements. The CCC chairman is a Shire Councillor and deputy chairman of the Hinchinbrook Shire, Chairman of Works, member of the Herbert River Improvement Trust, a member of the Rural Drainage Proposed Board and he is involved in several other committees. He and several others in the CCC should not be on the CCC Board. These people should be replaced because they cannot make a decision that is good for all the organisations they represent. Fingers in too many pies. I enclose a copy of the Herbert River Express dated December 5th which outlines my views on why I oppose the decision making capacity of the Trust member, Cr. Barnes. I and the organisation I represent have been asking for this work to be done for more than 15 years. When it could be done cheaply, now we see a very high cost involved. Too much talking and very little factual work has been performed.

Extensive land clearing due to caneland expansion. Mahogany Gliders Issue has possibly made some people more environmentally aware. Also created friction between landowners and government agencies.

An increasing awareness of the need for water storage for agriculture in the upper catchment. ICM will be coordinating and monitoring any moves in this direction.

Buffer zones on land clearing.

A loss of confidence on government's ability to manage resources was the most significant impact. A decline in drinking water quality, higher production costs, higher taxes, and emotional stress on individuals were also highly ranked.

PART 5 SUMMARY AND CONCLUSIONS

These conclusions are couched in terms of the evaluation model presented in S1.2.

5.1 Problem Definition

It is crucial to the evaluation of the ICM process to identify what is *the problem* and how it affects the policy implementation process. For this purpose, it is convenient to disaggregate resource management into technical and socio-economic dimensions (without losing sight of their close interdependencies). From a *technical* point of view resource management is finding effective mechanisms to address specific well defined biophysical problems such as soil erosion, flooding, nutrient enrichment, unreliable water supplies, loss of biodiversity. The solutions are defined in terms of land management practices, engineering structures, input usage and similar hard technological matters. From a *socio-economic* point of view, resources management is a matter of designing and implementing socially acceptable and effective solutions and preventative actions to these same problems through awareness raising and education, economic, administrative and legal measures

The survey revealed that there are clear enough technical solutions to many of the natural resources management problems in Queensland. These have been canvassed and promoted in some cases for decades and longer - eg floodplain management, soil erosion control, groundwater depletion and acidification. In the Herbert for example there have been three flood studies and three drainage studies over the past twenty years. The proposed technical solutions have been similar in each case, but the resources management problem still exists because of lack of implementation.

Other emergent problems, such as biodiversity conservation and nutrient enrichment of waterways are not so well defined in technical terms, and ICM groups where these are key issues have greater difficulty focusing their priorities and activities. They need research support to gain a greater understanding of the processes involved and to demonstrate the necessity and effectiveness of technological solutions.

In a very large State like Queensland, there is a wide diversity of issues. While it may be possible to "regionalise" resources management to gain some efficiencies, this diversity limits the degree of diffusion of technical solutions that can occur from catchment to catchment. This makes ICM much more difficult to implement than other more pervasive public policies such as health care, education and engineering construction standards for example.

All the respondents acknowledged the difficulty of promoting a program with relatively few immediate benefits but often with immediate cost imposition on land holders. This problem is intrinsic to ICM, and can only be alleviated by a change in ethics in the community as a whole. It would be assisted by technical and economic data that demonstrated the severity of the problems and reality of the long term benefits. Those catchments with more apparent and visible resource issues (such as water shortages or acute soil erosion) will have a better chance of focussing community attention.

The integrated approach emphasises that there is not a single issue but a multitude of interdependent issues that must be addressed. It is difficult for society to solve single environmental issues - extremely difficult to establish means to address interdependent issues.

The Queensland ICM program is part of the struggle to move from sectoral approaches to resources management to an integrated whole of landscape approach. The survey revealed that the biggest obstacle to ICM is the *process* within the community and within government to redress and prevent resource management problems - social processes to apply technological solutions. There is no well tested solution to this problem as a guide to action. Not surprisingly, this change of philosophy is accompanied by uncertainty and resistance especially when the way forward is not signposted.

The traditions of the past within government and the relationships between different groups in the community must change. Attitudes of land owners and managers, conservationists and government officials in sectoral agencies with a long record of sectoral thinking must also change. This is the major problem facing integrated resources management and ICM in particular.

The move towards an integrated approach to natural resources management has come at a time when community expectations about environment and resources issues have increased. In some cases these changes have been rapid and the shift in resource management and economic goals magnifies the extent of attitude and behaviour change required. For example, twenty years ago, farmers were encouraged to develop natural resources such as irrigation, tree clearing for grazing, clearing and drainage for agriculture. Recently, they have been asked to revise their practices substantially.

These changing requirements for resource management have to a considerable extent been isolated from the economic development decision making process although their are promising signs that the merger of resource and environmental issues with economic development issues is beginning to occur in rural areas of the State. For example decisions on water resources development, agricultural expansion, water control, use rights and land tenure, resources extraction are becoming the concern of ICM groups. In order to do this successfully, further and more pervasive behaviour change will be required by the major players in natural resources management. At present the ICM program is largely limited in scope to a relationship between farmers and the Department of Natural resources (formerly Primary Industries). Sustainable development requires a whole of government and a whole of community approach to decision about resources and economic issues.

5.2 Context for ICM

The Queensland ICM program has been active only since 1990. Consequently a major constraint to this evaluation is the relatively short period of time that CCCs have been in existence and the opportunities they have to bring about change. A progression of activities was recognised from organisational activities - public awareness and involvement - issues generation - catchment planning - technical studies - implementation. Judging from the diversity of responses, it requires approximately five years before a CCC will reach maturity along this spectrum. A considerable amount of time is taken establishing the CCC, creating some coherence amongst its members, learning the challenges and opportunities and having the platform for planning and implementation.

Perhaps for the reason that ICM requires a complex process of social learning there was a disturbing low level of satisfaction amongst the respondents at the state level (especially the Coordinators).

CCCs have to contend with low awareness in the general public about resources management issues and a general resistance to external intervention. A surprising, consistent and very significant result from the survey was respondents universal view that there is too much government regulation. People in rural Australia resent government controls on land use

whether they arise from World Heritage listing and conservation generally, tree clearing regulations, water and land management regulations, changes to land tenure and land rights laws. There is a clear message here that landholders in particular will resist any solution to ICM problems that involve state and Australian government regulations.

Respondents accepts the significance of NRM issues which were rated equally with major economic issues such as unemployment or social issues such as crime or health care in terms of importance.

DNR is the lead agency for ICM which was perceived to be a successful partnership between DNR and the rural land owner interests and not much more than that. There was a widely held view that local governments, both politically and at officer level have not been involved effectively in the ICM process.

Despite the need for ICM to integrate across government agencies there is a clear absence of a "whole of government" approach , commitment or involvement in ICM. State politicians seemed to ignore ICM and there was ineffective, even counter productive involvement of some state agencies. While there was no reported hostility from politicians, agency staff and community groups, it seems that CCCs must create these supporting links themselves with little support from outside. A program with such ambitious goals for integration must cope with the lack of interest and commitment from some essential stakeholders.

On a positive note there was wide agreement about the supportive role of the media and of the essential role that the CCCs, its Chairs and Coordinators play in gaining support from the stakeholders. Clearly, the ability of these people is critical to the success of individual ICM programs. The study could not assess these abilities and what skills are essential, personal or technical.

5.3 Institutional Structure

Queenslands ICM program has very broad, and from a community point of view somewhat nebulous goals. This might create scope for specification at the local level but it also provides relatively little guidance to newly formed CCCs. There is general agreement on the ultimate purpose of ICM, but also a wide spread of opinions as to the purpose and operation of CCC among the various individuals and catchments in the State. Perhaps this is not a deficiency of the program given that it is intended to be community based. It is also based on social-learning and the extent to which the goals were prescriptive from the top down, the program would limit local ownership.

Financial resources for a program with such ambitious goals has been erratic and low (about the same as the operating costs for the parliamentary refectory). A key source of funds has been the NLP, without which ICM would struggle to survive. CCCs are required to find funding on their own initiative rather than use established revenue sources as do most public programs. They have no revenue raising capacities. There is a lack of confidence in government funding for implementation which is of particular concern given that once CCCs have been established and created strategies, their requirement for funds for on-ground works will increase their financial requirements. Planning is inexpensive relative to action.

As discussed above, CCCs have not had effective involvement from local governments nor from key agencies with statutory resources management responsibilities. As coordinating focus for mainstream decisions affecting resources, ICM have not yet been successful. Examples of important resources management decisions which could have focussed on, or at least specifically include ICM include:

- approval of mining projects

- tree clearing guidelines
- Water Policy under the state Environmental Protection Act
- regional planning under the Local Government Planning and Environment Act
- wildlife conservation programs

None of the relevant statutes or policies incorporates ICM at this time.

CCCs are served by a cadre of competent and enthusiastic coordinators. There is no career path from them and apart from the State Coordinators Conference, no tailored professional development activities. Their network is however strong.

APPENDIX 1

QUEENSLAND ICM COORDINATOR'S SURVEY

Background

1. Which catchment do you represent?

2. How long have you lived in this catchment? _____ years

3. What year did you assume your present responsibilities?

4. When you assumed your present position, what did you expect the CCC to accomplish by this time?

5. Since assuming your current responsibilities, how well has the CCC met your expectations: (please tick):

_____ very well
_____ well
_____ moderately well
_____ not well
_____ not very well

Context of ICM with other issues

6. In your opinion, what is the significance of the following issues in your catchment? Rate using the following scale:

1 = very high
2 = high
3 = moderate
4 = low
5 = very low
6 = not applicable

_____ Provision of schools
_____ High crime rate
_____ High unemployment
_____ Public health care
_____ Ineffective land valuation for municipal tax purposes
_____ High level of spending by government
_____ High taxes
_____ Government inefficiency
_____ Too much government regulation
_____ Agricultural land problems (*e.g.* soil salinity, urban development)
_____ Water quality problems (*e.g.* nutrient enrichment, dirty drinking water)
_____ Water quantity problems (*e.g.* flooding, poor drainage)
_____ Degradation of natural environment (*e.g.* habitat loss)

7. In your opinion, what is the significance of the following natural resource management problems in your catchment? Rate using the following scale:

1 = very high
2 = high
3 = moderate
4 = low
5 = very low
6 = not applicable

_____ Erosion of crop land
_____ Productivity decline of crop land
_____ Erosion of grazing land
_____ Productivity decline of grazing land
_____ Soil salinity

_____ Weed problems
_____ Insects and disease on crops
_____ Urban expansion into agricultural lands
_____ Land clearing
_____ Surface water salinity
_____ Surface water nutrient enrichment (algae)
_____ Pesticides in waterways
_____ Degradation of freshwater/aquatic natural life
_____ Groundwater quality
_____ Acid soils
_____ Surface water availability
_____ Wastewater management
_____ Allocation of cane land
_____ Management of public land
_____ Groundwater availability
_____ Rural flooding
_____ Rural drainage
_____ Urban flooding
_____ Urban drainage
_____ Instream and offstream water use conflicts
_____ Stream bed and bank erosion
_____ Dryland vegetation habitat loss
_____ Freshwater habitat loss
_____ Coastal wetland habitat loss
_____ Barriers to fish migration
_____ Others (list)

8. In your opinion, what is the significance of the impacts associated with these natural resource problems on the people in the catchment? Rate using the following scale:

1 = very high
2 = high
3 = moderate
4 = low
5 = very low
6 = not applicable

_____ loss of scenic land values
_____ loss of other environmental amenities (e.g. wildlife habitat)
_____ higher cost of water supplies
_____ loss of on-farm productivity
_____ degraded drinking water quality
_____ personal health problems
_____ emotional stress for individuals
_____ significant conflicts with other resource users
_____ higher taxes
_____ decline in recreational and/or commercial fishery
_____ loss of access to other recreational activities
_____ loss of confidence in government's ability to manage resources effectively
_____ Other (specify)

9. Who do you believe is most responsible for solving these resource management problems? (Please tick)

_____ individuals (e.g. producers, landowners)
_____ local CCC
_____ Local Government
_____ Other local agencies/interests (e.g. Valley Trust, Drainage Board, CANEGROWERS, industry) (specify)
_____ State Government
_____ Commonwealth Government
_____ GBRMPA
_____ Others (specify)

10. In your opinion, what is the level of public awareness about these natural resource problems and associated impacts? Rate using the following scale:

1 = very high
2 = high
3 = moderate
4 = low
5 = very low
6 = not applicable

_____ Erosion of crop land
_____ Productivity decline of crop land
_____ Erosion of grazing land
_____ Productivity decline of grazing land
_____ Soil salinity
_____ Weed problems
_____ Insects and disease on crops
_____ Urban expansion into agricultural lands
_____ Land clearing
_____ Surface water salinity
_____ Surface water nutrient enrichment (algae)
_____ Pesticides in waterways
_____ Degradation of freshwater/aquatic natural life
_____ Groundwater quality
_____ Acid soils
_____ Surface water availability
_____ Wastewater management
_____ Allocation of cane land
_____ Management of public land
_____ Groundwater availability
_____ Rural flooding
_____ Rural drainage
_____ Urban flooding
_____ Urban drainage
_____ Instream and offstream water use conflicts
_____ Stream bed and bank erosion
_____ Dryland vegetation habitat loss
_____ Freshwater habitat loss
_____ Coastal wetland habitat loss
_____ Barriers to fish migration
_____ Others (list)

11. How strong is public support regarding the need for the ICM process to solve these natural resource problems in your catchment? (Please tick)

_____ very high
_____ high
_____ moderate
_____ low
_____ very low

12. Please rate your level of agreement with the following statements concerning how the nature of resource management problems in your catchment affects implementation of ICM according to the following scale:

1 = completely agree
2 = agree
3 = neither agree nor disagree
4 = disagree
5 = completely disagree

12a. _____ The lack of an appropriate technical solution to the natural resource management problems in this catchment seriously detracts from effective implementation.

12b. _____ Because resource management problems in the catchment are not well understood, effective implementation is very difficult.

12c. _____ The long-term and incremental nature of the impacts associated with resource management problems in the catchment seriously detracts from effective implementation.

12d. _____ The absence of a single acute resource management issue within the catchment significantly detracts from effective implementation.

12e. _____ The long time frame between implementing a solution and seeing the benefits seriously detracts from effective implementation.

12f. _____ The high level of behavioural change required by private landowners to effectively solve resource management problems seriously detracts from effective implementation.

12g. _____ The high level of behavioural change required by industry to effectively solve resource management problems seriously detracts from effective implementation.

12h. _____ The high level of administrative, legal and financial change required from existing government agencies to effectively solve resource management problems seriously detracts from effective implementation.

12i. _____ The absence of clear and immediate economic benefits seriously detracts from effective implementation

13. In the last 12 months, have resource management problems (circle one) increased/stayed the same/declined in importance within the catchment? If changes have occurred, please explain what has changed.

_____

Context for ICM

14. What level of public support do you believe your CCC has? (Please tick)

_____ very high level of support
_____ a high level of support
_____ moderate level of support
_____ low level of support
_____ very low level of support

15. How significant have the following items been in gaining acceptance from the public? Rate using the following scale:

1= very high
2= high
3= moderate
4= low
5= very low
6=not applicable

_____ ICM policy statement
_____ strong local government support (political level)
_____ strong state government support (political level)
_____ strong support from local government agencies (administrative level)
_____ strong support from state government agencies (administrative level)
_____ strong financial resources of CCC
_____ strong leadership of CCC Chair
_____ strong leadership of CCC coordinator
_____ positive outcomes associated with CCC activities
_____ strong support from relevant industry and community groups
_____ other (specify)

16. How effectively have the efforts of your CCC group been accepted by other government agencies within the catchment? (Please tick)

_____ very effectively
_____ effectively
_____ somewhat effectively
_____ ineffectively
_____ very ineffectively

17. How significant have the following items been in gaining acceptance from other government agencies? Rate using the following scale:

1 = very high
2 = high
3 = moderate
4 = low
5 = very low
6 = not applicable

_____ ICM policy statement
_____ strong local government support (political level)
_____ strong support from QDPI (political or administrative levels)
_____ strong public support
_____ strong financial resources of CCC
_____ strong leadership of CCC Chair
_____ strong leadership of CCC coordinator
_____ positive outcomes associated with CCC activities
_____ strong support from relevant industry and community groups
_____ other (specify)

18. How effectively have the efforts of your CCC been accepted by relevant local industry and community organisations? (please tick)

_____ very effectively
_____ effectively
_____ somewhat effectively
_____ ineffectively
_____ very ineffectively

19. How significant have the following items been in gaining acceptance from relevant industry and community organisations? Rate using the following scale:

1 = very high
2 = high
3 = moderate
4 = low
5 = very low
6 = not applicable

_____ ICM policy statement
_____ strong local government support (political level)
_____ strong support from QDPI (political or administrative levels)
_____ strong public support
_____ strong financial resources of CCC
_____ strong leadership of CCC Chair
_____ strong leadership of CCC coordinator
_____ positive outcomes associated with CCC activities
_____ other (specify)

20. What have been the main activities of your CCC in the last 12 months? Please list and rate their significance according to the following scale:

1 = very high
2 = high
3 = moderate
4 = low
5 = very low

RATING ACTIVITIES

_____
_____
_____
_____
_____
_____
_____
_____

21. How effective has the involvement of the following groups been to the CCC?

1 = very effective
2 = effective
3 = moderately effective
4 = ineffective
5 = very ineffective
6 = not applicable

_____ rural producers (specify)
_____ local government politicians
_____ local government administrators
_____ state government politicians
_____ state government agencies:
  _____ DPI
  _____ DEH
  _____ Housing, Local Government and Housing
  _____ Department of Lands
_____ Valley Trust
_____ Drainage Board(s)
_____ Sugar Industry Infrastructure Package Program
_____ rural industry organisations (specify)
_____ environmental organisations (specify)
_____ local urban community (specify)
_____ media

22. What news media do you regularly use to present your CCC's views of resource management issues? (Please tick)
_____ newspaper (specify)
_____ radio (specify)
_____ TV (specify)

23. How effectively do these media report your position on an issue?
_____ very effectively
_____ effectively
_____ somewhat effectively
_____ effectively
_____ very effectively

24. Over the last 12 months, has the level of acceptance of your ICM program among the public, government agencies, and relevant industry and environmental groups (circle one) increased/ stayed the same/ decreased? If changes have occurred, explain why.

25. Please identify your level of agreement with the following statements concerning the context of your CCC's activities according to the following scale:

1 = strongly agree
2 = agree
3 = moderately agree
4 = disagree
5 = strongly disagree

25a. _____ The large size of the catchment (or poor transportation links between parts of catchment) seriously detracts from an effective level of cooperation being developed among CCC membership.

25b. _____ The wide variety of values and beliefs among CCC members seriously detracts from an effective level of cooperation developing among them.

25c. _____ The media has played a very constructive role in developing a sense of cooperation among CCC members.

25d. _____ The media has played a very constructive role in developing a sense of cooperation between the CCC and the catchment community.

25e. _____ All the important constituency groups are effectively contributing through the CCC in developing an effective level of cooperation.

25f. _____ The perception that ICM has been forced on the catchment by the state government has seriously detracted from an effective level of cooperation developing among CCC members.

25g. _____ The lack of an effective level of interest by CCC members seriously detracts from an effective level of cooperation developing among CCC members.

25h. _____ The lack of trust in government-sponsored initiatives seriously detracts from effective implementation.

25i. _____ The lack of interest in community type activities seriously detracts from effective implementation.

25k. _____ The lack of financial resources within the community seriously detracts from effective implementation.

Institutional Aspects of ICM

26. Rate your level of agreement with the following statements concerning the operations of the CCC according to the following scale:

1 = strongly agree
2 = agree
3 = moderately agree
4 = disagree
5 = strongly disagree

26a. _____ The objectives of the local ICM are very clear to all members.

26b. _____ There is a strong consensus among CCC members concerning CCC functions.

26c. _____ A very important function of the CCC is to coordinate the implementation of state and local government resource management programs.

26d. _____ A very important function of the CCC is to prioritise resource management problems in the catchment.

26e. _____ A very important function of the CCC is to provide a forum for conflict resolution among resource users.

26f. _____ A very important function of the CCC is to educate the public about the catchment's resource management problems and solutions.

26g.. _____ A very important function of the CCC is to provide for information sharing within and between public and private resource managers.

26h. _____ A very important function of the CCC is to prepare a strategic resource plan.

26i. _____ A very important function of the CCC is to implement resource management initiatives noted in the strategic plan.

26j. A very important function of the CCC is to identify a common set of policies which will be implemented by relevant resource managers within the catchment.

26k.. _____ A very important function of the CCC is to make private resource managers/owners more responsible for the impacts arising from their activities.

26l. _____ The activities of our CCC have been effectively coordinated with the activities of other state and local government agencies.

26m. _____ The membership of the CCC effectively represents the interests of the catchment community.

26n.. _____ At CCC meetings, all CCC members participate actively.

26o. _____ The local ICM process allows for an effective resolution of resource conflicts.

26p. _____ The local ICM process is a very efficient for resolving resource management conflicts.

26q. _____ The local ICM process is an open approach for resolving resource management conflicts.

26r. _____ The ICM process is very accountable.

26s. _____ The ICM process is responsive to local needs.

26t. _____ A CCC member's role is to provide their personal views on resource management issues at CCC meetings.

26u. _____ A CCC member's role is to provide the resource management views of their constituency group at CCC meetings.

26v. _____ A CCC member's role is to provide a catchment-wide perspective of natural resource management issues at CCC meetings.

26w.._____ The CCC is solving the priority natural resource management problems in the catchment.

27. Over the last 12 months, the level of financial and in kind support from QDPI has (circle one): remained the same/declined/increased. Explain any changes.

28. Over the last 12 months, the level of financial and in kind support from other state and local agencies, and other external funding organisations (*e.g.* Landcare) has (circle one): remained the same/declined/increased. Explain any changes.

29. How effectively have your CCC initiatives been coordinated with the activities of the resource agencies? Rate using the following scale:

1 = very effective
2 = effective
3 = somewhat effective
4 = ineffective
5 = very ineffective
6 = not applicable

_____ QDPI
_____ QDEH
_____ Queensland Department of Lands
_____ Department of Housing, Local Government and Planning

_____ Wet Tropics Management Agency
_____ Great Barrier Reef Marine Park Authority
_____ River Improvement Trusts
_____ Drainage Boards
_____ Cane Assignment Committees
_____ Local Government
_____ Landcare
_____ Industry groups (specify)
_____ Environmental groups (specify)
_____ Others (specify)

30. How clear is the role(s) of the following groups in the local ICM process? Rate using the following scale:

1 = very clear
2 = clear
3 = neither clear nor unclear
4 = unclear
5 = very unclear
6 = not applicable

_____ QDPI
_____ QDEH
_____ Queensland Department of Lands
_____ Department of Housing, Local Government and Planning
_____ Wet Tropics Management Agency
_____ Great Barrier Reef Marine Park Authority
_____ River Improvement Trusts
_____ Drainage Boards
_____ Cane Assignment Committees
_____ Local Government
_____ Landcare
_____ Industry groups (specify)
_____ Environmental Groups (specify)
_____ Others (specify)

31. What has the level of attendance been at CCC and relevant sub-committee meetings from the following groups? Rate using the following scale:

1 = very high
2 = high
3 = moderate
4 = low
5 = very low
6 = not applicable

_____ QDPI
_____ QDEH
_____ Queensland Department of Lands
_____ Department of Housing, Local Government and Planning
_____ Wet Tropics Management Agency
_____ Great Barrier Reef Marine Park Authority
_____ River Improvement Trusts
_____ Drainage Boards
_____ Cane Assignment Committees
_____ Local Government
_____ Landcare
_____ Industry groups (specify)
_____ Environmental Groups (specify)
_____ Others (specify)
_____ Media

32. If there are any further comments you wish to make about ICM, please feel free to do so.

APPENDIX 2

QUEENSLAND ICM CHAIR'S SURVEY

Background

1. Which catchment do you represent?

2. How long have you lived in this catchment? _____ years

3. What year did you assume your present responsibilities?

4. When you assumed the Chair, what did you expect the CCC to accomplish by this time?

5. Since assuming your current responsibilities, how well has the CCC met your expectations: (please tick):

_____ very well
_____ well
_____ moderately well
_____ not well
_____ not very well

Context of ICM with other issues

6. In your opinion, what is the significance of the following issues in your catchment? Rate using the following scale:

1 = very high
2 = high
3 = moderate
4 = low
5 = very low
6 = not applicable

_____ Provision of schools
_____ High crime rate
_____ High unemployment
_____ Public health care
_____ Ineffective land valuation for municipal tax purposes
_____ High level of spending by government
_____ High taxes
_____ Government inefficiency
_____ Too much government regulation
_____ Agricultural land problems (*e.g.* soil salinity, urban development)
_____ Water quality problems (*e.g.* nutrient enrichment, dirty drinking water)
_____ Water quantity problems (*e.g.* flooding, poor drainage)
_____ Degradation of natural environment (*e.g.* habitat loss)

7. In your opinion, what is the significance of the following natural resource management problems in your catchment? Rate using the following scale:

1 = very high
2 = high
3 = moderate
4 = low
5 = very low
6 = not applicable

_____ Erosion of crop land
_____ Productivity decline of crop land
_____ Erosion of grazing land
_____ Productivity decline of grazing land
_____ Soil salinity
_____ Weed problems

_____ Insects and disease on crops
_____ Urban expansion into agricultural lands
_____ Land clearing
_____ Surface water salinity
_____ Surface water nutrient enrichment (algae)
_____ Pesticides in waterways
_____ Degradation of freshwater/aquatic natural life
_____ Groundwater quality
_____ Acid soils
_____ Surface water availability
_____ Wastewater management
_____ Allocation of cane land
_____ Management of public land
_____ Groundwater availability
_____ Rural flooding
_____ Rural drainage
_____ Urban flooding
_____ Urban drainage
_____ Instream and offstream water use conflicts
_____ Stream bed and bank erosion
_____ Dryland vegetation habitat loss
_____ Freshwater habitat loss
_____ Coastal wetland habitat loss
_____ Barriers to fish migration
_____ Others (list)

8. What is the significance of the impacts associated with these natural resource problems on the people in the catchment? Rate using the following scale:

1 = very high
2 = high
3 = moderate
4 = low
5 = very low
6 = not applicable

_____ loss of scenic land values
_____ loss of other environmental amenities
_____ higher cost of water supplies
_____ loss of on-farm productivity
_____ personal health problems
_____ emotional stress for individuals
_____ significant conflicts with other resource users
_____ higher taxes
_____ decline in recreational and/or commercial fishery
_____ loss of access to other recreational activities
_____ loss of confidence in government's ability to manage resources effectively
_____ Other (specify)

9. Who do you believe is most responsible for solving these resource management problems? (Please tick)

_____ individuals (e.g. producers, landowners)
_____ local CCC
_____ Local Government
_____ Other local agencies/interests (e.g. Valley Trust, Drainage Board, CANEGROWERS, industry) (specify)
_____ State Government
_____ Commonwealth Government
_____ GBRMPA
_____ Others (specify)

10. In your opinion, what is the level of public awareness about these natural resource problems and associated impacts? Rate using the following scale:

1 = very high
2 = high
3 = moderate
4 = low
5 = very low
6 = not applicable

_____ Erosion of crop land
_____ Productivity decline of crop land
_____ Erosion of grazing land
_____ Productivity decline of grazing land
_____ Soil salinity
_____ Weed problems
_____ Insects and disease on crops
_____ Urban expansion into agricultural lands
_____ Land clearing
_____ Surface water salinity
_____ Surface water nutrient enrichment (algae)
_____ Pesticides in waterways
_____ Degradation of freshwater/aquatic natural life
_____ Groundwater quality
_____ Acid soils
_____ Surface water availability
_____ Wastewater management
_____ Allocation of cane land
_____ Management of public land
_____ Groundwater availability
_____ Rural flooding
_____ Rural drainage
_____ Urban flooding
_____ Urban drainage
_____ Instream and offstream water use conflicts
_____ Stream bed and bank erosion
_____ Dryland vegetation habitat loss
_____ Freshwater habitat loss
_____ Coastal wetland habitat loss
_____ Barriers to fish migration
_____ Others (list)

11. In your opinion, how strong is public support regarding the need for the ICM process to solve these natural resource problems in your catchment? (Please tick)

_____ very high
_____ high
_____ moderate
_____ low
_____ very low

12. Please rate your level of agreement with the following statements concerning how the nature of resource management problems in your catchment affects implementation of ICM according to the following scale:

1 = completely agree
2 = agree
3 = neither agree nor disagree
4 = disagree
5 = completely disagree

12a. _____ The lack of an appropriate technical solution to the natural resource management problems in this catchment seriously detracts from effective implementation.

12b. _____ Because resource management problems in the catchment are not well understood, effective implementation is very difficult.

12c. _____ The long-term and incremental nature of the impacts associated with resource management problems in the catchment seriously detracts from effective implementation.

12d. _____ The absence of a single acute resource management issue within the catchment significantly detracts from effective implementation.

12e. _____ The long time frame between implementing a solution and seeing the benefits seriously detracts from effective implementation.

12f. _____ The high level of behavioural change required by private landowners to effectively solve resource management problems seriously detracts from effective implementation.

12g. _____ The high level of behavioural change required by industry to effectively solve resource management problems seriously detracts from effective implementation.

12h. _____ The high level of administrative, legal and financial change required from existing government agencies to effectively solve resource management problems seriously detracts from effective implementation.

12i. _____ The absence of clear and immediate economic benefits seriously detracts from effective implementation.

13. In the last 12 months, have resource management problems (circle one) increased/stayed the same/declined in importance within the catchment? If changes have occurred, please explain what has changed.

Context for ICM

14. What level of puyblic support do you believe your CCC has? (Please tick)

_____ very high level of support
_____ a high level of support
_____ moderate level of support
_____ low level of support
_____ very low level of support

15. How significant have the following items been in gaining acceptance from the public? Rate using the following scale:

1= very high
2= high
3= moderate
4= low
5= very low
6=not applicable

_____ ICM policy statement
_____ strong local government support (political level)
_____ strong state government support (political level)
_____ strong support from local government agencies (administrative level)
_____ strong support from state government agencies (administrative level)
_____ strong financial resources of CCC
_____ strong leadership of CCC Chair
_____ strong leadership of CCC coordinator
_____ positive outcomes associated with CCC activities
_____ strong support from relevant industry and community groups
_____ other (specify)

16. How effectively have the efforts of your CCC group been accepted by other government agencies within the catchment? (Please tick)

_____ very effectively
_____ effectively
_____ somewhat effectively

_____ ineffectively
_____ very ineffectively

17. How significant have the following items been in gaining acceptance from other government agencies? Rate using the following scale:

1 = very high
2 = high
3 = moderate
4 = low
5 = very low
6 = not applicable

_____ ICM policy statement
_____ strong local government support (political level)
_____ strong support from QDPI (political or administrative levels)
_____ strong public support
_____ strong financial resources of CCC
_____ strong leadership of CCC Chair
_____ strong leadership of CCC coordinator
_____ positive outcomes associated with CCC activities
_____ strong support from relevant industry and community groups
_____ other (specify)

18. How effectively have the efforts of your CCC been accepted by relevant local industry and community organisations? (please tick)

_____ very effectively
_____ effectively
_____ somewhat effectively
_____ ineffectively
_____ very ineffectively

19. How significant have the following items been in gaining acceptance from relevant industry and community organisations? Rate using the following scale:

1 = very high
2 = high
3 = moderate
4 = low
5 = very low
6 = not applicable

_____ ICM policy statement
_____ strong local government support (political level)
_____ strong support from QDPI (political or administrative levels)
_____ strong public support
_____ strong financial resources of CCC
_____ strong leadership of CCC Chair
_____ strong leadership of CCC coordinator
_____ positive outcomes associated with CCC activities
_____ other (specify)

20. What have been the main activities of your CCC in the last 12 months? Please list and rank their significance according to the following scale:

1 = very high
2 = high
3 = moderate
4 = low
5 = very low

RATING ACTIVITIES

_____
_____
_____
_____
_____
_____
_____
_____

21. How effective has the involvement of the following groups been to the CCC?

1 = very effective
2 = effective
3 = moderately effective
4 = ineffective
5 = very ineffective
6 = not applicable

_____ rural producers (specify)
_____ local government politicians
_____ local government administrators
_____ state government politicians
_____ state government agencies:
  _____ DPI
  _____ DEH
  _____ Housing, Local Government and Housing
  _____ Department of Lands
_____ Valley Trust
_____ Drainage Board(s)
_____ Sugar Industry Infrastructure Package Program
_____ rural industry organisations (specify)
_____ environmental organisations (specify)
_____ media

22. How effectively do the news media present your CCC's views of resource management issues? (Please tick)

_____ very effectively
_____ effectively
_____ somewhat effectively
_____ ineffectively
_____ very ineffectively

23. Over the last 12 months, has the level of acceptance of your ICM program among the public, government agencies, and relevant industry and environmental groups (circle one) increased/ stayed the same/ decreased? If changes have occurred, explain why.

24. Please identify your level of agreement with the following statements concerning the context of your CCC's activities according to the following scale:

1 = strongly agree
2 = agree
3 = moderately agree
4 = disagree
5 = strongly disagree

24a. _____ The large size of the catchment (or poor transportation links between parts of catchment) seriously detracts from an effective level of cooperation being developed among CCC membership.

24b. _____ The wide variety of values and beliefs among CCC members seriously detracts from an effective level of cooperation developing among them.

24c. _____ The media has played a very constructive role in developing a sense of cooperation among CCC members.

24d. _____ The media has played a very constructive role in developing a sense of cooperation between the CCC and the catchment community.

24e. _____ All the important constituency groups are effectively contributing through the CCC in developing an effective level of cooperation.

24f. _____ The perception that ICM has been forced on the catchment by the state government has seriously detracted from an effective level of cooperation developing among CCC members.

24g. _____ The lack of an effective level of interest by CCC members seriously detracts from an effective level of cooperation developing among CCC members.

24h. _____ The lack of trust in government-sponsored initiatives seriously detracts from effective implementation.

24i. _____ The lack of interest in community type activities seriously detracts from effective implementation.

24j. _____ The lack of financial resources within the community seriously detracts from effective implementation.

Institutional Aspects of ICM

25. Rate your level of agreement with the following statements concerning the operations of the CCC according to the following scale:

1 = strongly agree
2 = agree
3 = moderately agree
4 = disagree
5 = strongly disagree

25a. _____ The objectives of the local ICM are very clear to all members.

25b. _____ There is a strong consensus among CCC members concerning CCC functions.

25c. _____ A very important function of the CCC is to coordinate the implementation of state and local government resource management programs.

25d. _____ A very important function of the CCC is to prioritise resource management problems in the catchment.

25e. _____ A very important function of the CCC is to provide a forum for conflict resolution among resource users.

25f. _____ A very important function of the CCC is to educate the public about the catchment's resource management problems and solutions.

25g. _____ A very important function of the CCC is to provide for information sharing within and between public and private resource managers.

25h. _____ A very important function of the CCC is to prepare a strategic resource plan.

25i. _____ A very important function of the CCC is to implement resource management initiatives noted in the strategic plan.

25j. _____ A very important function of the CCC is to identify a common set of policies which will be implemented by relevant resource managers within the catchment.

25k. _____ A very important function of the CCC is to make private resource managers/owners more responsible for the impacts arising from their activities.

25l. _____ The activities of our CCC have been effectively coordinated with the activities of other state and local government agencies.

25m. _____ The membership of the CCC effectively represents the interests of the catchment community.

25n. _____ At CCC meetings, all CCC members participate actively.

25o. _____ The local ICM process allows for an effective resolution of resource conflicts.

25p. _____ The local ICM process is a very efficient for resolving resource management conflicts.

25q. _____ The local ICM process is an open approach for resolving resource management conflicts.

25r. _____ The ICM process is very accountable.

25s. _____ The ICM process is responsive to local needs.

25t. _____ The CCC is solving the priority natural resource management problems in the catchment.

25u. _____ Over the last 12 months, QDPI has provided an adequate level of funding and in kind support to our CCC.

25v. _____ Over the last 12 months, our CCC has received an adequate level of financial assistance and in kind support from other state government agencies.

26. Over the last 12 months, the level of financial and in kind support from QDPI has (circle one): remained the same/declined/increased. Explain any changes.

27. Over the last 12 months, the level of financial and in kind support from other state and local agencies, and other external funding organisations (*e.g.* Landcare) has (circle one): remained the same/declined/increased. Explain any changes.

28. How effectively have your CCC initiatives been coordinated with the activities of the resource agencies? Rate using the following scale:

1 = very effective
2 = effective
3 = somewhat effective
4 = ineffective
5 = very ineffective
6 = not applicable

_____ QDPI
_____ QDEH
_____ Queensland Department of Lands
_____ Department of Housing, Local Government and Planning
_____ Wet Tropics Management Agency
_____ Great Barrier Reef Marine Park Authority
_____ River Improvement Trusts
_____ Drainage Boards
_____ Cane Assignment Committees
_____ Local Government
_____ Landcare
_____ Industry groups (specify)
_____ Environmental groups (specify)
_____ Others (specify)

29. How clear is the role(s) of the following groups in the local ICM process? Rank using the following scale:

1 = very clear
2 = clear
3 = neither clear nor unclear
4 = unclear

5 = very unclear
6 = not applicable

_____ QDPI
_____ QDEH
_____ Queensland Department of Lands
_____ Department of Housing, Local Government and Planning
_____ Wet Tropics Management Agency
_____ Great Barrier Reef Marine Park Authority
_____ River Improvement Trusts
_____ Drainage Boards
_____ Cane Assignment Committees
_____ Local Government
_____ Landcare
_____ Industry groups (specify)
_____ Environmental Groups (specify)
_____ Others (specify)

30. What has the level of attendance been at CCC meetings from the following groups? Rank using the following scale:

1 = very high
2 = high
3 = moderate
4 = low
5 = very low
6 = not applicable

_____ QDPI
_____ QDEH
_____ Queensland Department of Lands
_____ Department of Housing, Local Government and Planning
_____ Wet Tropics Management Agency
_____ Great Barrier Reef Marine Park Authority
_____ River Improvement Trusts
_____ Drainage Boards
_____ Cane Assignment Committees
_____ Local Government
_____ Landcare
_____ Industry groups (specify)
_____ Environmental Groups (specify)
_____ Others (specify)
_____ Media

Personal Demands and Motivations

31. On average, how many hours per month do you devote to ICM? _____ hours/month

32. Identify your level of agreement with the following statements according to the following scale:

1 = completely agree
2 = agree
3 = moderately agree
4 = disagree
5 = completely disagree
6 = not applicable

32a. _____ The amount of time I devote to ICM significantly interferes with my own business/job requirements.

32b. _____ The amount of time I devote to ICM significantly interferes with my family commitments.

32c. _____ My involvement with the CCC causes significant out-of-pocket expenses.

32d. _____ I find being a member of the CCC personally rewarding because I can contribute to the community.

32e. _____ I find being a member of the CCC personally rewarding because I care about natural resource management.

32f. _____ I find being a member of the CCC rewarding because I can meet other members of the community who can influence resource management decision making.

32g. _____ A CCC's member's role is to provide their personal views on resource management issues at CCC meetings.

32h. _____ A CCC member's role is to represent the resource management views of their constituency group at CCC meetings.

32i. _____ A CCC member's role is to provide a catchment-wide perspective of natural resource management issues at CCC meetings.

33. If there are any further comments you wish to make about ICM, please feel free to do so.

Chapter 2

What They Told us:
The Views of Queensland Catchment Committee Chairs and Coordinators on ICM

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Summary This paper reports on a survey of Queensland Catchment Committee Chairs and Coordinators. The mail survey sought to find their views on how they thought the ICM process was going in the state and what were the issues that made it successful or were obstacles. Apart from some preliminary analysis by the authors in the discussion at the end of the paper, this summary is limited to "what they told us". Opinions are presented on the major issues for catchment management, levels of support from various quarters and suggestions on how to make the process work better.

THE SURVEY AND RESPONDENTS

This report is a summary of the responses of the Chairs and Coordinators of the 14 Catchment Coordinating Committees (CCCs) that operated in Queensland in late 1995 to a survey of their opinions about the Queensland ICM program. Individuals responded to the survey on the understanding that their views would be confidential and used only in providing summary information. The survey sought their responses to a number of questions concerning:

- the activities of their own catchment committee,
- important catchment management issues,
- the level of support provided by the community, other agencies and NGO groups,
- the difficulty of resolving catchment management issues,
- the institutional and financial arrangements for ICM and the general process adopted in Queensland.

This is only a small fraction of the information supplied by the respondents and a complete tabulation of the results is available from the authors. The Mazmanian-Sabatier model of policy implementation provided the theoretical framework for this survey but theoretical perspectives are kept in the background in this discussion.

The state-wide survey was limited to the Chairs and Coordinators of the 13 recognised CCCs and one Catchment Care Group operating in November 1995. It was very pleasing for the quality of the survey that fourteen Coordinators (100%) and 11 Chairs (78%) responded to the questionnaire. All the responses were satisfactory, and most respondents provided significant additional written comments. All the ICM committees are quite young and most of the respondents were the initial appointees in their CCC. Many of the Coordinators were recent arrivals into the catchments as young professionals moving in to take up the newly created jobs with a few notable exceptions. Most of the Chairs are lifetime residents and have lived in their catchments more than 15 years (60%), although there are some relatively new arrivals amongst the Chairs (34%).

The Activities and Progress of Catchment Groups

The major activities of the Queensland CCCs are summarised in Table 1.

Table 1: Activities Undertaken by ICM groups in Queensland

Activity	*Yes*	*No*
Awareness and education programs	14	0
Prepared a situation statement	5	9
Catchment strategy	11	3
Advice to Landholders	6	9
Conducted on-ground projects	9	5

Respondents reported a wide range of activities reflecting largely the age and maturity of the CCCs. Some have been in operation effectively since 1988, whereas some are still in the process of being formed. A progression of activities can be recognised from organisational activities - public awareness and involvement - issues generation - catchment planning - technical studies. The range of activities are all envisaged in the Queensland ICM Policy which now requires the preparation of catchment strategies before funding is provided for projects (Queensland

Department of Primary Industries, 1992)

Table 2: Level of Satisfaction with Progress in their ICM Program

	Chairs	Coordinators
Very unsatisfied	0	0
Unsatisfied	0	3
Neither satisfied nor unsatisfied	4	4
Satisfied	6	4
Very satisfied	1	1
No response	0	1

Less than half the coordinators were satisfied with progress in their CCC and three were unsatisfied, one to the point of resigning over it. The Chairs were generally more satisfied with progress, and while none was actually dissatisfied, almost half were ambivalent.

Local Issues

The issues seen as significant by the respondents naturally varied between regions. In all regions natural resource issues were approximately on par with social and economic issues. Most significantly both Chairs and Coordinators believed that too much government regulation was the single most significant issue, exceeding all other issues. The most significant natural resource issue was water quantity, substantially higher than land degradation and water quality problems, although these too also were significant in most catchments.

Those issues rated highly and very highly by coordinators included economic sustainability, native and feral animal management and pests in national parks, creek bank erosion and siltation, groundwater salinity, land tenure and uncoordinated farm drainage and cross border coordination. Chairs rated only a few issues highly and very highly including rural residential development and storm water and native tree species management.

Table 3: The Significance of Social, Economic and Natural Resource Issues

Issue	*Coordinators ratings*						*Chairs ratings*						
	1	2	3	4	5	6	0	1	2	3	4	5	6
Social Issues													
Crime	2	6	4	1					5	5	1	1	
Unemployment		3	5	4	1				2	3	5	1	
Economic and Institutional Issues													
Land valuations		1	4	4	3	1			2	4	3	2	
High taxes		2	1	3	5	2	1		1	2	4	3	
Too much Government regulation		1	3	1	8				1	2	4	4	
Natural Resource Management Issues													
Agricultural land degradation problems			6	4	3				1	3	4	3	
Water quality problems		2	4	5	2				2	2	5	2	
Water quantity problems		2	2	1	8				1	3	3	4	
Nature conservation	1	2	4	3	3				1	6	3	1	

(0 = no response, 1 = very low, 2 = low, 3 = moderate, 4 = high, 5 = very high, 6 = NA/don't know.)

Attitudes and Support

Most respondents believed that support from the general public was low due largely to the public's low level of awareness about natural resource management issues. (Table 5)

Table 4: Level of Public Awareness about Natural Resource Issues and Impacts

Level	*Coordinators*	*Chairs*
Very high	0	0
High	4	1
Moderate	4	5
Low	5	5
Very low	0	1

Only 35% of Coordinators are satisfied with the acceptance of their CCCs by other government agencies. Chairs are more positive on this point.

A wide range of factors generate support from industry and community organisations, especially the efforts of the CCC Chairs. Again both groups of respondents were commonly unhappy with political support and of the acceptance of local government at both the agency and political levels. As in many other results of the survey there are regular exceptions to common patterns. Other community groups rating as important include Landcare groups, Recreational fishing, Commercial Fisherman's Association, Aboriginal. Council, Sugar Industry (Mills), Tourism. Environmental organisations considered to be valuable for CCC groups included ACF, QCC, Regional Environmental Council, Marine Conservation Society (although there was ambivalence on this, some respondents believed that these groups were obstructionist).

All groups use local newspapers as the most frequent form of media outlet.. ABC rural programs were mentioned by many respondents and a slightly lesser number mentioned local commercial radio. A few CCCs were able to use TV, one even place subsidised advertisements on regional TV. Only one respondent believed the media to be ineffective in supporting the CCC. Eighty percent of Coordinators believed the media to be effective. One said the media were "The Key!" and two others found the MDBC videos very valuable.

An overall summary of the importance of support from different groups is provided in Table 5. Clearly and not surprisingly, the dominant effective partnership is between the CCCs, the DPI (now DNR) and rural producer groups. There was less agreement between the Chairs and Coordinators on the effectiveness of the involvement of local government and even some ambivalence on the involvement of others such as the Department of the Environment. Coordinators did not in general seem impressed with the involvement of Lands and Local Government.

Table 5: The Effectiveness of Involvement in the CCC by Various Groups

Group	*Coordinators ratings*							*Chairs ratings*						
	0	1	2	3	4	5	6	0	1	2	3	4	5	6
Rural producers				3	7	3		1			1	8	1	
Local government politicians	1		3	4	3	2			1	2	2	5	1	
Local government administrators			3	5	3	2		1	1	2	3	2	2	
State government politicians			5	4	2	1	1	1	1	2	3	2	2	
Qld Department of Primary Industries			1		6	6						4	7	
Qld Department of Environment and Heritage		2	1	5	1	4				1	3	5	1	
Qld Department of Housing, Local Govt and Planning		2	4	3	3	1			2	2	2	3		2
Qld Department of Lands		2	2	5	2	2				1	4	4		2
Valley Trusts (or similar)	1	1		1	4		6	1	1		3	2		4
Drainage Board(s)		1		2	3		7		1		2	1	1	6
Media	5		1	4	2	1		2	1	2	2	3	1	

(0 = no response, 1 = very ineffective, 2 = ineffective, 3 = neither, 4 = effective, 5 = very effective, 6 = NA/don't know)

Institutional Arrangements and Finance

Table 6 provides results that probe into the difficulties within CCCs. Coordinators believe that some of the most significant difficulties are due to the wide variety of beliefs amongst CCC members, a view not so strongly held by Chairs; a perception that the program has been forced on the catchment by the State Government in communities without finical resources to respond, and a lack of trust in the public in government sponsored initiatives. The Chairs hold similar views differing significantly as a group only in relation to the significance of the wide variety of beliefs and values of CCC members and to a lesser extent on the difficulties posed by the large size of catchments. Both groups believe that the CCCs have the important groups represented. There are some potentially fatal problems identified here, although many can be overcome in time as the ICM process matures and achieves ownership and clearer common perceptions.

Table 6: The Reasons Implementation of ICM in CCCs is Difficult

Reason	*Coordinators ratings*						*Chairs ratings*					
	1	2	3	4	5	6	1	2	3	4	5	6
Large size of catchment or poor transportation links	1	5	2	4	1		1	3	1	1	4	1
Wide variety of values and beliefs among CCC members		2	1	8	2		1	4	2	2	2	
Media don't report resource issues accurately	1	6	6				1	5	4		1	
Important groups are not represented on the ICM committee	1	5	3	4			2	4	4	1		
Perception that ICM has been forced on the catchment by the state	1	4	3	3	2		2	5	1		3	
Lack of an effective level of interest by CCC members		3	5	5			1	4	2	2	1	
Public's lack of trust in state or local government sponsored initiatives		2	2	3	5	1		2	1	5	3	
Public's lack of interest in community type activities		3	1	8	1			3	1	6	1	
The lack of financial resources within the community	1		1	6	5			2	1	1	7	

(1 = strongly disagree, 2-disagree, 3 = neither, 4 = agree, 5 = strongly agree, 6 = NA/don't know)

Table 7 reveals more detail on the operation of the CCCs themselves. Perhaps the most interesting feature of these results is the wide spread of opinions as to the purpose and operation of CCC among the various individuals and catchments in the State. Coordinators for example are not in clear agreement as to what they and their CCCs should do - some believe that Coordinators and CCCs should coordinate activities and give advice to landowners, others do not. Significant differences in opinion exist as to whether the objectives of the local ICM programs are clear to all members and to the level of participation of their CCC members in meetings. They too do not always agree as to whether the CCC should give advice to landholders.

Table 7: Chairs and Coordinators Opinions on the Role and Conduct of CCCs

Statements	*Coordinators*						*Chairs*							
	0	1	2	3	4	5	6	0	1	2	3	4	5	6
Purpose of ICM														
The objectives of the local ICM are very clear to all members	1		6	2	3	1				2	1	6	1	1
There is a strong consensus among CCC members concerning what the CCC should do	1		3	4	5					4	2	3	1	1
The CCC should coordinate state and local government resource management programs	2	1	3	1	3	3				3		4	3	1
The CCC should prioritise resource management problems in the catchment	1				6	6				1		5	4	1
The CCC should provide a forum for conflict resolution among resource users	1		1		6	5					3	4	3	1
The CCC should educate the public about the catchment's resource management problems and solutions	1				6	6					2	3	5	1
The CCC should provide a forum for information sharing within and between public and private resource managers	1				7	5					1	4	5	1
The CCC should prepare a strategic resource management plan	1			1	6	5					1	4	6	1
The CCC should stimulate community or regional development	1		2	3	3	4				2	1	5	2	1
The CCC and its coordinator should provide advice to landholders	2	1	4		4	2		2	1	1	1	5		1
Membership and Role														
The membership of the CCC effectively represents the interests of the catchment community	1			2	7	3						6	4	1
At CCC meetings, all CCC members participate actively	1	3	3	1	5							8	2	1
A CCC member's role is to provide their personal views on resource management issues at CCC meetings	1	3	3	1	5			2	2	2	1	2	1	1
A CCC member's role is to provide the views of their constituency group on resource management at CCC meetings	1	1		1	5	5		2		1		3	4	1
Performance														
The ICM process is very responsive to local needs	1		2	3	7					1	2	7		1
The CCC is solving the priority natural resource management problems in the catchment	1		4	3	4	1		1		2	3	3	1	

(1 = strongly disagree, 2-disagree, 3 = neither, 4 = agree, 5 = strongly agree, 6 = NA/don't know)

DISCUSSION

Problem Definition

It is crucial to the evaluation of the ICM process to identify what is *the problem* and how it affects the implementation process. From a *technical* point of view resource management is finding effective mechanisms to address specific well defined problems such as soil erosion, flooding, nutrient enrichment, unreliable water supplies, loss of biodiversity. The solutions are defined in terms of land management practices, engineering structures, input usage and similar hard technological matters. From a *socio-economic* point of view, resources management is a matter of designing and implementing socially acceptable and effective solutions and preventative actions to these same problems through awareness raising and education, economic, administrative and legal measures

The survey revealed that there are clear enough technical solutions to many of the natural resources management problems in Queensland. These have been canvassed and promoted in some cases for decades and longer - eg floodplain management, soil erosion control, groundwater depletion and acidification. In the Herbert for example there have been three flood studies and three drainage studies over the past twenty years. The proposed technical

solutions have been similar in each case, but the resources management problem still exists. Other emergent problems, such as biodiversity conservation and nutrient enrichment of waterways are not so well defined in technical terms, and ICM groups where these are key issues have greater difficulty focusing their priorities and activities. They need research information to gain a greater understanding of the processes involved and to demonstrate the necessity and effectiveness of technological solutions.

All the respondents acknowledged the difficulty of promoting a program with relatively few immediate benefits but often with immediate cost implications for land holders. This problem is intrinsic to ICM, and can only be alleviated by a change in ethics in the community as a whole. It would be assisted by technical and economic data that demonstrated the severity of the problems and reality of the long term benefits. Those catchments with more apparent and visible resource issues (such as water shortages or acute soil erosion) will have a better chance of focussing community attention.

The Queensland ICM program is part of the struggle to move from sectoral approaches to resources management to an integrated whole of landscape approach. The survey revealed that the biggest obstacle to ICM is the *process* within the community and within government to redress and prevent resource management problems - political and social processes to apply technological solutions. Not surprisingly, this change of philosophy is accompanied by uncertainty and resistance especially when the way forward is not signposted. As yet there is no well tested solution to this problem as a guide to action.

The move towards an integrated approach to natural resources management has come at a time when community expectations about environment and resources issues have increased. In some cases these changes have been rapid and the shift in resource management and economic goals magnifies the extent of attitude and behaviour change required. For example, twenty years ago, farmers were encouraged to develop natural resources such as irrigation, tree clearing for grazing, clearing and drainage for agriculture. Recently, they have been asked to revise their practices substantially. These changing requirements for resource management have been isolated to a considerable extent from the economic development decision making process although there are promising signs that the merger of resource and environmental issues with economic development issues is beginning to occur in rural areas of the State. For example decisions on water resources development, agricultural expansion, water control, use rights and land tenure, resources extraction are becoming the concern of ICM groups. In order to do this successfully, further changes will be required by the major players in natural resources management. At present the ICM program is largely limited in scope to a relationship between farmers and the Department of Natural resources (formerly Primary Industries). Sustainable development requires a whole of government and a whole of community approach to decision about resources and economic issues.

Context for ICM

The Queensland ICM program has been active only since 1990. Consequently a major constraint to any evaluation is the relatively short period of time that CCCs have been in existence and the limited opportunities they have to bring about change. A progression of activities was recognised from organisational activities - public awareness and involvement - issues generation - catchment planning - technical studies - implementation. Judging from the diversity of responses, it requires approximately five years before a CCC will reach maturity along this spectrum. A considerable amount of time is taken establishing the CCC, creating some coherence amongst its members, learning the challenges and opportunities and having the platform for planning and implementation.

Perhaps for the reason that ICM requires a complex process of learning, there was a disturbing low level of satisfaction amongst the respondents at the state level (especially the Coordinators).

CCCs have to contend with low awareness in the general public about resources management issues and a general resistance to external intervention. A surprising, consistent and very significant result from the survey was respondents universal view that there is too much government regulation. People in rural Australia resent government controls on land use whether they arise from World Heritage listing and conservation generally, tree clearing regulations, water and land management regulations, changes to land tenure and land rights laws. There is a clear message here that landholders in particular will resist any solution to ICM problems that involve state and national government regulations.

DNR is the lead agency for ICM which was perceived to be a successful partnership between DNR and the rural land owner interests and not much more than that. There was a widely held view that local governments, both politically and at officer level have not been involved effectively in the ICM process.

Despite the need for ICM to integrate across government agencies there is a clear absence of a "whole of government" approach , commitment or involvement in ICM. State politicians seemed to ignore ICM and there was ineffective, even counter productive involvement of some state agencies. While there was no reported hostility from politicians, agency staff and community groups, it seems that CCCs must create these supporting links themselves with little support from outside.

On a positive note there was wide agreement about the supportive role of the media and of the essential role that the CCCs, its Chairs and Coordinators play in gaining support from the stakeholders. Clearly, the ability of these people is critical to the success of individual ICM programs. The study could not assess these abilities and what skills are essential, personal or technical.

Institutional Structure

Queenslands ICM program has very broad, and from a community point of view, somewhat nebulous goals. There is general agreement on the ultimate purpose of ICM, but also a wide spread of opinions as to the purpose and operation of CCC among the various individuals and catchments in the State. Perhaps this is not a deficiency of the program given that it is intended to be community based.

Financial resources for a program with such ambitious goals has been erratic and low. A key source of funds has been the NLP, without which ICM would struggle to survive. CCCs are required to find funding on their own initiative rather than use established revenue sources as do most public programs. At present they have no revenue raising capacities and there is a lack of confidence in government funding for implementation, which is of particular concern given that once CCCs have been established and created strategies, their requirement for funds for on-ground works will increase their financial requirements. Planning is inexpensive relative to action.

As discussed above, CCCs have not so far had effective involvement from local governments nor from key agencies with statutory resources management responsibilities but the problem is understood and action being taken (DNR, 1996). As coordinating focus for mainstream decisions affecting resources, ICM have not yet been universally successful but then we are talking about a long term process.

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Chapter 3

What they Told us

A Survey of the Views of Queensland ICM Chairs and Coordinators 1997

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PART I INTRODUCTION

1. Survey Objectives

The primary objective of the survey reported here is to provide a benchmark against which the activities and achievements of the Herbert River Catchment Coordinating Committee (HRCCC) can be prepared. The results of the survey together with results of monitoring the institutional arrangements and performance of integrated catchment management in the state and indeed nationally and internationally provide a fundamental context and yardstick for the evaluation of the HRCCC.

This survey is the second statewide survey of all ICM groups in the Queensland, the first being conducted in 1995.

Other papers and reports of this research program define the conceptual framework for observing change and evaluating the ICM implementation process. The framework combines aspects of the Mazmanian-Sabatier framework of policy implementation analysis with the criteria identified by Syme's PRIME framework to provide overall direction to the program and to define dimensions of implementation to be included in the survey reported here.

2. Research Design and Implementation

The study is based on a mail survey of the Chairs and Coordinators of all recognised ICM Committees and groups throughout the state. The manager of the State ICM program provided the names of these individuals.

The survey used a self-administered questionnaires designed to be readily completed by the respondents (Appendix 1).

Conduct of the survey involved the following steps:

- the questionnaire was structured to follow the conceptual framework; further detail on this is available in the 1995 report
- the questionnaire was an adaptation of the one used largely successfully in 1995. Some questions were deleted or reworded as a result of the 1995 experience to make the questionnaire shorter and clearer
- mail out of the state-wide survey in October 1997,
- mail our of reminder letters to non-respondents in late November 1997
- the survey was 'closed' in December 1997

3. ICM Groups in Queensland

There are four categories of ICM groups recognised in Queensland based primarily on their functional role:

(a) *Catchment Coordinating Committees* (CCCs): these are the most common type of catchment group whose key roles are to provide a forum for community input and discussion, to foster community awareness and understanding of the interactions between natural resources and the value of a coordinated catchment-wide approach for managing these resources, and to prepare and oversee voluntary implementation of catchment management strategies. Membership is broadly based involving representatives of significant stakeholder groups and interests in the catchment, with a majority of non-government members. These groups are usually assisted by a full or part time catchment coordinator, technical support from state and local government agencies and other

tertiary institutions, cash and inkind support from organisations in the catchment and state government establishment and basic operational grants.

(b) *Regional Catchment Coordinating Committees* (RCCCs): these catchment groups have the role of overseeing the preparation of a regional strategy, coordination of subcatchment planning and implementation, and linking with other regional activities. Membership is broadly based involving representatives of significant stakeholder groups and interests with a majority of non-government members. These groups are usually assisted by a full or part time catchment coordinator, technical support from state and local government agencies and other tertiary institutions, in kind support from working groups, cash and inkind support from organisations in the catchment and state government establishment and basic operational grants

(c) *Steering Groups* (SGs): these are catchment groups in a formative phase whose terms of reference are to work on setting up a CCC. There role, membership and support provided is similar to that of CCCs -some have formal coords and some not..

(d) *Catchment Care Groups* (CCGs): from a policy point of view, CCGs no longer exist, although there is one remaining formally established group. Their principal role is to provide a forum for public discussions on catchment management issues identified by community action groups, agencies or members of the public to foster community awareness and cooperative solutions to local catchment issues. This role is therefore more akin to that of a Landcare group within the context of a whole catchment. Membership involves interested individuals, and no specific support mechanisms are provided.

Table 1. ICM Groups in Queensland 1995-1997

	1995	**1997**
CCCs (include Fitzroy)	14	22
RCCC	1	2
Steering Groups	6	9
Catchment Care Groups	1	1
Total	**22**	**34**

Table 2. Classification of Queensland Catchment Groups in 1997

1. Catchment Coordinating Committees

Central

Lower Fitzroy Catchment Care Group Inc
Fitzroy Catchment Coordinating Group Inc.
Pioneer Integrated Catchment Management Assoc Inc
Dawson Valley Development Association Inc.

North

Johnstone River Catchment
Douglas Shire Catchment Coordinating Committee
Management Association Inc.
Mitchell River Watershed Management Association Inc.
Russell-Mulgrave Catchment Coordinating Committee
Herbert River Catchment Coordinating Committee
Cardwell Shire Catchment Coordinating Committee
Barron River ICM
Weipa Catchment Coordinating Committee

South East

Bremer River Catchment Coordinating Association Inc.
Burnett Catchment Care Incorporated
Maroochy Mooloolah Catchmentcare Committee
Mary River Catchment Coordination Assn. Inc.
Noosa River Catchment Management Committee
Pumicestone Region Catchment Coordinating Committee
Norman Creek Catchment Coordinting Committee
North and South Pine Rivers Integrated Catchment Assn Inc
Lockyer Resource Management Group Inc.

South

Border Rivers Catchment Coordinating Committee
Murray-Darling Basin Regional Coordinating Committee
Balonne-Maranoa Catchment Coordinating Committee
Condamine Catchment Coordinating Committee

West
Warrego-Paroo Catchment Coordinating Committee

2. Steering Groups
Southern Gulf Catchments Coordinating Committee Steering Group
Annan River Catchment Management Group
Sarina Steering Committee
Baffle Creek Catchment Management Interim Committee
Catchment Management Lake Eyre Basin Steering Group
Endeavour Catchment Group
Whitsunday Steering Committee

3. Catchment Care Groups
Lake Baroon Catchment Care Group Inc.

4. Survey Response

Surveys were distributed to Chairs and Coordinators of all Catchment Groups in Queensland. Two groups currently have Coordinators only (Weipa and Norman Creek), while five groups have a Chair only (Annan River, Endeavour, Sarina, Whitsunday, Baffle Creek). The responses received are shown in Table 3.

Table 3: Number of ICM Groups of all Types and Survey Response

	Total Groups	Total Chairs	Total Coordinators	Responses from Chairs No. (%)	Responses from Coordinators No. (%)
CCC	22	21	22	11 (52)	15 (68)
RCCC	2	2	2	1 (50)	0 (0)
SG	9	8	4	3 (38)	2 (50)
CCG	1	1	1	0 (0)	1 (100)
Total	34	31	29	15 (52)	18 (62)

Of the Steering Groups, 4 groups (Lake Eyre Basin, Southern Gulf, Barron, Weipa) have formal Catchment Coordinators appointed and have developed to a stage that they effectively have a role and function of a CCC. Therefore for the purpose of the analysis of ICM Chairs and Coordinators opinions in Queensland, responses from these four catchment groups will be included with CCCs and RCCCs and analysed as follows:

Table 4: Number of Catchment Coordinating Committees and Responses

	Total Groups	Total Chairs	Total Coordinators	Responses from Chairs No. (%)	Responses from Coordinators No. (%)
CCC groups	29	26	28	13 (50)	17 (61)
Other	5	5	1	2 (40)	1 (100)
Total	34	31	29	15 (52)	18 (62)

Note There were 8 CCCs for which both the Catchment Coordinator and the Chair responded: Douglas Shire, Russell-Mulgrave, Herbert, Bremer, Burnett, Mary, Condamine, Balonne-Maranoa

Given that there were 29 CCC groups at the time of the survey and that both Chairs and Coordinators replied from eight of them, the survey received a response from either Chairs and/or Coordinators from 22 of the 29 groups. Another way of looking at the response rate is that there is a response from 75% of the catchments. Pairwise comparisons would have been very valuable to chart progress. Regrettably the numbers are too small to provide meaningful statistical analysis while protecting confidentiality. There were only five groups for which we received responses from chairs in both surveys (and only two with the same chair!) and six groups common to both surveys where coordinators responded and only three with the same coordinator two years later.

PART II SURVEY RESULTS

1. ICM Activities and Achievements (Q1-8)

Question 2 How long have you lived in this catchment (years) ?

	< 2	2 - 5	6 - 10	11 - 20	21 - 30	31 - 40	> 40	N/a	Total
Coordinators	6	8	0	1	0	1	0	2	18
Chairs	0	1	1	2	1	2	6	0	13

Note: Excluding blank responses but including values of zero.

While occasionally a new resident becomes a CCC Chair, most are lifetime residents. This contrasts markedly with Coordinators, most of whom moved to the catchment to take up their position. It is quite significant that most of the coordinators have lived less than five years in their catchments and many less than two.

Question 4 What year did you assume your present responsibilities with the catchment group?

	1992	1993	1994	1995	1996	1997	N/A	Total
Coordinators	1	0	2	4	8	2	1	18
Chairs	0	4	0	4	2	1	2	13

Recency of appointment is no surprise given that many of the CCCs are new, almost half being created between 1995 and 1997. There are a few long serving members of the older CCCs, but even in them there is considerable turnover.

Question 5 Since assuming your current responsibilities, how satisfied are you with progress in the CCC?

	Very Satisfied	Satisfied	Neither	Unsatisfied	Very Unsatisfied	No Response	Total
Coordinators	2	13	1	1	0	1	18
Chairs	2	8	3	0	0	0	13

Several Chairs and one Coordinator are ambivalent about their successes but the majority of both Chairs and Coordinators are satisfied, two it is pleasing to see, are very satisfied. While a few are non-committal, only one coordinator claimed to be unsatisfied.

Question 6 How much money did your CCC spend last year (approximately) on.

	Projects	Administration	Consultancies	Other
No Funding	11	9	17	12
Less than $50,000	1	8	1	5
$50,001 to $100,000	3	1	0	0
$100,001 to $150,000	1	0	0	0
$150,001 or more	2	0	0	1

Note: This table uses the Coordinators' responses. A value of zero may represent 'No Funding' or 'No Response' at this stage

CCCs are in general financially poor. While several CCCs had significant project funding. The majority are able only to fund essential committee costs, mostly the salaries of Coordinators. Almost all the longer running CCCs gain their core funding from two sources – either Queensland Department of Natural Resources operating grant together with either operating or project funds from the Natural Heritage Trust and its components the NLP, Bushcare, Rivercare and Coastcare and Waterwatch. Several CCCs indicated receiving

financial support from local councils and in-kind support from councils and local industry sources. Only one mentioned significant funding from private corporations (mining companies).

Question 7 What have been the major achievements of your CCC?

	Coordinators (18)		Chairs (13)	
	Yes	No	Yes	No
Prepared situation statement on the catchment	7	11	3	10
Prepared a catchment strategy or plan	14	4	12	1
Offered advice to landowners	7	11	6	7
Conducted projects	9	9	5	8
Other	3	15	1	12

Note: For details on what 'Other' represents, refer to the Notes on Question 7

Question 7 List of Other Activities of CCC Groups

Artificial wet land in cane field drainage system	Augmentation of mangroves and fisheries ponds
Bore drain replacement – Greta Artesian Basin	Catchment wide Dairy Effluent Project
Cleaning-up Acid Mine Drainage	Community monitoring of urban water quality
Construction of wetlands	Coordinated water quality monitoring program
Creek Floodgate	Developing localised "action" plans
Implementing sub catchment action plans	Integrated Information Management System for Catchment Managers
Integrated pest management	Landholders inventory
Major river mgt projects	Model Sub Catchment
National Riparian Project	Nutrient Management Planning
Owl nesting box program	Principles and guidelines for land use planning
Property development planning	Resolve inventory project
Resource atlas	River bank stabilisation using landowners IDCAS/ownership
Riverbank Restoration	Soil conservation works $200 000
State of Rivers - Anderson method.	Streambank Revegetation
Teachers professional training day.	Total grazing pressure. Safe carrying capacity
Vetiver Grass Trials	Voluntary riverbank restoration program
Waterwatch	

Most of the longer running CCCs have now prepared catchment strategies, the newer ones being preoccupied with group formation or in the early stages of strategy formation. Many of these strategies have been endorsed by the Queensland Catchment and Landcare Council. (See Map 1) There have also been other related strategic activities in committees, such as Identification of issues and development of options, development of natural resources & environmental management plan. Despite rumours that abound that CCCs only prepare catchment strategies to qualify for project funding, most respondents state that their plans were prepared for the "right" reasons and that they have assisted their committees focus on priority issues and to identify the way forward. These views are best reflected in the comments made by chairs and coordinators in response to Question 8.

Question 8 Responses Given to About the Purpose and Usefulness of Catchment Plans

Prepared strategy or catchment plan?	For what purpose?	Useful?	Why?
CHAIRS			
Yes	Identify areas of concern in relation to catchment management	Yes	It gives direction and works towards goals in prioritised order
Yes	To identify where investment and effort will achieve the greatest positive impact on resource management	Yes	Forced people to put personal agenda's aside. Finalised the development of a genuine community government partnership

Prepared strategy or catchment plan?	For what purpose?	Useful?	Why?
No	Have completed second discussion paper.	N/A	
In Progress	To assist with coordination of actions by community & agencies	N/A	Still developing
Yes	Set goals for catchment management. Sustainable Natural Resource Management	Yes	Enlightening experience for the ICM Committee. Makes us aware of the inter dependence and fragility of all sections of the catchment's
In Progress	Present situation statement & future	N/A	Will be
Yes	Addressing issues of concern in catchment and seeing their implementation continually updating	N/A	Only ready for printing.
Yes	For the communities use and advice and to address priority issues	Yes	Helped to develop the regional plan and assist with funding applications
Yes	We believe that a strategy is the focal point for our assn. This will support any funding applications & also give us local credibility on issues	In Progress	Our strategy is still being developed - stage one is complete, stage two currently being developed - will be submitted to the state body in the new year
Yes	Even though the strategy is broad. It does give land u se managers guidelines on how to manage their land use so as to minimise overall negative affect on the general environment	Yes	The plan will soon be adopted but it has already focused land users decision makers on all aspeccts of the development
Yes	The sustainable management of natural resources of our district	Yes	As a basis for dealing with issues in a coordinated way
COORDINATORS			
Yes	For the better management of all the natural resources of the catchment	Yes	Provides focus to citizenry and govt agencies
In Progress	To provide direction for how we will manage our natural resources by developing strategies and action plans by encouraging/promoting a change in community attitudes, behaviour and the adoption of self regulation practices	N/A	
Yes	Identify issues, agree on them, Id options & best approaches, rank Id responsible stakeholders for implementation. Involve stakeholders	Yes	Stakeholders are agreeing on some of the issues - leading to dev & rehab plan
Yes	To set direction & priorities. To give equal priority to soil, water & vegetation & fauna issues	Yes	Shapes priorities for projects in the catchment eg. NHT funding, private enterprise sponsored projects
Yes	Prioritise issues, strategies & actions to minimise duplication, maximise benefit on ground & to encourage partnerships between government, industry & community	Yes	Greater appreciation of issues. High involvement of all stakeholders. Provide direction for activities. Established better links between stakeholders
Yes	We have affirmed the BCC's Norman Ck Catchment Management Plan (1996). From this NCMP we have reprioritised certain action plans and related them to broader social objectives of the N4C. The above NCMP had its limitations but as the N4C matures and educates itself the inherent deficiencies will I hope be overcome by our community social	Yes	Yes. It has been the culmination of four years of hard work by RAGE to influence the BCC to develop the plan. It was the catalyst of forming the N4C. However its ongoing effectiveness cannot be evaluated at this point in time until runs are on the bd
Yes	Draft strategy to propose a way forward	Yes	Has been useful in moving the process forward and generating debate
Yes	Provide direction, set priorities, promote a joint community/government partnership using a shared vision	Yes	Provided direction. For localised action plans. Set priorities within the catchment & region. Helped to identify projects required to meet catchment objectives. Negotiating point with other stakeholders in catchment
Yes	To provide a focus and priority to the catchment community (including L.G. and State agencies) for catchment action over the	Yes	Developing a shared perspective on issues. Engendering a deeper understanding of causes behind issues

Prepared strategy or catchment plan?	For what purpose?	Useful?	Why?
	next 10-20		(through the debating and discussing side of preparing the Strategy). Useful in keeping the CCC focussed rather than running off up every blind gully
No	Process of doing so. To promote ICM/INRM and Sustainable Development. To guide NHT investment in CQ	N/A	
No	In the process of: for long term planning & coordination of resources. Seeking financial support	N/A	Developing stages.
Yes	ID priority action/needs/responsibilities. Aid in funding applications	N/A	Draft form - final by May 98
Yes	Basis to prepare acceptance implementation of action plans for sustainable management	Yes	Just starting to test it through local government plans river improvement trust and rural industry
Yes	To guide the councils agencies & landholders in a coordinated way to develop sustainable resource management	Yes	Completed one week ago, the process has involved community education & a genuine ownership of the issues & the plan

2. Problem Characterisation and Role of the Group (Q9)

Question 9 Please rank your level of agreement with the following statements about the role your CCC has played in the catchment. The local CCC has:

	Strongly Agree	Agree	Neither	Disagree	Strongly Disagree	N/a
Coordinators (18)						
9a. Helped negotiation among resource stakeholders to accommodate a wide range of resource uses	2	10	3	2	1	0
9b. Helped stakeholders in defining the source of resource problems and solutions to them	1	11	4	2	3	0
9c. Helped stakeholders in ensuring their resource management practices are effective, efficient, equitable, accountable	1	5	9	2	1	0
9d. Encouraged research and data gathering and analysis in order that solutions to resource problems can be better understood	2	11	4	1	0	0
9e. The ICM program in Queensland is well-suited to address complex resource issues within this catchment?	3	7	3	2	3	0
Chairs (13)						
9a. Helped negotiation among resource stakeholders to accommodate a wide range of resource uses	0	7	3	0	1	2
9b. Helped stakeholders in defining the source of resource problems and solutions to them	1	10	0	0	1	1
9c. Helped stakeholders in ensuring their resource management practices are effective, efficient, equitable, accountable	0	5	4	1	1	2
9d. Encouraged research and data gathering and analysis in order that solutions to resource problems can be better understood	3	8	1	0	0	1
9e. The ICM program in Queensland is well-suited to address complex resource issues within this catchment?	2	5	3	0	1	2

There is wide agreement that CCCs helped negotiation amongst resource users and other stakeholders in defining problems and solutions. Most encouraged research and data gathering also. There was less uniformity, indeed one might say ambivalence, especially amongst coordinators that the Queensland ICM program was suited to addressing the problems of catchments. The differences between coordinators and chairs on this question are significant – coordinators being less certain that the Queensland ICM model is well-suited to address the problems. Two-thirds of respondents did not believe that they had directly helped stakeholders in resolving their own resource management practices.

3. Information Use (Q10)

Question 10. Information relevant to ICM and CCCs and their activities may be available in a number of forms (eg., databases, reports, pamphlets, maps). How useful has information or data about the following topics been to you and your CCC

	None Available	Very Useful	Useful	Neither	Not Useful	N/A
Coordinators (18)						
10a.Catchment natural resources ?	2	8	8	0	0	0
10b.Population and land use in your catchment?	2	9	6	1	0	0
10c.Local organisations, industry and community groups in your catchment?	4	6	6	2	0	0
10d.Government institutional arrangements for ICM, Landcare, natural resources, and related issues?	0	5	10	1	2	0
10e.Government policies and regulations on natural resources and related issues?	1	5	4	2	5	1
10f.Options for funding of ICM and other community activities?	5	3	8	2	0	0
10g.Group management and administration?	5	7	2	3	1	0
Chairs (13)						
10a.Catchment natural resources ?	1	4	6	2	0	0
10b.Population and land use in your catchment?	1	5	6	1	0	0
10c.Local organisations, industry and community groups in your catchment?	0	5	7	0	0	1
10d.Government institutional arrangements for ICM, Landcare, natural resources, and related issues?	1	4	5	2	1	0
10e.Government policies and regulations on natural resources and related issues?	1	1	7	4	0	0
10f.Options for funding of ICM and other community activities?	0	3	8	1	0	1
10g.Group management and administration?	0	6	3	2	1	1

Coordinators and Chairs from most catchments found that information on catchment natural resources, population and land use, local organisations, industry and community groups, options for funding for ICM, and group management and administration was most useful to the CCC. A small but significant number believed that information on government policies and regulations on natural resources either not useful or neither useful nor unuseful. Nearly 30% of Coordinators identifed information relating to both options for funding ICM activities and group management and administration was not available to the CCC.

4. Public Attitudes, Support and Recent Developments (Q11-18)

Question 11 In your opinion, what is the level of public awareness about natural resource issues in your catchment?

	Very High	High	Moderate	Low	Very Low
Coordinators (18)	1	4	8	4	1
Chairs (13)	0	2	8	3	0

Coordinators and Chairs from most catchments believed that the level of public awareness about resource management issues in most catchments was moderate to low. There is a small but significant number of catchments however where this is not the case.

Question 12 What level of public support do you believe your CCC has?

	Very High	High	Moderate	Low	Very Low
Coordinators (18)	0	3	13	2	(
Chairs (13)	0	1	8	4	(

The level of public support for CCCs remains moderate to low but many of the coordinators and chairs make positive statements about the trends and about activities and events that have had a positive influence on public support and awareness.

Question 12 Comments on Changes in Public Awareness

Chairs

Treated with suspicion Cannot understand why.

Not much

Become aware of the complexity and number of issues that need to be dealt with

Outside catchment committees little change. We have involved a local government which potentially means greater understanding

Several issue have arisen (eg) acid sulphate soils, clearing of water holes on streams. These issues were well publicised. The owl nesting box story lifted public perception. Issue of catchment Atlas & later CD of the Atlas

Public awareness probably hasn't changed much in 12 months if anything it's improved a little

Considerably, our activities have highlighted certain issues and the controversy over the Kurrerava Cotton Project has created interest

People expect things to change overnight. Catchment Management is slowly catching on in areas of NRM. What has been bad practice in the past take a while to rectify and achieve good results

The promotion of the strategic plan

Coordinators

The drought has increased competition for access to water so people especially water users, have been forced to look at the sustainability of bath surface & ground water use through at the Condamine

There has been a shift of emphasis from weed/land management concern to a prioritisation of water management (especially allocation and access)

Mining. Live cattle exporting.

Through Waterwatch, WAMP & increasing demands for water

Public consultation with strategy document. Tourism industry active lobbying eg sewage & effect on GBR

Through a clarification of groups roles & responsibilities within the area.

Release & presentation of Bremer Catchment Strategy. Release of draft Brisbane R Management Plan. Release of discussion paper on Water Quality. Wide ranging programs with Ipswich Enviroplan.

I'd say it's increased due to our projects & media coverage of issues

More awareness as Burnett Catchment Care Association becomes involved in more community activities

Increased especially during & as a result of the catchment planning process

There has been 2 discernible change but its hard to quantity. The perception of public awareness change relates move to intuitive 2nd subjective feelings related to how the CCC's going. At the moment its positive and optimistic

More people are aware of ICM especially the "ICM process" of negotiation and partnerships

Very slightly. A marketing campaign is needed & will be looked at in the near future

Has been a turn around in how to deal with riverine problems. Awareness in key areas (such as the Mayors) has increased greatly. General positive "vibes" coming from field days, night meetings etc with community groups, farmer groups regarding

the approach of the CCC & the catchment concept.
I think we have done a lot of work on raising the issues - whether or not people's understanding at the issues has improved is another thing
It hasn't. People nurtured our womb-to-tomb welfare are robbed of initiative. Most know little of what is outside their own yards and care less
Don't know (still waiting on NHT funding to get our education & awareness program up & running)

Question 12 A Selection of Opinions as to Whether Public Support for CCCs is Rising or Not

Chairs
Public support is rising as the displays and education programs through the schools and to the general public take effect.
More inquiries to CCC for advice
Increased with local government. Is increasing as we become more professional & accountable
We have promoted awareness and offered solutions. Our committee is not a negative group - most of us would prefer to educate by example & find outcomes as part of the public awareness campaign
There is confusion on the role of ICM & Landcare and some other major projects which are in process.
Moral support is moderate but when it comes to the bulk of the public doing things - apathy takes over
Because of the direction of our research we have not really considered this. I would suggest there has been increased support but only from certain community sectors
Younger people are becoming more supportive and my overall view would be yes
An awareness that strategic planning is this further direction

Coordinators
Possibly increased slightly due to a recent turnover in members (only every 3 yrs) & establishment of an independent office out of DNR. Generally public support is low - people are generally unaware of our goals
Many sectors of the community would be more aware of the existence of our CCC. Some sectors are more supporting now that our group is more active, but many people are still suspicious of our group, our role
Now have a core membership of 13 stakeholder groups
Very little: The same people have been involved, although local governmentt has shown increasing interest.
Increase in membership - currently 100
Unsure - many still see ICM as arty farty that is green and doesn't really help them on the ground
In urban catchment its move a case of establishing a profile 2nd this for the N4C has been slow & steady. Enquires are building up 2nd network development is becoming more established - in short, yes!
The CCC in this catchment is going through a transition phase and the process has generated more involvement
There has been a slight increase in support - although generally the "public" do not have an adequate understanding of CCC & how they may be able to help
2,3 but increasing. More people making suggestions to improve actions (as opposed to not accepting the actions in the strategy). More landholders joining in the CCC's projects. More dollars coming from Local Govt.
Increased participation at meetings we have opened a catchment information centre and are getting more drop ins
It will improve when the above planning and proposed projects are carried out. The public realises that the NRCCC is a sound natural resource body & has definite long term benefits for the broader community

Question 13 How effective has the involvement of the following groups been to the CCC?

	Very Effective	Effective	Neither	Ineffective	Very Ineffective	Not Applicable
Coordinators (18)						
13a.Rural producers	3	9	2	1	1	2
13b.Rural industry organisations	1	6	4	3	2	2
13c.Local government politicians	2	6	4	3	3	0
13d.Local government administrators	3	3	5	5	1	1
13e.State government politicians	0	4	5	6	1	2
13f. State government agencies DPI/DNR	2	12	1	1	0	2
13g.Forestry	2	2	9	1	1	3
13h.Land Management	0	8	3	3	2	2
13i.Lands Administration	0	3	7	3	2	3
13j.Department of Environment	0	8	7	2	0	1
13k.Local Government and Planning	1	6	7	3	0	1
13l.River Improvement Trust	1	5	5	1	1	5
13m.Drainage Board(s)	0	2	6	1	0	9
13n.Environmental Organisations	3	7	6	0	0	2
13o.The Media	1	11	2	1	1	2
13p.Landcare Groups	5	10	1	0	1	1

	Very Effective	Effective	Neither	Ineffective	Very Ineffective	Not Applicable
Chairs (13)						
13a.Rural producers	1	11	1	0	0	0
13b.Rural industry organisations	2	6	2	2	0	1
13c.Local government politicians	2	6	3	1	0	1
13d.Local government administrators	2	6	4	1	0	0
13e.State government politicians	0	2	5	3	0	3
13f. State government agencies DPI/DNR	2	4	5	1	0	1
13g.Forestry	5	2	3	1	1	1
13h.Land Management	2	5	3	0	1	2
13i.Lands Administration	2	1	5	1	2	2
13j.Department of Environment	1	6	4	2	0	0
13k.Local Government and Planning	1	6	4	1	1	0
13l.River Improvement Trust	2	2	1	1	1	6
13m.Drainage Board(s)	0	1	2	0	0	10
13n.Environmental Organisations	1	3	4	0	3	2
13o.The Media	1	5	2	3	1	1
13p.Landcare Groups	2	9	2	0	0	0

As expected, the respondents believed that rural producers and their counterparts in DNR were the most effectively involved in the ICM process. Community groups such as Landcare groups and environmental groups are also effectively involved. The media too played an important role. In about half the CCCs, producer organisations were not effectively involved – although coordinators and Chairs differed significantly on this issue.

Those stakeholders that should be involved, but were not effectively involved in a number of CCCs, included local government administrators and politicians and in particular state government politicians. It remains a very apparent weakness of the ICM process that local and state government politicians do not engage themselves with the ICM process.

An interesting feature of the respondents' views is that Chairs had, on average and for the same catchment, a more positive opinion on the level of involvement of most groups compared with coordinators who were more restrained in their assessment of effectiveness.

Question 14 Selected Opinions on What Can be Done to Gain Greater Involvement of Community and Other Stakeholder Groups

Chairs

Sponsor seminars and promotions state wide about ICM and Landcare presence in each community

More understanding of ICM process

Stop the self interest & use of position for own benefits.

More publicity, find ways to involve public more

Regional press releases/brochures regular briefing by dept managers, more advice/info on dept field officer activites in our area

Formal structure ie trust or board. Competitive appointments of members groups better resourced. Better alignment of agency programs with strategies. Separation of RAP's & Regional Strat Groups - transparency

Govt Agencies must make the effort to advise what they are doing in the catchment.

Grass roots contact and full identification of issues. Change in attitude by all bodies who at present appraoch the programmes with a parochial attitude. This includes State Govt as well as Local Govt

Coordinators in catchments working with community and industry offering advice on how to address situations. Education in schools from an early age

More communication with public, more involvement by gov agencies

Promotion of ICM for all state depts to facilitate whole of government approach

DNR ICM staff should visit the regions more often and ask us what our needs are, rather than tell us e.g. communications unit. Improve links with Local Governments. Disband River Improvement Trust & Development. Giving

Coordinators

State advertising

State wide or regional media campaign, insist councils become involved

Help with PR to include positive linkage with CCCs. CCC stability within district through support for permanent

coordinators. More formal linkage/contact with govt dept officers. More stability in funding support system.
Awareness campaign - relevance to different areas to do things like this we need assistance - time & resources. It would be better for the locals to be involved in this but the time & cost is to great - they need some financial support
State: More generic promotional material. State: Info on legislative requirements. State: Info on jurisdictions.
Govt should get serious about strategies for r Mgt issues, population & sustainability
Closer ties with local government. CCC's should be used by LG as a resource to comment on land use & planning issues
Remove the immediate association of the general community that it is another part of government & is government owned
Greater resourcing of CCC activities. Greater coordination of state & local govt so that in kind assistance is more focused at the grass-roots level 2nd available to CCC's etc. A major priority of CCC's is to have 2 public shop front to enable them to be a focal point for ICM activities. This is where state/local govt has a role to play.
Local govt project is proceeding perhaps followed by some implementation funds for LGS that identifies issues with CCC & develops partnerships
Marketing campaigns to gain more. Community ownership
State - get rid of that dickhead advising Hobbs - less insertion of extra layers of bureaucracy through regional CCC especially their projects
Full cooperation from government agencies. Make CCC's Strategy authorities with power to enforce change. Up here is Comalco land people feel abandoned by the govt altogether - we can't ever get a local government authority so approaches (SEQ anyway). Direct budgetting to ICM Committees! Local groups should promote themselves better - public participation is poor. Resolve the deadlock is negotiations with aboriginal communities
1. Adequate funding. 2. Concerted media and public awareness campaign. Professionally organized and run at state level 3. An acceptance by Cairns City Council that it is responsible for the old Mulgrave Shire as well since the previou slabor govt forced amalgamation - too much spirit in Cairns
An education & awareness campaign on radio & television outlining the community benefits of the ICM process

Question 15 What types of involvement or linkages has your CCC had with Local Governments in your catchment?

	Coordinators (18)		Chairs (13)	
	Yes	No	Yes	No
None	0	18	0	13
Joint projects or activities	12	6	6	7
CCC has a referral agency on natural resource issues/projects for local government	6	12	6	7
Local Government as a source of information/advise for the CCC	11	7	8	5
CCC strategy development	13	5	10	3
Local Government planning schemes/strategy development	9	9	7	6
Other	13	5	4	9

The links between CCCs and local government are increasing markedly in Queensland ICM. As shown on the Table, many local governments are involved in joint activities and assist CCCs in strategy development. Conversely, CCCs are increasingly involved in local government planning schemes and as a source of advice.

Question 17 The implementation of ICM in this catchment is difficult because:

	Strongly Agree	Agree	Neither	Disagree	Strongly Disagree	N/A
Coordinators (18)						
17a. The large size of the catchment (or poor transporation links between parts of catchment	4	6	2	2	4	0
17b. The wide variety of values and beliefs among CCC members seriously detracts from an effective level of cooperation developing among them	0	4	4	5	5	0
17c. Some important constituency groups are not represented in the ICM process	2	8	2	3	3	0
17d. The perception that ICM has been forced on the catchment by the state government	1	5	7	3	2	0
17e. The lack of an effective level of interest by CCC members	1	4	2	9	2	0
17f. The public's lack of trust in state/local government-sponsored initiatives	4	7	6	1	0	0
17g. The public's lack of interest in community type activities	1	6	3	5	3	0

17h. The lack of financial resources within the community	4	10	3	1	0	0
17i. The lack of agreement among CCC members concerning its objectives	0	1	4	9	4	0
Chairs (12)						
17a. The large size of the catchment (or poor transporation links between parts of catchment	5	2	1	4	0	0
17b. The wide variety of values and beliefs among CCC members seriously detracts from an effective level of cooperation developing among them	0	3	2	7	0	0
17c. Some important constituency groups are not represented in the ICM process	0	2	0	8	2	0
17d. The perception that ICM has been forced on the catchment by the state government	0	2	3	6	1	0
17e. The lack of an effective level of interest by CCC members	0	3	3	4	2	0
17f. The public's lack of trust in state/local government-sponsored initiatives	2	6	2	2	0	0
17g. The public's lack of interest in community type activities	3	5	1	3	0	0
17h. The lack of financial resources within the community	5	3	3	1	0	0
17i. The lack of agreement among CCC members concerning its objectives	1	0	2	7	2	0
17j. The lack of agreement on feasible solutions	1	1	3	5	2	0
17j. The lack of agreement on feasible solutions	0	2	7	7	2	0

Obstacles to ICM include the size of some catchments, or poor transport links, and perceived financial constraints. A majority of Coordinators agree that there are important missing constituency groups, a view not largely shared by Chairs. There is agreement between Coordinators and Chairs that the public lack trust in government sponsored initiatives. It is interesting to note that a majority of Chairs believe the community's lack of interest in community affairs is an obstacle – a view not so strongly held by Coordinators.

Question 18 Rate your level of agreement with the following statements

	Strongly Agree	Agree	Neither	Disagree	Strongly Disagree	N/A
Coordinators (18)						
18a. There is a strong consensus among CCC members concerning CCC functions	2	10	1	4	1	0
18b. At CCC meetings, all CCC members participate actively	0	9	0	7	2	0
18c. The local ICM process effectively resolves resource conflicts	0	5	7	6	0	0
18d. The ICM process is responsive to local needs	1	9	6	1	1	0
18e. The CCC is solving the priority natural resource management problems in the catchment	0	11	6	0	1	1
Chairs (13)						
18a. There is a strong consensus among CCC members concerning CCC functions	1	7	3	1	1	0
18b. At CCC meetings, all CCC members participate actively	3	8	1	1	0	0
18c. The local ICM process effectively resolves resource conflicts	0	4	5	3	0	1
18d. The ICM process is responsive to local needs	1	9	3	1	0	1
18e. The CCC is solving the priority natural resource management problems in the catchment	0	6	3	1	0	3

Question 18 addressed issues relating to the performance of Committees. In some CCCs respondents were not sure that the CCC members had consensus about their functions, although 75% were. In common with most meetings, not all members participate actively, a situation that 80% of Chairs and 50% of Coordinators noted.

Perhaps the most telling finding here is that only 28% of Coordinators and 30% of Chairs agreed that the local ICM process effectively resolves local resource conflicts. Much higher proportions of respondents at least believe that the process is responsive to local needs and is addressing priority problems.

5. Personal Demands and Motivations (Q19-20)

Question 19 On average, how many hours per month do you devote to ICM?(hours / month)

	Range		
		Median	Average
Coordinators	40-255	180	186.76
Chairs	8-60	25	25.92

Question 20 The implementation of ICM in this catchment is difficult because:

	Completely Agree	Agree	Moderately Agree	Disagree	Completely Disagree	N/A
Coordinators (18)						
20a.The amount of time I devote to ICM significantly interferes with my own business/job requirements	2	3	1	1	2	9
20b.The amount of time I devote to ICM significantly interferes with my family commitments	4	6	1	2	0	5
20c.My involvement with the CCC causes significant out-of-pocket expenses	2	1	1	6	1	7
20d.I find being a member of the CCC personally rewarding because I can contribute to the community	6	8	0	0	0	4
20e.I find being a member of the CCC rewarding because I care about natural resource management	8	7	0	0	0	3
20f.I find being a member of the CCC rewarding because I can meet other members of the community who can influence resource management decision making	5	9	0	1	0	3
20g.A CCC's member's role is to provide their personal views on resource management issues at CCC meetings	2	2	5	4	3	2
20h.A CCC member's role is to represent the resource management views of their constituency group at CCC meetings	7	7	2	1	0	1
20i.A CCC member's role is to provide a catchment-wide perspective of natural resource management issues at CCC meetings	6	7	1	2	0	2

Chairs (13)						
20a.The amount of time I devote to ICM significantly interferes with my own business/job requirements	5	1	4	3	0	0
20b.The amount of time I devote to ICM significantly interferes with my family commitments	2	4	2	5	0	0
20c.My involvement with the CCC causes significant out-of-pocket expenses	4	2	3	3	1	0
20d.I find being a member of the CCC personally rewarding because I can contribute to the community	4	9	0	0	0	0
20e.I find being a member of the CCC rewarding because I care about natural resource management	7	6	0	0	0	0
20f.I find being a member of the CCC rewarding because I can meet other members of the community who can influence resource management decision making	4	7	1	1	0	0
20g.A CCC's member's role is to provide their personal views on resource management issues at CCC meetings	2	5	4	2	0	0
20h.A CCC member's role is to represent the resource management views of their constituency group at CCC meetings	5	6	1	1	0	0
20i.A CCC member's role is to provide a catchment-wide perspective of natural resource management issues at CCC meetings	5	6	2	0	0	0

For chairs, ICM interferes to some extent with business and family interests, but all agree that they have personal rewards from contributing to the community.

In terms of the role of CCC members, chairs mostly agree that members' role is to present their own and constituency views at meetings, many coordinators do not agree that it is appropriate for members to present personal views.

PART III DISCUSSION

1. Overall Discussion of 1998 Results

The number of ICM groups has expanded continuously in Queensland. Now there are 32. A consequence is that they are mostly new and many of the older ones have been executive turnovers.

Many respondents are satisfied with progress but would like to move faster.

CCCs are in general financially poor. Most have funding from DNR and/or NHT for their coordinators and some project funds from the same sources. There is no doubt that the NHT has been a major driving force in the Qld ICM process, but the core support remains in DNR.

Most of the CCCs have prepared plans which they believe have assisted substantially in focussing people on priorities. This was the major achievement of the majority of CCCs.

Public awareness and support to CCCs is still only moderate to low in most cases but showing signs of increasing due to various CCC activity.

A notable feature was increasing interaction with local government.

Only about 30% of respondents believed ICM was effectively resolving local resource management issues.

2. Comparative Analysis 1995-1998

Since assuming your current responsibilities, how satisfied are you with progress in the CCC?

		Very Satisfied	Satisfied	Neither	Unsatisfied	Very Unsatisfied	No Response
1995	Coordinators (13)	1	4	4	3		1
	Chairs (11)	1	6	4			
1997	Coordinators (18)	2	13	1	1	0	1
	Chairs	2	8	3	0	0	0

Levels of satisfaction increased significantly between 1995 and 1997, despite the fact that many new committees were formed that may not have consolidated sufficiently to have major achievements.

What have been the major achievements of your CCC? (Coordinators responses)

	1995		1997	
	Yes	No	Yes	No
Prepared situation statement on the catchment	5	9	7	11
Prepared a catchment strategy or plan	11	3	14	4
Offered advice to landowners	6	9	7	11
Conducted projects	9	5	9	9

Note: For details on what 'Other' represents, refer to the Notes on Question 7

What level of public support do you believe your CCC has?

		Very High	High	Moderate	Low	Very Low
1995	Coordinators	2	2	6	3	0
	Chairs	0	1	8	2	0
1997	Coordinators (18)	0	3	13	2	0
	Chairs (13)	0	1	8	4	0

Public support has not changed noticeably over the period.

How effective has the involvement of the following groups been to the CCC? (Coordinators responses)

		Very Effective	Effective	Neither	Ineffective	Very Ineffective	Not Applicable
Rural producers	1997		9	2	1	1	2
	1995		7	3			
Local government politicians	1997	2	6	4	3	3	0
	1995	2	3	4	3		
State government politicians	1997	0	4	5	6	1	2
	1995	1	2	4	5		

State government agencies						
DPI/DNR 1997	2	12	1	1	0	2
1995	6	6	0	1		
Lands Administration 1997	0	3	7	3	2	3
1995	2	2	5	2	2	
Department of Environment 1997	0	8	7	2	0	1
1995	4	1	5	1	2	

Sources of support and involvement vary significantly between catchments, depending on relevance of particular issues and state department priorities. The involvement of state politicians has not improved in most catchments and that of local politicians varies considerably from catchment to catchment. Some coordinators remain unhappy about the effectiveness of Lands Administration and Department of Environment involvement.

Perhaps most importantly, coordinators in most catchments regard the involvement of rural producers as effective and remaining so.

ICM Queensland - Statewide Surveys of Chairs and Coordinators in 1995 and 1997

ICM Groups in 1995

	Total
CCCs (include. Fitzroy)	14
RCCC	1
Steering Groups	6
Catchment Care Groups	1
Total	22

ICM Groups in 1997

	Total Groups
CCC	22
Regional CCC	2
Steering Groups	9
Catchment Care Groups	1
Total	34

Of the Steering Groups, 4 groups (Lake Eyre Basin, Southern Gulf, Barron, Weipa) have formal Catchment Coordinators appointed and have developed to a stage that they effectively have a role and function of a CCC.

APPENDIX

ICM IN QUEENSLAND
ICM COORDINATOR'S AND CHAIR'S OPINIONS

BACKGROUND

1. Which catchment are you involved in? ……

2. How long have you lived in this catchment? …….Years

3. What is your occupation? ……

4a. What year did you assume your present responsibilities with the catchment group? ……..

4b. What are your responsibilities?

☐ CCC Chair

☐ Catchment Coordinator

5. Since assuming your current responsibilities, how satisfied are you with progress in the CCC? (please tick)

☐ very satisfied

☐ satisfied

☐ neither satisfied nor unsatisfied

☐ unsatisfied

☐ very unsatisfied

6. How much money did your CCC spend last year (approximately) on:

Projects	$……
Administration	$……
Consultancies	$……
Other (Please Specify)	
……	$……
……	$……
……	$……..

Please list the principal sources of the CCC's income:

……

……

……

……

7. What have been the major achievements of your CCC? (please tick)

- ☐ prepared situation statement on the catchment
- ☐ prepared a catchment strategy or plan
- ☐ offered advice to landowners
- ☐ conducted projects
- ☐ other (Please specify)

……

……

……

……

Please list some of the most significant projects:

……

……

……

……

8a. Has your Committee prepared a catchment strategy/plan? (Yes/No)

For what purpose?

……

……

……

……

8b. Has the catchment strategy/plan been useful? (Yes/No)

Why?

……

……

……

……

9. Please rank your level of agreement with the following statements about the role your CCC has played in your catchment.

	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree	Don't know
The local CCC has:						
Helped negotiation among resource stakeholders to accommodate a wide range of resource uses.	☐	☐	☐	☐	☐	☐
Helped stakeholders in defining the source of resource problems and solutions to them	☐	☐	☐	☐	☐	☐
Helped stakeholders in ensuring their resource management practices are effective, efficient, equitable, accountable.	☐	☐	☐	☐	☐	☐
Encouraged research and data gathering and analysis in order that solutions to resource problems can be better understood .	☐	☐	☐	☐	☐	☐
The ICM program in Queensland is well-suited to address complex resource issues within this catchment?....	☐	☐	☐	☐	☐	☐

10. Information relevant to ICM and CCCs and their activities may be available in a number of forms (eg., databases, reports, pamphlets, maps).

	None available	Very Useful	Useful	Neither	Not useful
How useful has information or data about the following Topics been to you and your CCC					
Catchment natural resources?.....	☐	☐	☐	☐	☐
Population and land use in your catchment?.....	☐	☐	☐	☐	☐
Local organisations, industry and community groups in your catchment?.....	☐	☐	☐	☐	☐

	None available	Very Useful	Useful	Neither	Not useful
Government institutional arrangements for ICM, Landcare, natural resources, and related issues?.....	☐	☐	☐	☐	☐
Government policies and regulations on natural resources and related issues?.....	☐	☐	☐	☐	☐
Options for funding of ICM and other community activities?	☐	☐	☐	☐	☐
Group management and administration?	☐	☐	☐	☐	☐
Other - please specify:					
....	☐	☐	☐	☐	☐
....	☐	☐	☐	☐	☐

Please list some of the most significant reasons why information has been useful/lacking?:

……

……

……

……

……

PUBLIC ATTITUDES AND RECENT DEVELOPMENTS

11. In your opinion, what is the level of public awareness about natural resource issues in your catchment? (please tick)

☐ very high
☐ high
☐ moderate
☐ low
☐ very low
☐ don't know

How has public awareness changed over the last year?

……

……

……

……

12. What level of public support do you believe your CCC has? (please tick)

- ☐ very high
- ☐ high
- ☐ moderate
- ☐ low
- ☐ very low
- ☐ don't know

How has public support for the CCC changed over the past year?

……

……

……

……

13. How effective has the involvement of the following groups been to the CCC?

	Very effective	Effective	Neither	Ineffective	Very ineffective	Not applicable
Rural producers (specify)	☐	☐	☐	☐	☐	☐
Rural industry organisations (specify)	☐	☐	☐	☐	☐	☐
Local government politicians	☐	☐	☐	☐	☐	☐
Local government administrators	☐	☐	☐	☐	☐	☐
State government politicians	☐	☐	☐	☐	☐	☐
State government agencies:						
DPI	☐	☐	☐	☐	☐	☐
DNR						
.....Forestry.....	☐	☐	☐	☐	☐	☐
.....Land Management	☐	☐	☐	☐	☐	☐
.....Lands Administration.....	☐	☐	☐	☐	☐	☐
Dept of Environment.....	☐	☐	☐	☐	☐	☐
Local Government and Planning.....	☐	☐	☐	☐	☐	☐
River Improvement Trust.	☐	☐	☐	☐	☐	☐
Drainage Board(s).....	☐	☐	☐	☐	☐	☐
Environmental organisations (specify)	☐	☐	☐	☐	☐	☐
The Media……	☐	☐	☐	☐	☐	☐
Landcare Groups.....	☐	☐	☐	☐	☐	☐

Other (please specify):

..... ☐ ☐ ☐ ☐ ☐ ☐

..... ☐ ☐ ☐ ☐ ☐ ☐

..... ☐ ☐ ☐ ☐ ☐ ☐

14. What could or should be done at state/local levels to improve the acceptance and involvement of relevant groups and the general public in your CCC process?

……
……
……
……
……
……
……

☐ **What types of involvement or linkages has your CCC had with Local Governments in your catchment? Pleas tick.**

☐ None

☐ Jint projects or activities

☐ CCC as a referral agency on natural resource issues/projects for local government.

☐ Local Government as a source of information/advise for the CCC

☐ CCC strategy development

☐ Local government planning schemes/strategy development

☐ Other (please specify).

……
……
……
……
……
……
……

Please list some of the significant reasons for and benefits/disbenefits of this involvement?

……
……
……
……
……
……

16. What have been some of the recent major changes (political, financial, economic, or environmental issues at local, regional or national scales) that have significantly influenced the CCC's efforts?

……
……
……
……
……
……
……

17. The implementation of ICM in this catchment is difficult because:

		Strongly agree	Agree	Neither	Disagree	Strongly disagree	Don't know
17a	The large size of the catchment (or poor transporation links between parts of catchment)	☐	☐	☐	☐	☐	☐
17b	The wide variety of values and beliefs among CCC members seriously detracts from an effective level of cooperation developing among them	☐	☐	☐	☐	☐	☐
17c	Some important constituency groups are not represented in the ICM process	☐	☐	☐	☐	☐	☐
17d	The perception that ICM has been forced on the catchment by the state government	☐	☐	☐	☐	☐	☐
17e	The lack of an effective level of interest by CCC members	☐	☐	☐	☐	☐	☐
17f	The public's lack of trust in state/local government-sponsored initiatives	☐	☐	☐	☐	☐	☐
17g	The public's lack of interest in community type activities	☐	☐	☐	☐	☐	☐
17h	The lack of financial resources within the community	☐	☐	☐	☐	☐	☐
17i	The lack of agreement among CCC members concerning its objectives	☐	☐	☐	☐	☐	☐
17j	The lack of agreement on feasible solutions	☐	☐	☐	☐	☐	☐

18. Rate your level of agreement with the following statements:

18a	There is a strong consensus among CCC members concerning CCC functions.....	☐	☐	☐	☐	☐	☐
18b	At CCC meetings, all CCC members participate actively.....	☐	☐	☐	☐	☐	☐
18c	The local ICM process effectively resolves resource conflicts.....	☐	☐	☐	☐	☐	☐
18d	The ICM process is responsive to local needs	☐	☐	☐	☐	☐	☐
18e	The CCC is solving the priority natural resource management problems in the catchment.....	☐	☐	☐	☐	☐	☐

PERSONAL DEMANDS AND MOTIVATIONS

19. On average, how many hours per month do you devote to ICM? **……Hours/months**

20. Identify your level of agreement with the following statements according to the following scale:

		Completely agree	Agree	Moderately agree	Disagree	Completely disagree	Not applicable
20a	The amount of time I devote to ICM significantly interferes with my own business/job requirements.....	☐	☐	☐	☐	☐	☐
20b	The amount of time I devote to ICM significantly interferes with my family commitments.....	☐	☐	☐	☐	☐	☐
20c	My involvement with the CCC causes significant out-of-pocket expenses	☐	☐	☐	☐	☐	☐
20d	I find being a member of the CCC personally rewarding because I can contribute to the community.....	☐	☐	☐	☐	☐	☐
20e	I find being a member of the CCC rewarding because I care about natural resource management.....	☐	☐	☐	☐	☐	☐
20f	I find being a member of the CCC rewarding because I can meet other members of the community who can influence resource management decision making	☐	☐	☐	☐	☐	☐

20g	A CCC's member's role is to provide their personal views on resource management issues at CCC meetings	☐	☐	☐	☐	☐	☐
20h	A CCC member's role is to represent the resource management views of their constituency group at CCC meetings.....	☐	☐	☐	☐	☐	☐
20i	A CCC member's role is to provide a catchment-wide perspective of natural resource management issues at CCC meetings.....	☐	☐	☐	☐	☐	☐

OTHER COMMENTS

21. If there are any further comments you wish to make about ICM, please feel free to do so.

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Chapter 4

ICM in Queensland 1990-1999: An Anthology

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1. INTRODUCTION AND EXPLANATORY NOTES

This report is an anthology of papers on the origins and development of Integrated Catchment in Queensland over the period 1990 to 1999. The report consists largely of papers and extracts from documents that track the progress of this policy initiative and its implementation. There is relatively little new interpretative or critical evaluation provided by the authors here, although a number of extracts and papers included do provide critical evaluations.

Resource management in general and ICM in particular is a constantly changing policy area in government. Knowing what the current state of policies and programs in any region or state at any given time is a challenge. Legislation changes frequently as governments come and go, funding sources and levels of support vary from year to year (eg the NHT) and administrative arrangements are constantly restructuring. It is difficult to name another area of public policy subject to such variability over time.

The purpose of this report is to provide researchers, students and managers with a convenient source book of key reports and data to enable them to understand the historical evolution of ICM in Queensland. Many of the extracts included are from government policy papers, program publicity and evaluation studies that are not easily found now. Some of the papers here are from conference proceedings and other fugitive sources. It is important to note the essential historical nature of many of the documents included which describe policies or issues at a given time and may now be obsolete.

The anthology begins with a brief overview of the *national context* to show how the ICM program in Queensland (at least in 1997) compares with other states. At the time of writing a Commonwealth parliamentary inquiry into ICM was underway. The report and findings of this inquiry will provide essential reading when they become available.

Section 2 of the report contains a brief explanation of the *origins of ICM* in Queensland together with key elements of most of the policy paper released in 1991 that created the program.

Section 3 of the report contains documents and data that track the *development of ICM since 1991*. It includes an important progress report by Rowland and Begbie, two key agency staff involved in managing the ICM program almost since its inception. There is information on funding for ICM and reviews of related legislation and programs including the recently very important Natural Heritage Trust. Catchment Committee staff and members have met on a number of occasions to review progress and recommend improvements – summaries from their meetings are included here also.

Section 4 reproduces a significant part of the recently published Guide to Catchment Management in Queensland. It details the current *progress in the formation of catchment groups*, the key issues they deal with and their progress in catchment planning.

Section 5 specifically addresses the relationship between *ICM and Landcare,* based on a policy review paper on the topic and explanation of the structure and role of the Landcare and Catchment Management Council.

The final two sections focus on emerging directions of the ICM program – the development of regional strategies as frameworks for catchment planning and the adoption of catchment management by local governments.

ICM as practised in Queensland is a community based "bottom-up" process. It has bi-partisan support in state government but still has a fragile funding base. It has been a real time

experiment in locally based resource management and is in constant change. This report hopefully captures some of the key documents that show that process through time and can help provide a baseline for further informed development.

2. INTEGRATED CATCHMENT MANAGEMENT IN A NATIONAL CONTEXT

A river catchment is a naturally-defined natural resources ecosystem, characterised by a clearly-definable physical boundary, the watershed, determined by its hydrological and geomorphological history and established a natural barrier for many of the biological and physical processes at work within it (Burton, 1988: 43). Misuse of soils and water in a catchment will be clearly revealed in the waterways - the natural integral of land management – and human use must be managed to provide desired ends in water quantity and quality for other human uses and for the needs of in-stream natural life.

ICM has become a rallying point for renewed efforts in land conservation in Australia in recent years. Integrated Catchment Management is the integration of water and land management activities and the contributions of government agencies involved in these activities, within a catchment in a cooperative manner. For the purposes of this review we define ICM to be **formal** government policies, programs and laws for the management of land and water resources on a catchment basis. Of course many land use activities can be designed for better catchment outcomes without being defined as ICM.

In Australia, land use planning and natural resources management are State Government functions, undertaken by a range of conventional and essentially single-purpose agencies. All of the Australian States have adopted programs of integrated catchment management under a variety of names and using a variety of policy and legislative frameworks. In some states ICM is called Total Catchment Management (TCM) or Integrated Catchment Management. At present the application of ICM varies widely throughout Australia, with some states such as NSW having established legislation, whilst others such as WA and Qld have no specific legislative powers. In effect there have been six experiments running in parallel but as yet no dominant model has emerged.

There is a considerable literature on the principles and practice of ICM in Australia, most of starting with the NSW efforts to create Total Catchment Management in the mid-1980s. Key sources for tracking this development of ICM are the two National Workshops, the initial formative one held in 1988 and the other later in 1997 which provided a comparative reflection on structures, processes and performance. Other key references include Laut and Taplin (1988), Mitchell and Hollick (1993) and AACM (1995)

In this section, two papers of the study team authors are included, Symes, Butterworth and Nancarrow's 1993 review of ICM nationally and McDonald's keynote paper at the second national workshop on ICM held in 1997.

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2.1 NATIONAL WHOLE CATCHMENT MANAGEMENT A REVIEW & ANALYSIS OF PROCESSES

S. Syme, J. Butterworth and B. Nancarrow

(Source: Extracts from Syme, S., Butterworth, J., Nancarrow, B. 1993. *National Whole Catchment Management. A Review and Analysis of Processes.* CSIRO Australia, Division of Water Resources, Australian Research Centre for Water in Society)

1.0 INTRODUCTION

The Land and Water Resources Research and Development Corporation (LWRRDC) in partnership with the Murray-Darling Basin Commission and the National Landcare Program established a national program on dryland salinity research, development and extension. The program seeks to develop a national response to dryland salinity that optimises the use and sustainability of natural resources.

To fully integrate and coordinate the program's activities, one focus catchment has been selected in each of the five mainland States. Outcomes and experiences gained in these catchments will be extrapolated to other regions.

The five focus catchments comprise the Loddon-Campaspe (Victoria), Liverpool Plains (New South Wales), Upper South East (South Australia), Upper Burdekin (Queensland) and Kent River (Western Australia).

In acknowledging that the management of salinity has to be considered within the broader context of whole catchment planning and management, a principal aim of the program is to foster the development and implementation of catchment management plans which are closely linked to State salinity and/or whole catchment planning strategies. The program intends to support activities related to the priorities and recommendations outlined in catchment management plans which have been developed at the community level with appropriate State agency assistance. Each of the five catchments are currently at different stages in developing such plans, with some not yet under way.

Related to these different stages of development are factors such as social history, environmental differences, socio-economic differences, variations in community cohesion and structure and differences in policy and institutional approaches between the States. One striking similarity throughout the country, however, is that the concept of Whole Catchment Management (or the equivalent concepts of "Integrated Catchment Management and "Total Catchment Management") is at a fledgling and relatively untried stage of development. Thus, as with any novel policy or approach, Whole Catchment Management is destined to undergo various teething problems and frequent processes of refinement and reassessment. Action at the grass roots level will be the major testing ground. Therefore, it is necessary to examine current approaches and the various institutional linkages from farmers to Government Ministers.

As part of the program, a framework which can assist the development of whole catchment plans is required. Of equal importance within this framework are mechanisms that can facilitate and provide continuity to the implementation, monitoring and evaluation of such plans. This report aims to outline such a framework.

Specifically, a study was undertaken in accordance with the following terms of reference.

(1) Assess different approaches taken nationally to prepare whole catchment plans, drawing conclusions as to the procedural requirements for each approach. Derive and compare common similarities and differences.
(2) Where relevant, consider how salinity issues relate to broader catchment management issues in these approaches and how they are dealt with.
(3) Consider what the role of the community has been in the process of preparing whole catchment management plans, how their participation has been fostered and what lessons are to be learnt.
(4) Develop a framework for the preparation of whole catchment management plans and make recommendations as to how the process of planning should be managed and what the roles and responsibilities of relevant stakeholders and agencies should be in the development, implementation, monitoring and evaluation of catchment management plans.
(5) Make recommendations as to how catchment management plans can be integrated into State-wide salinity strategies.

These terms of reference are addressed in the following sections of the report.

Terms of reference:

(1) and (2) in section 6.0;
(3) in section 7.0;
(4) in sections 8.0 and 9.0;
(5) in section 10.0.

No attempt has been made to compare the strengths and weaknesses of the different State approaches, as it was considered that this would be unproductive and meaningless. Therefore, in being predominantly concerned with the necessary processes rather than specific structures for whole catchment management, the recommendations, guidelines, roles and responsibilities in this report are tailored in such a way as to traverse the States' various structural arrangements. Consequently, any recommendations as to national structural requirements are along generic and needs-based lines.

Examination of case studies in each state are used to derive a number of general guidelines or "overarching principles". They are proposed as a means to streamline Whole Catchment Management from the farmer to Federal Government. Procedural and role criteria are identified for determining if the guidelines have been met and to form the basis for assessing progress from a national perspective. While recognising the differing needs and issues of catchments across the country, the guidelines are at a level of generality that is applicable in all contexts.

2.0 Methodology

The following investigative methodology was adopted.

2.1 Literature Review

A review of all available, relevant literature was undertaken. This involved an examination of documentation regarding the five focus catchments, as well as other areas nationally where the processes of catchment management are under way and would provide a range of both techniques used and progress made in relation to dryland salinity and whole catchment management. The review included:

- consultancy reports which have lead to the development of the National Dryland Salinity Program; draft and completed catchment management plans;
- any relevant government agency or research institution research/consultancy reports, or policy documents;
- any possible community initiated research/consultancy reports;
- any documentation of previous public involvement exercises or processes in each catchment and in other areas;
- literature on participatory environmental management;
- other sources, such as newsletters, brochures and booklets.

2.2 Telephone Discussions

Preliminary discussions were conducted with government personnel and community "leaders" to obtain an initial impression of catchment and dryland salinity management issues in each State and, more specifically, in the five focus catchments and other selected areas. When required, follow-up discussions were conducted to clarify issues raised.

2.3 Site Visits

The focus catchments (with the exception of the Upper Burdekin- see below) were visited to obtain a first hand impression of community/government relationships and interactions and community perceptions of the effectiveness of present dryland salinity and catchment management processes. Other areas in each state where the processes of catchment management are under way and considered relatively progressive were also visited. Catchments were also selected to provide a wide range of management approaches and on the basis of the issues being addressed, from the single issue of salinity management to multiple issues involving "whole-community" efforts.

Catchments were chosen in accordance with these criteria. Based also on time and budgetary constraints and from advice from people familiar with and active in the Upper Burdekin catchment, it was decided to omit the Burdekin from the intended visits. However, two catchment areas and the central office of the Department of Primary Industries were visited in Queensland to ensure that relevant issues were illustrated.

Where possible, each site visit comprised interviews on a group or individual basis with key government agency personnel and members of local or regional groups with a resource management focus. A number of field trips to demonstration sites and other areas of interest were also made to gain further appreciation of specific, catchment-based issues.

2.4 Previous Experience

Insights gained by the study team from past studies on catchment and land management were used to assist in the interpretation of comments from the interviews and phone discussions.

3.0 SCOPING WHOLE CATCHMENT MANAGEMENT

Integrated Catchment Management (ICM) and Total Catchment Management (TCM) are coordinated, community involved, whole of government approaches to natural resource management on a catchment-wide basis. The key components are public involvement, inter-government cooperation and policy and program coordination among state agencies such that the community and government work together to achieve sustainable, natural resource management. Importantly, effective catchment management needs to be considered as a long-term exercise, since it is necessary not only to address immediate problems but also to change organisational cultures, individual and community perceptions and attitudes and some traditional modes of operation (Mitchell, 1991).

As noted by Martin and colleagues (1992) ICM, TCM and associated activities such as Landcare, dryland salinity management and property or whole farm management planning are viewed throughout Australia under a "myriad of different names and perspectives". However, despite these differences, "the central thrust has been an appreciation of the need for a more integrated - and coordinated - approach" to natural resource management (p. 187).

Coordinated planning and action at all levels - including the Commonwealth, State, regional, local and individual land manager - is considered paramount chiefly because land degradation problems often transcend property boundaries. The actions in one part of a catchment can affect other areas in the catchment. Consequently, farms and other land holdings can no longer be managed as closed systems.

For the purposes of simplicity, when discussed in general terms in this document, ICM and TCM will be referred to as Whole Catchment Management (WCM).

In recent years, there have been many advances in the understanding of and action towards amelioration of land degradation by both farmers and State and Federal Government agencies. However, as a general summary, the need for WCM emerged, among other things, from concern about:

- continuing and increasing degradation of land, water and related resources;
- conflicting government policies;
- different agencies with statutory responsibilities leading to programs not always being complementary;

increasing public expectations for involvement in decision-making.

As the unifying theme for action, WCM is presented as a:

* **philosophy** - WCM needs to foster an organisational culture and associated attitudes which view cooperation and collaboration as essential. For example, authorities and groups need to be encouraged to work toward common objectives by consultation, responsibility sharing and joint financing.
* **process** - if WCM is to be effective, there needs to be a well understood planning and implementation process through which it is delivered. This should reflect the philosophy of WCM.
* **product** - the resultant plan or set of implementation guidelines will vary from place to place, depending on conditions and needs. Any guidelines should, however, incorporate environmental, economic and social considerations and should clearly relate to specific resource management outcomes.

Without guidelines and objectives, it is difficult to set directions, establish roles relevant to other programs and activities and monitor progress. However, in some quarters, the relatively late attention to defining what the product of WCM should be has contributed to a lack of understanding about WCM and a loss of enthusiasm.

Therefore, while WCM is regarded by many as a philosophical and overarching planning framework, in the long-term, an appreciable association of WCM with a product needs to be established. Essentially, the product of WCM needs to be the planning and implementation of sustainable agricultural practices, whether via Landcare or other means. In this way, landholders can contribute to WCM by initiating and maintaining action on the ground. Additionally, procedures outlining the means to achieve these desired ends, including detail as to how effective

participation may be achieved in practice must be articulated in accessible terms. Otherwise, landholders may fail to comprehend how WCM is translated into real and practical terms and, consequently, WCM will attain little validity within catchments.

The building blocks on which WCM is based must be made explicit and need to emphasise that WCM has philosophical, procedural and product components. Ultimately these building blocks need to become part of the culture of agencies and groups. These are as outlined by Hollick and Mitchell (1991):

(1) **A systems and integrated** (rather than comprehensive) **approach** in which attention is directed to the key issues (rather than all issues) and to the linkages among the key issues.

(2) **A stakeholder approach.** All stakeholders have to be acknowledged and given input into WCM on an equitable basis. For WCM to be successful, representatives of all stakeholder interests have to be brought to at least a minimum common level of understanding of issues, such as land use, degradation problems and constraints to adoption. Thus, there is a need to define standards for use of information (Webb, 1993).

(3) **A partnership approach.** This will require the search for and achievement of, common objectives in an efficient and equitable manner and decisions about the relative roles and power of stakeholders.

(4) **A balanced approach**. This will, for example, require the achievement of a balance between economic development, protecting natural ecosystems and satisfying social norms and values.

3.1 Relationship of WCM toTo other Policies and Strategies

WCM policy needs to be considered in the broader policy context. Parallel policy hierarchies do exist between Federal and State in relation to land, water and the environment. At the national level, for example, the National Conservation Strategy, the Agricultural and Resource Management Council of Australia and New Zealand (ARMCANZ), the National Soil Conservation Program strategy (NSCP) and Australian Environment Council (AEC) policies on land and water care provide broad, top-level statements of principle. Other major statements, such as the National Decade of Landcare Plan (NDLP), can be seen as derivatives, or frameworks for the implementation, of these principles. While there is no formal Federal WCM policy, the Government is pursuing this approach via its funding programs.

3.2 The National Landcare Program

The Commonwealth Government has a significant role in providing leadership and overall direction for WCM. For example, Commonwealth policies, legislation and strategies impact on State priorities and community attitudes and behaviour. In particular, as a coordinating and facilitating mechanism, Commonwealth funding programs (aimed at sustainable resource management, conservation and long-term productive capacity) have a motivating role in focusing community and State Government action.

At the national level, the Commonwealth Government has used the NDLP and the Commonwealth funding program, the National Landcare Program (NLP), as a vehicle to influence the policy environment, help control land degradation and promote sustainable land use. The NDLP emphasises the need for an integrated approach to resource management and collaboration of all levels of government, industry groups, community groups and individuals. This undertaking encourages groups of people to work together in their local area and emphasises that "land" includes a whole ecosystem. Notably, many Landcare groups form around a single issue, but often move towards a more comprehensive outlook as they develop. This is also a practical progression as Commonwealth funding is more likely for overall strategies than for individual projects or single resource solutions.

Ultimately, the actions of Landcare groups and individual farmers will make the biggest difference to rural land. Groups, however, have differing strengths and varying needs. Group needs may also change over time as groups progress through different developmental stages. Options to help establish and maintain groups includes direct support such as technical advice and assistance, while others include encouraging the establishment of networks of Landcare groups. Funding also facilitates work that would otherwise be beyond the scope of many groups (NSW Interim Decade of Landcare Plan, 1992).

Also at the national level, opportunities exist for providing coordination and skills transfer. These include, the development of procedures for social and economic assessment of salinity (and other resource) management options, the development of decision support systems and a general framework for communication across groups (Webb, 1993). In addition, Mitchell (1991) recommends that regular exchange among WCM State representatives could help to avoid problems or become aware of other approaches to resolving problems.

3.3 The Development of WCM

Development and implementation of the WCM concept has encountered mixed fortunes and some basic problems continue to obstruct general progress at the government and institutional level. Two main concerns are:

- resistance by government agencies to a truly integrated approach;
- lack of adequate resources to finance the development and implementation of WCM strategies.

On the first point, Hollick and Mitchell (1991) highlight a strong sentiment within the agricultural industry that WCM should essentially be community-based and locally managed rather than a top-heavy structure. However, some government agencies and staff may still possess ambivalence toward public involvement, being unconvinced of its value and often seeing it more as an encumbrance. It is also important at this time to remember that (often for good historical reasons) local communities may hold suspicion and cynicism about the motives and objectives of government agencies, making it difficult to develop solid working relationships. One of the reasons for this is the long history of expert-layperson interaction that has dominated extension services and general government programs in Australia.

According to Martin and colleagues (1992), the quality of interaction between rural people and bureaucracy at the local level varies considerably and involves a number of complex factors. This may depend on the attitudes of local extension officers, the commitment of regional bureaucracy to Landcare and WCM, local perceptions of the State and the motivations of people for forming or joining groups. However, "the historical technocentric and scientistic orientation of the government agencies involved in resource management impose significant barriers to the recognition of rural people as competent partners in resource management. Whatever reasons ultimately lie behind the adoption of TCM and Landcare, unless government agencies are sensitive to the logic of the participatory process, the results of their overall actions... may not yield the desired outcomes " (p. 190).

On the second point, Synnott (1991, p.42) argues that a basic impediment to the progress of WCM in Australia has been "lack of adequate resources to finance the development and implementation of WCM strategies". Hence, it is essential to consider what resources are needed to facilitate the implementation of WCM objectives as it is pointless and counterproductive on many occasions to develop plans which cannot be implemented in the foreseeable future. This question, however, cannot be addressed until WCM priorities are clearly defined.

Hollick and Mitchell (1991) suggest to determine financial and other resource needs at the State level, it would be advantageous to conduct analyses of the needs in priority catchments. This has been the approach in several States and now nationally. Included should be consideration of the need for and costs of providing:

- incentives for landholders to adopt conservation measures;
- administrative support to catchment-based community groups;
- compensation to individuals to cover costs of participation. The analysis could, for example, consider opportunities for joint Commonwealth-State initiatives in areas such as taxation (Hollick and Mitchell, 1991).

With particular reference to dryland salinity management in Australia and from his review of the five focus catchments in the National Dryland Salinity Program, Webb (1993) highlights a number of pressing problems with current initiatives. These are:

- much of the technical expertise required is already heavily committed;
- limited resources;
- fragmentation of research;
- lack of continuing involvement from agencies, groups and individuals;
- the lack of development of R&D outputs into practices which can be integrated into production systems;
- the general perception existing in all states that the likely success of salinity management depends on the extent to which it is based on economically attractive production systems.

Difficulties also remain in comparing individual programs and discriminating good WCM from bad WCM. On this point, financial viability and adequate resourcing have been proposed as possible tests of successful WCM and at least provide some indication of political and community support. However, by itself, availability of resources is an inadequate measure of WCM success because it raises the issue of "how much is enough" (Synnott, 1991).

Despite the attention to resources paid by the above authors, a social response (rather than an economic or government intervention) model, which seeks to shape public attitudes through persuasion rather than prescriptive direction, currently dominates WCM in Australia. The dominance of this model may explain the proliferation (but hardly coordinated) range of individual programs. These include national programs for soil conservation, salinity management, water management and afforestation. As vehicles for directing the response of different interest

groups, this distribution of programs makes sense. While the diversity ensures that there is something for everyone, a more focused approach to WCM might create greater coherence in the use of public resources and, thus, encourage more even progress in a holistic sense.

In summary, there is a widespread conviction that the management of specific issues such as dryland salinity should not be viewed in isolation, but undertaken within an integrated planning framework on a catchment scale. Such an endeavour should acknowledge the complexity of dryland salinity management and include comprehensive environmental, economic and social assessment. To this end, the Dryland Salinity Management Working Group (1993) recommended that dryland salinity management be projected as an integral subset of WCM and as being related to other resource-use and degradation issues.

As an aid to distinguishing WCM, Landcare and dryland salinity management, all three components can be presented within the general model shown in Table 1.

In conclusion, WCM, which has central aims of maximising stakeholder involvement and fostering community empowerment, is presently considered the most effective means of coordinating and overseeing initiatives such as dryland salinity management and Landcare. However, its apparent strengths notwithstanding, WCM appears to have had limited application as a means for the complex management of natural resources. To date, it has mainly been used as a vehicle for community awareness programs. For instance, all planning and policy documentation which has been produced endorses participation, but provides little detail as to how it may actually be achieved in practice (beyond structural changes that allow rural people more say in decision-making). Across Australia, in both WCM and Landcare, the challenge still remains of reconciling "top-down" provision of funds and services, with a "bottom-up" direction of work on the ground.

Ultimately, the success of WCM depends on committed support, solid leadership and major changes in established social and bureaucratic actions in resource management. Most importantly, to maximise the adoption of sound remedial measures, the facilitation of maximum (and sustained) community awareness, acceptance and ownership of WCM objectives should be the underlying principle in the plans and implementation strategies for each catchment.

Table 1
Distinguishing WCM, Landcare and Dryland Salinity Management

COMPONENT	POSITION
WCM	*Catchment focus/ecology centred:* - An "overall umbrella", systems approach to planning.
WCM Charter	- To encourage plans from local to State levels to be developed according to WCM guidelines.
WCM Program	- To encourage processes and implementation of sustainable agricultural practices according to WCM philosophy.
Landcare	*Sub-catchment focus/people centred*: - the landcare ethos is about caring and "close management" of the land through encouraging the formation of groups of people who share a common natural resource problem and who live in the same catchment; - Landcare is the vehicle for implementing whole catchment plans.
Dryland Salinity Management	*Problem focused and centred*: - Salinity is often the most pressing and manifest problem to focus on; - In many instances, often for expediency, a focus on salinity has acted as the impetus for group formation, fund raising, planning and action. In many of these areas, structures and processes are now in place to relate to and deal with broader issues. Additionally, while a focus on salinity may be framed singularly, environmental issues are interrelated and the operational issues and benefits of salinity management broaden out to encompass other concerns.

4.0 CATCHMENT DEFINITION

As experience in a number of the areas visited during the study has shown, the definition of catchments purely in geographical terms may act to the detriment of achieving WCM. Indeed, if the majority of landholders do not recognise or perceive the existence of a "catchment-based community" or "regional" community, coordinators, group leaders and the like will be hard pressed to achieve the collaboration and support that is required for WCM to be effective.

Essentially, it is important for people to organise themselves in ways they consider to be comfortable or acceptable. Group organisation will be less than optimal (and possibly non-existent) if this is not the case. For example, in Section 9.0, the local context is characterised at a sub-catchment or catchment level in which the local community can be easily defined by common interest or a clear environmental variable such as soil type. Without these clear similarities, allowance will need to be given for a time-lag between the initial stages of developing awareness of the catchment-based nature of WCM and its application. To instigate programs, it may therefore be more advantageous to define catchments according to social as well as physical parameters and to examine the interplay between the two. In this respect, the "measurement of community" (defining the natural, existing boundaries of communities, based on variables including common interest and the local acceptability of any suggested community boundaries) has merit in determining the likely response to WCM as a feasible concept within each catchment.

The complexity of achieving a national response to dryland salinity management through a whole catchment management framework is also highlighted by noting that different communities will react differently to policy initiatives (Branch, 1984) and that some communities will deal with change better than others (Ayres & Potter, 1989). The assertion that different approaches are needed for different areas also indicates that general recipes for community participation are unrealistic (Wilkinson & Barr, 1993) and that there is a need to better account for cultural, economic and regional differences between and within communities.

The clear messages here, therefore, are that:

- Communities are not static nor passive recipients of policy initiatives;
- In many, if not most, instances, communities are not formed and do not function according to prescribed catchment lines. Landholders and other stakeholders can at best be ambivalent toward the concept of whole catchment management if they are largely unaware of the catchment they live in. Additionally, many farmers still regard Landcare as "green", so how, during a rural downturn, will they react to the more ambiguous or sketchy concept of Whole Catchment Management?;
- To assist the development of Whole Catchment Management as an ethic and a component of farm management, catchments need to be defined in social terms. Accordingly, at this early stage in the evolution of resource management on a whole catchment basis, it may be more productive for stakeholders to work with naturally formed communities and groups rather than groupings of people based on geographical criteria;
- In line with the above points and complex environmental realities, Whole Catchment Management must be viewed as a long-term exercise. Expectations and goals need to be couched in realistic short to medium terms so that progress towards WCM can be measured and appreciated by stakeholders.

Looking ahead, community development will need to be integrated if resource management within catchments is to be integrated (Chamala & Mortiss, 1990). As a general classification, the development needs facing catchment-based communities or groups can be seen as two interdependent but distinct problems.

- To gain access to resources outside the catchment, such as government programs, sources of financing and technical information.
- To develop the capacity of persons within the catchment to work together to pursue common goals. In part, this will entail developing structural and organisational capacities to effectively access outside resources. Moreover, it will involve increasing the capacity of those within the defined community and area to develop their own potentials (O'Brien, Hassinger, Brown & Pinkerton, 1991).

In summary, the social dynamics operating within rural communities may act to facilitate or impede efforts to achieve sustainable approaches to resource management. As a logical extension of physical planning research, research of a community nature can enrich the information and knowledge about communities, including existing constraints to change and factors that may facilitate change (Nowak, 1992). In short, catchment planners, coordinators, agency personnel and others need to give attention to defining catchments in social as well as environmental terms.

5.0 THE STAKEHOLDERS

Achieving WCM is dependent on the coordinated activity of a variety of groups with particular values and interests. It is essential therefore that these interests are defined and incorporated in the principles and procedures of WCM.

Laut (1992) stated that "the key to successful catchment management lies in the development of suitable political/administrative structures to allow catchment communities and state agency personnel to collaborate in the development of regional catchment management policies and their implementation". Many authors have also emphasised the importance of a coordinated approach to community analysis to achieve WCM (eg. Martin et al, 1992; Syme, 1992). Community cohesion will best be created through planning mechanisms which enhance the aspirations of stakeholders as much as is possible.

It must be emphasised, however, that the labelling of the stakeholders presented here is little more than stereotypical. There are, for example, substantial differences in the attitudes, values and modes of operation of differing Landcare groups or Local Governments, as will be shown in the review of current procedures. There are also many people who have multiple roles, especially in rural communities. Nevertheless, the categorisation does provide an aide in considering the human resources available. For example, many tend to assume that WCM is primarily the concern of the farming community and the government alone. To do so is to ignore the potential contribution of Local Government, urban dwellers, conservation groups and others. **Whole Catchment Management is a Whole Community Issue**.

However, it is important to state that, since the landholder has primary immediate responsibility for sustainable land management, there is a necessity for WCM programs to assume that the public good is well served by making it as easy as possible for the landholder to achieve this. In this sense, the landholder may be considered as a *central client* for the WCM process.

The following are the stakeholders who need to be considered in the derivation of a WCM approach. There has been no attempt to ascribe values to each group, but their desirable roles are examined in relation to specific procedures in later sections.

a) The Community

- Individual Landholders
- Local Landcare Groups
- Catchment Groups
- Local Government
- Urban Dwellers
- Conservation Groups
- Community Interest Groups (eg. Farm Improvement Groups, Service Clubs)
- Industry (including industry associations)

b) Institutions

- Schools
- Universities/TAFE/Agricultural Colleges
- Research Institutions (eg. CSIRO)

c) State Government

- Local/Regional Public Servants
- Head Office Public Servants

d) Federal Government

- Relevant Federal Government Departments' Public Servants

e) Politicians

- State and Federal Government Politicians

A note should be made here about the classification of Local Government. Although it can be logically categorised as a third level of government, its significance, in WCM terms, is that it can, and often does, provide a local focus and catalyst for catchment issues. It also has the potential to act as a coordinator of available resources and is a natural body for any local revenue raising, should it be deemed necessary. Already, therefore, Local Government is a highly significant stakeholder. As its role is widened, as is currently the trend, more Local Government influence and involvement may be expected and encouraged. This widening of the role has been to bring Local Government closer to the community.

6.0 THE STATE APPROACHES

6.1 Victoria

WCM appears largely to be lead by salinity management in Victoria, although activities associated with salinity management have come to address wider environmental issues. In fact, salinity management in Victoria is the most organised and advanced in Australia (Webb, 1993) and, after WA, Victoria has had the longest experience in dealing with salinity issues. In addition, due to the early onset and recognition of dryland salinity and the progressiveness of its salinity program, many aspects of the Victorian experience are widely drawn upon by other States.

Resolve to tackle problems in a comprehensive manner stemmed from community criticism of earlier salinity management approaches in Victoria and the realisation that imposition of technical solutions through Government action had been inadequate. This led to the release in 1987 of the Conservation Strategy for Victoria, the creation in 1988 of the Victorian Government Salinity Control Program and a detailed Salinity Control Strategy (known as "Salt Action: Joint Action") in which the community has a major role in developing salinity management plans for the State's catchments and irrigation districts. The philosophy behind the program is that salinity management cannot succeed without active, local community involvement and support, with the latter being considered likely to come from community input to plan development.

The three key agencies in the Salinity Program are the Department of Conservation and Natural Resources (DCNR), the Department of Agriculture and the Rural Water Corporation. While not the "lead" agency, DCNR has acted as the coordinating agency in dryland areas. The concept of integrating land and water management has a fairly precise meaning in Victoria following the formation of the DCNR in August 1990. The department includes environmental planning, water resource management and fisheries and forestry management. Ultimately, the Salinity Sub-Committee of Cabinet has responsibility for salinity management. The Landcare program is currently being held within by the Ministers for Naturl Resources, and Conservation and Environment, although efforts are being made to broaden this out to include Agriculture through the Salinity Sub-Committee (or equivalent).

The Salinity Bureau (situated within the Department of Premier and Cabinet) has an overall role in the ongoing coordination and implementation of the Salinity Control Strategy (SCS). The rationale for this institutional development was to locate a body within a "neutral" department (separate from the 3 key agencies), with direct links to the Premier and Cabinet and with some prominence within the structure of government. This includes an "independent" and guaranteed budget. While its positioning has often been contentious, the Bureau has maintained a central role in setting budgets and provide an independent source of information for the rural community. The Salinity Bureau has, however, been criticised by some for having insufficient authority and staffing to adequately undertake the monitoring role envisaged by the SCS and ensure that Strategy objectives are met (Special Report No. 19: Salinity, 1993).

As part of the SCS, the State has been divided into nine "salinity regions" and eight sub-regions in dryland areas, within which land management units have been identified and used as the basis for planning. In this way, the SCS provides the basis for simplifying salinity management and for preparing salinity management plans at the sub-regional, regional and State level. As outlined in the Strategy's framework, these plans are developed by community-based working groups, such as the Salinity Program Advisory Committee (SPAC), which receive technical input from relevant agencies. During the planning phase these working groups have been fully funded by the State. As a gauge of community influence in the SCS, SPACs, or their equivalents, have been required to review and determine the R&D program for their regions.

The basis of the planning process involves a comparative economic, environmental and social evaluation between a "no intervention" option and a series of options including planning horizons and costs and benefits. In addition, the dryland planning process typically identifies and maps areas with similar geological and hydrogeological features and salinity characteristics, termed "Land Management Units" (LMUs). Common groupings of salinity control options are developed for the same LMU classification.

Developed for each region and sub-region of the State, each plan involves a thorough process extending over two or more years. After the relevant plan is endorsed by Government, the implementation phase is expected to extend conceivably over a period of between 10 and 50 years, highlighting the long-term nature of the Program (Special Report No. 19: Salinity, 1993).

It is important to note that dryland salinity in Victoria, Western Australia and South Australia has tended to be treated as a separate entity, whereas in Queensland and New South Wales salinity is regarded as one of several forms of land degradation. There do appear to be some benefits from this more general approach of Queensland and New South Wales, including more correspondence with initiatives of the Decade of Landcare (Dryland Salinity R&D, 1992).

In Victoria, management linkages between salinity and other forms of land degradation has not been overly clear and until the NDLP initiative in 1989 (and subsequent release of the Victorian Decade of Landcare Plan), salinity, in particular irrigation salinity, was the primary focus of concern. Processes of integration between salinity management and other Landcare concerns (and thus, a movement or `evolution' towards an ICM approach) are presently under way, with the Victorian Landcare Plan aiming to build on the SCS, with salinity management becoming a subset of Landcare. In this way, the Victorian Landcare Program is seen as the focus for all resource management program activities.

As a consequence, a State-wide coordinating body - the State Landcare Committee - has been established. Further, it is required that Regional Landcare Plans be developed for each (salinity) region in the State. Presently at, or nearing the completion stage, plans have been developed collaboratively between participating agencies and non-government regional communities, with the DCNR acting as lead agency. The intention has been to build on and incorporate existing information, such as the regional salinity management plans, as a means to formulate an overall (and more integrated) strategy for land and water management at the regional level. At the same time, salinity management approaches can use the Landcare plans to address and include other issues where relevant. Among other things, the Regional Landcare Plans provide consideration of:

- catchment processes;
- implementation targets and responsibilities;
- recommendations for ongoing coordination and review/upgrade;
- possible community advisory structures;
- the need to encourage greater community participation and stronger community networks;
- the roles and responsibilities of agencies ;
- the need to encourage greater sharing of resources between agencies;
- priorities for resource allocation;
- regional Landcare boundaries;
- interface issues with adjacent regions.

The Landcare plans provide a more general overview than the salinity management plans and were developed over a shorter period. As noted in the Goulburn Regional Landcare Plan (1993) the aims are "to set future directions for Landcare activities, to set the scene for on-going community involvement and the future allocation of resources... and to advise the Government on appropriate administrative and community consultation arrangements". Accordingly, the Avoca-Loddon-Campaspe plan aims to "propose how the community's values and desires can be determined and acted on by government departments". In addition, "the plan brings together the excellent work prepared by salinity community groups and suggests a natural progression to the community's management of all Landcare programs for the catchment".

These Plans also outline the establishment of a Goulburn-Broken ICM Council and Avoca-Loddon-Campaspe Regional Landcare Council, with both having the responsibility for ongoing community consultation, coordination and plan implementation. The Councils would be responsible to the State Landcare Committee and comprise a community-majority representation. It has also been recommended that the Councils undertake some roles previously held at the State level.

To summarise the complementary linkages between Landcare and dryland salinity management, the new Regional Landcare Plans recommend that all existing plans will retain their integrity and will not be affected. In effect, the Regional Landcare Plans will provide a framework within which other plans can operate. Provision may also be made for the role of salinity working groups to appropriately be extended to incorporate a regional Landcare support role. For example, in the Goulburn region, the new Dryland Program Group is seen to replace the SPAC Dryland sub-committee, while the overall SPAC maintains a focus for the development and implementation of programs.

In addition to these developments, "Catchment and Land Protection" legislation has been proposed (a discussion paper has been released for public comment and a draft Bill will be presented to the spring session of Parliament) that seeks to integrate the Soil Conservation Act (1958) with the Vermin and Noxious Weeds Act (1958). Such a proposal has occurred through the acknowledgment of the role of the community in natural resource management

and is seen as a means to review and update legislation and to achieve a catchment-based, "whole systems" approach across the State.

Highlighting the continuing coordination of policy and the movement toward catchment-based responses to salinity and other resource management concerns, it is noteworthy that the current Victorian Water Policy advocates an integrated catchment perspective and approach to water and salinity management. Additionally, the Water Act (1989) compels the water authorities to consult with "Catchment Coordinating Groups". (Special Report No. 19: Salinity, 1993).

A number of concerns, however, have been raised about the increase in the number of different initiatives operating at the State level. For example, it has been suggested that an ICM legislative framework is unwarranted and unwise at this time and, at best, is catch-up legislation to a strong community-led approach. In the words of one interviewee, "it's a process looking for a reason and will remove power from the community-based advisory approach". The existing approach is seen to be evolving naturally from an initial single-issue focus to a more comprehensive and integrated form. Thus, achieving ICM is essentially a developmental and long-term process, rather than a prescriptive one.

Secondly, there is widespread opinion that if legislation is considered appropriate, it should only outline the means to formally endorse a coordinating structure and ensure stakeholder representation. Thus, ICM should not require an exacting organisational form but be presented more as a principle or philosophy. In addition, ICM legislation may not provide the panacea for resolving all problems and there may still be a number of procedures to undergo in order to spell out some of the issues, such as the degree of legislation being proposed, more thoroughly.

6.2 New South Wales

Endorsed as a NSW Government policy in 1987, Total Catchment Management (TCM) acts as the umbrella administrative framework for natural resource management in the State. In 1989, a Catchment Management Act was passed in NSW, providing a formal structure and statutory basis for the coordination of TCM. The Act defines TCM as the coordinated and sustainable use and management of land, water, vegetation and other natural resources on a catchment basis so as to balance resource utilisation and conservation. The lead agency for TCM is the Department of Conservation and Land Management (CaLM). CaLM and the Department of Water Resources (DWR) share responsibility for the management of dryland salinity. Responsibility for administering the Catchment Management Act lies with the Minister for Land and Water Conservation.

Like ICM, the two broad objectives of TCM are to ensure that natural resources are managed by coordinating policies, programs and activities and to achieve active community participation. Similarly, the underlying emphasis of the TCM process is to foster a solid working relationship between community and government. Under the Act and with input from the NLP, provision has been made for three components or levels of coordination. These comprise:

(a) Local Action
Local (usually Landcare) groups address "common" natural resource management issues. Such groups currently number over 400 in NSW.

(b) Regional Action
Regional Catchment Management Committees (CMCs), Catchment Management Trusts and Landcare coordinators and facilitators (funded by NLP) provide oversight and coordination of TCM policies and programs at a regional, or entire river valley level. As mentioned in the Interim Decade of Landcare Plan for NSW (1992), there is some cooperation and informal links between Landcare groups and CMCs (open discussion and communication are encouraged by CMCs), but CMCs have no direct control over the actions of Landcare groups, which are considered as independent (farmer based and farmer controlled) bodies. However, a primary objective of the Interim Plan is that the establishment of CMCs will greatly assist the planning and coordination of Landcare initiatives within regions.

Regional strategies prepared by CMCs form blueprints for action at the regional level. CMCs also coordinate the preparation of programs for funding; facilitate related research; assess funding requests from Landcare groups and monitor, evaluate and report on the progress of TCM plans and strategies. All agencies' roles continue but are coordinated by the CMCs.

CMC membership and participation is voluntary. The CMCs (and Trusts) are made up of community and government members who live and work in the region for which they are established. They consist of a majority representation of landholders (TCM Annual Report, 1991-92).

Catchment Management Trusts are established by the State Government when natural resource degradation within a particular region is deemed to be adversely affecting local communities. As corporations, Trusts are required to prepare a corporate plan containing a written scheme of the strategies and programs they intend to implement. To fund these initiatives, they also have the authority to levy rates on all land within a Trust area declared to be a "catchment contribution area".

(c) State Action

A State Catchment Management Coordinating Committee (SCMCC) provides the central coordinating mechanism for the implementation of TCM throughout NSW. In endeavouring to bring a State perspective on regional issues, the committee coordinates the establishment and operation of the CMCs and liases with the Catchment Management Trusts. Its structure, comprising community, CMC, industry, environmental, Local Government and State agency representatives, is intended to be flexible and needs-based. The SCMCC is responsible directly to the Minister for Land and Water Conservation regarding rural issues and to the Minister for the Environment for urban issues.

A number of subcommittees, including the Salt Action Task Force, the Natural Resources Programs Coordinating Subcommittee (NRPCC) and the Landcare Working Group assist the SCMCC. For example, "Salt Action", the NSW Salinity Control Strategy (a 5 year program released in 1989 and a component of the TCM Program) provides coordination at a State level, operates (through CaLM) on a regional basis and promotes community involvement in salinity management. The Salt Action task force comprises representatives from NSW Agriculture, DWR and the Environmental Protection Authority. This State initiative has been supplemented by funding programs such as Natural Resources Management Strategy for the Murray-Darling Basin (NRMS) and the National Soil Conservation Program (NSCP).

Additionally, while there is no formal or direct link between Landcare and TCM, the Landcare Working Group has the roles of planning for the Decade of Landcare and developing and monitoring Landcare policy and activity respectively. A State Landcare Coordinator and a Decade of Landcare Coordinator assist in this regard.

The NLP operates within the TCM framework and provides input into TCM by acting as the central funding mechanism for components of the NRMS, the Save the Bush Program and the One Billion Trees Program. Under the NLP, local community and agency applications for funding are reviewed and prioritised by the relevant CMCs and the NRPCC. Final assessment and recommendation for funding is made annually by a State Assessment Panel which is made up of all CMC Chairs and all members of the NRPCC. In addition, the SCMCC is currently in the process of developing a draft State Strategy for Natural Resources Management. This is intended to assist the coordination of TCM efforts and enable funding priorities and project selection criteria to be set under the NLP.

Another important aspect of TCM is the role of Local Government in the implementation of TCM. The need for Local Government representation in formal TCM processes is highlighted when noting that Shires are responsible for development control in their area. They prepare local environmental plans and allocate land for particular purposes. They are also responsible for the construction of roads, drainage systems and amenities and must ensure that land degradation and pollution are avoided.

However, a number of critical problems with TCM, many based around under-resourcing, have become manifest. Notably, there appears to be a thin spread of technical support at the local level. Additionally, the SCMCC has shown concern about the resourcing of TCM and the proliferation of CMCs pursuing statutory status. Martin and colleagues (1992) also highlight the criticism that, unlike Landcare, the development of TCM policy has been limited mainly to NSW Government initiatives. TCM and Landcare have also lacked integration at the centralised policy level. As a result, the TCM concept is often viewed with suspicion and/or confusion by many rural people. As noted, "at the interface of government agencies and the community within TCM and Landcare there emerges the contradictory nature of bureaucratic practice within a policy of participatory environmental management" (Martin et al., 1992, p. 190).

The economic rationalisation policies of the Liberal-National Government in NSW are also considered problematic by some for TCM at the regional level. For example, CMCs -where the major policy initiative is placed - receive a meagre allocation of resources for coordinating natural resource management. As argued, "the State Government wishes to shift responsibility for environmental management towards rural people at the regional level but seems unwilling to supply the resources needed" (Martin et al., 1992, p. 203).

6.3 South Australia

The lead agency with the major operational responsibilities for dryland salinity management in South Australia is the Department of Primary Industries (SADPI). Other contributing agencies include the Engineering and Water Supply Department (EWS), the Department of Mines and Energy and the Woods and Forests Department. The SADPI also has the responsibility for the NDLP, with the State Landcare Plan (1992) being coordinated by its Soil and Water Conservation Branch. Dryland salinity is considered a component of the Landcare Plan and it is coordinated with other agencies through the State Dryland Salinity Committee (DSC).

The DSC was established in 1989 as the main coordinating body for dryland salinity management in the State. Following on from the development of the South Australian Salinity Program by the SADPI, a Technical Strategy formulated and released in 1990 by the DSC forms the basis for the dryland salinity component of the State Landcare Plan. The Strategy is funded by the relevant agencies and through additional sources including NRMS, NSCP and LWRRDC.

Both the DSC and the Technical Strategy have accelerated the implementation of the Salinity Program, given limited resources (PDP Australia, 1992). The committee is chaired by the SADPI and comprises representatives from the relevant agencies, CSIRO Divisions of Soil and Water Resources and the University of Adelaide. Included in its terms of reference is to:

- develop and oversee the implementation of a strategy aimed at minimising the impacts of dryland salinity on the State's soil, water and vegetation resources.
- ensure efficient resource allocation by maintaining a coordinating mechanism between relevant government bodies.
- provide a coordinating role for organisations and agencies and a priority-setting role for funding proposals.
- promote discussion on planning and technical issues.
- ensure effective community collaboration and education.

As outlined in the State Soil Conservation and Landcare Act (1989), planning and management of natural resources in South Australia is founded primarily on a regional basis, with the emphasis on "district" planning within Soil Conservation Districts. Covering the entire area of the State and aligned along Local Government boundaries, each district is under the jurisdiction of Soil Conservation Boards (SCB), comprised of representatives from Local Government, State agencies, industry and the community. Links may also exist between SCBs and (more localised) Landcare groups.

In having the responsibility for soil degradation issues in their district, each SCB is required to prepare a soil and/or water conservation plan for their district within five years of becoming listed as a Board. This involves providing an outline of the key land-use issues and, finally, recommending `best-bet' work programs for managing dryland salinity and/or other problems such as water erosion and wind erosion. At the level of government, the Soil Conservation Council (comprising community and government representation) oversee the formation of Boards, review draft conservation plans and advise the Minister for Primary Industries. The Natural Resources Council (NRC) is the peak body (one under cabinet) and comprises CEOs of all land-use agencies and chairpersons of the land-use councils; the Soil Conservation Council, Water Resources Council and Native Vegetation Council. Notably, the NRC has acted as the proponent of the management plan developed for the Upper South East region.

There is presently no formalised structure or recognised process for WCM in South Australia (no natural resource management plans have specifically been termed "WCM" plans). In fact, it appears that only catchments in the Adelaide Hills area are considering resource management issues on a catchment basis. At this time, the future development of an WCM model for the State depends largely on the outcomes from this area.

Currently, the potential for WCM lies with largely uncoordinated systems and structures, such as government agencies (eg., the Department of Environment and Natural Resources, SADPI and EWS), SCBs, Drainage Boards, Water Resources Committees, Local Government and the community. In particular, to achieve a uniform response to whole catchment management issues State-wide, a more unified government view and commitment is required. Agricultural, water and environmental interests in government need to be integrated and coordinated. It has been argued that, on their own, technical solutions to salinity and other catchment problems will falter without this broad vision.

In summary, in assessing the potential for South Australia to develop a whole catchment management framework, a number of issues have been identified. These are as follows.

- Implementation of plans largely depends on organisation and funding. It has been suggested that funding arrangements are geared to integrate the three levels of funding (Commonwealth, State and Local). In particular, State commitment is essential, especially in initiating the beginning stages of implementation.
- While possessing some legislative authority, Soil Conservation Boards are hindered in their actions by under-resourcing. Consequently, local community representatives seem to be overwhelmed by the tasks set them to the extent that the boards are not functioning anywhere near full potential.
- As a means to further develop a regional and more comprehensive focus for natural resources management, there appears to be advocacy for the establishment of Regional "Natural Resources" Boards. This would provide a means of pooling expertise and integrating a number of (seemingly unrelated) regional planning strategies.
- As is occurring in other states, recent widespread and ongoing changes in State Government and bureaucratic structures are creating a good deal of concern. For example, the amalgamation of State agencies (reduced from 30 to 12) appears to many to be based more on economies of scale than a philosophy of agency coordination. Major staff cutbacks and difficulties with defining the functions and operations of new departments are also occurring. Apart from issues surrounding centralisation and job security, the question has arisen as to how these moves will act in the interests of developing resource management approaches based on responsiveness, long-term commitment and adequate resourcing.

6.4 Queensland

Responding to community interest and building on the foundation created by the NDLP, the Queensland Government launched an ICM Program in 1990 as part of the Natural Resources Management Program. In 1991, a State Steering Committee (comprising representatives of rural industry organisations, community and conservation groups, Landcare groups, River Improvement Trusts, universities, local authorities and government agencies) was formed to develop a Program and Strategy for ICM, which were released in October 1991. Although foreshadowed in the Strategy (and currently being reviewed), there is as yet no new or specific legislation for ICM, with all activities operating through existing legislation. Because there is no statutory basis for ICM and as ICM cuts across established and traditional agency mandates, administrative commitment and bipartisan political support are regarded as having critical importance.

Most of the State functions relating to ICM and Landcare have been amalgamated into an enlarged Department of Primary Industries (QDPI). Dryland salinity issues are also dealt with virtually exclusively by the QDPI. Additionally, management and operational aspects of the QDPI have recently been regionalised into five areas State-wide. Each region has a regional director and four or five regional managers representing different sections of the QDPI.

The ICM Program seeks to integrate the management of land, water, vegetation and other biological resources in order to achieve sustainable and balanced use of these resources (QDPI, 1991; 1993) The Program is founded on notions of common understanding of issues between stakeholders (from individual landholders to government), individual responsibility, voluntary changes in the use of natural resources and the provision of opportunities for individuals to contribute through participation in representative community groups (QDPI, 1991). Goals also include community cooperation and coordination (on a local level, regional level and with government) and economic sustainability.

To illustrate, the formal structure of the ICM Program includes provisions for the community and government to work together in developing and implementing ICM strategies through catchment and State-wide coordinating committees (QDPI, 1993). The initiative is also built on the Landcare Program and aims to incorporate the network of Landcare groups established throughout the State. The Queensland Program also states specifically that ICM is the means to provide catchment-wide objectives and strategies and Landcare is the means to foster the local action required to achieve sustainable and balanced resource use.

As an initial step to State-wide adoption, the ICM Program has initiated Pilot Studies focusing on five key river catchment areas, with studies intended for completion by 1996. Each study area involves the establishment of a Catchment Coordinating Committee (CCC) supported by a Catchment Coordinator from the QDPI. The committees comprise representatives from key government agencies, industry and community groups. They provide a forum for input and debate on catchment issues, are responsible for identifying and prioritising important issues and develop and promote the implementation of ICM strategies (QDPI, 1993). In addition, the ICM approach is also being adopted by conservation groups, Landcare groups, local authorities and government agencies in at least ten other catchments in the State.

For example, while most activity in ICM has been centred on coastal rivers separate from the Darling River system, an ICM project has commenced in the Queensland part of the Murray-Darling Basin (after Queensland joined the Murray-Darling Basin agreement in July 1992). A proposed structure was determined, four key catchments areas were identified and a CCC was formed in each catchment. To coordinate activities across the Basin, a regional CCC comprising representatives of the four committees has also been established. A management strategy for the Basin was released in April 1993.

A Catchment Management Coordinating Committee (CMCC) has been established to oversee the development and implementation of the ICM Strategy (developed in 1991) at the State level. This body comprises representatives of government, industry and community. Priorities include: fostering coordination among agencies, industry and community organisations; creating public awareness of ICM; recommending State priorities for ICM; monitoring and reviewing the ICM Program; and, providing advice to CCCs on the means to gain technical and financial support and how to prepare and implement catchment management strategies. An ICM unit within the QDPI assists the CMCC in achieving these priorities. The CMCC is responsible to the Minister for Primary Industries.

CMCC subcommittees have also been formed to consider and report on specific aspects of the CMCC's responsibilities (QDPI, 1993). These have various directives including examining the integration of ICM with other land use initiatives, supporting catchment-based initiatives and meeting community expectations by seeking to minimise the impacts of agricultural practices on downstream ecosystems.

In contrast to the other states, Queensland does not have its own dryland salinity strategy per se and tends to place a lower priority on this form of land degradation than others (PDP, Australia, 1992). However, through the Strategy for Natural Resource Management (developed by the Natural Resource Management Unit of the QDPI), dryland salinity is being addressed on a statewide basis as one of several resource management considerations rather than a separate problem. This overall approach indicates that dryland salinity is a relatively minor and, at this point in time, manageable problem in the State.

Current QDPI priorities for salinity management are not clear but are reported to be responding to community (Landcare) requests. However, while it is considered that solutions need to be farmer-driven, the Queensland Government has received criticism for setting many salinity management priorities at the State level with little input from community groups.

The Queensland approach, however, does emphasise that involvement of Local Government is integral to the success of ICM. The evolution of ICM in each area is seen to necessitate input from key players in local authorities who have the capacity to keep priorities and objectives on track. This is viewed as a means of providing a local focus for ICM, heightening local ownership, enabling resources to be accessed more locally and increasing the potential for securing external sources of funding. The potential to feed Local Government strategic plans into the catchment plan of each CCC is also regarded as possible and desirable.

6.5 Western Australia

The two main agencies that deal with land degradation, dryland salinity management and agricultural environmental issues in Western Australia are the Department of Agriculture (WADA) and the Water Authority of Western Australia (WAWA), with WADA acting as the lead agency. The multi-agency Steering Committee for Research on Land and Stream Salinity and the Soil and Land Conservation Council (SLCC) act as coordinating bodies for R, D & E. The Decade of Landcare Plan is managed by WADA and the SLCC and includes salinity management as an integral component.

Amendments to the Soil and Land Conservation Act, 1982, provided for the establishment of Soil Conservation Districts to address land degradation problems. The subsequently renamed Land Conservation Districts (LCDs) and "self-directing" LCD Committees (LCDCs) have received strong support from the local communities, with nearly all of the pastoral and agricultural areas now contained within 139 LCDs. This is seen as a significant event that has raised the awareness, enthusiasm and involvement of local communities in salinity and other land management concerns (PDP Australia, 1992).

The Soil and Land Conservation Act provides for an LCD to be established where a group of landholders determine the boundaries of a District and make a request to the Minister of Agriculture. Subsequently, the LCDC is appointed, with membership and representation being determined by the community involved. Relevant government agencies (most commonly WADA) are usually represented on the Committees. Local Government

representation is seen as essential. The WADA representative acts as a general advisor by convention and, therefore, can place the problem in a total land use scenario and identify necessary technical input (Robertson, 1989).

In areas dominated by agriculture, the Landcare activities of the LCDCs incorporate some of the basic ideas of ICM, particularly consideration of the linkages between land and water degradation. In addition, the committees are often considered the logical departure point for more localised, catchment, or sub-catchment management initiatives. In general, LCDCs assume more of an "executive" role and catchment groups more of a "doing" role. Catchment groups now number over 250 within the agricultural LCDs.

In areas not dominated by agriculture, however, other interests (such as industry, forestry, nature conservation and tourism) may need to be incorporated into planning and management. As a result, conflicts of interest are inevitable in ICM. Thus if ICM is to succeed, there is a recognition that processes of interest-based negotiation and conflict resolution need to be emphasised.

The WA State Government initially sought the development of ICM in 1987 and released a policy on ICM in 1989. The Government considered that WA had adequate legislative powers in place to undertake ICM. Hollick and Mitchell (1991), however, make the point that if administrative commitment and bipartisan support are not forthcoming, then legislation may need to be considered to provide credibility for ICM.

The intended coordinating mechanisms and their roles and objectives for ICM in WA are described below. However, it must be noted that many mechanisms are not yet fully developed and often only partially applied. There is concern by some that verticle integration of ICM from Local to State levels is some way from being effective. Nevertheless, the description of the intended structure is of assistance in considering general principles for WCM.

(a) Local action

As the ICM process has evolved, the decision was taken to create Community Catchment Groups (CCGs) in different catchments with representatives from community-based groups. It is envisaged that this could become a main mechanism for providing public involvement in defining problems and developing strategies. At this stage, the CCG concept is in its early phase of development. However, care should be taken to avoid uncertainty in the future in regard to the relative roles of CCGs, LCDCs, State agencies and Local Governments. Partly to this end, Mitchell (1991) recommends that at least several members of CCGs be representatives of Local Governments.

(b) Catchment-wide action

The CCGs act within their jurisdictions and influence the overall direction of ICM, which is coordinated by a regional **Catchment Coordinating Group**. This group provides the focus for facilitating community involvement in a catchment, coordinating community and government actions and providing the main link between Local and State Government policies and activities. As noted, in catchments dominated by agriculture, LCDCs may assume this role.

The Catchment Coordinating Group represents the relevant interests in the community, ideally has links with the Government Officers Technical Advisory Group (GOTAG - see below) and the Integrated Catchment Management Coordinating Group (ICMCG - see below) and reports to relevant Ministers. Typical membership includes representatives from groups involved in local action, (non-voting) State agency personnel and one representative from GOTAG.

The Catchment Coordinating Group is envisaged to oversees the development of an ICM "Plan", representing the collective activities of the broad community, local authorities and State agencies. By drawing together all relevant information as a guiding basis for future decisions in a catchment, the plan provides an overall view of management objectives for the catchment. The plan also needs to include mechanisms and processes that provide a streamlined framework for people to gain access to relevant information and allow constant revision.

GOTAG ideally provides technical advice to and works in parallel with Catchment Coordinating Groups. Membership varies between catchments, but usually includes officers from WAWA, Waterways Commission, WADA, the Environmental Protection Agency (EPA), the Department of Planning and Urban Development (DPUD) and the chairperson of the Catchment Coordinating Group. Other agencies such as the Department of Conservation and Land Management (CALM) are represented when appropriate.

(c) *State action*

The ICMCG is a State-level inter-departmental committee formed to address the inter-agency implications of resource and environmental policies, provide collaboration among agencies and to coordinate inter-agency policy,

objectives and actions required to implement ICM plans. The ICMCG is responsible directly to the Minister for the Environment.

Related priorities include:
(i) developing guidelines for joint, long-term financing of multi-agency initiatives;
(ii) developing recommendations on how the Government should provide funding for ICM activities;
(iii) reviewing the capability of existing legislation and agencies to implement ICM;
(iv) considering appropriate forms of power-sharing among stakeholders;
(v) determining research needs;
(vi) developing performance indicators at catchment and State levels.

Only government members are represented on the ICMCG, the argument being that such an arrangement is more likely to result in agencies seriously considering possible trade-offs (Hollick and Mitchell, 1991). However, as noted by Mitchell (1991), ICMCG does not "own" ICM but is considered solely as the appropriate forum to determine agency and partnership roles and priorities.

The Office of Catchment Management (OCM) is a small independent secretariat created to support the ICMCG, focus full-time on ICM and serve as a facilitator and catalyst in the implementation of ICM. In this regard, the OCM undertakes its own initiatives and hence assumes a proactive role relative to ICM.

The WA Water Resources Council (WAWRC) and the SLCC provide policy advice to the Minister for Water Resources and the Minister for Agriculture respectively. Hollick and Mitchell (1991) consider it appropriate for WAWRC and SLCC to continue to exist alongside the ICMCG despite some overlapping functions (eg., in determining the effectiveness of operational programs). However, unlike the ICMCG, both Councils include community representation and report to Ministers other than the Minister for the Environment. Notably, responsible Ministers will vary from catchment to catchment depending on the circumstances. However, the Minister for the Environment is always involved.

Mitchell (1991) recommends that since ICM is relatively recent in WA, there should be no radical changes to its implementation at this time. Instead, efforts should be made to make current arrangements work more effectively. In this regard, there are deemed to be adequate powers in existing legislation which only require coordination. This has the advantages of enabling substantial progress to be made without the disruption and delays that would be brought about by radical change; allowing the present system the opportunity to prove its worth and highlighting any weaknesses before any further structural adjustments are considered. Thus, an evolutionary rather than a revolutionary approach is advocated.

Hollick and Mitchell (1991) also state that cooperation between agencies in WA appears to be better than in some other states (although many public servants still carry a "territorial imperative"), thereby reducing the need for ICM legislation and increasing the prospects for successful implementation through non-statutory mechanisms. By comparison, the structure of governance in WA is also considered relatively simple.

However, in WA, it is still necessary to clarify roles for and relationships among all stakeholders. It must be noted, for example, that many pivotal issues and terms of reference regarding the composition, roles, powers and resources of Catchment Coordinating Groups vis a vis State agencies, local authorities and other community groups are yet to be resolved and defined. This highlights an important point that unless care is taken to determine the basis on which local or catchment-wide structures are to be established, unrealistic community expectations, frustration and loss of confidence in ICM may result (Hollick and Mitchell, 1991).

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2.2 The Way Forward: Barriers and Bridges to Progress in Integrated Catchment Management in Australia.

G. T. McDonald, The University of Queensland

(Source: McDonald, G.T. 1997. *The Way Forward: Barriers and Bridges to Progress in Integrated Catchment Management in Australia.* Keynote Address 2nd National Workshop on Catchment Management. Canberra)

Summary: There are seven markedly different institutional models for ICM in the Australian states. This paper briefly reviews progress to date in catchment management in Australia and identifies emerging trends and promising developments.

The main source of data is a questionnaire survey of the leading practitioners of ICM to gauge their views on the barriers and bridges to the better implementation of ICM in Australia. The main conclusion is that most people in the business of ICM have their own clear prescription as to what should be done, but there is no dominant or commonly accepted way forward.

Progress to date fits the four-phase adaptive model applied so effectively in Gunderson, Holling and Light's *Barriers and Bridges to Renewal of Ecosystems and Institutions*. In Australia we are still in the alpha phase, looking for a new paradigm of integrated resources management to replace the undeniably inadequate old exploitive and compartmentalised one.

Introduction

The Second National Workshop on Catchment Management heard from some of the best speakers in Australia and indeed internationally on what should be done to increase the effectiveness of ICM programs in Australia. Furthermore the participants had hours of workshops and discussions on this matter as reported elsewhere on what needs to be done. What could be possibly left to say?

The purpose of this paper is to tie some of this together - to stand back and see the larger picture. I will take several approaches to this. The first and obvious point to note in this regard is that there is no compelling and clear cut direction to take that the workshop participants or any other large group of people would necessarily agree on. Individual participants at the workshop had strong views on what they believe was the best way forward, but collectively no single path emerges. Mapping the way forward at this time will have to consider a potentially distracting complexity of possible paths.

The rise of ICM resulted from the failure of all levels of government to have the right policies and programs for natural resources management, and the recognition of this by industry and community groups. Regrettably, governments responded slowly and failed to be the main source of warning and action about these problems.

Recent synthesis of natural resources management by Gunderson, Holling and Light's is helpful in this regard (Gunderson et al, 1996). The commonality between Australia's search for better resources management and those that other countries have experienced is remarkable.

This commonality is briefly canvassed to reveal some barriers and bridges. In Australia we are still in the alpha phase, looking for a new paradigm of integrated resources management to replace the undeniably inadequate old exploitive and compartmentalised one.

This paper also presents the results of a survey taken during the workshop. It reviews the opinions of this group of committed ICM professionals and participants. The participants were government agency staff involved in NRM, Catchment Committee members, researchers and landholders.

Terminology and scope is a problem in discussing ICM. The focus in this paper is on the formal government programs for ICM - the specific legislation, policies, administrative arrangements and finance provided for the integrated management of land and water on a catchment basis. ICM is a subset of natural resources management, which in a general sense also needs an integrated approach - leading to integrated (natural) resource management. Of course integrated management can occur without new and specific programs. The combined effect of enlightened management by separate land and water management agencies certainly can be directed at better and holistic catchment management.

Where are we now?

Notable features of the 2nd National Workshop were the breadth and depth of activities in ICM in Australia and, as shown in workshops and open forums, just how committed people are to ICM. Australia clearly has made great progress in identifying the needs for better resources management and in doing something about it. Diversity between state activities is one of the major features, as the summaries in Table 1 reveal.

Table 1 Summary of ICM Activities by States in Australia.

State	ICM Structure	ICM Processes and Outcomes
New South Wales	Total Catchment Management Act (1989) provides a legislative basis for the Catchment Management Coordinating Committee and the Catchment Management Committees (CMCs) and Trusts operating at the regional level that cover much of the state managed by DLWC.	CMCC consist of senior state department officials and representatives of land user groups, environmental and the CMCs; providing advice to ministers, policy programs and setting of state priorities CMCs, which have representatives of local government, business, land users, regional departmental officers and environmental interests, prepare regional strategies and programs
Victoria	Established Catchment Management Authorities (9) on 1 July, 1997. Combines roles of previous Catchment and Land Protection Boards, river management authorities, salinity implementation groups, and others	Prepare Regional Catchment Strategies Advising government on priorities and negotiating with DENR for services delivery
Queensland	ICM continues under the ICM Policy of 1991. Over 30 Catchment Coordinating Committees have been formed with funding and support from DNR. New NRM Legislation is being drafted	Role is advisory. It is voluntary and structures are not prescribed. CCCs prepare catchment strategies and seek the cooperation of local and state government agencies to implement them.
South Australia	Created a Natural resources Council in 1992 Water Resources Act 1997 subsumed earlier Catchment Water Management Act 1995 is establishing catchment boards (Patawalonga and Torrens, Murray River) Managed by DENR Soil Conservation and Landcare Act operational since 1988 established Soil Boards which still exist	Catchment Boards prepare catchment water management plans using prescribed consultation process advice to the minister promote community awareness
Western Australia	Adopted as government policy in 1987 but not legislative. A range of community based and specific cases have emerged. Supported also by the Soil and Land Conservation Act with district and catchment committees. Also the Salinity Action Plan and Focus Catchments	Environmental Protection Policies and State Planning Policies have been used for priority areas such as the Peel Harvey and the Swan.
Tasmania	No specific ICM programs or legislation Implemented through State Resource Management and Planning System	Development of ICM principles is underway
NT	No single legislation but implemented through the enabling provisions of the Water Act which enables a whole of catchment approach	Not statutory or formal but advisory Examples include the Mary River and Ludmilla Catchments which have Committees formed under the Water Act

Sources: Reports on the current position around Australia - this volume.

It is tempting to say that the diversity is just the old railway gauge problem all over again. Perhaps more positively, it should be concluded that the states are at different points along the evolutionary path and are doing it their own way. This could be viewed as seven different experiments and as Cullen noted there may be a benefit in having some diversity at this stage in development of ICM (Cullen, 1997). What is clear from the state of the states papers in this volume is that many states have made significant changes to their programs for ICM in recent years (SA and Vic) and others (Qld and NSW) are planning reviews. The key differences are whether or not ICM is supported by specific legislation. The administrative structures of resource and environmental agencies also varies markedly between the states, the main differences being in the varying relationship between production agencies, resource management, land management and administration and environmental programs. These relationships also change from time to time in most of the states. There is a search going on for better ICM practice. We are now in the phase of looking for the best policy to adopt - to move to a new paradigm.

Moving Forward - The Options

The essential purpose of ICM is to improve and maintain the long term condition of land and water resources. Given that under completely natural conditions this problem would not emerge, the solution to ICM relies totally and exclusively on changing people's behaviour - to have those people, land managers and others whose activities impinge on land and water resource outcomes, to behave in a way consistent with the goals of ICM. In a physical sense this means affecting the behaviour of the people actually using and changing the natural environment in various ways - cultivating, clearing, extracting water, disposing wastes. In a policy and community sense it means affecting the circumstances of the on-ground managers' behaviour through a range of government policies and community actions. These actions range from relatively un-intrusive and passive activities such as information gathering and research, aimed at influencing the land managers' understanding of resource condition and issues through to quite intrusive activities such as laws and regulations proscribing/prescribing activities. (See Figure 1) It is probably desirable to use the least intrusive and restrictive interference possible consistent with achieving ICM

objectives. For example, restrictive resource controls although seemingly effective in a superficial sense may be politically difficult to establish and enforce; whereas economic incentives, built into pricing policies for inputs and reflected in licensing charges for the use of environmental services, such as water, are more politically attractive and feasible.

Figure 1. Options for Achieving Better Resource Management - focus on land managers' behaviour

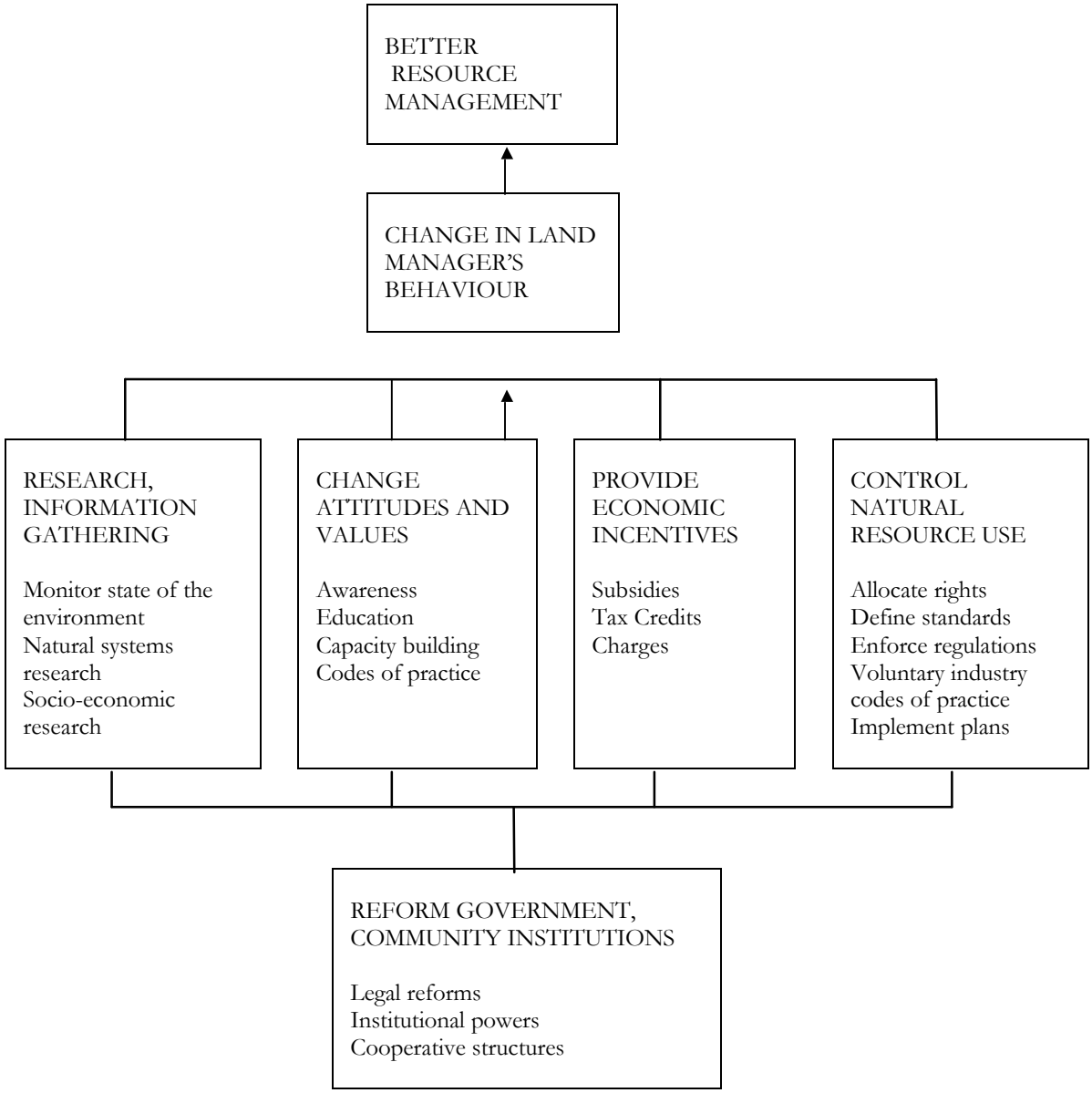


Figure 1 shows the relationships between these policy options and resource management outcomes. It shows the primacy of government and community institutions in selecting the right policy mix to deal with what are intrinsically "common property" problems. Critical in this regard is the feedback loop between information and awareness raising programs and the reform of institutions. Without pertinent and accessible information, community support and government responses for resource management will be retarded. This is a critical loop that many of the workshop participants emphasised. Table 2 shows how these generic policy options can be translated into specific actions that might be taken for moving ICM forward. This framework was used for the design of the questionnaire used in the workshop and reported in the next section of this paper.

Opinions of the Workshop Participants on Priority Actions

The Survey

A large number of ICM committee members, professionals in government agencies and private industry and from the research community attended the Second National Workshop which provided an excellent population to survey about progress to date and the way forward. These people expressed their views in many forums and workshops which are summarised elsewhere in the workshop proceedings.

In addition each participant received a two page (one sheet) written survey giving them a chance to express their views and to bring together the findings across the broad spectrum of the activities shown on Table 2. Three hundred people registered for the Workshop although only approximately 250 were regular and full-time attendees - full participants. Responses were received from 128, just over 50% of these people.

The responses are a mine of information on the opinion of the core group of people engaged in ICM. Clearly, this was a biased group, consisting of those directly involved in ICM.

Table 2 Some Specific Actions that Can be Taken to Advance ICM in Australia

I Information Gathering and Research	**IV Resource Use Controls**
Design of more integrated local solutions	Define resource rights
More socio-economic research	Defining water rights and allocations
More scientific research into resources management	Give ICM plans statutory force
Research on decision making by resource users	Planning
Research on the economics of options	Reduce area under irrigated pasture
Monitoring project/program effectiveness	Stronger resource use regulations
Monitoring resource condition	Restrictions on feed lot production
More funds for CRCs	Set strong standards at the national level
II Change Attitudes and Values	**V Institutional Reforms**
Awareness raising amongst politicians	Better representation on ICM committees
Capacity building in local communities	Create new autonomous regional institutions
Communication of knowledge to decision makers	Create elected catchment groups
More multi-disciplinary trained experts	Formalise and legislate the duty of care principle
	Give catchment groups financial powers
	Strengthen institutional arrangements
III Economic Incentives and Finance	Commonwealth government NRM structures
Invest in capital works	State gov't NRM structures
Levy landholders who cause off-site problems	Catchment management organisations
Reimburse (tax, rates) landholders who carry out prescribed conservation works	Local governments
	Landcare
Reform resource pricing systems	Reform Local government boundaries
Funds to local Landcare/ICM groups	Privatise water authorities
Increase funds for on-ground projects (works)	Use local governments as the prime instruments for implementing ICM

Representation of "client" groups, the landholders and the community were notably absent, except to the extent they were members of these other groups - hardly a representative sample nevertheless. Three groups dominated the Workshop - ICM committee members, government officials involved in natural resource management and researchers from tertiary institutions and research agencies such as the CSIRO. (See Tables 3, 4, 5)

Table 3 Respondents' State of Origin

State	Number
New South Wales	45
Victoria	19
South Australia	12
Queensland	31
Western Australia	9
Tasmania	2
Northern Territory	1
ACT	7
Other	2
Total	**128**

Table 4 Respondents' Length of Involvement in ICM

Length of Involvement in ICM	Number
None	2
Less than 2 years	21
2-5 years	51
6-10 years	30
More than 10 years	22
Not known	2
Total	**128**

Table 5 Respondents' Main Types of Involvement in ICM

Type of involvement in ICM	Number
Research and education	27
Government program administrators	38
Politician	1
Agribusiness	2
Consultant	5
Local government officer	5
Landholder/farmer	29
Catchment Committee member	8
Other	

Information Gathering and Research Priorities

The outstanding feature of this set is the almost universal view that the highest priority is to provide better access to information (Tables 6 and 7). This result was consistent across all groups and States. There was only medium support for the need for more scientific research into the resources themselves. Some typical comments were:

"More research which has been identified by community groups - NOT academics in isolation of the community working"

"Collate all existing and proposed research data and present it all to the lowest common denominator -'those doing the on ground action'. It is essential that available knowledge is owned by those working at the 'coal-face' of ICM."

"Results of (hands on - ie - understandable) research delivered in an understandable way to the "masses". Understanding the "Nature of the Place", then relating that understanding to catchment repair via a process of Strategic Thinking (not Planning) and step wise actions"

Table 6 Information Gathering and Research Priorities - Frequencies

	V.High 6	High 5	Med 4	Low 3	Nil 2	U 1	Mean
Research into best/good practice	24	54	35	12	0	0	4.7
More socio-economic research	25	35	45	16	0	1	4.5
More scientific research into resources management	15	33	58	12	2	1	4.4
Better access to existing information	74	43	7	2	0	0	5.5
Research on the economics of options	23	44	38	13	0	0	4.7
Monitoring project/program effectiveness	45	50	24	6	6	0	5.1
Monitoring resource conditions	40	56	24	4	0	0	5.1

Table 7 Information Gathering and Research Priorities - Means for Groups

	Research into Good Practice	Socio-econ research	Scientific research	Access to Information	Economic research	Project Monitoring	Resource Monitoring
Researchers	4.9	4.6	4.4	5.5	4.7	5.1	4.8
Administrators	4.6	4.3	4.2	5.4	4.7	5.1	5.1
Landholders	4.8	4.9	4.6	5.7	4.4	5.2	5.4
Catchment Group	4.6	4.7	4.5	5.4	4.7	5.0	5.1
Others	5.1	4.0	4.4	5.9	5.0	4.7	5.3

Priorities for Changing Awareness and Attitudes

Awareness raising, so important to generate support for ICM, particularly the need to raise the awareness of the community, politicians and decision-makers, had general strong support from respondents. (Tables 8 and 9) There was believed to be less need for awareness raising in government agencies or for the training of multi-disciplinary staff for ICM. Typical comments were:

"Awareness raising of politicians. They have a moral responsibility to focus on terms longer than three years or their term in office"

"Attitudes and values change as a result of prescription and legislation. If we wait for education/peer pressure to take effect there'll be nothing left"

"Aiming to make local communities interested in having effective input into management of local catchments"

"This whole area has a very high priority. Without an understanding and acceptance at the NRM imperatives in the whole community ICM will find it very difficult to make any significant impact"

Table 8 Priorities for Changing Awareness and Attitudes - Frequencies

	V.High 6	High 5	Med 4	Low 3	Nil 2	U 1	Mean
Awareness raising in local communities	65	39	19	4	0	0	5.3
Awareness raising amongst government agencies	37	50	28	8	3	0	4.9
Awareness raising of politicians	60	37	22	4	2	1	5.2
Capacity building in local communities	49	46	16	3	2	0	5.2
Communication of knowledge to decision makers	62	42	18	2	1	0	5.3
Training of more multi-disciplinary trained staff	27	47	36	12	1	1	4.7

Table 9. Priorities for Changing Awareness and Attitudes - Means for Groups

	Local Awareness Raising	Govt agency awareness raising	Politician Awareness raising	Capacity building in local communities	Communication to decision makers	Training more staff
Researchers	5.0	4.8	5.2	5.1	5.3	4.9
Administrators	5.1	4.6	5.1	5.3	5.2	4.5
Landholders	5.7	5.3	5.6	5.3	5.2	4.6
Catchment Group	5.5	5.1	5.3	5.1	5.6	4.8
Others	5.6	5.0	4.8	5.2	5.1	4.6

Priorities for Economic Incentives and Finance

There was surprisingly low priority given to the need for economic incentives as a means of implementing ICM programs. Only one-third of the respondents believed that using either positive or negative incentives for landholders were important or that resource pricing reform was a high priority. Providing increasing funds to ICM programs was also relatively low priority and investing in capital works for resource management very low. Respondents clearly understood the role of these policy tools but did not rate them highly compared with other policy options.

Some comments:

"To allow for "externalities", to have more accurate pricing of environmental resources (but being sensitive to equity). A role for ICM is to progress this debate"

"People will do the work if shown that it will "work" for them ($$, practical, outcomes). Priority is to develop incentive system integrated with adoption process, not more funding"

"Restructuring tax and rebates on rural landholders to provide financial incentives for ESD and SAD. At the same time tie government grants to local government to ESD and SAD planning and approvals criteria"

Priorities for Resource Use Controls

There was moderate support for the need for greater controls over land and water use. There was very low support for the setting of strong standards at the national level. In particular respondents expressed a view that more action oriented catchment plans were needed.

"Use national standards to create regional standards and workable regional systems. Then use regulations etc. to "enforce" adoption of standards"

"The ICM statutory body based on regional or catchment jurisdiction needs power to raise revenue and enforce its regulations within the context of a catchment plan that is available to all people affected for their information"

"Unsure of whether ICM should have statutory force, rather a change of thinking that will allow content of plans to be recognised and implemented in other plans"

Table 10. Priorities for Economic Incentives and Finance - Frequencies

	V.High 6	High 5	Med 4	Low 3	Nil 2	U 1	Mean
Invest in capital works	6	21	56	27	4	1	4.0
Levy landholders who cause off-site problems	25	44	43	4	3	3	4.6
Reimburse landholders doing conservation works	33	43	33	10	3	0	4.8
Reform resource pricing systems	46	42	23	5	2	0	5.1
Increase funds to local Landcare/ICM groups	29	42	41	9	1	0	4.7
Increase funds for on-ground projects (works)	44	37	36	5	2	0	4.9

Table 11. Priorities for Resource Use Controls - Frequencies

	V.High 6	High 5	Med 4	Low 3	Nil 2	U 1	Mean
Define resource rights	34	49	31	5	0	0	4.9
Give ICM plans statutory force	36	46	28	8	2	3	4.8
Prepare more action oriented catchment plans	46	55	17	4	1	0	5.1
Enforce stronger resource use regulations	30	46	36	9	0	2	4.7
Set strong standards at the national level	26	34	33	20	8	2	4.4

Table 12. Priorities for Resource Use Controls Means - Means by State

	Define rights	Statutory ICM	Stronger plans	Regulations	National standards
NSW	5.0	5.0	5.2	4.6	4.4
VIC	4.9	4.8	5.2	4.9	4.3
SA	4.9	4.8	5.2	4.7	4.0
QLD	5.0	4.6	5.2	4.8	4.5
WA	4.3	5.0	5.1	5.5	5.0
TAS	5.0	4.0	4.5	3.5	3.0
NT	5.0	3.0	5.0	3.0	3.0
ACT	5.1	4.6	4.7	4.6	4.1

Priorities for Institutional Reform

There was more diversity amongst the responses about institutional reforms than for other questions. There was low support for the creation of new or autonomous regional catchment groups, or for strengthening Commonwealth structures for dealing with catchments. Improvement in catchment organisations themselves and strengthening the links with local government were the highest priorities for institutional reform.

> "Co-ordination of local government, state government agency and catchment boundaries. Most catchment problems could be at least partially addressed by improved local government planning"
>
> "Better access of the community and other sectors for decision making on resource management issues - at individual, local and state levels"
>
> "Improve coordination between stakeholders, agencies and governments and ensure "land users" groups in general form coordinated comprehensive strategy. Tie in with each other and programs/processes ALREADY on line, eg. National Forest Policy, Montreal Process, Biodiversity Strategy etc."

"Proper representation from community. In Victoria Catchment boards are chosen by the Minister and often not representative at all. "

"Better representation in ICM committees' - In whose opinion? The community in general and those who are going to have change forced upon them in particular must be confident their views are represented"

"Give catchment groups statutory financial powers and reform local government boundaries

"Integration and coordination urgently needed in WA. Must include community who can be empowered to lead, scrutinise, etc."

"Formalise the status of catchment strategies as a guide/consideration in existing natural resource management structures such as land use planning"

Table 15 shows the opinions about institutional reforms by State, revealing some significant variations arising out of differing state experiences. While all the states' respondents supported the need for catchment committee organisational reforms and the need to forge better links with local governments and their planning processes:

- Victorian respondents were more concerned about committee representation than other states,
- Queensland respondents held substantially stronger beliefs in the needs to involve local governments,
- Western Australian respondents were particularly concerned about the financial powers of ICM groups and,
- South Australians were more concerned about their state's arrangements for ICM.

Discussion

Those priorities rating highest (means over 5 for all respondents) were:

1 Providing better access to existing information

2 Awareness raising in local communities
3 Communication of knowledge to decision makers
4 Awareness raising of politicians
5 Monitoring resource conditions
6 Prepare more action oriented catchment plans

There is an overall pattern in these results. All actions are important priorities in the minds of at least a significant minority of the respondents - some more than others, with the exception of increasing capital works programs which very few want. Better access to information and the greater awareness of local communities and politicians were the clear highest priorities. Presumably respondents believed that ignorance and apathy were limiting involvement and adoption of ICM principles by resource managers and their elected representatives. Only with higher awareness of the importance of ICM can the commitment, including commitment of funds and changing behaviours necessary to achieve better resource management, occur.
There were needs for institutional changes in most areas, but particularly in the character and performance of ICM groups themselves. This was a view of all groups from all states, but particularly those working in the catchment groups.

The most outstanding feature of the collective results of this survey are the high levels of significance the respondents placed on almost all the possible actions posed in the survey. Everything seems important and urgent to many people and almost all the actions to be critical to at least a minority of ICM participants. Very few of the potential solutions were classed as undesirable.

The Transition from Exploitation to Conservation

What does all this mean? Gunderson and Holling and Light recently published a book that provides valuable insights on this situation. (Gunderson, Holling and Light, 1996) *Barriers and Bridges to the Renewal of Ecosystems and Institutions* attempts to explain the process of institutional change in ecosystem management and explored the processes of managing complex regional systems. They and their contributors were particularly concerned with situations such as the Columbia River and the Everglades where management problems were acute and substantial change in the management paradigm was required. The new synthesis can be traced directly to Holling's 1986 paper in which he reviewed a large number of managed ecosystems in search of more general explanations. (Holling, 1986)

> "One of the puzzles mentioned in an introductory chapter was the apparently inevitable emergence of a pathology of regional development, at least in its early phases, as the consequence of initially successful exploitation and management of natural resources and the environment of a region. In the case studies we examined in the early 1970s, the ecosystem and environment became more vulnerable to surprise and crisis as resilience decreased, the management institutions became more rigid and less responsive both to the resource dynamic and to the public, and the citizenry became more dependent and with fewer options for self-reliance." (Gunderson, Holling and Light, 1996, 508)

The synthesis finds similarities between social and ecological adaptation theories. These contrast gradualist life cycle models with revolutionary ones - where long periods of slow change are punctuated by periods of rapid transformation. These theories outline the deep structures that result in gradual and only incremental changes in "equilibrium" periods, followed by brief periods of revolutionary change when the deep structure itself changes. (See also Kuhn (1970) who describes this as a paradigm shift). The process of change is described in a four-phase process as follows:

Table 13 Priorities for Institutional Reform - Frequencies

	V.High 6	High 5	Med 4	Low 3	Nil 2	U 1	Mean
Better representation on ICM committees	22	38	39	13	1	0	4.6
Create new autonomous regional institutions	13	14	26	33	18	12	3.4
Create elected catchment groups	8	20	36	24	16	12	3.5
Formalise and legislate the duty of care principle	32	39	28	16	1	1	4.7
Give catchment groups statutory financial powers	29	35	33	15	3	2	4.6
Strengthen Commonwealth NRM structures	17	38	32	20	4	0	4.4
State Government NRM structures	19	45	34	8	6	0	4.6
Catchment management organisations	49	53	15	1	0	0	5.3
Local government planning systems	48	40	20	5	2	0	5.1
Landcare	23	42	29	13	4	1	4.6
Industry planning practice for NRM	26	52	27	5	1	0	4.9
Reform local government boundaries	36	32	17	19	6	3	4.6
Local governments as the implementer for ICM	34	24	19	15	14	7	4.2

Table 14. Priorities for Institutional Reform - Means by Group

	Rep. on ICM	Regional institut.	Elect. grps	Duty of care	Financ. powers to ICM	Clth NRM	State NRM	ICM orgs.	Local plan. systems	Landcare	Ind. plan.	Local bound.	Local govts as ICM
Research	4.6	3.7	3.8	5.2	4.8	4.4	4.9	5.1	5.1	4.3	4.9	4.7	4.3
Administrators	4.6	3.6	3.6	4.6	4.5	4.0	4.4	5.1	4.9	3.9	4.6	4.6	4.5
Landholders	4.4	3.7	4.0	4.2	4.3	4.3	4.5	5.3	5.0	5.3	4.8	4.1	4.2
CCC	4.5	3.0	3.1	4.7	4.4	4.9	5.0	5.5	5.3	5.2	5.2	4.8	4.3
Other	4.8	3.4	3.3	4.9	5.0	4.8	4.1	5.4	5.6	4.5	4.6	3.9	3.7

Table 15. Priorities for Institutional Reform - Means by State

	Rep. on ICM	Reg'l institut.	Elect. grps	Duty of care	Financ. powers to ICM	Clth NRM	State NRM	ICM orgs.	Local plan. systems	Landcare	Ind. plan.	Local bound.	Local govts as ICM
NSW	4.6	3.1	3.2	4.6	4.6	4.4	4.3	5.3	5.0	4.9	4.9	4.9	4.2
VIC	4.8	3.9	3.7	4.7	4.4	4.2	4.4	5.3	5.1	4.5	4.9	3.4	3.4
SA	4.6	3.8	4.3	4.2	4.9	4.0	4.8	5.1	4.5	4.2	4.3	4.1	3.8
QLD	4.6	3.4	3.7	4.9	4.5	4.4	4.7	5.3	5.5	4.7	5.1	4.9	4.8
WA	4.3	3.4	2.7	4.8	5.0	5.0	5.7	5.5	5.3	4.3	4.5	4.5	4.0
TAS	3.5	3.0	4.0	4.5	3.5	3.0	4.0	4.5	4.5	3.5	4.5	5.0	5.0
NT	5.0	3.0	4.0	4.0	3.0	5.0	6.0	6.0	4.0	4.0	5.0	5.0	5.0
ACT	4.8	3.1	3.5	5.2	5.0	5.2	4.2	4.8	4.8	3.4	4.6	4.8	5.0

1. Ω phase:-
   crises inevitably occur as systems (ecological, economic or social) mature, producing an increasing brittleness or susceptibility to crisis. Crises in this context is revealed as the "undeniable inadequacy" of policy. In the case of ICM evidence of this is the acute and chronic health of our rivers, land degradation and community conflict over scarce resources - something went wrong and we need to fix it.

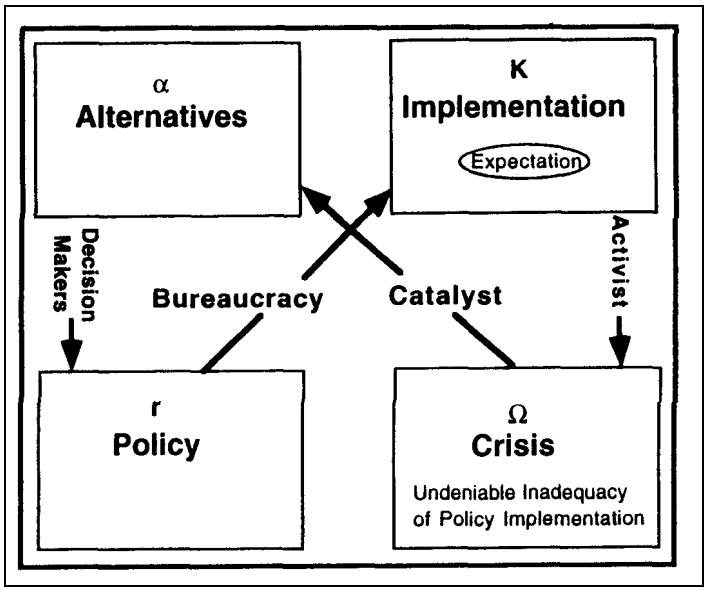
2. α phase:-
   in institutions following the crises, informal collaboration develops among groups of people outside the institutions to develop an integrated and shared understanding from which a variety of options for solving the crisis can emerge. There must be a search for solutions - how do we solve these new problems that previously existing

   institutions have not. The second phase requires activities that can launch the adaptive process. Their task is to find new solutions that overcome the problems of the past.

3. r phase:-
   specific but transient processes result in a reorganisation of the management institutions and society, with new goals, policies and organisational processes in place. This leads to a revision of policy and the subsequent continuation on a new path of better management

4. K phase:-
   implementation of the new "paradigm" and so the cycle continues until new crises occur. Of course the whole purpose of adaptive behaviour by ecological or social systems is to avoid the crises in the first place - to adapt continually to the condition of the resources and social demands on them.

Figure 2 Gunderson, Holling and Light's four-phase model of institutional change



(Gunderson, Holling and Light, 1996, 499)

The role of different groups in this process are:

i. *Bureaucrats:* concentrate on increasing efficiency in their implementation task and often focus on Are we doing this right? Rather than Are we doing the right things? They are often insular and surprised when the inevitable crisis occurs. Sometimes this is explained by the limited range of professional expertise.
ii. *Activists:* are essential to the move to the crisis stage. "The activists tenacious focus on narrowly defined goals and their need to identify enemies challenges whatever current goals are in practice guiding the institutions." p 501. While bureaucrats may ignore the activists, but when the public interest is aroused, the period of crisis ensues which exposes the weakness in policy and its implementation. This begins Holling Ω phase, the adaptive change in policy. Activists want something done now, and invoke conflict and trouble in order to achieve it.
iii. *Catalysts:* In the disruption of normal policy/implementation, a temporary "shadowy" group emerges of technical people who "functioned informally outside traditional institutions but drew on contacts within them" p 503. For these people the normal constraints of policy involvement are relaxed. Gunderson and his colleagues see three types of people in this group, visionaries, respected integrators and loyal heretics. These people are geared towards "unlearning" to forget/ignore old rules and to find new solutions. The outside visionary can transform "myths" amongst those intimately involved; the wise and respected "integrator" is respected by those inside and outside the system and can call on a veil of honesty to overcome countervailing obstacles; the loyal heretic (or bureaucrat) can also play a critical role because of the respect they hold inside and outside the system.

How can we interpret the current state of ICM programs in the light of this international experience? At what stage is ICM in and where might we hope or expect it to move next?

There is no doubt that Australia has experienced an "undeniable crisis in policy" in natural resources management which became evident in the 1970s and 1980s and lead to a search for a better way. A range of activists and catalysts emerged to help, especially from the community sector, people like John Burton, Watershed Jackson and others. Change did occur and ICM programs were created.

At present it could not be concluded that a mature, generally supported model for ICM exists in Australia. There are seven different state models which is not a pattern found in other policy areas such as health, education or law enforcement for example. Furthermore, some of these models are clearly not working well despite the loyal and well-intentioned actions (and statements) of those involved. Several states have indicated that they will review their programs in the near future.

In a conclusion acutely relevant for ICM, the Gunderson et al study concludes that "the traditional planning-led change process is rarely successful because it is imbedded in bureaucracies whose participants for all intents and purposes ignore change" p 505. Also planning is not a way to learn because it is dominated by (conservative) bureaucracies (Michael, 1973).

The diversity of views on priorities also suggests that ICM in Australia is neither well-structured nor meeting its objectives. There is considerable disagreement on the best way forward.

I would conclude that ICM is still in the omega phase - the activists are still searching for the best new alternative for policy - the new paradigm.

Conclusions

The summary of the state programs and the survey of a significant proportion of people involved in ICM in Australia confirm that there is no clear path present but that there are multiple paths that must be taken. Australia is not yet converging on a new paradigm for ICM although there are many valuable experiments going on that are beginning to show the shape of the paradigm. Perhaps the state of Victoria has progressed furthest in this respect. They have created the links between natural resources management in a hierarchy from Landcare to regional catchment strategies to state policy on natural resources management. They are well-advanced in exploring the links with local planning and the role of local government as a key implementer of ICM.

My own view is that ICM is as yet still a fringe activity to the core business of government - the economic (including infrastructure programs), resource management, development planning, and approval processes. These need to be incorporated. Whether or not there is a role for ICM as formal programs or whether ICM as practiced can be subsumed within the integrated management of development remains to be seen. This would be the New Zealand solution.

It is not at all clear to me that community empowerment, so central to the Landcare program can be translated easily up the scale to ICM. Landcare deals with voluntary small catchment works, tree planting and water controls whereas ICM deals with resources allocation at the river basin scale. ICM must deal with issues of resource rights and regulations not at all part of the Landcare ethic. ICM has more of a government role and thereby needs statutory foundations. It could even be envisaged as a regional form of government whether by delegation or independent elected and participatory form is a moot point. On the other hand, why create new agencies? Why not reform the existing agencies at each level to do a better job? To simply add another functional group - the ICM is perhaps to lead to further splitting of responsibilities rather than integration as its title suggests.

Is it now the right time to prepare a **"National Blueprint for Catchment Management"**? Such a model, similar to conservation, regional development and other policies, would set out the ideal catchment management model on the basis of experience by all the states, for adoption by the states with substantial assistance from the Commonwealth. It might include consideration of:

- what are the structures - legislation, regionalisation, boards (committees)
- what are the processes
- what should be the links with associated resources management and policies at all levels. Many of the key note speakers at the Workshop commented on this.

Bridges to the achievement of improved ICM through a national blueprint include increasing the considerable interaction and information sharing that already occurs. The NHT with its requirement that there be a regional approach to resource management projects, is certainly providing some convergence in this aspect at least.

Barriers to the agreement on the contents of such a structure would be states rights issues. The perennial problem of states rights (and the idiosyncratic bureaucratic structures) of states would certainly mitigate against a national model. Providing the model was not too prescriptive, there may well be agreement for variation in application within broad principles. A further barrier may be the belief that the issues are so fundamentally different between states. In particular there is a often discussed view that the southern states, and especially the Murray darling Basin have a different set of management problems than other parts of Australia. Certainly the issues are different but the blueprint need not be prescriptive about technical solutions.

In Gunderson, Holling and Light's terms how else can we move out of the alpha phase?

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3. ORIGINS OF ICM IN QUEENSLAND

Integrated Catchment Management began in Queensland in 1991 as a State Government initiative supported by the Minister of Primary Industries at that time, Mr Ed Casey. The ICM initiative was a response to a community interest in dealing with and managing issues such as water quality, land degradation and river and stream management using a catchment-wide approach. The former Department of Primary Industries (DPI) had the lead administering role and important roles of other agencies, including the Departments of Environment and Heritage, Lands, and Housing and Local Government were recognised. (Rowland and Begbie, 1997: 1).

ICM in Queensland is defined as:

> *"Integrating the management of land, water, vegetation and other biological resources on a catchment basis in order to achieve the sustainable and balanced use of these resources." (DPI Queensland, 1993: 1)*

Queensland has no specific legislation for ICM and catchment coordinating committees (CCCs) were created under the DPI 1991 Guidelines. CCCs are formally appointed groups with members who have interests in catchment issues, including primary producers, environmental conservation, land use planning, river engineering and other aspects of natural resource management. The community and government work together in developing and implementing strategies for improving river catchment management. ICM encourages voluntary changes in the way people use and manage their natural resources. (DPI Queensland, 1993: 1).

The Catchment Management Coordinating Committee (CMCC) coordinated ICM programs at a State wide level. CMCC was comprised of representatives from peak industry, government and community sectors who have an interest in the management and use natural resources. The CMCC aimed to inform industry, and other sectors of the community interested in natural resources, of its activities. (DPI Queensland, 1993: 2)

The roles of the CMCC were to:

- recommend State priorities for the long-term implementation of the ICM program and the annual allocation of resources available for the program;
- provide advice on the provision of technical and financial support for catchment coordinating committees and the preparation and implementation of catchment management strategies;
- provide advice on new ICM legislation, monitor its effectiveness and recommend any amendments required to ICM an related statutory and administrative procedures;
- recommend State-wide ICM policies and identify the need for, and participate in the preparation of related policies;
- foster coordination between government agencies, industry, and professional and community organisation in their land, water and related biological resource management programs;
- foster the implementation of a State-wide ICM public awareness campaign and the distribution of catchment management information;
- maintain a register of catchment management strategies in Queensland, and
- monitor the implementation and progress of the ICM Strategy, and review its performance every three years." (DPI Queensland, 1993: 2).

The initial stage of the ICM program focused on five Pilot Study Areas: Johnstone River, Lockyer Valley, Pioneer River, Mitchell River and the Mary River. Catchment coordinating committees were established for each study area and were comprised of representatives from key interests groups from government, industry and the community. The committees role is to hold forums on catchment issues for community comments, identify and prioritise issues of concern in the catchment and develop and promote the implementation of catchment management strategies. The ICM approach has now been adopted in over 30 other catchments throughout

Queensland by local authorities, conservation groups, landcare groups and other state departments (DPI Queensland, 1993: 1)

This section contains extracts from the original strategy document.

Further Reading

AACM & CWPR. April 1995. *Enhancing the Effectiveness of Catchment Management Planning.* AACM International Pty Limited, Adelaide

DPI Queensland. 1993. *A Guide to ICM in Queensland.* Queensland Government Department of Primary Industries, Brisbane.

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The Source – Integrated Catchment Management News and Views. April 1992. 1.

3.1 Queensland Integrated Catchment Strategy – Summary

Department of Primary Industries

(Source: Extracts from Queensland Government Department of Primary Industries (DPI). 1991. *Integrated Catchment Management – A Strategy for Achieving the Sustainable and Balanced Use of Land, Water and Related Biological Resources*. Department of Primary Industries, Brisbane)

Purpose:
The purpose of the Strategy is to integrate the management of land, water and related biological resources in order to achieve the sustainable and balanced use of these resources.

Goals:

Community understanding, coordination and cooperation	• To have the community and government better understanding the interactions between land and water resources and related components of the ecosystem and the need to manage these resources on a catchment basis. • To have effective coordination within government, between government and the community, and within the community, of activities and policies relating to the management of Queensland's land and water resources. • To have effective cooperation between relevant government agencies, authorities, companies, industry and community groups, landholders and individuals involved in the management of Queensland's land and water resources.
Common goals and priority action	• To have all sectors of the community and government share common or agreed goals for land and water management. • To have all users or managers of land and water resources take account of the effects of their actions on these and other related natural resources. • To address interrelated land and water issues on a priority basis within catchments.
Economic and ecological sustainability	• To maintain economically viable industries within an ecologically sustainable framework. • To maintain, and where feasible, restore and improve the quality and productivity of land, water and related biological resources. • To maintain essential ecological processes, ecosystems and biodiversity. • To minimise detrimental environmental effects due to the development of land, water and related biological resources, within and beyond catchment boundaries. • To protect the wild, scenic and natural characteristics of rivers, lakes and the landscape.

Why Integrated Catchment Management?

Integrated Catchment Management (ICM) is a coordinated approach to the management of natural resources in Queensland. Its overall purpose is to integrate the management of land, water and related biological resources in order to achieve their sustainable and balanced use.

The ability of our land and water resources to meet our needs in the future is being threatened by continuing degradation and increasing demands on these resources for a range of uses. As a result, we are faced with problems such as soil erosion, salinity, siltation of creeks and rivers, flooding, water logging, polluted water supplies and damage to terrestrial and aquatic ecosystems.

Many of the problems affecting our land and water resources are interrelated and cannot be effectively solved individually. A cooperative and coordinated approach is needed to resolve these issues. ICM draws together those involved in primary production, environmental conservation, land use planning, river engineering and other aspects of natural resource management. It fosters joint action to address priority issues within river catchments.

The ICM Strategy

The Integrated Catchment Strategy

- **provides** a framework for fostering cooperation and coordination between the many landholders and other resource users, community groups and government agencies involved in the use and management of land and water resources;
- **is dependent** on landholders, the community and government having a sound understanding of the interactions between land and water and the need for a coordinated catchment-wide approach for addressing issues affecting them;
- **encourages** the community and government to promote an understanding of the value of an ICM approach and its underlying principles; and
- **recognises** that there will be many situations where existing groups and organisations can address important environmental problems. Land Care groups, local authorities, river improvement trusts and community groups play key roles in promoting the sound management of our land and water resources.

Issues

This strategy is designed to address interrelated land and water resource issues such as:

- The impact of land use on water quality
- Soil erosion and sedimentation of watercourses
- Stability of bed and banks of watercourses
- Salinity induced through clearing of vegetation
- Loss of habitat on land, in rivers and streams
- Flood mitigation and floodplain management
- The impact of land and water use on coastal and marine environments
- Productivity decline due to the degradation of land and water resources
- Spread of weeds by water
- Competition for land and water resources

Principles

The principles on which the ICM Strategy is based are:

Land and water resources are basic and interactive components of natural ecosystems
These interactions mean that changes in any one component of any ecosystem will frequently have an effect on other components. Because of this, no one component can be managed in isolation. People who use and manage natural resources must therefore understand the natural of the interactions in order to ensure that their decisions and actions do not adversely impact on another part of the ecosystem.

Management of land and water resources should be based on geographic units which account for the interactions between these resources.
River catchments often provide the most suitable unit for the management of land and water resources. A river catchment is characterised by a clearly definable physical boundary, which has been determined by natural history and establishes a natural barrier or interface for many of the physical, chemical and biological processes at work within and outside the catchment. It provides natural resource products and amenities of direct and indirect value to all life.

River catchments are continuously changing in response to natural processes.
Human activity will alter the rates and the way in which these changes occur. Such changes can be slow, like the siltation of water storages, or very rapid and obvious, like large-scale tree clearing or the effects of a flood. The management of river catchments much recognise and take account of the changes that are occurring due to natural and human causes.

Management of land and water resources must be coordinated.
Many people, community and industry groups, government agencies and authorities are involved in the use and management of land and water resources. Individually they tend to focus their attention on specific issues, such as forest management, water supply and conservation, in specific areas like floodplains, national parks and individual landholdings or within artificial administrative boundaries such as local authority areas.

Sound land and water resource management often requires coordinated action across whole river catchments by many of these individuals and groups. For example, successful flood mitigation and management require not just watercourse management (which may be the responsibility of State Government agencies, a local authority or a river improvement trust), but erosion control and careful land use planning throughout the river catchment (the responsibility of landholders, government agencies and local authorities).

Land and water resource management decisions must be based on the best available information.
Information on land and water resources, particularly on the interactions between these resources, is often deficient or not readily accessible. While additional information is often desired, management decisions will need to be made using available data to avoid unacceptable delays.

In a democratic society sound land and water management is best achieved through the informed action of the individual users and managers of these resources.

Mechanisms for community participation and education are necessary to encourage informed action, leaving enforcement of statutory controls as a 'last resort'.

A balance between economic development and conservation of land and water resources must be maintained.
The future economic viability and lifestyles of rural and urban communities depend on the sound use of land and water resources. An economically viable landholder, industry or resource user is better able to implement sound resource management practices than one who is not.

Land and water use practices which enhance and sustain economic performance in the long term, while maintaining and improving land and water resources, will benefit landholders, industries and the community.

Elements of the Strategy

The Strategy provides a framework for integrating the management of land, water and related biological resources by fostering the adoption of sound resource management practices and the coordination of government and community planning and action. The Strategy is designed to apply to both rural and urban areas of river catchments.

The key elements are:
- Awareness
- Community Action
- Government Action and Support

Awareness
The sustainable and balanced use of land and water resources depends on landholders and other resource users, the community in general, and government agencies and authorities having a sound understanding of the interactions between land and water, and of the need for a coordinated catchment-wide approach for addressing issues affecting these resources. A good understanding of these principles will enable all people and organisations involved to identify the need to change existing practices and adopt practices best suited to their own situation, without damaging other parts of the ecosystem.

Community Action
Long-term action to address land and water management issues in a catchment will only occur when landholders and other resource users and managers seek resolution of these issues. The Strategy encourages informed action by individual users and managers in their own activities and provides opportunities for them to contribute to the resolution of catchment management issues.

Government Action and Support
The planning and implementation of catchment management strategies will require the support and coordinated action of all levels of government – local, State and Commonwealth.

Individual Action
Individuals have a responsibility to ensure that their actions do not have adverse impacts on others or the environment. The Strategy encourages all people who use or manage land and water resources to use practices which maintain, restore or improve the quality and productivity of these resources. It also provides opportunities for individuals to contribute to the resolution of catchment wide issues through participation in community action groups.

Implementing the Strategy
Everyone has a role in adopting a whole catchment approach to the use and management of land, water and related biological resources. To achieve the sustainable and balanced use of these resources, it is important that the community and government accept the following roles.

Roles of Individuals include:

On the land

Adopting a whole property and whole catchment approach to property management, such that the effects of managing one component or part on another component or part in the same or other areas are understood and accounted for. For example: clearing land in accordance with sound land use and environmental protection guidelines, not constructing unauthorised levee banks or other works which may interfere with the flow of flood water.

In the office

Considering the full range of benefits and costs of proposed works and management plans. For example: designing transport corridors that minimise impacts on natural drainage systems; considering in-stream water requirements when allocating water for off-stream use; considering environmental and hydraulic aspects when proposing to develop swamps or wetlands.

During construction

Using machinery and carrying out work in a manner that does not cause erosion of land and watercourses, or pollute and block watercourses.

At leisure and play

Using only designated areas for boating, hiking, driving and other activities and in a manner that does not cause erosion, stream pollution, fires or other unwanted effects.

At home

Using water wisely, disposing of waste thoughtfully, recycling materials whenever possible and conserving energy.

Role of the community include:

- Establishing and supporting Catchment Groups or Committees as needed to address land and water issues
- Identifying interrelated land and water issues that should be addressed, and contributing to the development of solutions
- Participating in the development of catchment management strategies
- Influencing the community and individuals through local action groups to achieve results on the ground
- Promoting within the local community the concepts and principles of sustainable and balanced use of land and water resources
- Contributing funds to develop and implement catchment management strategies

Roles of local government include:

- Fostering community awareness and the formation of Catchment Care Groups
- Contributing technical and financial support to Catchment Groups and Committees, on a voluntary basis and as resources permit
- Participating in the development of catchment management strategies
- Contributing voluntarily to the implementation of catchment management strategies by considering incorporating relevant parts of these strategies in local authority plans, by-laws and administrative procedures and in their own field activities

Roles of the State Government include:

- Fostering community awareness and the provision of educational material and services
- Participating in the development of catchment management strategies
- Contributing technical and financial support to Catchment Coordinating Committees as resources permit
- Establishing policies, institutional arrangements and necessary legislation to facilitate the implementation of integrated catchment management
- Contributing to the implementation of catchment management strategies by considering the incorporation of relevant parts of these strategies in appropriate legislation, regulations and administrative procedures, and in the management of public land and water resources and the provision of infrastructure and services
- Developing State-side catchment management strategies and programs and monitoring their progress
- Ensuring interdepartmental coordination of land and water resource programs.

Roles of the Commonwealth Government include:

- Participating in the development of catchment management strategies
- Adopting catchment management strategies on land used or managed by the Commonwealth Government or its agencies
- Providing financial support to priority catchment projects where national interests apply
- Providing taxation and other financial incentives for expenditure on land and water conservation

Catchment Coordinating Committees

Catchment Coordinating Committees are established to address complex catchment management issues that involve many community groups and government agencies.

Catchment Coordinating Committees comprise representatives of the major sectors of the community and government which are involved in, or influenced by, the management of land and water resources in the catchment.

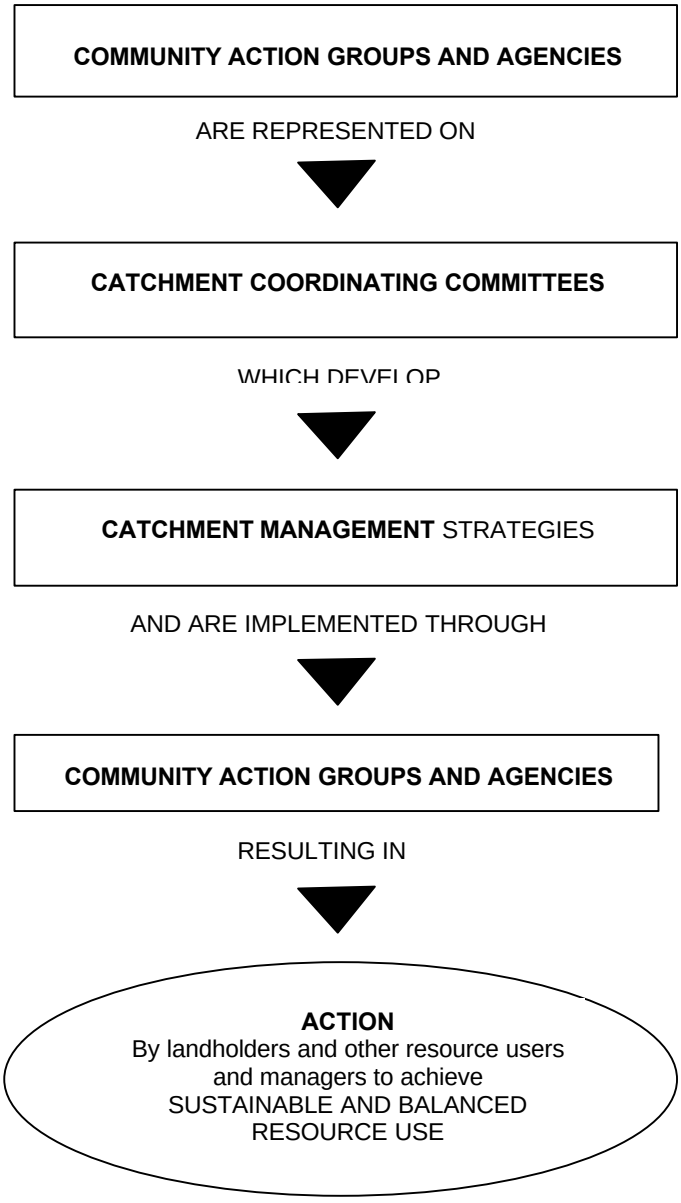
Their major roles are to provide a forum for community input and discussion, to prioritise the issues and to develop and promote the adoption of catchment management strategies.

Catchment Management Strategies

Catchment management strategies provide a broad assessment of the priority land and water issues in the catchment and contain recommended actions to address particular issues.

Catchment Coordinating Committees foster the voluntary implementation of catchment management strategies through existing government and community organisations. While catchment management strategies are not legally binding, they provide guidelines and recommended policies and action plans which all people who use and manage natural resources are encouraged to adopt.

How the ICM Strategy Works in a Catchment



Strategy Results

This strategy will help to achieve:

- **An understanding** and accounting by all users and managers of land, water and related biological resources and of the effects of their decisions and actions on these resources;
- **Cooperation** and coordination between the community and government in their land and water resource management activities;
- **Economically** viable industries within an ecologically sustainable framework; and
- Clean water, fertile soil and ecologically diverse and productive ecosystems.

Outcomes of the Strategy

The adoption of the ICM philosophy and processes will result in:

- All users and managers of land and water resources under-standing and accounting for the interrelationships between these natural resources in their management decisions and activities
- All sectors of the community and government accepting their individual responsibilities for the sound management of land, water and related biological resources
- Integrated policies and programs for the management of land, water and relation biological resources
- Common goals, strategies and coordinated action by the community and government in addressing priority land and water management issues
- The sustainable use of land and water resources while providing for the material, residential, industrial, recreational and environmental needs of current and future generations
- The maintenance of essential ecological processes, ecosystems and biological diversity.

4. DEVELOPMENT OF ICM IN QUEENSLAND

The Queensland ICM model is not a legislative approach but one based on cooperation between statutory agencies together with a substantial dependence on local initiative, ownership and drive. This section traces the development of ICM in Queensland following its initiation in 1991. It incorporates an overview by Rowland and Begbie, two DNR staff intimately involved in ICM since its inception.

The ICM program has been surprisingly robust – its philosophy and implementation have remained relatively constant. Many changes have occurred in the policy and institutional context however, and these are summarised.

Critical to the survival and success of any program is the level of commitment through funding and staffing. ICM has survived using a mixture of state program and core funds and, most importantly through the National Landcare Program and its successor, the Natural Heritage Trust. We trace these programs here. It is difficult to define accurately just what resources have been available for the ICM program and the Catchment Committees. Most significantly, the host Department, DPI then DNR (from 1995), provide in-kind support centrally and in the regions in the form of staff time and operational expenses. No one has estimated this accurately, because catchment related research, planning and implementation support are closely interconnected with many programs. Disentangling specific ICM related expenditures (eg river improvement, water allocation) is difficult and conceptually dangerous. There is therefore an in-built bias in the financial tables below towards underestimating whole-of-public-sector commitment to ICM.

The ICM program in Queensland has been experimental, evolutionary and incremental. The early pilot studies informed the expansion and maturing process to the point that over 35 catchments are now formally included in the program. Catchment Coordinating Committees are formally endorsed by the (now) Landcare and Catchment Management Council. Until 'committees' gain this recognition they are termed 'groups'.

This developmental process depended on improved understanding of community-based processes, acceptance and adoption of the need for strategies to guide catchment action, and more recently scaling up to the regional level in the form of regional NRM strategies. We include here the guidelines for these planning processes.

The adoption of a strategic approach was encouraged by strong incentives – no strategy, no funding. Section 3.4 tabulates the progress of ICM groups towards having LCMC endorsed strategies. Several papers in this chapter outline the process and there have been reviews by DPI (1993) and since 1995 regular fora of the ICM Coordinators and chairs.

Further Reading

AACM & CWPR. April 1995. *Enhancing the Effectiveness of Catchment Management Planning.* AACM International Pty Limited, Adelaide

DPI Queensland. 1993. *A Guide to ICM in Queensland.* Queensland Government Department of Primary Industries, Brisbane.

Queensland Department of Primary Industries (DPI). 1994. *Integrated Catchment Management - Guidelines for the Formation of a Catchment Coordinating Committee.* Queensland Government, Department of Primary Industries, Brisbane.

Queensland Department of Primary Industries (DPI). 1995. *Integrated Catchment Management - Guidelines for obtaining endorsement and support funding for Catchment Coordinating Committees.* Queensland Government, Department of Primary Industries, Brisbane.

Rowland, P. and Begbie, D. 1997. Integrated Catchment Management in Queensland - an overview and review. Paper presented to the *2nd National Workshop on Integrated Catchment Management. Advancing Integrated Resource Management: Processes and Policies.* Australian National University, Canberra, 29 September-1 October.

The Source – Integrated Catchment Management News and Views. April 1992. 1.

4.1 INTEGRATED CATCHMENT MANAGEMENT IN QUEENSLAND - AN OVERVIEW AND REVIEW

Philip Rowland, Department of Natural Resources, Brisbane Queensland
Don Begbie, Department of Natural Resources, Brisbane, Queensland.

Integrated Catchment Management has been operational in Queensland on a state wide scale since 1991. Since then over thirty catchment coordinating committees have formed covering 77% of the state. The formation and participation of committees is voluntary, there not being a legislative framework. Committees undertake planning and coordination roles and to date, nine have produced catchment management strategies. Considerable community and government support has been generated for ICM and much of the planning work is now being translated into action. Significant issues facing ICM in Queensland include the need to clarify linkages with other planning and resource management structures and processes (for example regional planning initiatives for growth management), the lack of major funds for implementation, possible legislation needs to underpin implementation and the maintenance of a significant organisational structure built primarily on volunteers.

1 INTRODUCTION

This report is based on a number of sources of information including statewide workshops held in 1994 and 1996, reviews of ICM in the Lockyer Valley and Mitchell River, a survey of catchment committee chairs and coordinators and various academic reports on aspects of ICM in Queensland. The paper was reviewed by Mr Ken Stallman.

Integrated Catchment Management in Queensland was a State Government initiative. The lead administering role was given to the then Department of Primary Industries and the important roles of other agencies, including the Departments of Environment and Heritage, Lands, and Housing and Local Government were recognised. Initially the program had three key elements:

1. A Strategy for ICM in Queensland was published in 1991. This document outlined the broad policy and structural arrangements.
2. Five 'case studies' were initiated with Departmental support. Selected catchments were the Johnstone and Mitchell Rivers in north Queensland, the Pioneer River in central Queensland, and the Mary River and Lockyer Creek in south east Queensland
3. A special allocation of funding was secured by the Department for the ICM program which also included significant Treecare and Research (Downstream Effects of Agricultural Practices) components.

In developing the Queensland Strategy for ICM, models of similar programs or initiatives already operational in other states were reviewed, and aspects considered appropriate for Queensland, were incorporated. The resultant strategy was a mix of the approach being taken in Western Australia (strongly based on the Mitchell and Hollick proposals) and NSW as interpreted by John Burton. In summary, the significant elements of the approach promoted in Queensland were:

- Voluntary program. Participation in ICM was to be voluntary for both community and government.
- Community based, meaning that all structures were to have a majority of community members. Formation of catchment coordinating committees (CCCs) was dependent on interest from the community and other sectors.
- Partnership between the levels of government, industry and the community. All sectors and key stakeholders are to be involved. As the CCCs do not have statutory "teeth", implementation of strategies relies on negotiated and voluntary action by responsible agencies and individuals.
- Processes used by the committees in coordinating and integrating management of the catchment are to be participative and consultative.
- ICM is about taking a strategic and planned approach to tackling important issues. This should be a feature of the actions of all catchment management groups.

The five pilot studies provided an opportunity to learn about the processes needed for the formation of catchment committees and to develop an understanding of the nature of the interactions between the groups and individuals involved. Deliberately, all the pilot study catchments were different in the way they formed their catchment committees and tackled the issues in the catchment. However, the approaches used were consistent with the overall framework for ICM as set out in the State Strategy. Reviews of the pilot studies and other catchments (particularly the Mitchell, Lockyer Creek and Herbert) have confirmed the framework but a number of aspects of the program have been identified as needing attention. They are described later in the paper.

ICM Framework

Structural components of the program comprised catchment coordinating committees and catchment care groups organised in catchments across the state and the Catchment Management Coordinating Committee (CMCC) to provide state-wide policy. A support unit for ICM and landcare was established within the Department of Primary Industries. By 1993 it became apparent that there was a degree of confusion between the roles of catchment care groups and landcare groups. This was resolved by CMCC deciding not to encourage formation of catchment care groups, but that local groups interested in catchment management come under the landcare banner.

Features of the various structures are summarised in Table 1.

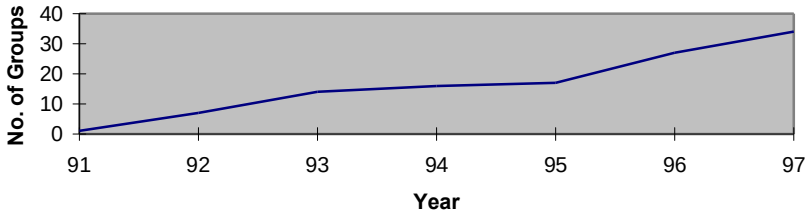
Apart from the pilot studies, the CMCC sought to encourage the formation of catchment committees in priority areas. This was prompted by the preparation of a brief document outlining priority areas for ICM action. Priorities of the Department of Primary Industries and other state departments, and Regional Assessment Panels were the targets of the document.

Using the experience gained in the pilot studies and other catchments, guidelines for the formation of catchment committees were produced. It became apparent that the formation of groups was a two phase process. First a steering group was formed to scope the issues needing attention and to prepare and oversee a plan for establishment of a formal catchment committee to address these issues. Second, a CCC was formed and endorsed by the Minister for the then Department of Primary Industries, now the Department of Natural Resources (DNR).

Catchment groups were initiated by local governments (there are 132 in Queensland), local interest groups, landcare groups, water boards and river improvement trusts. DNR provides facilitation support through Regional Extension Officers (ICM and landcare) and technical advice. Initially establishment and operating grants were somewhat nominal, but now up to $10,000 is paid per annum to some committees for operational support. Attendance fees are not paid but most committees meet at least the out-of-pocket expenses of members.

Most interest in catchment management was initially focused on the coast with groups in the wet tropics, and south east coastal areas where rapid development was increasing concerns about the condition of the catchment and adjacent coastal areas. Progress in the formation of catchment groups is shown in Figure 1.

Fig 1 Formation of catchment groups in Queensland



In 1992, Queensland joined the Murray Darling Basin Agreement. There were some conditions attached to Queensland's involvement including limiting involvement in pooling arrangements for infrastructure maintenance and exclusion of some decisions of the Ministerial Council prior to joining. Using an extensive process of community consultation, a preferred structure for Murray Darling Basin in Queensland was determined. It involved the formation of four CCCs and a regional CCC based around the four major catchments in the basin.

While there have been few changes to the CMCC since its formation in 1992, a recent review of the CMCC and the Queensland Landcare Council has resulted in a decision to merge these bodies into one called the Landcare and Catchment Management Council (LCMC). This new body has yet to meet. A significant sub-committee of the CMCC, entitled Downstream Effects of Agricultural Practices (although it deals with all land use impacts on water resources), meets three times a year and coordinates and leads research and development as well as monitoring of catchment condition and catchment processes. Considerable interest exists in understanding the impact of land based and river activities on estuarine and marine habitats, particularly the Great Barrier Reef.

Funding

State government support for the program was initially provided through a $5M new initiative grant from Queensland Treasury. This funding was only available for three years but at the end of that time it was added to base allocation for the Department, ensuring ongoing funding to ICM activities.

As well as establishment and operating grants, the state government provides over $250,000 per year in project grants to catchment committees and other bodies for conduct of projects leading to the development of a catchment

management strategy. Since 1995, a further $750,000 has been provided per year as grants for the implementation of catchment strategies. These grants have been administered in conjunction with the NLP/NHT assessment process and a number of projects have attracted commonwealth funding.

2. CURRENT SITUATION

Catchment Coordinating Committees

From three catchment coordinating committees in 1992, there are now 32, including two regional coordinating committees. A list of groups is provided in the Appendix. While not recognised under legislation, all committees are encouraged to be incorporated. Most are.

Over 77% of the state is covered by catchment committees, the major areas not currently involved in ICM are the upper Burdekin catchment area, areas in Cape York, and some areas on the coastal south east.

The Catchment Management Lake Eyre Basin Steering Group is not formally a catchment group under ICM. The current charter of the group is to assess the need for, and role of a catchment group should one be formed. A meeting scheduled for late 1997 will decide these issues.

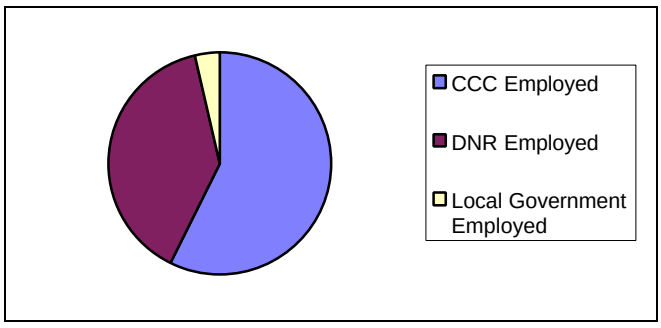
While the majority of catchment groups are formally recognised under the State Government's ICM initiative, there are a number of other groups practising ICM that do not come under this umbrella. These include the Brisbane River Management Group and the Logan Catchment Resource Management Group.

Reflecting the partnership approach, membership of all recoginsed CCCs is diverse. However, they have at least an officer from the DNR as a member, and most committees have other government departments as active members also.

All catchment steering groups and endorsed groups have access to establishment and operating grants although not all utilise these sources of funds. A number of local governments provide limited support in cash, while all catchment groups have members representing local government (either elected members or staff). Local governments and some producer organisations (for example CANEGROWERS) provide in kind support in the form of office accommodation and administration.

All catchment groups have a part-time or full-time coordinator/project officer/administrator. Initially these positions were provided by the state government, but increasingly committees have employed their own staff. A breakdown of the employment status of coordinator/project officer/administrator is shown in Figure 2.

Figure 2 Current employment status of coordinators/project officers/administrators



Catchment Management Strategies

CCCs have produced nine endorsed catchment management strategies including one regional strategy. Another seven are in an advanced draft condition.

Policy Framework

There have not been any significant changes to the state policy on ICM since its preparation in 1991. The only significant change has been encouraging groups that may have been called catchment care committees to come under the banner of Landcare.

Policy and guideline development has focused on operating grant support to groups and the preparation, endorsement and implementation of catchment management strategies.

The key role of local government has been recognised as important to ICM in Queensland. An ICM and Local Government Communication Plan was developed in 1995 to guide the linkages needed between catchment management and local government. A number of the strategies in the plan are in the process of being implemented, including a project to prepare guidelines to assist local government planners implement catchment management principles and practices in planning schemes.

New legislation for Natural Resource Management is being drafted. It will provide for the formation of statutory bodies or trusts to manage catchments. Several catchment groups are looking into forming statutory bodies, particularly to oversee the implementation of strategies and action plans.

Institutional Arrangements

Project grants are available (approximately $1M in 1997/98) through state grants for the preparation and implementation of strategies. Groups also avail themselves of over $4M in grants directly through the Natural Heritage Trust.

A network of Landcare and ICM extension officers (at least one in each of the five DNR regions) provide process support to CCCs.

The new Landcare and Catchment Management Council has yet to meet. The DEAP sub-committee will report to this body.

3 VISION/STRATEGIC DIRECTIONS

For ICM to progress in Queensland, a number of strategic directions and actions are needed. From consultation with catchment groups and others, these key areas have been identified.

1. A significant task of the new LCMC will be the preparation of a strategic and business plan to guide the direction of ICM. It will need to address many of the points listed below.
2. Confirmation of political support within State Government is needed to ensure the considerable investment by government and community will be able to continue long enough to fulfill its charter. Changes in government and policy positions has a destabilising effect on continued community commitment.
3. Local Government has been identified as a crucial player in advancing integrated resource management due to its pivotal role in land use planning and development control. Enhanced involvement by local government in CCC activities and the implementation of catchment management principles and practices is required. Improved awareness and communication with local government, as outlined in the ICM and Local Government Communication Plan will enhance this process.
4. Better integration and broad government support will assist catchment groups in preparing and implementing their strategies.
5. As a number of catchment groups are moving from the planning phase to implementation, new structures may be needed to achieve implementation. The use of Trusts or other statutory structures may be needed in some situations.
6. As implementation resources are limited, catchment management groups need to focus their efforts and target those significant issues which can have most impact. This applies at all levels in the structure - state, regional or catchment.
7. Flexibility in the nature and operation of catchment groups will ensure they are tailored to and meet community needs and expectations.
8. Additional catchment groups are required, particularly in priority areas like the upper Burdekin and Gold Coast.
9. The support base for catchment groups should be widened so that it is not seen as only a DNR initiative, but one very much involving the community with whole-of-government support.
10. Training and skills development for CCC members and project officers has been identified as a high priority need.
11. Linkages between CCCs, regional planning bodies (local government based) and planning process for NHT need to be clarified.

4 SUMMARY AND RECOMMENDATIONS

Before making recommendations an analysis of the ICM approach, as practised in Queensland, is presented. This analysis is not exhaustive and forms a start for thought and discussion of the issues. It is presented in the SWOT format which does result in some repetition of comments between categories.

Analysis

Strengths

- Broad and somewhat nebulous goals provide opportunities for a variety of ways of doing ICM and for tailoring the approach to suit the situation.
- Network of CCCs has been established and a mass of people have been exposed to, and had the opportunity for, some involvement in ICM.
- ICM has become institutionalised within DNR, and there is considerable support (at least at a policy level) for ICM in other government departments and local government
- Both levels of government, the community and industry have responded to the philosophy of catchment management in a variety of ways. The broad goals of ICM provide for a range of interests to be involved and contribute to achieving these goals.
- The participative approach has been well received by most sectors of the community. It has assisted in making catchment plans and management activities consistent with local needs and goals.
- Most CCCs have used a representative model for membership of the management committee. This has resulted in a broad diversity of interests coming together on the committees - often for the first time - with generally very positive results.

Weaknesses

- Breadth of the program has resulted in the need for individuals and groups to gain an understanding of what is trying to be achieved and how to apply it. This is a costly and time consuming process (for example it takes up to five years for catchment groups to be become fully operational)
- Financial resources to achieve these broad but ambitious goals have been erratic and low.
- CCCs have no statutory powers or revenue raising capability.
- Participants are concerned that the linear planning then implementation approach to ICM has resulted in questions being asked about the availability of resources to implement once all the planning is completed.
- Complex planning process are required with no single process being used. Each catchment group has needed to invent its own.
- Absence of a 'whole of government' approach, commitment or involvement.
- Emerging problems like biodiversity conservation and nutrient enrichment of waterways (particularly in the estuarine and marine areas) are not well defined technically, and ICM groups have found it difficult to focus their priorities and activities where these are key issues.
- Implementation mechanisms for catchment strategies are non existent or unclear.
- Funding guidelines and arrangements keep on changing making the targeting of these resources difficult.
- The public generally has a low level of awareness of natural resource management issues.
- Only a small percentage of the public are active participants in catchment management activities.
- Lack of monitoring and feedback mechanisms to provide data on the impacts of ICM and the effectiveness of the approach.
- Representative model used to form management committees is not always effective in getting the right individuals involved. It leads to assumptions about the quality of communication between the group and the constituent member organisations. There is a need for all members to take a whole-of-catchment view of issues - not protect sectarian interests.
- Differences in perceptions between the chairs and coordinators of progress in achieving the aims and objectives of catchment groups.

Opportunities

- Clear technical solutions exist for many of the natural resource management problems in Queensland.
- A critical mass of people has been established with an understanding of ICM and skills in its application.
- ICM has challenged people to understand causes and respond to them through targeted action to get real changes (for example much of the riparian zone management and rehabilitation activities).
- Local government is being increasingly involved in catchment management in a variety of ways (from stormwater management to rural residential design). Interest by local government continues to grow.
- Among those involved in, or at the fringes of groups doing ICM, there is a much greater acceptance of the need for a planned and strategic approach than seven years ago. The challenge is in translating this interest into practical action.
- The planning that has already occurred provides those groups with opportunities to tap into funding resources that require strategic and integrated solutions to problems (for example the NHT regional component).

Threats

- High expectations of what ICM can deliver by the community and government.
- Over reliance on voluntary contributions by community and industry without commensurate rewards, particularly in the short term.
- The level and breadth of skills needed to actually implement the complex catchment management plans produced.
- Identification and establishment of the right implementation arrangements (structures, policy and resources) for it to go ahead.
- On going resourcing of what are very large, voluntary based organisations.
- Ongoing commitment to technical and administrative support by government agencies, local government, industry organisations and tertiary institutions is required for the partnership between these bodies and the community to work. Voluntary community people involved in catchment groups require this support.

5 CONCLUSION

While it has had its teething problems ICM is alive and well in Queensland. This is reflected not only in the proliferation of community based groups practicing and promoting catchment management, but also the increasing number of agencies and organisation who see ICM as a 'way of doing business'.

Some of the broader coordination issues like that between landcare and ICM is being tackled in catchments and more recently at a state level through the formation of the Landcare and Catchment Management Council. DNR has also recently re-formed a landcare and catchment management group to coordinate, steer and support both initiatives.

Structures and mechanisms to achieve coordination between regional landcare, catchment management, regional planning and natural heritage trust arrangements are being developed and should result in better outcomes delivered more efficiently.

In the short term, a review of pilot studies is planned for 1997/98 to better identify weaknesses in the current arrangement and to assist in planning the changes needed. Training needs of CCC members is also a priority task for this year.

In the longer term, key areas requiring attention include:

- How to do more with less. The budgets of most public organisations are shrinking - what ways can we assist CCCs and others do what needs to be done without needing to find vast additional resources?
- The needs of accountability and performance are increasing. It will be a challenge to find ways to identify and monitor the tangible benefits that accrue from ICM.

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Table 1 General features of catchment management structures in Queensland 1991 to 1997

Structure	Role	Membership	Operation	Support
Catchment Coordinating Committees	• Foster community awareness and understanding • Prepare and oversee implementation of catchment management strategies	• Broadly based with a majority of non-government members. Needs to include all significant stakeholder groups and interests. • Representational membership from key organisations.	Monthly/bimonthly	• Cash and inkind from organisations in the catchment • Establishment and Operating grants from DNR • Technical support from state government agencies, local government and tertiary institutions • DNR provided public liability and personal accident insurance cover
Regional Catchment Coordinating Committees	• Oversee preparation of Regional Strategy • Coordination of subcatchment planning and implementation • Link with other regional planning activities.	• Broadly based with a majority of non-government members. Includes all significant stakeholder groups and interests. • Representational membership from key organisations and CCCs in subcatchments	2 or more times per year	• Inkind support through working groups • Cash and inkind from organisations in the catchment • Establishment and Operating grants from DNR • Technical support from state government agencies, local government and tertiary institutions • DNR provided public liability and personal accident insurance cover
Catchment Management Coordinating Committee	• Policy/advisory at State level • Recommend priorities and allocation of resources • monitor implementation and progress • foster coordination between key organisations and agencies	• Peak industry and community bodies and state government departments • Appointed by Minister	3 times per year	• Executive support • Inkind support through sub-committees • DNR provided public liability and personal accident insurance cover
Catchment Care Groups	• Education/awareness	• Interested individuals	As needed	• No specific support mechanisms. • DNR provided public liability and personal accident insurance cover

APPENDIX

CATCHMENT COORDINATING COMMITTEES

Central
Dawson Valley Development Association Inc
Fitzroy Catchment Coordinating Group Inc.
Lower Fitzroy Catchment Care Group Inc
Pioneer Integrated Catchment Management Association Inc

North
Cardwell Shire Catchment Coordinating Committee Inc.
Douglas Shire Catchment Coordinating Committee Inc.
Herbert River Catchment Coordinating Committee Inc.
Johnstone River Catchment Management Association Inc.
Mitchell River Watershed Management Association Inc.
Russell-Mulgrave Catchment Coordinating Committee Inc.

South East
Bremer Catchment Association Inc.
Burnett Catchment Care Incorporated
Lockyer Resource Management Group Inc.
Maroochy/Mooloolah Catchmentcare Committee Inc.
Mary River Catchment Coordination Assn. Inc.
Noosa River Catchment Management Committee
Norman Creek Catchment Coordinting Committee
North & South Pine Rivers Integrated Catchment Association Inc
Pumicestone Region Catchment Coordination Association Inc.

South
Balonne-Maranoa Catchment Management Association Inc.
Border Rivers Catchment Management Association Inc.
Condamine Catchment Management Association Inc.
Murray-Darling Basin Regional Coordinating Committee

West
Warrego-Paroo Catchment Coordinating Committee

STEERING GROUPS

West
Catchment Management Lake Eyre Basin - Steering Group
Southern Gulf Catchments Coordinating Committee Steering Group

North
Annan River Catchment Management Group
Barron River ICM
Endeavour Catchment Group
Sarina Steering Committee
Weipa Catchment Coordinating Committee
Whitsunday Steering Committee

South East

Baffle Creek Catchment Management Interim Committee

CATCHMENT CARE GROUPS

Lake Baroon Catchment Care Group Inc.

4.2 Framework, Arrangements and Policy

4.2.1 Arrangements, Policy and Legislation

Initial Stage

1. Strategy for ICM (DPI 1991)
2. Five Pilot Studies – provided opportunities about the processes needs for the formation of CCCs
3. Special Allocation of funding secured by the Department for ICM – program included – Treecare and DEAP
   - focused on five pilot study areas (each involving the establishment of a CCC)
   - local authorities, conservation groups, Landcare groups and other State departments and agencies are also adopting the ICM approach in up to a dozen other catchments

ICM Framework

"Structural components of the program comprised catchment coordinating committees and catchment care groups organised in catchments across the state and the Catchment Management Coordinating Committee (CMCC) to provide state-wide policy. A support unit for ICM and Landcare was established within the Department of Primary Industries. By 1993 it became apparent that there was a degree of confusion between the roles of catchment care groups and Landcare groups. This was resolved by CMCC deciding not to encourage formation of catchment care groups, but that local groups interested in catchment management come under the Landcare banner.

Apart from the pilot studies, the CMCC sought to encourage the formation of catchment committees in priority areas. This was prompted by the preparation of a brief document outlining priority areas for ICM action. Priorities of the Department of Primary Industries and other state departments, and Regional Assessment Panels were the targets of the document.

Using the experience gained in the pilot studies and other catchments, guidelines for the formation of catchment committees were produced. It became apparent that the formation of groups was a two-phase process. First a steering group was formed to scope the issues needing attention and to prepare and oversee a plan for establishment of a formal catchment committee to address these issues. Second, a CCC was formed and endorsed by the Minister for the then Department of Primary Industries, now the Department of Natural Resources (DNR).

Catchment groups were initiated by local governments (there are 132 in Queensland), local interest groups, water boards and river improvement trusts. DNR provides facilitation support through Regional Extension Officers (ICM and Landcare) and technical advice. Initially establishment and operating grants were somewhat nominal, but now up to $10 000 is paid per annum to some committees meet at least the out-of pocket expenses of members.

Most interest in catchment management was initially focused on the coast with groups in the wet tropics, and south east coastal areas where rapid development was increasing concerns about the condition of the catchment and adjacent coastal areas.

In 1992, Queensland joined the Murray Darling Basin Agreement. There were some conditions attached to Queensland's involvement including limiting involvement in pooling arrangements for infrastructure maintenance and exclusion of some decisions of the Ministerial Council prior to joining. Using an extensive process of community consultation, a preferred structure for Murray Darling Basin in Queensland was determined. It involved the formation of four CCCs and a regional CCC based around the four major catchments in the basin.

While there have been few changes to the CMCC since its formation in 1992, a recent review of the CMCC and the Queensland Landcare Council has resulted in a decision to merge these bodies into one called the Landcare and Catchment Management Council (LCMC). A significant subcommittee of the CMCC, entitled Downstream Effects of Agricultural Practices (although it deals with all land use impacts on water resources), meets three times a year and coordinates and leads research and development as well as monitoring of catchment condition and catchment processes. Considerable interest exists in understanding the impact of land based and river activities on estuarine and marine habitats, particularly the Great Barrier Reef." (Rowland and Begbie, 1997: 2)

Policy Framework

"There have not been any significant changes to the state policy on ICM since its preparation in 1991. The only significant change has been encouraging groups that may have been called catchment care committees to come under the banner of Landcare.

Policy and guideline development has focused on operating grant support to groups and the preparation, endorsement and implementation of catchment management strategies.

The key role of local government has been recognised as important to ICM in Queensland. An ICM and Local Government Communication Plan was developed in 1995 to guide the linkages needed between catchment management and local government. A number of the strategies in the plan are in the process of being implemented, including a project to prepare guidelines to assist local government planner implement catchment management principles and practices in planning schemes." (Rowland and Begbie, 1997: 3)

Relevant Agencies; Their Role and Legislation

"During the beginnings of ICM the program was managed by the Department of Primary Industries (DPI) but was coordinated by a Catchment Coordinating Committee which included input from the Departments of Lands (DOL); Housing, Local Government and Planning (DHLGP); and Environment and Heritage (DEH). Currently, ICM is managed by the Department of Natural Resources (DNR) but coordinated by the Landcare and Catchment Management Council (LCMC) with inputs from the Department of Primary Industries (DPI), Department of Environment and Heritage (DEH), the Department of Local Government and Planning (DLGP), the Queensland Conservation Council, Greening Australia, The Queensland Farmers' Federation, the fishing industry, the water industry, the Local Government Association of Queensland and community members."

Department of Natural Resources (DNR)

"The DNR was formed in 1996 and combines the former Lands Department functions with the Water Resources and Resource Management units previously resident in the Department of Primary Industries. The DNRs aim is to address present and future management issues in the areas of land administration, water and resource management through an innovative and coordinated approach. The DNR is the lead agency responsible for facilitating ICM in Queensland. The DNR is responsible for managing the land, water and vegetation within the state of Queensland. The main programs provided by the DNR are: Land Services; Resource Management; Regional Infrastructure Development; Resource Science and Knowledge; Commercial Water Services; Land Court and Tribunals and Corporate Management. ICM is a sub-program of the Resource Management program. With regard to community participation programs such as ICM, the DNR aims to provide 'a sound and productive working partnership with the community and clients in both the public and private sectors, across the whole range of departmental activities - particularly in relation to provision of services, infrastructure and value-adding information and other assets of the department."

Department of Primary Industries (DPI)

"The DPI had responsibility for natural resource management for primary production and was the state agency responsible for the national landcare, save-the bush, and one billion trees programs. DPI administered 11 separate pieces of legislation which dealt with natural resource policy. These include the:

- *Soil Conservation Act* (Qld., 1986);
- *Water Resources Act* (Qld., 1989);
- *River Improvement Trust Act* (Qld., 1940);
- *Forestry Act* (Qld., 1959);and
- *Recreation Areas Management Act* (Qld., 1988).

The DPI initiated the Queensland ICM program and remained its prime mover until 1996 when the DNR was formed. The then Minister for Primary Industries, Mr Ed Casey showed strong support for the ICM program during his term in office. Interagency communication on ICM was initially limited, and started at the state Catchment Management Coordinating Committee (CMCC), which included members from DOL, DEH, the Local government Association and DHLGP.

The Government of Queensland adopted a whole of government (WOG) approach to natural resource management, with many planning and resource management issues being widely distributed within the government for consideration. DPI used the WOG approach to promote ICM at a state level. The (CMCC) has now been replaced by the (LCMC). The next institutions after the (LCMC) are Catchment Coordinating Committees (CCCs). These committees combine local industry leaders, local authority representatives, and selected staff from DNR, DPI, DEH and DLGP. The inclusion of community members and government is intentional - it develops co-management partnerships for natural resource management."

Department of Environment and Heritage (DEH)

"The Department of Environment and Heritage includes the National Parks and Wildlife Service, and various environmental agencies responsible for environmental impact assessment, environmental aspects of planning, and codes of practice for activities which impact on the environment. DEH administers a number of legislative instruments including the:

- *Nature Conservation Act* (Qld., 1992);

- *Environmental Protection Act* (Qld., 1994); and
- *Contaminated Lands Act* (Qld., 1991).

Codes of Practice for Agriculture have been developed under the Environmental Protection Act which have the potential to act as a framework for implementation of ICM activities relevant to agriculture.

There is no formal process for integrating the activities of DEH and DPI and DNR or DoE in catchments or on properties. However, the Codes of Practice offer an opportunity for close collaboration between DEH, DPI and DNR during the development, promotion, implementation, and monitoring of the Codes. This has already happened in some catchments - for example the Johnstone - where Best Management Guidelines have been developed for each agricultural industry as a means of compliance with the Codes of Practice for Agriculture."

Department of Local Government and Planning
"THE DEPARTMENT OF LOCAL GOVERNMENT AND PLANNING (DLGP) OVERSEES THE ACTIVITIES OF LOCAL AUTHORITIES AND STATE PLANNING REGULATIONS. THE DEPARTMENT ADMINISTERS THE:

- *Local Government (Planning and Environment) Act* (Qld., 1990); and
- *Local Government Act* (Qld., 1993).
- *Integrated Planning Act 1997*

DLGP has responsibility for regional development strategies, such as SEQ2001 and FNQ2010, and works with DNR, DPI and DEH on these."

Local Government
"Local Government, and their regional associations, play an integral role in catchment management in Queensland. In addition to having significant control of planning and development activities, local authorities have responsibilities for the delivery of water and sewage services to urban areas. This combination ensures that local authorities have a vested interest in water quality at the delivery and discharge ends of the reticulation system. Local authorities have widely supported landcare groups in many areas of Queensland. DPI and other departments work with Town Planners and City Engineers in a collaborative but informal relationship. There are 12 Shires in the Mary River Catchment, and a single regional association of local authorities. There are 2 Shires in the Johnstone River Catchment." (AACM & CWPR. April 1995: 34-38).

ICM Legislation

"Integrated Catchment Management is not currently covered by any special legislation. However, a range of existing legislative mechanisms can be used to achieve its aims. Catchment coordinating committees operate through existing legislation administered by government departments, local governments and statutory agencies. The table below shows the relationships between various government Acts and natural resource management issues.

Statute	**Governing areas**
Local Government (Planning and Environment) Act	Local government planning schemes; landuse zoning; State planning policies; strategic planning
Soil Conservation Act*; Soil Survey Act*	Coordinated runoff; erosion control
River Improvement Trust Act*; Resources Act*; City of Brisbane (Flood Mitigation Works Approval) Act*	Water Streambank erosion; clearing in watercourses; watercourse alteration; water storage; levee banks; water allocation and licensing; materials extraction in watercourses
Forestry Act* Sawmill Licensing Act*	State Forest management; forest products on Granting of sawmill licenses
Fisheries Act Fishing Industry Organisation and Marketing Act	Fish habitats; fisheries management Quality assurance, marketing, price
Mineral Resources Act	Water quality downstream from mines; rehabilitation; environmental standards on mine sites
Rural Lands Protection Act; Land Act (Queensland)	Clearing vegetation on leasehold land; property reconstruction; management of leasehold land; control of weeds and pest animals
Contaminated Lands Acts	Management of contaminated lands
Environmental Protection Bill Nature Conservation Act	Standards for water and air quality; environmental protection policies Protected areas; critical habitats; endangered species; nature conservation plans
Coastal Protection Bill Great Barrier Reef Marine Parks Act	Coastal protection areas; management plans Zoning and management of marine waters

Native Title Act; Native Title (Queensland) Act	Recognition and protection of native title; mechanisms for determining title claims
Community Services Act	Support and assistance to Aboriginal and Torres Strait communities
Recreation Areas Management Act	Activities and conduct in recreational areas
Brisbane Forest Park Act	Protecting Forest Park, by zoning, land use criteria
Wet Tropics World Heritage Protection Management Act	Protection of fragile areas, tourism management

These Acts are part of the Natural Resource Management legislation."
Queensland Government Department of Primary Industries. *Integrated Catchment Management, Bringing People Together.* Queensland Government, Department of Primary Industries, Brisbane.

Queensland Government Integrated Planning Act 1997.
The Act provides a framework to integrate planning and development assessment so that development and its affects are managed in a way that is ecologically sustainable and for related purposes.

The purpose of the Act is to seek to achieve ecological sustainability by -
a. coordinating and integrating planning at the local, regional and State levels; and
b. managing the process by which development occurs; and
c. managing the effects of development on the environment including managing the use of premises.

4.2.2 Funding

"In the 1990 State Budget, the Queensland Government provided a special allocation of $3.5m for an Integrated Catchment Management (ICM) initiative. This involved a coordinated land, water, forest and wetland management program based on key river catchments and designed to boost management of the resource base so fundamental to the long-term future of rural industries (1990 Budget Paper No. 8).

The ICM initiative was to be built on the highly successful Landcare program, and to incorporate the valuable network of community groups which had been established throughout Queensland. Its overall aim was to achieve long-term sustainability of the State's primary production by focussing on the natural systems in the landscape and utilising the expertise available in forest, land and water management in the restructured Department of Primary Industries.

The ICM initiative was continued during the 1991/92 and 1992/93 financial years, with special allocations of $3.5m each year, and was reviewed in May 1993 to evaluate its achievements and to determine its future direction and funding requirements. In 1999 the ICM is still operating in Australia. (DPI, 1993: 1-2)

ICM Funding 1993/94

LANDCARE AMD CATCHMENT MANAGEMENT SPECIAL

Item	CHQ	Central ($)	North ($)	South ($)	Southeast ($)	West ($)	Total ($)
ICM Subprogram Component							
Catchment Care Information	195 000						195 000
Catchment Management Planning	502 000	6 000	313 000	240 000	213 000		1 274 000
Catchment Strategy Implementation			177 000				177 000
Natural Resource Management Education	26 000						26 000
Resource Assessment and Monitoring (DEAP monitoring)	179 000	35 000	179 000		66 000		459 000
Research and Development (DEAP research)					43 000		43 000
Treecare Extension	170 000	55 000	162 000	60 000	350 000	43 000	840 000
Treecare Research					237 000		237 000
Sub-total	**1 062 000**	**96 000**	**831 000**	**300 000**	**909 000**	**43 000**	**3 241 000**
LAP Subprogram Component							
Resource Planning		44 000	88 000	197 000			329 000
Resource Management		32 000	74 000	135 000	74 000		315 000
Landcare		50 000			16 000		66 000
Sub-total		**126 000**	**162 000**	**332 000**	**90 000**		**710 000**
Total	**1 062 000**	**220 000**	**931 000**	**632 000**	**999 000**	**43 000**	**3 951 000**

ICM Funding 1994/95

LANDCARE AND CATCHMENT MANAGEMENT SPECIAL 1994/95 ALLOCATIONS

Item	CHQ ($)	Central ($)	North ($)	South ($)	Southeast ($)	West ($)	Total ($)
ICM Subprogram Component							
Catchment Management Planning	595 000		246 000	259 000	309 000		1 409 000
Catchment Strategy Implementation			146 000	89 000			235 000
Resource Assessment and Monitoring (DEAP monitoring)	244 000	13 000	58 000		10 000		471 000
Resource Assessment and Monitoring (Riverine Habitat Assessment)	8 000	50 000	23 000	8 000		30 000	119 000
Research and Development (DEAP research)	33 000		92 000	39 000	81 000		245 000
Treecare Extension	330 000	35 000	32 000	55 000	168 000	52 000	672 000
Treecare Research					292 000		292 000
Salinity Research			28 000				28 000
Catchment Care Information	185 000	30 000					115 000
Natural Resource Mgt Educ.	28 000						28 000
Sub-total	**1 423 000**	**128 000**	**625 000**	**450 000**	**860 000**	**82 000**	**3 568 000**
LAP Subprogram Component							
Resource Planning		130 000		190 000			320 000
Landcare		65 000	48 000		61 000		174 000
Sub-total	**0**	**195 000**	**48 000**	**190 000**	**61 000**	**0**	**494 000**
RMAD Subprogram Component							
Research and Development			4 000				4 000
Resource Planning			135 000	135 000			270 000
Sub-total	**0**	**0**	**139 000**	**135 000**			**274 000**
Field Crops Subprogram Component							
Extension Officer (Conservation Farming (Development)				76 000			76 000
Extension Officer (ICM and Landcare)			37 000				37 000
Extension Officer (Devp't)					61 000		61 000
Sustainable Cane Farming Prog.			45 000		25 000		70 000
Extension Officer (Sustainable Farming Systems Development & Hermitage)				214 000			214 000
Conservation Farming Section of Information Centre and Sustainable Farming Section Ext.Officer			65 000				
Landcare Groups				10 000			10 000
Conservation Tillage Equipment Demonstration and Hire Scheme							
Sub-total	**0**	**0**	**147 000**	**300 000**	**86 000**	**0**	**468 000**
TOTAL	**1 423 000**	**323 000**	**959 000**	**1 075 000**	**1 007 000**	**82 000**	**4 869 000**

ICM Funding 1995/96

ICM SUB-PROGRAM
1995/96 ALLOCATIONS BY REGION

Item	CHQ ($)	Central ($)	North ($)	South ($)	Southeast ($)	West ($)	Total ($)
Total New Base[1]							
Catchment Planning	290 000		231 000	287 000	513 000	25 000	1 346 000
Catchment Strategy Implementation			503 000	135 000	100 000		738 000
Environmental Planning	115 000	63 000		57 000	60 000		295 000
Regional Management		23 000	33 000	73 000			129 000
Regional Management (Enterprise Bargaining Adjustment)	10 000	4 000	13 000	6 000	9 000	2 000	44 000
Resource Assessment and Monitoring (DEAP monitoring)	360 000	156 000	111 000	15 000			642 000
Resource Assessment and Monitoring (Riverine Habitat Assessment)	14 000	50 000	48 000		50 000	15 000	177 000
Resource Assessment and Monitoring (Enterprise Bargaining Adjustment)	11 000	4 000	3 000		1 000		19 000
Research and Development (DEAP research)	175 000	51 000	203 000	63 000			492 000
Research and Development (Salinity Research)	170 000				64 000		234 000
Research and Development (Chemical Contaminants)	82 000						82 000
Research and Development (Decision Support Systems)	72 000		91 000	45 000			208 000
Research and Development (Enterprise Bargaining Adjustment)	15 000	1 000	7 000	1 000	8 000		32 000
Resource Planning (Community group project grants)	10 000	70 000	110 000		70 000	15 000	275 000
Resource Planning (Enterprise Bargaining Adjustment)	15 000	2 000	8 000	4 000	13 000		42 000
Resource Planning (Sub-program planning)	196 000				90 000		286 000
Treecare Extension	280 000	69 000	113 000	104 000	362 000	81 000	1 009 000
Treecare Research					418 000		
Free/Concessional Trees		25 000	88 000	29 000	100 000	5 000	247 000
Forest Corp Adjustment	-80 000	-7 000	-12 000	-11 000	-33 000	-8 000	-151 000
NRM Education	107 000	56 000	71 000	90 000	69 000	9 000	402 000
Catchment Care Information	175 000	66 000			10 000		251 000
CCC Support		15 000	19 000	20 000	15 000	5 000	74 000
Sub-total	**2 017 000**	**648 000**	**1 640 000**	**918 000**	**1 919 000**	**149 000**	**7 291 000**
Old Base							
Catchment Planning					83 000		83 000
Catchment Strategy Implementation			61 000	37 000		`	98 000
Environmental Planning	115 000	63 000		57 000	60 000		295 000

[1] **Notes:** 1. Allocation for Free/Concessional trees to be reviewed after six months.
2. $250 000 base funds for Implementing Catchment Management Strategies allocated to North $150 000 and Southeast $100 000.
3. Additional $500 000 Special Treasury allocation for Implementing Catchment Management Strategies to be allocated to regions during the year.
4. Additional $250 000 from the Capital Works fund for Implementing Catchment Management Strategies to be allocated to regions during the year.

Item	CHQ ($)	Central ($)	North ($)	South ($)	Southeast ($)	West ($)	Total ($)
Regional Management		23 000	33 000	73 000			129 000
Resource Assessment and Monitoring (DEAP monitoring)	137 000	156 000	63 000	15 000			371 000
Resource Assessment and Monitoring (Riverine Habitat Assessment)	6 000				21 000		27 000
Research and Development (DEAP research)	140 000	51 000	174 000				365 000
Research and Development (Salinity Research)	170 000				64 000		234 000
Research and Development (Chemical Contaminants)	82 000						82 000
Research and Development (Decision Support Systems)	72 000			45 000			117 000
Resource Planning (Sub-program planning)	196 000				90 000		286 000
Treecare Extension	100 000	34 000	81 000	49 000	194 000	29 000	487 000
Treecare Research					156 000		156 000
NRM Education	79 000	56 000	90 000	69 000			294 000
Catchment Care Information					10 000		10 000
Sub-total	**1 097 000**	**383 000**	**412 000**	**366 000**	**747 000**	**29 000**	**3 034 000**
Ex-Landcare and Catchment Management Special							
Catchment Planning	290 000		231 000	287 000	430 000	25 000	1 263 000
Catchment Strategy Implement'n			292 000	98 000			390 000
Resource Assessment and Monitoring (DEAP monitoring)	223 000		48 000				271 000
Res. Assessment and Monitoring (Riverine Habitat Assessment)	8 000	50 000	48 000		29 000	15 000	150 000
Research and Development (DEAP research)	35 000		29 000	63 000			127 000
Research and Development (Decision Support Systems)			91 000				91 000
Treecare Extension	180 000	35 000	32 000	55 000	168 000	52 000	522 000
Treecare Research					262 000		262 000
NRM Education	28 000		71 000			9 000	108 000
Community group project grants	10 000	70 000	110 000		70 000	15 000	275 000
CCC Support		15 000	19 000	20 000	15 000	5 000	74 000
Catchment Care Information	175 000	66 000					241 000
Sub-total	**949 000**	**236 000**	**971 000**	**523 000**	**974 000**	**121 000**	**3 774 000**
Implementing Catchment Works Special[2]							
Catchment Strategy Implement'n	30 000		250 000		150 000		430 000
Resource Assessment and Monitoring (DEAP monitoring)	25 000		25 000				50 000
Res. Assessment and Monitoring (Riverine Habitat Assessment)	20 000						20 000
Sub-total	**75 000**	**0**	**275 000**	**0**	**150 000**	**0**	**500 000**
Capital Works – Implementing Catchment Works[3]							
Catchment Strategy Implement'n			250 000				250 000
Sub-total	**0**	**0**	**250 000**	**0**	**0**	**0**	**250 000**

[2] **Notes:** 1. $50K allocated to commence action plan for DEAP monitoring in grazing land
2. $20K allocated to enhance State of the Rivers Project
3. $30K W&CM for administration for State and Regional assessment panels

[3] **Notes**: 1. $250K North Regions includes $190K for O'Connell River RIT work

External Funding[4]							
Catchment Planning			49 000	190 000		5 000	244 000
Catchment Strategy Implementation				54 000			54 000
Resource Assessment and Monitoring (DEAP monitoring)	159 000	130 000					289 000
Resource Assessment and Monitoring (Riverine Habitat Assessment)			179 000				179 000
Research and Development (DEAP research)	352 000		178 000		53 000		583 000
Research and Development (Salinity research)	340 000	80 000					420 000
Research and Development (Chemical Contaminants)	94 000			90 000			184 000
Research and Development (Decision Support Systems)	114 000		262 000				376 000
Treecare Extension				32 000			32 000
NRM Education	108 000		67 000			9 000	184 000
Sub-total	**1 167 000**	**210 000**	**735 000**	**366 000**	**53 000**	**14 000**	**2 545 000**
TOTAL	**5 305 000**	**1 477 000**	**4 283 000**	**2 173 000**	**3 843 000**	**313 000**	**21 894 000**

ICM Funding 1998/99

CPD Total 1998-99

Item	**CHQ ($)**	**Central ($)**	**North ($)**	**South ($)**	**Southeast ($)**	**West ($)**	**Total ($)**
BASE 1998/99							
Catchment Management	53 000	103 444	178 906	283 206	321 759	95 501	1 035 816
Catchment Grants	275 000						275 000
Regional Strategies							0
Landcare	125 327	154 720		147 399	179 093		621 539
ICM/Community Participation	253 345	62 560		19 381	8 000	35 000	386 584
River Trust	45 968	26 306	15 188	14 026	3 909		105 397
NRM Education	466 172	91 102	65 610	88 962	54 608	23 125	789 579
RAP/SAP	207 000						207 000
Sub-program Management	97 000						97 000
Sub-Total	**1 546 110**	**438 132**	**259 704**	**552 974**	**567 369**	**153 626**	**3 517 915**
Unfunded Base 98/99	276 000		40 000			63 000	379 000
SPECIAL TREASURY 1998/99 ($)							
Item	CHQ	Central	North	South	Southeast	West	Total
Catchment Management		55 000					55 000
Catchment Grants	500 000			2 700 000			3 200 000
Regional Strategies		52 000	46 000		88 000	143 000	329 000
Landcare						26 000	26 000
ICM/Community participation							0
River Trust							0
NRM Education							0
RAP/SAP	211 000	87 000	127 000	87 000	87 000	87 000	686 000
Sub-program Management							0
Sub-Total	**711 000**	**194 000**	**173 000**	**2 787 000**	**175 000**	**256 000**	**4 296 000**
Other Group output areas		141 000			80 000		221 000

[4] **Notes:** 1. Includes NLP, ANCA, LWRRDC, SRDC and BSES.

EXTERNAL 1998/99 ($)							
Item	**CHQ**	**Central**	**North**	**South**	**Southeast**	**West**	**Total**
Catchment Management			78 000	42 675	44 700		165 375
Catchment grants							0
Regional strategies						28 225	28 225
Landcare		42 496	76 500	389 500	138 843	241 596	888 935
ICM/Community participation							0
River Trust							0
	52 000	113 800	78 000				243 800
RAP/SAP	399 000	24 000	39 000	64 250	47 000	36 000	609 250
Sub-program management							0
Sub-Total	**451 000**	**180 296**	**271 500**	**496 425**	**230 543**	**305 821**	**1 935 585**

CAPITAL - RETAINED REVENUE 1998/99 ($)							
Item	**CHQ**	**Central**	**North**	**South**	**Southeast**	**West**	**Total**
Catchment Management			65 000		25 000	50 000	140 000
Catchment Grants	250 000						250 000
Regional Strategies							0
Landcare							0
ICM/Community Participation							0
River Trust	250 000						250 000
NRM Education							0
RAP/SAP							0
Sub-program management							0
Sub-Total	**500 000**	**0**	**65 000**	**0**	**25 000**	**50 000**	**640 000**
TOTAL	**3 208 110**	**812 428**	**769 204**	**3 836 399**	**997 912**	**765 447**	**10 389 500**

SUMMARY OF FUNDING

YEAR	CHQ ($)	Central ($)	North ($)	South ($)	Southeast ($)	West ($)	TOTAL
1993/94	1 062 000	220 000	931 000	632 000	999 000	43 000	3 951 000
1994/95	1 423 000	323 000	959 000	1 075 000	1 007 000	82 000	4 869 000
1995/96	5 305 000	1 477 000	4 283 000	2 173 000	3 843 000	313 000	21 894 000
1998/99	3 208 110	812 428	769 204	3 836 399	997 912	765 447	10 389 500
Total	10 998 110	2 832 428	6 942 204	7 716 399	12 695 912	1 203 447	41 103 500

4.2.3 Related Land and Water Management Programs

There are a number of land and water management programs that are closely linked to ICM. They include, State of the Rivers, WAMP, Waterwatch, Waterwise, National Heritage Trust Activities.

Waterwise

Waterwise Queensland' is an outcome of the Commission study 'Water Supply Sources of South-east Queensland.' Following this study, Cabinet directed that new water supply storages be investigated and existing supplies be conserved through better urban water demand management. By creating a change in attitude towards use, consumption levels can be reduced, existing resources will meet community needs for longer and capital expenditure on new resources can be deferred.

Some local authorities have already instigated their own water conservation strategies. These have generally been costly exercises. The Commission project team has assembled a statewide public education campaign which can be customised to suit individual local authorities in Queensland. This will avoid duplication and other saving in literature and other communication costs through economies of scale.
(The Source - Integrated Catchment Management News and Views. April 1992. 1: 6).

State of the Rivers

"The State of the Rivers project originated from a clear need for comprehensive information on the physical and environmental condition of the rivers and streams of Queensland, especially in terms of in-stream habitats, values and condition. DPI has already established programs for monitoring water quality and stream flows on a statewide basis. Assessment of the condition of some river sections has been undertaken by other agencies but is restricted in scope. There was a need for a catchment by catchment assessment of the ecology and physical condition of all the States' watercourses using a consistent and objective methodology. The data

collected can be related to other databases and will establish a baseline for use in the long-term monitoring of watercourse condition.

Dr John Anderson of AquaEco Services, East Lismore was commissioned to develop the methodology. The methodology is focused on taking a 'snap shot' of the condition of streams now, that is, at the time of survey. It does not aim to establish trends or the dynamics of changes in stream condition. But it is possible to establish trends or the dynamics of changes in stream condition. But it is possible to establish current condition in terms of a perceived extent or deterioration compared with the original pristine condition, using local undisturbed sites as a standard against which change can be measured.

Actions are coordinated with ICM groups and DNR and DPI staff to undertake surveys of priority streams. *(The Source - Integrated Catchment Management News and Views.* May 1993. 3: 8).

Waterwatch

"At a local level, Waterwatch programs are hosted by Landcare and ICM committees, environmental groups, local governments and other community organisations. Some of these groups were involved in water quality issues before the Waterwatch network was launched in 1993. Other programs have been established only recently.

Limited resources mean that groups in the network depend on sponsorship so they can continue to carry out their work. Various local community organisations and industries provide financial assistance, in-king support or people to do Waterwatch legwork. Waterwatch Queensland is also supported by the three levels of government. As well, local governments in Brisbane, Logan, the Gold Coast, Redland and Caboolture directly fund their own Waterwatch programs. Pine Rivers and Ipswich councils have also initiated Waterwatch activities.

The groups have similar themes, promoting:

- the need for an environment which will sustain diverse communities of indigenous species as well as human populations.
- the ecologically sustainable use of our natural resources.
- community empowerment, so that ordinary people can make a real contribution to managing and protecting their environment.

TWO CORE WATERWATCH ACTIVITIES ADDRESS THESE THEMES: Education and water quality testing. Most groups provide a valuable educational role by raising community awareness of water quality and catchment management issues. Given the interrelationship between human activity, catchment health and biodiversity (which requires a range of healthy habitats), this is an important aspect of the Waterwatch program.

As well, many make use of their catchment management links to assist in the provision of water quality data to help support local decision making. Groups which are collecting data for this purpose are moving to ensure that it is collected in a scientifically rigorous way.

There are two main reasons why this is important. First, communities want their data to be a useful tool for monitoring the condition and trend of the natural environment. Second, to be able to convince sceptics of the need to look after natural environments in more sustainable ways, they need evidence to back them up.

The groups use some or all of a variety of established tests which measure various chemical balances and habitat values. The chemical tests include turbidity (ie. how much particle matter is suspended in the water), pH (ie. how acid or alkaline the water is), salinity, temperature, flow rate, and levels of nitrates and phosphates (commonly used in fertilisers) and dissolved oxygen. The biological tests include surveys of waterbugs and assessments of vegetation, macrophytes, faecal coliforms and algae. (The State of Queensland, Department of Natural Resources. 1998. *Waterwatch Queensland Reflections 1996-97.* The State of Queensland, Department of Natural Resources, Brisbane: *pp* iv-v)

WAMP

Water: A Precious Resource

Water is the essential ingredient in almost everything we do. We use it in and around our homes, at work, and in many of our recreational activities. Our industries, such as agriculture and manufacturing, are dependent on it for their success. However, water is not in endless supply. We need to use our water resources wisely to ensure everyone receives a fair share.

To cater for the many competing uses of water, Queensland must manage its water resources in such a way that everyone's interests are considered. It also has to plan for the future, so that this generation as well as the next will have access to quality water resources.

The quality of our water resources is dependent on how well we look after our river systems and groundwater supplies. Dams and weirs are useful in providing access to reliable supplies of water. However, such activities interrupt the natural flow of our river systems. If these interruptions are too severe, or prolonged, the health of the river will deteriorate, affecting ecosystems and, in some cases, water quality.

The water needs of instream ecosystems must be catered for in order to keep our river systems healthy, and to maintain the quality of water. The link between healthy ecosystems and water quality has been recognised by governments and the community. Therefore, the Queensland Government is looking at the way we manage our water resources, and is making changes so that our use of water will be ecologically sustainable.

These changes will be challenging and will take some time to make. They may also require us to reconsider the ways we use water. Despite these challenges, this is a very exciting time for the people of Queensland. If we all work together, it's a chance for Queensland to get it right, so that our precious water resources will be used for the maximum benefit now and in the future.

Most importantly, it's a chance for everyone to have a say and be involved in decisions about the way we manage our water.

Existing Framework

In order to understand why changes to the water industry are necessary, we need to look at the way our water resources are presently managed:

- In Queensland, all water resources in declared groundwater areas and in watercourses, lakes and springs – are controlled by the State.
- Water entitlements of users are established through a system of licenses issued by the Department Natural Resources, on behalf of the State. Licenses may be issued to users on regulated or unregulated watercourses and in declared groundwater areas. Applications for a license to obtain water are considered in relation to the availability of supply. Essentially, however, applications for new water entitlements are considered on a 'first come – first served' basis.
- When an entitlement is made under license, the entitlement is attached to a specific property description or parcel of land. A license entitlement (in whole or in part) is not transferable (on a permanent basis) to other persons or parts of the catchment.
- Riparian landholders have an 'as of right' stock and domestic entitlements to provide water for stock and basic human needs.
- Some individuals do not have a specific water entitlement, but rely on beneficial flooding. For example, some graziers rely on beneficial flooding. For example, some graziers rely on beneficial flooding to maintain pastures and floodplain waterholes for stock. Many floodplain ecosystems also rely on this flooding.
- The current allocation framework does not have specific provisions for the supply of water for the environment.
- Decisions about granting of licenses are made by the State with opportunity for community input. A right of appeal to prescribed categories of landholders exists in many cases.

Reasons for change

As competition for scarce water resources increases, and the water needs of the environment are recognised, problems with the existing allocation framework are emerging. Some of the concerns are:

- The 'first come –first served' approach to dealing with applications for new entitlements can lead to diminishing security of existing entitlements. License holders are seeking more security in their entitlements, so that they may plan for the future with more certainty.
- The attachment of an entitlement to a property description blocks the opportunity to transfer water to other parts of the basin for perhaps more beneficial uses.
- The lack of means to protect those who rely on beneficial flooding may result in such individuals being adversely affected.
- The lack of means to allocate water to satisfy the environment has, in some areas, resulted in the degradation of natural resources and deteriorating river health.
- The cost of administering the existing licensing system is likely to escalate as demand for water increases, and legal challenges to water licensing decisions are made.
- Limited opportunities exist for water users and the community in general to become involved in decisions about licensing the use of water and the effect this has on the State's water resources.

The planning process

To address the concerns with the existing system the Queensland Government is introducing two new planning processes. These are:

- **W**ater **M**anagement **P**lanning processes; and
- **W**ater **A**llocation and **M**anagement **P**lanning processes.

Both these processes will result in the development of a plan.

A **WAMP** plan is a more detailed and rigorous process based on the best available social and economic data, and involves detailed environmental and hydrological analyses. A WAMP is intended to provide the framework for establishing in the plan area, property rights in water and resources management conditions under which 'trading in water' can occur, separate from land.

A statutory **WMP** process was provided in amendments to the Water Resources Act, 1989, assented in December 1996. A WMP is intended to provide the policy and principles for dealing with license applications in 'sensitive' areas of the State. The WMP process doe not involve the same complexity and detail of hydrologic-modelling and environmental studies as a WAMP and will not result in any changes to the way existing entitlements are made.

This information booklet explains the details of the **WAMP** process. If you would like additional information on the **WMP** process, the Department of Natural Resources has also produced a booklet on that process.

The WAMP process aims to provide the guidelines which will encourage fairer, more efficient, and ecologically sustainable use of water.

The development of a WAMP will be based on the best available ecological, social, and economic data, and involves extensive hydrologic analysis of a catchment. Essentially, the WAMP process will progress through the following steps:

- the total water resources within a catchment will be defined;
- all existing entitlements within the catchment will be identified;
- environmental flow provisions will be determined;
- additional priority water requirements (for example, town water supplies) will be reserved;
- water resources (if any) for further allocation will be defined;
- existing entitlements will be defined under the hydrologic model and, where appropriate, will become tradeable within sections of the catchment; and
- the rules for further allocation and management of water will be described and documented in a Water Allocation and Management Plan.

Local communities will play a valuable advisory role throughout the steps of the WAMP process.

Benefits of the WAMP process

The establishment of Water Allocation and Management Plans will result in benefits to water users and the broader community. Specifically, a WAMP will result in:

- improved planning confidence for primary and secondary industries;
- increased community involvement in the way water will be used in the future, particularly when negotiating an acceptable balance between competing uses;
- healthier river systems and instream habitats through the inclusion of environmental flow provisions; and
- the introduction of tradeable "property rights" in water. Property rights will lead to the separation f licenses from land. They will become personal assets which can be, where appropriate, traded to others within the catchment.

Improved planning confidence

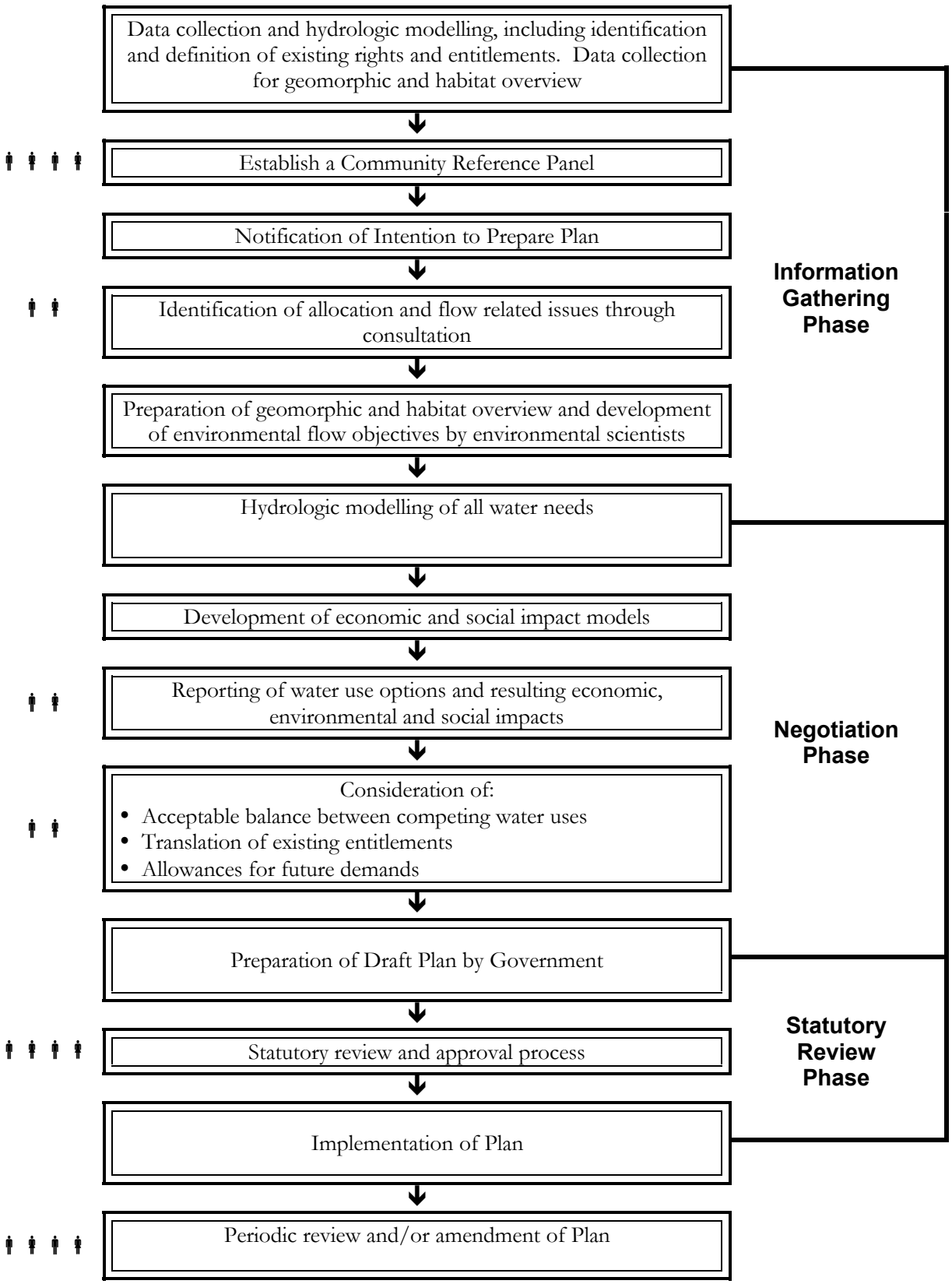
The WAMP process will result in improved planning confidence for users, as entitlements (existing and new) will be based on **basin-wide** hydrologic models. These models will include existing streamflow, licensing and storage data, as well as the amount of water available (if any) for future demand.

The additional knowledge and understanding of our river systems obtained from these hydrologic models will promote more informed decision making, and therefore ensure greater certainty of supply. The hydrologic models will be used as a planning tool to assess the impact of proposed developments on the environment, and the security of existing water entitlements.

Community input

The involvement of communities in decisions about the present and future use of water is a key feature in the WAMP process. Individuals and groups will be able to put forward their ideas and concerns through a community reference panel (CRP). A CRP will be made up of a broad mix of people to ensure everyone's interests are protected.

Water Allocation and Management Planning



Indicates stages in the process where Community Reference panel input is required

Indicates stages in the process where the general community will provide input

Throughout the WAMP process, the community will be kept informed and the Community Reference Panel will provide an observational role.

A CRP will be formed at the beginning of each WAMP process and will consist of representatives from key groups in the community, such as:

- Primary and Secondary industries
- Business and commerce groups
- Conservation groups
- Indigenous Australians
- Fishing industries
- Tourism industries
- Recreational groups
- Local governments
- Community groups

The CRP will meet during various stages of the WAMP process to provide advice and input and present community concerns. It is intended that members of the CRP will then report back tot he groups they represent to keep them informed of the progress of the WAMP process.

A regional WAMP coordinator, employed by the Department of Natural Resources, will liaise with CRP members and the broader community to provide information and support.

Protecting the environment

A key objective of the WAMP process is the maintenance and, where necessary/possible, improvement of instream ecosystems. This will be achieved by defining the water needs of these ecosystems (environmental flows).

A panel of environmental scientists will be appointed to identify particular environmental requirements of aquatic and riparian habitats. The panel will consist of experts from a range of scientific fields. For example, it may include a fish biologist, a river morphologist, and a riparian botanist. Defining how much water ecosystems need (and when it is needed) is a complex process, and it takes time and expertise.

Environmental flow requirements will be determined by the panel of environmental scientists after considering the needs of all ecosystems within the basin. Options for environmental flows will be developed.

All of the options will then be analysed for their impacts on water availability for other users. Each option will be considered in terms of its effectiveness in meeting environmental needs, as well as the resulting economic, social and indigenous impacts and opportunities.

A panel of experts, including resource economists and sociologists, will assess the economic and social impacts and opportunities. An indigenous input group will assess the impacts and opportunities with regard to the indigenous communities.

After careful consideration, the Department of Natural Resources (with advice from the CRP) will introduce the option with the best and fairest "mix" of water uses, taking into consideration the needs of all users in the basin.

Once environmental flows have been determined, they will be given formal recognition under the WAMP, much the same as other entitlements are protected. That is, the environment will have a legal right to water allocation.

Protecting the rights of existing water users

The WAMP process will include a basin audit to identify all existing entitlements. Existing and any new entitlements authorised within a WAMP will be described in a manner consistent with the hydrologic model for the basin.

The community will play a part in developing a "draft WAMP". Individuals will be able to view the draft plan to see how entitlements will be specified, and will be able to make submissions in response to the draft. All submissions will be reviewed, and some changes may be made to the draft. After approval of a WAMP, it will become the basis for allocation and management decisions.

It is expected that most licensees will retain their existing entitlements, but with a more comprehensive and secure definition, and that the terms of the license will not change significantly. However, if there are exceptions where entitlements are diminished, the license holder will be able to claim compensation. Principles for compensation are being developed as part of the proposed Natural Resource Management Legislation.

Interim arrangements

Existing license arrangements will continue to apply until a WAMP is fully developed. This means that, in some basins, existing arrangements will continue for several years. However, in basins where the allocation of water is already high, it may be necessary to restrict the issue of further licenses. This is to prevent over-allocation and to ensure that the hydrologic model, on which a WAMP is bases, is still accurate at the introduction of the plan.

When completed, a WAMP will become a statutory plan under the proposed Natural Resource Management Legislation. However, until this legislation is enacted, WAMPs will be developed as interim policies rather than statutory plans.

Water reforms
The Queensland Government, like other States and Territories, is a member of COAG (Council of Australian Governments). COAG consists of the Prime Minister, the State Premiers, the Territory Chief Ministers and the President of the Australian Local Government Association. By agreement among all governments, COAG develops major policies for the future of Australia.

At its meeting in February 1994, the members of COAG, including Queensland, agreed that action was needed to stop widespread degradation of our natural resources and to ensure the sustainable use of water.

The Queensland Government's Rural Water Pricing and Management document details the current approaches to a number of water reform matters in Queensland.

The WAMP process provides Queensland with a means of implementing reforms in regard to water resource allocations and entitlements that have been recommended by COAG.

When and where will WAMPs be undertaken
The WAMP process is very complex. To be sure everyone's interests are protected, the best mix of competing uses is achieved, and that everyone has had a chance to have a say. It may take about 2 years to develop a Water Allocation and Management Plan.

The WAMP process is currently under way (at various stages of development) in the following basins:
- Fitzroy
- Condamine-Balonne
- Border Rivers (jointly with NSW)
- Logan
- Barron

The WAMP processes are also planned to commence in 1997/98 in the following basins:
- Pioneer
- Burnett
- Burdekin

Additional information
For more information about the WAMP process in the above basins, please contact the relevant Department of Natural Resources office. These offices are listed in the back of this booklet.

4.2.4 Natural Heritage Trust – Operational Arrangements in Queensland

Purpose of this document

> This document has been prepared to inform industry, community and government – at local, regional and State levels – of the operational arrangements for the implementation of the Natural Heritage Trust (NHT) in Queensland. These arrangements have been endorsed by the Queensland Government and key stakeholders.

The Natural Heritage Trust: scope and components
The Natural Heritage Trust is about action. It represents the biggest financial commitment to the environment by any government in Australia's history - $1.25 billion Australia-wide. These funds will be available over fiver years for a range of integrated nature conservation, environmental protection, natural resource management and sustainable agriculture programs. The NHT recognises the fundamental link between these programs in achieving ecologically sustainable development (ESD)

The NHT covers five broad areas:
- vegetation (Bushcare: the National Vegetation Initiative, Farm Forestry Program)
- biodiversity (National Reserve System Program, Endangered Species Program, World Heritage Area Management)
- land (National Landcare Program, National Weeds Program, National Feral Animal Control Program, Advanced Property Management Planning)
- rivers (National Rivercare Program, Fisheries Action Program, Murray-Darling 2001, National Wetlands Program)

- coasts and marine (Coasts and Clean Seas Program including Marine Species Protection Program, Coastcare, Coastal and Marine Planning Program, and other programs)

Some NHT programs, such as the National Land and Water Resources Audit and those addressing clean air and waste management are managed by the Commonwealth Government on a national basis.

The Coasts and Clean Seas Program is currently administered under its own memorandum of understanding and has its own arrangements. The Department of Environment is the lead agent in Queensland for the delivery of all elements in the Coasts and Clean Seas Program.

NHT funding in Queensland is provided on three levels for:
- local community group projects
- regional projects (designed to implement priorities identified in regional strategies)
- projects that address State-wide issues

The bulk of NHT funding for Queensland is channelled through the State Government to regional areas, for implementing regional strategies and action plans through local and regional projects. The Queensland Government has entered into a partnership agreement with the Commonwealth Government. This agreement incorporates mechanisms at State and regional levels that target investment, account for expenditure and evaluate outcomes.

The Commonwealth has provided up to $40 million from NHT to protect the conservation and cultural values of Cape York. A Cape York NHT Plan has been prepared as an integrated regional initiative and will be administered under separate arrangements.

In recognition of the key role local government plays in the delivery of NHT program outcomes in Queensland, the State Government has prepared a memorandum of understanding with local government through the Local Government Association of Queensland.

Guiding principles of the NHT in Queensland
Commonwealth and State guidelines have been developed to ensure that the integrated package of NHT programs and related initiatives are delivered efficiently and effectively. The guidelines emphasise the importance of integrated delivery and the achievement of maximum on-ground outcomes, as well as partnerships between the community, industry and all levels of government. Queensland's process for NHT implementation is consistent with national guidelines.

There are 11 guiding principles for the NHT in Queensland:

1.Community groups (such as Landcare, catchment committees and conservation bodies), industry organisations and local government will be actively involved at local, regional and State levels in developing strategies, setting priorities, assessing funding proposals and evaluating results.

2.Bodies that develop and implement regional strategies will be separate from those that assess funding applications. However, these bodies will be linked through a common policy framework to ensure the integration of regional priorities with the assessment process.

3. Decision making will be devolved to the lowest level commensurate with efficient and effective application of available funds, and ensuring that national and State objectives, priorities and outcomes are met.

4.Bodies established to develop regional strategies and others established to assess funding applications will have an appropriate balance of interests in nature conservation, natural resource management and sustainable agriculture to reflect the range, breadth and expertise need to deliver NHT outcomes.

5. The regional management processes for the NHT will be sufficiently flexible to accommodate issues and communities that extend beyond any one region, eg. bioregional issues.

6. The encouragement and support of further regional strategic planning will enhance the integration of environment, natural resource management and sustainable agriculture programs. Priority will be given to ensuring all regions have the opportunity to develop a strategic approach to their issues.

7. Regional strategies will facilitate an integrated approach to investment that targets priority environmental, nature conservation, natural resource management and sustainable agriculture issues. While emphasising a strategic approach, opportunities still exist to support good local initiatives.

8. Regional organisations must have access to existing environmental data held by State agencies, in order to inform the preparation of regional strategies. The State must take the lead in coordinating access to data.

9. Every effort will be made to draw upon existing national, State, local government and catchment strategic plans. However, these plans must be amended to reflect the national and State objectives, priorities and outcomes of the NHT. No single regional strategic planning process for the NHT will be applicable across Queensland.

10. In allocating funds, priority will be given to
- implementing regional and catchment strategies and action plans
- targeting priority biodiversity and resource degradation issues across the State
- maximising social and economic benefits
- stimulating ongoing investment in ESD
- achieving on-ground change

11. Monitoring and evaluation of the development and implementation of the NHT in Queensland is critical, to ensure that funds are being allocated appropriately and that national and State outcomes are being achieved.

Queensland Management Arrangements
The NHT in Queensland is managed and implemented as a community-led process in partnership with government through a series of community and agency organisations (see Figure 1). These organisations include the Department of Natural Resources (DNR) which is the led agency for the NHT in the State. The Natural Heritage Committee of Ministers (NHCM), the Landcare and Catchment Management Council (LCMC) and regional strategy groups (RSGs) provide strategic direction for the NHT programs. The State Assessment Panel (SAP) and regional assessment panels (RAPs) ensure projects submitted for funding are technically sound and address priorities.

The Natural Heritage Committee of Ministers
The NHCM consists of the Minister for Natural Resources (as chairperson), the Minister for Environment, the Minister for Primary Industries, and the Minister for Local Government and Planning. The NHCM (with input from the Commonwealth) appoints the SAP and RAP chairpersons and members, and submits the State funding bid to the Commonwealth NHT Board.

The Landcare and Catchment Management Council
In recognition of the wide range of issues and interests the NHT addresses, the Queensland Government has appointed the LCMC to provide advice and strategic direction for the operation, management, administration, monitoring and evaluation of the NHT. The LCMC ensures that the NHT process is transparent and integrated and is responsible for reviewing the management arrangements. The LCMC also provides strategic advice to the Minister for Natural Resources on Landcare and catchment management in Queensland and provides a link between the community and government.

DNR provides executive support to the LCMC.

Membership structure of the LCMC
The LCMC has an independent Chairperson and Deputy Chairperson, appointed by the Minister for Natural Resources, and 18 members as follows:
- two members nominated by the Queensland Conservation Council – one with expertise in, and the ability to represent the interest of, in-stream freshwater or marine habitat conservation
- one member nominated by Greening Australia – Queensland
- three members nominated by the Queensland Farmers' Federation to represent extensive agriculture, intensive agriculture and grazing industries
- one member nominated by fishing interests
- one member nominated by water industries
- one member nominated by the Local Government Association of Queensland
- four government department representatives – one each from DNR, DPI, DoE and DLGP
- five community members to represent the five State regions.

Responsibilities of the LCMC
The responsibility of the LCMC come under the areas of planning and advice to government, community leadership and monitoring. They are as follows:

Planning and advice to government
- to develop the framework and provide strategic direction for the operation, management and administration of the NHT in Queensland
- to advise the Minister for Natural Resources on Landcare, catchment management and NHT issues

- to provide advice on State-wide priorities, policies, strategies and guidelines for the implementation of natural resource management, biodiversity conservation and sustainable production

Community leadership
- to develop guidelines for the membership and endorsement of RSGs, RAPs and the SAP
- to develop guidelines to ensure open and accountable assessment of project applications by RAPs and the SAP
- to provide guidelines for the preparation and endorsement of regional and/or catchment resource management strategies
- to endorse regional and/or catchment strategies and regional boundaries for the efficient management of regional strategy development and project assessment
- to foster support for land-holders and community groups in carrying out Landcare and catchment coordination activities
- to coordinate the implementation of State-wide public awareness and education campaigns
- to foster coordination and integration between government agencies and industry, professional and community organisations

Monitoring
- to develop a framework for monitoring, reviewing and evaluating the effectiveness of NHT programs in Queensland

State agency Coordination
DNR is the lead agency for the operation and management of the NHT in Queensland. The responsibility for NHT programs are shared by DNR, the Department of Environment (DoE) and the Department of Primary Industries (DPI). DNR is responsible for NHT policy, external funds management, Landcare, Murray-Darling 2001, Rivercare (including Waterwatch), Weeds and Feral Animal Control. DoE is responsible for Bushcare, National Reserves System, Endangered Species, Wetlands and World Heritage. DPI is responsible for Property Management Planning, Fisheries Action, and Farm Forestry.

The Department of Local Government and Planning (DLGP) also plays a key role in the delivery of NHT programs.

The administration of the NHT process is handled by a secretariat within NHR.

Major departmental policy and operational issues relating to NHT implementation that might arise will be dealt with by a committee of chief executive officers (CEOs) from the relevant government agencies. This committee is the CEO Committee of Natural Resources, Environment and Planning. Support for the CEO committee is provided by the NHT Interdepartmental Working Group, comprising representatives from each of the key agencies. This process will facilitate the adoption of a whole-of-government approach in support of the NHCM and the LCMC.

Management Structure of the NHT process in Queensland

Features of the NHT process (see Figure 1) include:
- The LCMC manages the implementation of Landcare and catchment management and develops the strategic framework for the operation of the NHT in Queensland
- Other councils, such as the Rural Lands Protection Board, Environment Protection Council and the Futureprofit Advisory Council, may provide technical input to the LCMC for each of the NHT program areas
- The LCMC provides guidance and direction to RSGs, RAPs and the SAP
- RSGs develop regional resource management, biodiversity conservation and sustainable production strategies
- The independent SAP appointed by the NHCM, with input from the Commonwealth, assesses State-wide projects and prepares the State bid for recommendation to the NHCM for funding.
- The NHCM recommends the State bid to the Commonwealth NHT Board

Queensland Priorities for NHT investment
Queensland's objectives, strategies and priorities have been incorporated into the partnership agreement between the State and the Commonwealth. They form an essential component of the NHT process to guide strategic plans, action plans and projects and are closely linked to the Commonwealth priorities.

The Queensland priorities will provide the benchmarks by which NHT projects will be ranked for funding allocation. These priorities will be reviewed annually to ensure that they are serving as the best guide to future planning.

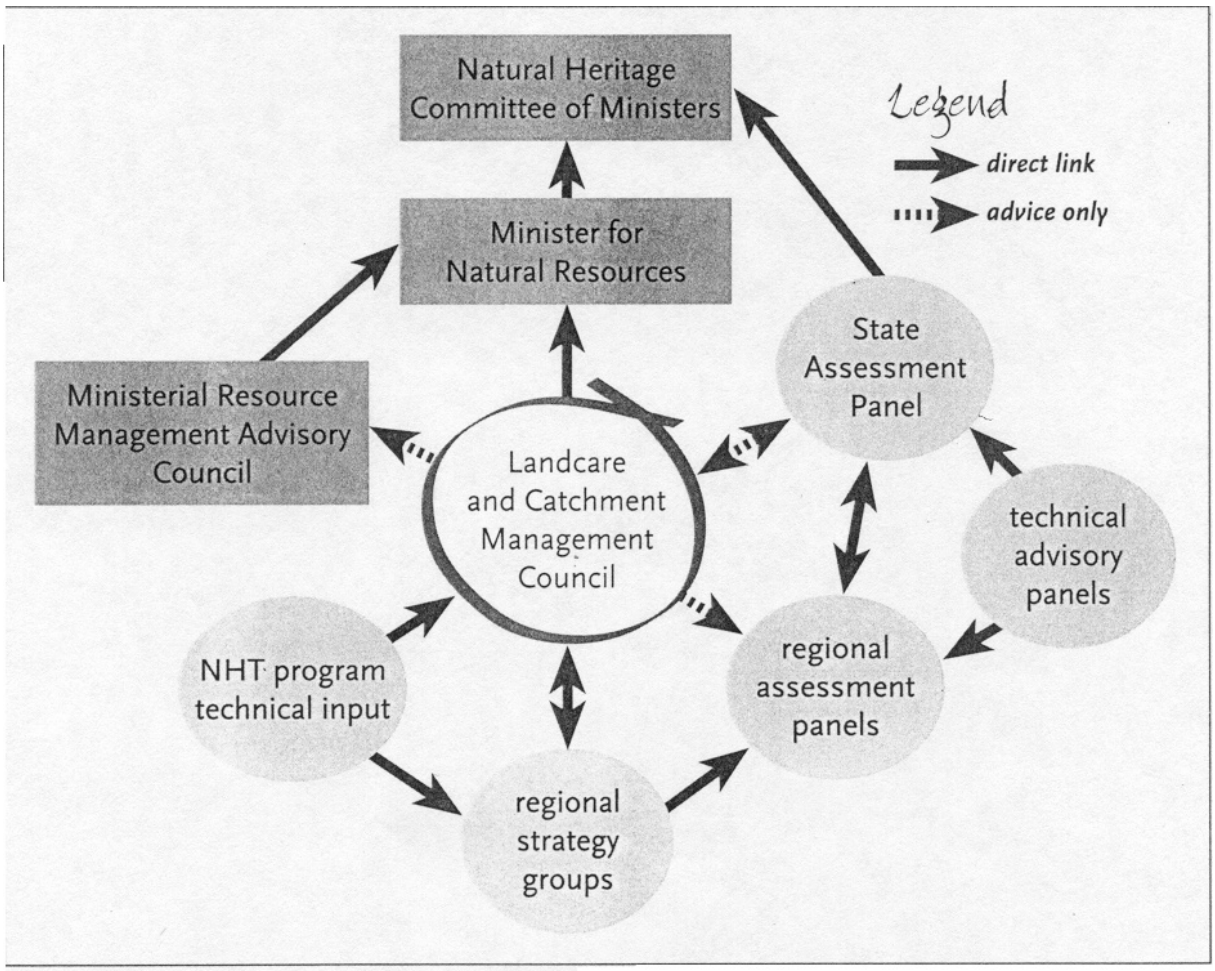


Figure 1 The NHT management process in Queensland

Regional strategy development

Queensland has 13 NHT regions (as shown in Figure 2) based on a combination of Landcare, catchment and bio-geographic boundaries. However, the boundaries should not be adopted rigidly. Some issues in a biogeographical region will often be relevant across a number of catchments or river basins and will therefore need to be dealt with in a number of regional strategies.

An RSG will be formed in each NHT region to prepare a regional resource management/biodiversity conservation strategy in accordance with guidelines prepared by the LCMC. The following criteria need to be met in the development of a regional strategy:

- Regional strategies should cover the range and breadth of environmental, nature conservation, natural resource management and sustainable agriculture issues, as well as NHT component objectives relevant to each region
- Regional strategies are to be developed primarily to facilitate an integrated approach to investment which targets priority issues within a region.
- Regional strategies should be consistent with State and national strategies and priorities, but should address the unique features, needs and priorities of each region
- The development of regional strategies should take up only a small proportion of the overall effort and resource put into addressing environmental, nature conservation, natural resource management and sustainable agriculture issues.
- Regional strategies should be regarded as dynamic documents which will need to be reviewed regularly to ensure they remain relevant after issues are addressed and new challenges emerge.

Regional Strategy Groups

Membership structure of RSGs

LCMC has prepared guidelines for the formation and endorsement of RSGs. Each RSG should be chaired by a community representative and encompass a broad membership. The membership is to include skills and experience covering environmental protection (including biodiversity conservation), sustainable agriculture and natural resource management.

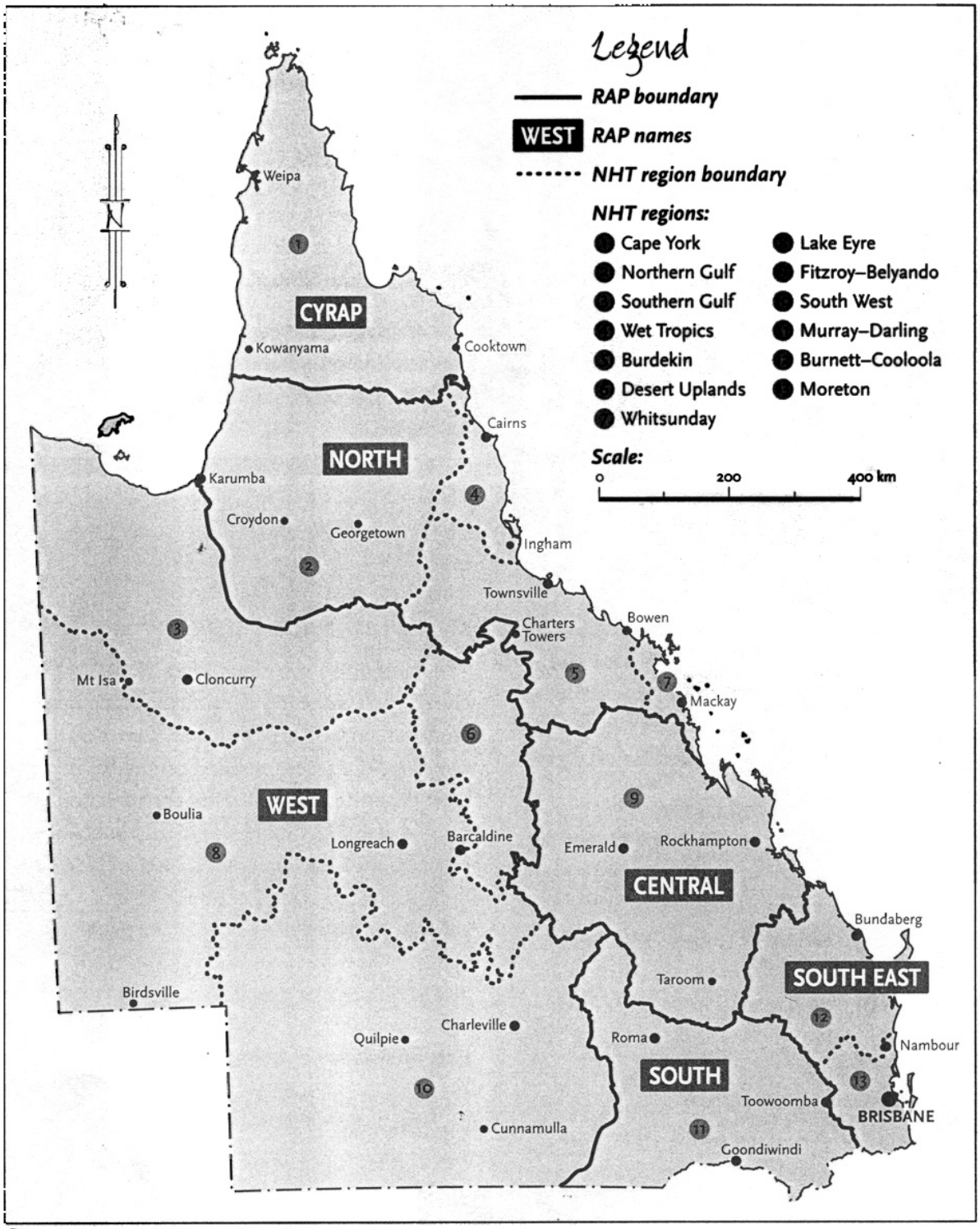


Figure 2 The NHT regional boundaries

People with skills in land, water, marine, vegetation, conservation, farming and indigenous land management should be included on each RSG as appropriate to the needs of each region. State and local government members must also be included in the RSGs.

Where possible the RSGs should build on, involve or use existing bodies rather than create new organisations. The membership structure of the RSGs should allow for differences between regions and ensure the most appropriate structure is established in each region.

Responsibilities of RSGs

The responsibilities of RSGs are as follows:

- To develop regional resource management strategies within the framework of State and national strategies and in accordance with State guidelines
- To identify priority issues to be addressed in the region.

- To develop action plans for the implementation of project activities by community groups and agencies in accordance with priorities identified in the regional strategy
- To maintain an overview of regional and community projects
- To identify gaps that need to be addressed to achieve priority outcomes identified in the regional strategy
- To commission project, where necessary, to deliver priority outcomes in the regional strategy and to address gaps identified by the RAPs and SAP.

It is envisaged that responsibility to manage the distribution of funds for approved projects across the regions could be developed to the RSGs.

Project Assessment
The LCMC will be responsible for establishing the annual NHT planning, assessment and evaluation framework (see Figure 3). Using the agreed procedures and guidelines, applications for project funding will be called for each year.

The regional assessment panels (RAPs) and State Assessment Panel (SAP) will assess the competing community, regional and State-wide bids in relation to Commonwealth, State, regional and local priorities and strategies. Applications for regional and community projects will be assessed by the RAPs. State-wide applications will be assessed by the SAP.

Regional assessment panels
Five RAPs are appointed by the NHCM in accordance with guidelines developed by the LCMC. RAPs consist of 8 to 10 community, local government and indigenous members, together with State agency staff.

The Cape York Regional Advisory Panel (CYRAP) has been established to provide advice to government on the implementation of the Cape York NHT Plan. It will also act as a RAP for the purposes of assessing NHT funding proposals from Cape York.

Membership Structure of RAPs
The community members of each RAP are chosen by a selection committee made up of community and agency people. Community members are recommended on the basis of their expertise in biodiversity conservation, natural resource management and sustainable production. Selection criteria also include skills in project assessment, monitoring and evaluation. The chairperson of each RAP is selected from the panel's community members and appointed for a three year term.

Responsibilities of RAPs
The responsibility of RAPs are as follows:
- To determine eligibility of projects for funding
- To assess, with technical support, project applications against regional strategies
- To recommend the regional funding bid to the SAP
- To identify and advise RSGs of needs not addressed in the regional bid.
- To monitor and evaluate regional and local projects
- To report on the progress of projects in achieving stated outcomes and provides feedback to project proponents

Under the arrangements established for Cape York, CYRAP will not recommend its funding bid to the SAP, but will deal directly with the NHCM.

The State Assessment Panel
The SAP has been appointed by the NHCM, in accordance with the LCMC guidelines. SAP membership is skills-based and includes expertise in the following areas: local government issues, regional and State biodiversity and natural resource management strategies, biodiversity and nature conservation, vegetation management, sustainable production, fisheries management and indigenous land use.

Membership structure of the SAP
The SAP has 18 members which include:
- An independent community chairperson appointed by the NHCM
- The chairpersons of the five RAPs
- One member each from the Local Government Association of Queensland, Greening Australia – Queensland, the Queensland Conservation Council, Threatened Species Network (World Wide Fund for Nature), Queensland Farmers' Federation, Queensland Commercial Fishermen's Organisation of Sunfish, the Aboriginal and Torres Strait Islander Commission and the LCMC
- One representative each from DNR, DoE, DPI and DLGP

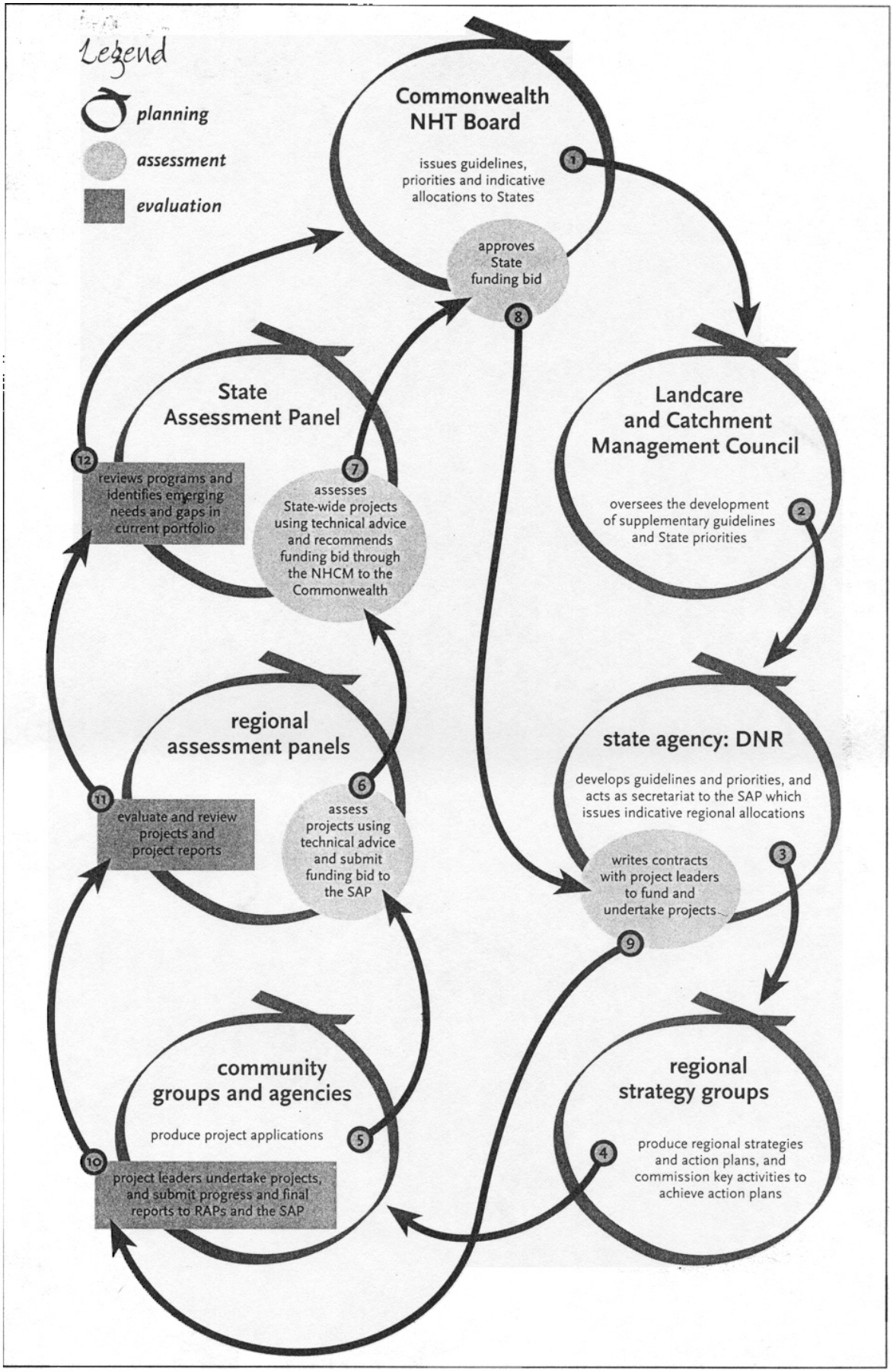


Figure 3 **The NHT planning, assessment and evaluation cycle**

Responsibilities of the SAP

The responsibilities of the SAP are as follows:

- To assess State-wide projects against the State-wide strategy

- To allocate funding across the regions based on merit and in accordance with priorities provided by the LCMC
- To integrate State-wide and regional project funding proposals into a State bid for approval by the NHCM
- To ensure open and accountable assessment or project applications in accord with State guidelines
- To oversee the monitoring and evaluation or State-wide projects
- To review programs and identify emerging needs and deficiencies in the current portfolio
- To report on the NHT operational arrangements as they impact on the State

Funding Arrangements
Following approval by the Commonwealth NHT Board, the Commonwealth Government will forward payments to DNR, the NHT lead agency in Queensland. DNR will generate project agreements between the State Government and community groups applicants for the implementation of projects. Community groups must be legal entities to receive payments.

DNR, through is regional offices, will forward approved NHT funds directly to community groups for the current year, for new and continuing projects

Funding for projects undertaken by other government agencies, for example the Department of Environment, are to be transferred to the agency under a generic agreement to cover all NHT funded projects for each year

4.2.5 A Strategic Analysis of Landcare and Rivercare Funding in Queensland: Report to the NHT State Assessment Panel. September 1999

Extract from Sue Rymer, (1999). Strategic Analysis of Landcare and Rivercare Funding in Queensland. Report to the State Assessment Panel, 27 September 1999. Publisher, DNR NHT Queensland State Secretariat.

Introduction

At the Queensland State Assessment Panel (SAP) meeting of 7 June 1999, the SAP considered an analysis of the geographical and thematic coverage of Bushcare projects in Queensland. This analysis had been prepared to assist the SAP in determining any "gaps" which may exist in Bushcare activity across the State. This Report presents similar information for Landcare and Rivercare projects. A summary of projects and funding covered by this Report is as follows:

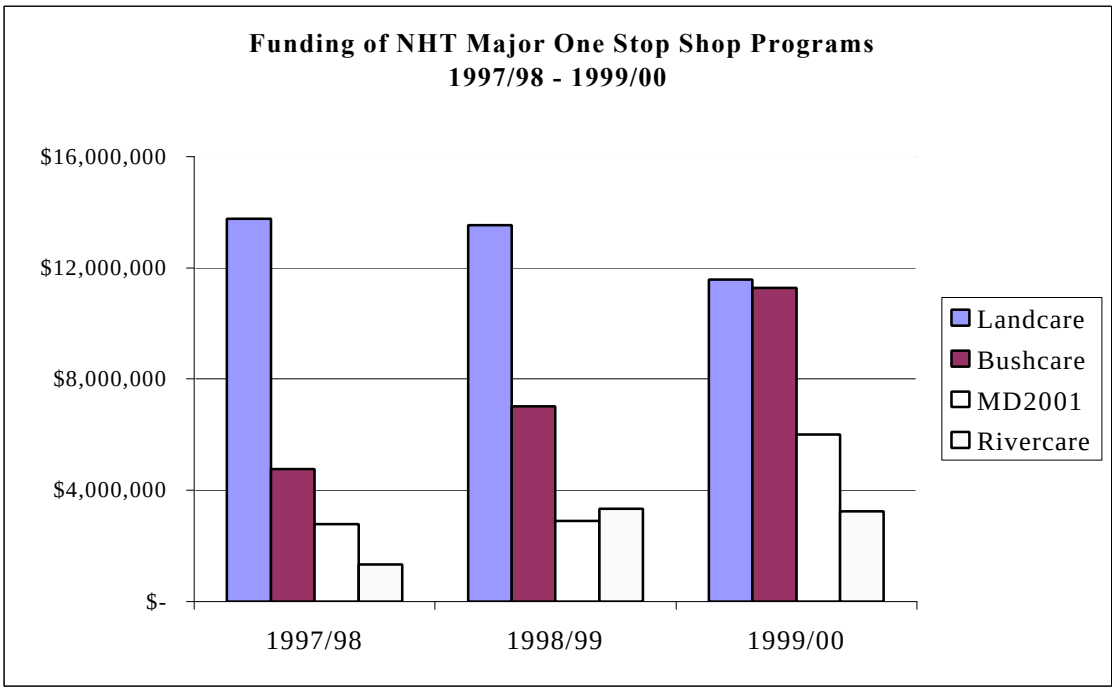
Table 1: Summary of Landcare Funding

	1997/98		1998/99		1999/00	
	No. of Projects	$'s Approved	No. of Projects	$'s Approved	No. of Projects	$'s Rec.
Continuing	108	7,539,544	135	9,761,703	127	8,450,746
New	120	6,216,991	58	3,769,491	42	3,130,682
TOTAL	228	$13,756,535	193	$13,531,194	169	$11,581,428

Table 2: Summary of Rivercare Funding

	1997/98		1998/99		1999/00	
	No. of Projects	$'s Approved	No. of Projects	$'s Approved	No. of Projects	$'s Rec.
Continuing	-	-	29	1,181,636	39	2,674,323
New	33	1,324,917	31	2,150,041	14	575,060
TOTAL	33	$1,324,917	60	$3,331,677	53	$3,249,383

To put these figures in perspective, the chart below indicates the relative levels of NHT funding over three years for the four largest One Stop Shop programs (99/00 figures are based on SAP recommendations only).The total funding for continuing/new projects is shown graphically below.



Methodology

The study included all approved 'one stop shop' projects for 1997/98 and 1998/99, as well as projects recommended for funding by the SAP in 1999/00. Cape York projects were not included in the study, as the Cape York RAP operates independently, and these projects are therefore not considered by the SAP. Two keys issues were addressed - the *geographic* and the *thematic* distribution of Landcare and Rivercare projects in Queensland.

The geographic distribution of projects was determined by analysing the proportion of funds approved and recommended for each RAP and NHT region. The NHT regions used are those specified in the document 'Natural Heritage Trust - Operational Arrangements in Queensland'

The thematic distribution of projects involved an examination of the activities and objectives of each project to determine the main Queensland strategy the project primarily addressed. The approved/recommended funding for that project was then allocated against that strategy. In developing the State bid for 1999/00, most of the projects recommended for funding were allocated against State strategies by Regional Coordinators, and for these projects this information was used to determine the primary strategy addressed. For other projects (ie. projects which finished in 1997/98 or 1998/99), allocations against strategies were primarily made on the basis of information in project applications and progress reports where available. Of course, there are some overlaps between strategies and many projects will address more than strategy. For example, although very few projects address community education and awareness as a primary strategy, most projects will have some outcomes in this area even if education/ awareness is not a primary objective. It should therefore be recognised that the results are providing an indication of the main emphasis of the funding.

The Queensland strategies are those specified in the document 'Queensland Natural Heritage Trust Strategic Priorities 1999/2000'. This document includes revisions made to the Queensland context section of the Partnership Agreement to reflect the current Queensland objectives, priorities and strategies.

State and community contributions to projects were also recorded, in addition to NHT funds, to give a better picture of the full investment in the projects reviewed. The term 'community' includes all contributions other than State Government funding (and includes, for example, local government contributions). As these contributions were taken from the information given in project applications it should be recognised that these figures are indicative only and must be viewed accordingly. For example, in project applications, some community groups identify only those contributions necessary to meet NHT cost sharing requirements, while others identify their full contribution to the activity. Similarly, other calculations, particularly in-kind contributions, are estimates only and community contributions may well exceed these estimations. Nevertheless, this data does provide a general indication of the level additional resources invested in NHT projects.

Discussion of Results -Landcare

The figure and table below present a summary of the geographic distribution of Landcare funding by NHT RAP Regions. Some of the key findings of the funding distribution between RAP regions are as follows:

- in general, Landcare funds have been distributed more evenly across RAP regions than Rivercare or Bushcare funds (for example, limited Bushcare funds were approved for projects in the West and Central RAP regions, with these regions receiving 3.4% and 5.2% respectively of total approved Bushcare funding for 1997/98 and 1998/99 combined);
- under Landcare, the Central region received the lowest proportion of funds in 1997/98 and 1998/99 (12% in each year), although this may change in 1999/00, with the Central region likely to receive the highest proportion (approximately 20%);
- while the North region received a significantly higher proportion of Landcare funding in 1997/98, this was largely due to the $1.3 million allocated to the Yungaburra Sewage Scheme in that year. As a result, the North region's allocation has dropped from 29% in 1997/98 to 16% in 1999/00;
- proportional funding for the other RAP regions (South, South East, and West) has remained relatively consistent over the three years, while Statewide funding has increased from 10% to 13% of total approved funds.

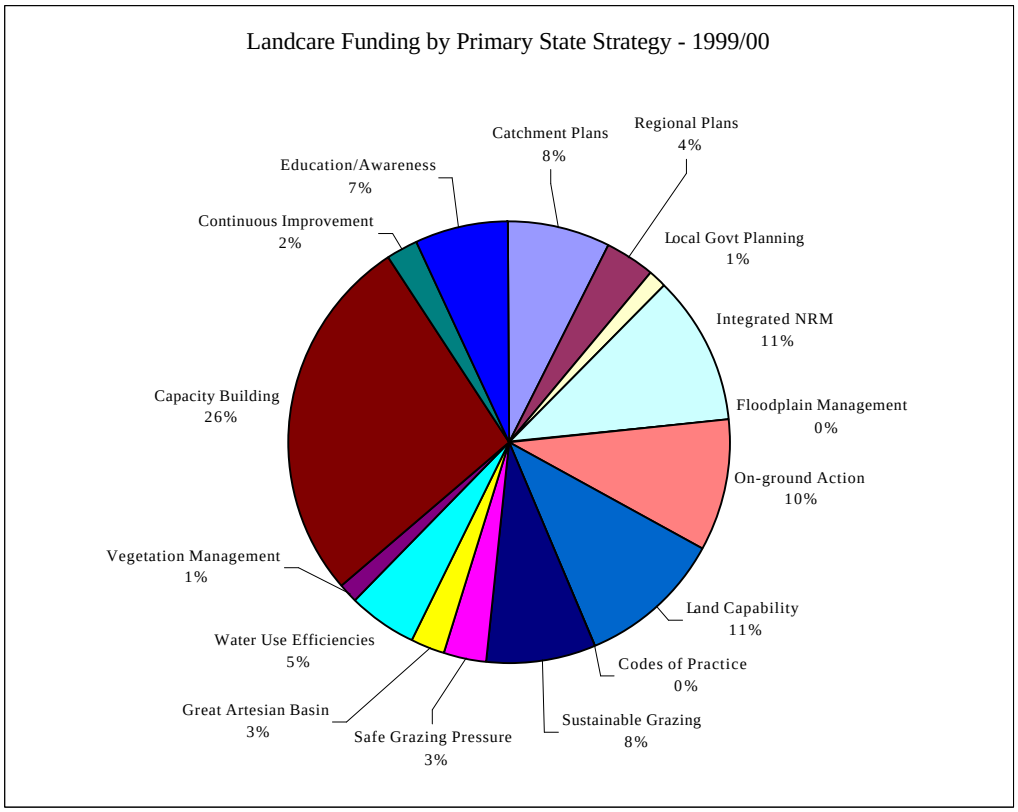
Table 3 Summary of Landcare Funding by Rap and NHT Region

NHT/RAP Region	1997/98 Approved $	%	1998/99 Approved $	%	1999/00 SAP Rec. $	%
Burdekin	822,926	6	867,243	6	578,406	5
Northern Gulf	390,274	3	69,798	1	109,350	1
Wet Tropics	2,064,913	15	1,006,972	7	683,739	6
Whitsunday	591,455	4	613,072	5	504,415	4
NORTH RAP TOTAL	3,869,568	28	2,557,085	19	1,875,910	16
Murray-Darling	2,215,378	16	2,630,730	19	2,092,478	18
SOUTH RAP TOTAL	2,215,378	16	2,630,730	19	2,092,478	18
Fitzroy-Belyando	1,681,443	12	1,653,815	12	2,215,317	19
CENTRAL RAP TOTAL	1,681,443	12	1,653,815	12	2,215,317	19
Desert Uplands	185,003	1	295,151	2	176,040	2
Lake Eyre	1,390,396	10	1,243,950	9	635,117	5
Southern Gulf	98,998	1	70,500	1	234,367	2
South West	305,218	2	528,647	4	701,942	6
WEST RAP TOTAL	1,979,615	14	2,138,248	16	1,747,466	15
Burnett- Cooloola	1,479,126	11	1,636,176	12	1,366,327	12
Moreton	1,170,997	9	887,025	7	772,077	7
STH EAST RAP TOTAL	2,650,123	19	2,523,201	19	2,138,404	18
STATEWIDE	1,360,408	10	2,028,124	15	1,511,853	13
TOTAL	13,756,535	100	13,531,203	100	11,581,428	100

It is also important to look at the distribution of funds within RAP regions because in many cases this provides a better indication of the geographic spread of funding. The distribution between NHT regions highlights the following:

- the Northern Gulf, Southern Gulf and Desert Uplands regions consistently receive lower levels of Landcare funding than other NHT regions. These regions only receive around 1-2% of total funding each, and relatively low proportions of the funding allocated to the respective RAP region (eg. the proposed Northern Gulf funding of $109,350 in 1999/00 represents less than 6% of proposed North RAP Region funding);
- the Fitzroy, Murray-Darling, and Burnett-Cooloola NHT Regions are likely to receive the highest proportion of funds in 1999/00 (approximately 19%, 18% and 12% respectively);
- Lake Eyre region funding has dropped from 10% in 1997/98 to 5% in 1999/00, largely because the Great Artesian Basin Rehabilitation Project is expected to be funded from another program in 1999/00. The South West region's share of funds, while still relatively low, is increasing steadily (from 2% in 1997/98 to 3% in 1998/99 and 6% in 1999/00).

The figure below presents a summary of the thematic distribution of total Landcare funding by Key Result Area and Primary State Strategy.



A key feature is that in most regions there has been a major emphasis on strategy 4.3.4(a) (*Building the capacity and enhancing the business and strategic resource management skills of resource managers to sustainably manage land, water and related vegetation at a landscape and property scale*). This is consistent with NLP priority 4.2(b), which is to "improving the business and resource management skills of resource managers". The West Region, in particular, has a significant proportion of funds (45% in 1999/00) primarily addressing this strategy. This is particularly due to large projects such as 972741: PMP in the Arid Zone, and a new project 992624: Building Community Capacity to Determine Integrated Safe Carrying Capacities in Western Queensland. Most regions also have a strong emphasis on strategy 4.3.1(a) (*Community based groups to design and implement catchment based integrated action plans and resource management activities*). The only exception is the West Region where there appears to be a greater emphasis on regional rather than catchment based planning.

Other regional issues are also illustrated:

- the emphasis on environmental strategies (4.3.2(a) - *priority on-ground action* and 4.3.2(b) - *determining land capability*) is significantly greater in the South East region than in other regions, although the South region also has a significant proportion of funds (21%) addressing 4.3.2(a);
- statewide projects concentrate on people strategies (as would be expected) with almost half the statewide funding in 1999/00 addressing this Key Result Area.

In terms of total Landcare funding across the State, a number of other issues are also identified in Attachment C:

- the proportion of funding for integrated regional planning (strategy 4.3.1(b)) has remained constant, at 4% in each of the three years. There has been a slight increase in the proportion of funding primarily addressing strategy 4.3.1(a) - the design and implementation of catchment based plans (with funding increasing from 6% in 1997/98 to 8% in 1999/00. This is to be expected as regional plans are completed and the focus of activities moves towards implementation at a catchment level;
- limited funds have been directed towards enhancing local government planning schemes (strategy 4.3.1(c)), or to developing floodplain management guidelines (strategy 4.3.1(e));
- there are no projects which have, as a primary objective, the development of codes of practice and guidelines for natural resource management. As noted in the Queensland NHT State Bid for 1999/00, while the Fruit and Vegetable Growers, Cane Growers, and the cotton industry have produced Codes of Practice in recent years, other industries have not yet submitted proposals for funding guidelines or manuals in this area;
- the development and extension of vegetation management practices also receives limited funding, although many vegetation activities are included under strategy 4.3.2(a) (priority on-ground action) or would be funded under Bushcare;

- very few projects address strategy 4.3.3(b) (determining safe grazing pressure) as a primary objective, although a number of projects include grazing pressure as a secondary objective (for example, approximately 10% of projects funded over the three years address, to varying degrees, grasslands issues or rangelands management);
- strategy 4.3.3(d) (optimising and promoting water use efficiencies and irrigation best practice) receives relatively low funding, despite the improvement of irrigation water use efficiency in rural areas being a priority for the program;
- the proportion of funds going to education/awareness activities has increased to 7% in 1999/00 (from 6% in 1997/98 and 5% in 1998/99), despite this being a low priority strategy.

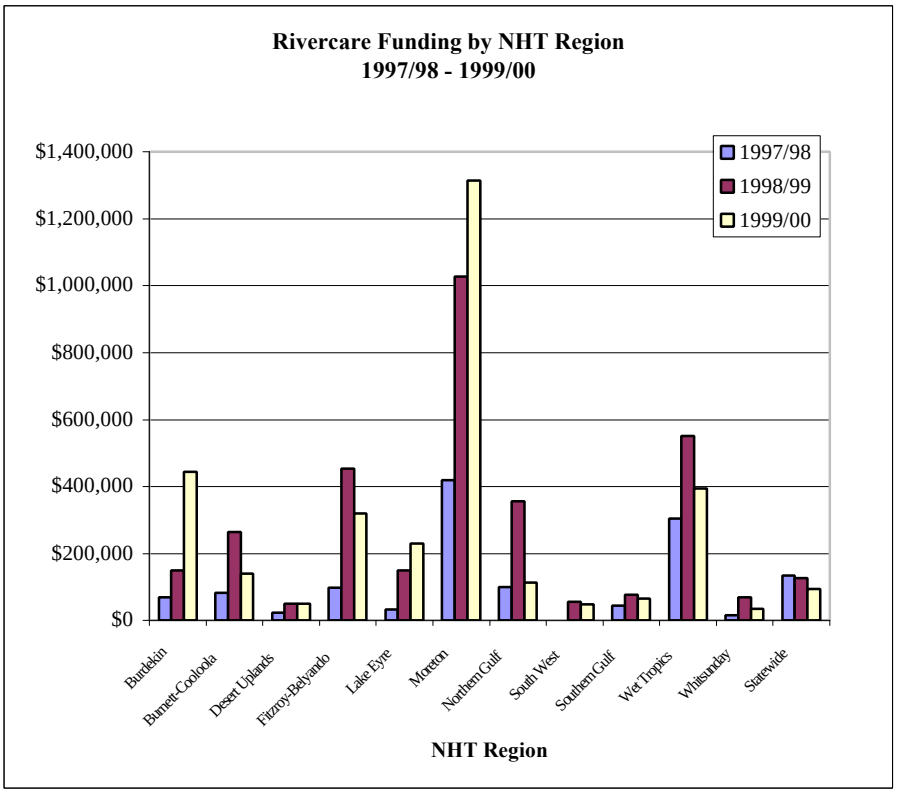
Discussion of Results - Rivercare

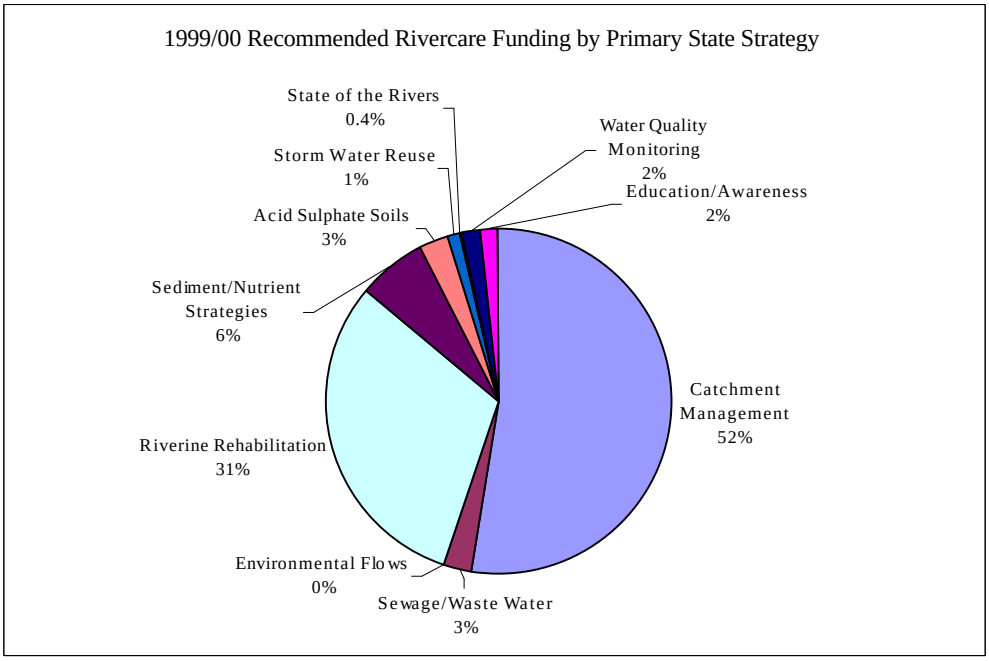
The table and figure below presents a summary of the geographic distribution of Rivercare funding by RAP region. There are no projects in the South region, as river restoration projects in that region are funded through the Murray-Darling 2001 program, which is not covered by this review. Some of the key findings of the funding distribution between RAP regions are as follows:

- the North and South East regions have consistently received significantly higher levels of funding than other regions, with the South East region's proportion expected to be 45% in 1999/00. This includes $350,000 recommended for one relatively large project: the Moreton Bay Catchment Water Quality Management Strategy (this represents 11% of Rivercare funding for the year):
  - one reason for this high level of funding in the south east is the high population density and high level of development which has resulted in significant water quality issues (for example, poor water quality, loss of riparian vegetation, un-coordinated planning, low community awareness, and loss of riverine values including in-stream habitat are common in closely settled areas);
  - the tropical, high energy nature of streams in the North region means that there are also significant issues to be addressed in this region (for example, flood damage, stream bank instability, loss of riparian vegetation, and loss of riverine ecosystems);
- the West Region's share of funding shows marginal increases over time (from 8% in 1997/98, to 10% in 1998/99 and a possible 12% in 1999/00), while Central region funding has varied, from 7% in 1997/98 to 14% in 1998/99, and back to 10% in 1999/00:
  - the relatively low levels of Rivercare investment in these two regions reflect the lower priority that river-related issues have in these drier, less settled areas where other natural resource management issues prevail;
- funding for Statewide projects has decreased from 10% in 1997/98 to 3% in 1999/00. It is likely that this is due to the shifting emphasis in NHT funding from broader planning and awareness raising activities to on-ground works.
- the South West, Desert Uplands, Southern Gulf and Whitsunday regions consistently receive lower levels of Rivercare funding than other NHT regions - around 1-2% of total funding each. This is a particular concern in the latter two cases, as the Mackay/Whitsunday and Gulf NHT regions are identified as priority regions under Rivercare for the development of community based river management strategies and action plans (see Attachment H – Rivercare priority 4.2(a));
- the Moreton catchment receives significantly higher funding than other NHT regions (eg. 39% of recommended 1999/00 funding), with the next highest proportion in 1999/00 being the Burdekin (13%). In addition, the proportion of funding for the Moreton region has been steadily increasing, while funding for the other South-East region, Burnett-Cooloola, has steadily declined (from 11% to 4%). These three NHT Regions are all identified as Rivercare priorities;
- other priority regions include the Wet Tropics region (where the proportion of funding has dropped steadily, from 23% to 12%), as well as Fitzroy-Belyando and the Northern Gulf, which have received reasonable levels of funding, although the proportion going to the Northern Gulf has dropped to 4% in 1999/00.

Table 4 Summary Of Rivercare Funding By Rap and NHT Region

NHT/RAP Region	1997/98 Approved $	%	1998/99 Approved $	%	1999/00 SAP Rec. $	%
Burdekin	69,000	5	150,000	5	444,000	14
Northern Gulf	100,000	8	356,875	11	113,900	4
Wet Tropics	304,156	23	551,597	17	394,793	12
Whitsunday	15,000	1	70,090	2	34,150	1
NORTH RAP TOTAL	488,156	37	1,128,562	34	986,843	30
Fitzroy-Belyando	97,264	7	454,467	14	320,288	10
CENTRAL RAP TOTAL	97,264	7	454,467	14	320,288	10
Desert Uplands	24,000	2	49,500	1	49,500	2
Lake Eyre	33,875	3	148,706	4	229,700	7
Southern Gulf	45,000	3	76,167	2	65,000	2
South West	-	0	56,620	2	49,070	2
WEST RAP TOTAL	102,875	8	330,993	10	393,270	12
Burnett- Cooloola	82,930	6	264,086	8	140,983	4
Moreton	419,802	32	1,027,109	31	1,314,279	40
STH EAST RAP TOTAL	502,732	38	1,291,195	39	1,455,262	45
STATEWIDE	133,890	10	126,460	4	93,720	3
TOTAL	1,324,917	100	3,331,677	100	3,249,383	100





The figure above presents a summary of the thematic distribution of total Rivercare funding by Primary State Strategy. Separate charts have only been produced for the South East and North RAP Regions for 1999/00, as projects in other regions only address a small number of strategies.

Clearly, the strongest emphasis of Rivercare projects is on the implementation of strategy (a) (which is to develop *'community-based approaches to catchment management; and prepare, coordinate and implement community based integrated river management action plans'*). This is consistent with priority (a) of Rivercare, which is to develop community based river management strategies and action plans.

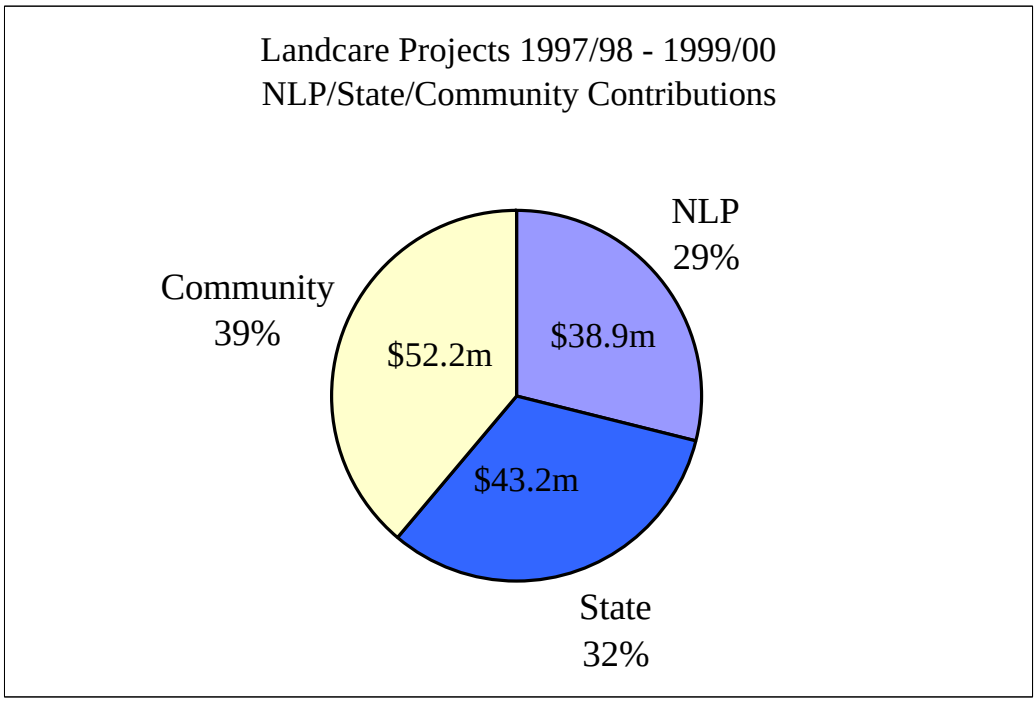
Strategy (d) (*protection and rehabilitation of riverine systems*) also receives a significant and increasing proportion of funds, which again is consistent with Rivercare priorities and strategies. This increase is also to be expected given the increasing onground emphasis of the NHT.

The figure also indicates that a number of other strategies are not being addressed through Rivercare projects:

- limited funds have been directed towards the promotion of alternative/improved sewage treatment and waste water reuse facilities (a high priority strategy). However, significant Landcare funding has addressed this strategy in the past. The Yungaburra Sewage Scheme project is an example. In addition, this strategy is likely to be addressed in the Moreton catchment through action arising from the Moreton Bay Catchment Water Quality Management Strategy;
- no projects address environmental flow requirements (another high priority strategy) as a primary objective. However, funding for this activity is provided through the National River Health Program and undertaken by the State via WAMPs;
- the implementation of pilot storm water reuse projects (strategy (g)) has also received little funding, although this is a medium priority strategy. Similarly, another medium priority, the amelioration of acid sulphate soil impacts, has also received limited Rivercare funds, although this issue is being addressed through some Landcare projects (eg. project *972712 - Statewide Acid Sulphate Soils Information: Extension and Coordination*. $79,800 has been recommended for this project in 1999/00).

Community and State Government Contributions

The following tables indicate the level of investment in Landcare and Rivercare projects by communities and the State Government. A breakdown of contributions by RAP Region for each program is provided at Attachment G. As these tables indicate, the relative contribution of NHT:State:Community funding for Landcare and Rivercare projects over three years has been roughly 30:30:40.



Conclusion

The study identified a number of gaps in the geographic distribution of Landcare and Rivercare funds in Queensland. In particular, the Northern Gulf, Southern Gulf and Desert Uplands NHT regions consistently receive lower levels of Landcare funding than other regions. In the case of Rivercare, the North and South East RAP Regions receive a significantly higher proportion of funds, with the South West, Desert Uplands, Southern Gulf and Whitsunday NHT regions consistently receiving limited funds.

The thematic analysis identified gaps in addressing state strategies for Landcare relating to the enhancement of local government planning schemes, addressing safe grazing pressure, the development of floodplain management guidelines, the development of codes of practice and guidelines for natural resource management, and the development of sustainable vegetation management strategies (although the latter three are only medium priority strategies). Rivercare strategies which receive limited funding include the promotion of alternative/improved sewage treatment and waste water reuse facilities, the determination of environmental flow requirements, the implementation of pilot stormwater reuse projects, and the amelioration of acid sulphate soils (again, the latter two are only medium priority strategies).

The analysis of State Government and community contributions gives an indication of the significant level of investment in NHT projects, above and beyond Commonwealth funding. On average, every NHT dollar generates well over two dollars of additional investment from Queensland.

Appendix 1 QUEENSLAND LANDCARE STRATEGIES

(Source: Queensland NHT Strategic Priorities - 1999/2000. A Guide for NHT Project Applications)

NATIONAL LANDCARE PROGRAM

4. Queensland Context

4.1 Objectives

a) To have strong community, industry and government partnerships in the management of natural resources.

b) To build the capacity and self reliance of land managers.

c) To maintain the stability and productivity of land resources.

d) To achieve the efficient and sustainable use of water resources.

e) To ensure the sustainable use of groundwater and improved groundwater quality management.

4.2 Priorities

a) Developing regional natural resource and environment management strategies for all regions of the State.

b) Improving the business and resource management skills of resource managers through the development and delivery of programs such as property management planning.

c) Maintaining the stability and productivity of the cropping and grazing lands of the State and floodplains in rural areas.

d) Improving irrigation water use efficiency in rural areas.

e) Sustaining groundwater use and management in:

- the Great Artesian Basin, including intake areas;
- groundwater areas where resources are over-committed - Atherton basalts, Pioneer Valley, Fitzroy Basin, Bundaberg, Lockyer Valley and Condamine; and
- areas subject to saltwater intrusion - Bundaberg and Pioneer Valley.

4.3 Strategies

Strategies	Priority
4.3.1 Integration and Institutional Strategies	
a) Community based groups to design and implement catchment based integrated action plans and resource management activities.	High
b) Develop integrated regional natural resource management and biodiversity conservation strategic plans.	High
c) Enhance local government planning schemes to address natural resource management and biodiversity conservation issues.	High
d) Develop integrated approaches to natural resource management at the property scale.	High
e) Develop floodplain management guidelines for rural areas and conduct appropriate planning.	Medium
4.3.2 Environmental Strategies	
a) Implement priority on-ground action consistent with integrated strategies and action plans.	High
b) Determine land capability and land suitability and monitor condition and trend of priority catchments.	Medium
c) Develop codes of practice and guidelines for natural resource management.	Medium
4.3.3 Sustainable Production Strategies	
a) Identify and or develop and extend sustainable grazing and cropping systems including integrated approaches to management of invasive weeds.	High

b) Determine safe grazing pressure and develop effective methods for managing total grazing pressure from domestic, feral and native pest animals.	High
c) Rehabilitate uncontrolled bores and construct pipelines to replace open bore drains in the Great Artesian Basin.	High
d) Optimise and promote water use efficiencies and irrigation best practice for the sustainable management of surface and ground water.	Medium
e) Develop and extend vegetation management practices and strategies to achieve sustainable and productive natural resource management systems.	Medium

4.3.4 People Strategies

a) Build the capacity and enhance the business and strategic resource management skills of resource managers to sustainably manage land, water and related vegetation at a landscape and property scale.	High
b) Encourage a culture of continuous improvement by primary producers of natural resources management.	Medium
c) Conduct community education and awareness raising activities.	Low

Strategies where the State provides support for agencies and community but are unlikely to receive NHT funding:

a) Develop and extend effective remedial measures for degradation and the impact of climate variability and drought.

b) Undertake risk assessment processes to determine groundwater systems where development of a management plan is a priority.

c) Develop water allocation and management plans for priority groundwater systems with major consumptive use demands.

d) Develop statutory water management plans for sensitive groundwater systems.

e) Develop groundwater management plans for priority groundwater systems with major consumptive use demands.

Appendix 2 NATIONAL RIVERCARE PROGRAM

4 Queensland Context

4.1 Objectives

a) To increase involvement and responsibility by industry, resource users and the community in the integrated management of natural resources on a catchment basis.

b) To maintain and enhance the water quality of river systems and associated wetlands.

c) To provide an appropriate balance between the consumptive and instream requirements of the water resources of river systems.

d) To maintain and enhance the ecological integrity and physical stability of river systems, including associated riparian zones and wetlands.

e) To provide high quality data and decision support systems which will support investment and decisions in relation to river health.

4.2 Priorities

a) Developing community based river management strategies and action plans for catchments in the Wet Tropics, Mackay/Whitsunday Coast, Burnett/Mary, Southeast, Burdekin, Fitzroy and Gulf NHT regions.

b) Addressing water quality issues, in particular eutrophication in the Fitzroy River basin and nutrient transport in river basins discharging into the Great Barrier Reef lagoon and Moreton Bay.

c) Developing and implementing:
- water allocation and management plans for the Fitzroy, Barron and Logan River basins and in the longer term for the Burnett, Burdekin, Pioneer, Mary, Brisbane and other river basins with defined water allocation issues.
- water management plans for the Cooper Creek and Mitchell River basins and in the longer term for the Herbert, Flinders and other river basins with defined water allocation issues.
- flow management plans for the Calliope/Boyne River basin.

d) Improving ecological integrity and physical stability of rivers in the Mackay/Whitsunday Coast, Wet Tropics, Burdekin, Burnett/Mary and Southeast regions, including the development and implementation of riverine quarry material management plans in stream reaches under extractive pressure.

e) Develop decision support systems and associated databases for natural resource allocation and management activities in the Wet Tropics, Mackay/Whitsunday Coast, Fitzroy, Burnett/Mary, Southeast, Burdekin, Lake Eyre Basin and Gulf regions.

4.3 Strategies

	Strategy	**Priority**
a)	Community-based approaches to catchment management; and prepare, coordinate and implement community based integrated river management action plans.	High
b)	Promote alternate/improved sewage treatment and waste water reuse facilities that reduce the flow of nutrients into rivers.	High
c)	Determine environmental flow requirements for river, estuarine and coastal ecosystems.	High
d)	Protect and rehabilitate riverine systems to provide stable, functional waterways that support healthy riparian and instream ecosystems, including weed, erosion and stock management.	High
e)	Develop and implement sediment, nutrient and pesticide management strategies to address their impacts on water quality and aquatic fauna in river systems.	High
f)	Develop and implement management strategies to ameliorate the impacts of acid sulphate soils.	Medium
g)	Implement pilot storm water reuse projects in rural and regional urban areas.	Medium
h)	Conduct integrated State of the Rivers/fish habitat surveys for priority rivers and document freshwater fish habitat requirements.	Medium
i)	Promote community based water quality monitoring activities.	Medium
j)	Conduct community education and awareness raising activities.	Low

Strategies where the State provides support for agencies and community but are unlikely to receive NHT funding:

a) Assess and report on conditions and trends of water quality of catchments.

b) Develop regional and catchment approaches for improving river and instream health by minimising water extractions from river systems, including alternate sources of water supply and adoption of improved water use efficiency measures.

c) Undertake risk assessment processes to determine river systems where development of a management plan is a priority.

d) Develop water allocation and management plans for priority river systems with major consumptive use demands.

e) Develop statutory water management plans for sensitive river systems.

f) Develop flow management plans for priority river systems with major consumptive use demands.

g) Develop and implement policies and procedures for the establishment of transferable water entitlements.

h) Develop riverine quarry material management plans for priority stream reaches.

i) Develop decision support systems and associated data bases to support resource allocation and management decisions.

j) Develop fish transfer requirements and effective fish transfer systems.

4.2.6 Catchment Management Strategies Guidelines 1995

Philip Rowland, (1995). Catchment Management Strategies. Notes prepared for Catchment Coordinating Committee's Mini-Forum. Maleny 26 February 1995

Why have Catchment Management Strategies?

Catchment Management Strategies will need to be a suitable standard and possibly of similar format if they are to receive formal recognition by State government (through Cabinet), local government and industry. While there is a degree of variation in the structure and content of strategies produced so far by catchment groups, a common set of topics are emerging.

'Strategies' and 'big picture plans' are all the rage at present in government and semi-government agencies. Most of the bodies who are potential sources of funding for catchment works are these types of agencies. A CMS provides a clear message to these bodies about what needs to be done.

A CMS is not an end in itself but a means to an end (see notes from a workshop in Ingham in 1993).

Rather than each catchment having to reinvent the wheel, it would be worth looking at CMS already prepared and using the structure, not the content, in preparing new CMS.

CMS should provide a framework or blueprint for resolving key issues of *catchment wide* importance in a catchment. It should be useful to groups and organisations within the catchment as well as to others outside (like funding bodies, state government etc) the catchment.

KEY COMPONENTS SUGGESTED FOR INCORPORATION IN A CMS ARE OUTLINED IN THE ATTACHED TABLE AND ARE DESCRIBED IN MORE DETAIL BELOW:

Setting the Scene

Physical, economic, biological and social attributes of the catchment should be described to set the context for natural resource management. The use and management of natural resources in the catchment need to be covered.

Describing the Vision

A general one-statement (or series of statements) describing of a vision for the catchment. It is important that this vision is generally accepted by all the key interests in the catchment.

Identifying Issues

Key general issues are determined. A maximum of eight issues is considered a workable number. Ranking these issues provides a basis for further planning.

Analysis of the issues and the identification of the causal factors and trends is a necessary requirement of the strategy. Scientific (qualitative and quantitative) as well as local knowledge should be used in the description and analysis of the issues.

A check on the issues once they have been identified is to ask the question - What key components of the catchment need to be changed to resolve the issue and assist if achieving the vision?

Goals for each issue need to be described.

For each Issue

Setting Objectives
Specific objectives for each goal are described. They need to be specific, measurable, achievable, relevant and timely.

Outcomes
Statements on the proposed outcomes resulting from the implementation of the CMS should be included. Indicators of these outcomes could be described as well as monitoring and evaluation processes.

Strategies
To achieve the objectives, one or more strategies are described. Major components of these strategies include:
- Activities to be carried out
- Organisations, government departments or agencies, local authorities and other key stakeholders that need to be involved.
- Resources (time, money, manpower) needed to carry out the activities

Performance Indicators
- The performance indicators identify the attributes that should be measured or determined to assess progress toward the objectives. The performance indicators do not relate specifically to the strategies to be used to achieve the objectives. Because of this they cannot necessarily be used to assess the effectiveness or otherwise of the individual strategies employed.
- The performance indicators are just that, indicators of achievement or otherwise of objectives. However, the lead agencies identified for each objective, in conjunction with the CCC, need to determine what change in the indicator represents acceptable progress toward the objective.
- In designing performance indicators, the resources and effort needed to determine the indicator need to be considered. There is no point in coming up with performance indicators that are impossible or very expensive to measure. Preferred indicators include those that are currently being monitored or can be readily assessed.

An additional optional section on outputs could be included.

Outputs

Outputs need to be framed within the context of the whole catchment and have applicability in the catchment. Specific outcomes need to take the form of
- Policies for use by local and state government, industry groups and other agencies.
- Guidelines for the use and management of natural resources in the catchment.
- Operational plans to redress or prevent degradation of loss of value with natural resources in the catchment.
- Institutional arrangements necessary to achieve better use and management of natural resources.

Implementation

This section should outline the various mechanisms and structures to be used in implementing the strategy. A good example is contained in the strategy prepared by the Johnson River CCC.

Evaluation and Review

Evaluation and review of the performance of the strategy should be built in from the start through the actions and performance indicators. However, there is an additional need to describe how the implementation of the strategy will be monitored so that appropriate changes can be made if necessary.

Preferred Structure of Catchment Management Strategies

Section	Contents	Size (pages)
Introduction	Set the scene, history, mention issues, directions	1
Summary	Stand alone description of the strategy	2
The Catchment Coordinating Committee	Describe who is involved, interests, roles of committee	2
Catchment Management Strategy	Goals/objectives of this document	0.5
Vision for the catchment*	A brief statement which captures a description of the catchment in 50 years time. It should reflect common values eg. quality of life, prosperity, conservation.	0.5
Issues	For each major issue (between 4 and 8), a brief description of the issue, its scope and causes	0.5 per issue
Strategies	For each major issue, objectives and outcomes are defined, strategies stated and actions outlined. Performance indicators for the objectives are also described	2 pages per issue
Implementation	Future role of the committee. Who does what about putting the actions in place.	3
Evaluation/Review	Describe how progress in getting the CMS implemented will be monitored	1
	Total	20-30

*Could be in the form of a series of principles

4.2.7 Catchment Management Strategies Guidelines 1999

Essential Characteristics of Regional and Catchment Management Strategies

Michael O'Brien
(Source: Queensland Department of Natural Resources, March 1999 - Draft document)

Characteristics of Effective Resource Management Strategies

Introduction

This checklist identifies a range of characteristics that relate to the document context and process associated with developing an effective resource management strategy. It is derived from a number of documents related to the preparation of resource management strategies, including:

- Australian Local Government Association. 1997. *Regional Environmental Strategies: How to prepare and implement them*;
- Greening Australia. 1997. *Regional Strategy Checklist: Essential Characteristics of Natural Resources Management Strategies*; and
- DNR. 1998. *Interim Guidelines for the Development of Natural Resources and Biodiversity Conservation Regional Strategies*

The checklist is intended as practical tool for use during the development of a resource management strategy. It identifies key content that should be presented in an effective strategy, and gives an indication of the philosophy and key processes that lie behind effective resource management. This checklist is intended to compliment a range of publications that may be of assistance in the preparation of a resource management strategy.

What is necessary for preparing an effective management strategy?

The preparation of an effective regional or catchment management strategy involves a synthesis between the processes used in preparing the strategy and the actual content within the finished document.

It is essential that a comprehensive process of community and government involvement and consultation takes place, in order to clearly define a regional vision, and to identify the key management issues within the region. Additionally, adequate community consultation, followed by the seeking of endorsement by community and government will help to ensure that the community and government accept the actions outlines within the strategy. It also helps to establish that community and government agencies or groups are made accountable, with actions able to be signed off upon completion by the appropriate agency or group. Equally important is that process of ongoing benchmarking and collection of information, which will ensure that the resource inventory for the region is continually improving, and that monitoring and review throughout implementation of the strategy leads to the development of appropriate future management actions.

However, process alone does not guarantee an effective management strategy. It is also necessary to provide within the strategy sufficient background information to clearly identify the region, its patterns of development and the particular natural resource issues that are to be managed, and to then put those issues into their proper context. It is also necessary to include enough detail of the various stakeholder groups so that their role in the overall development and implementation of the strategy is clear. This professionals and the community to understand and that lends itself towards achieving effective natural resource management.

Why use a checklist?

During the preparation of a management strategy, it may be useful to have at hand a checklist of the key requirements, particularly if the strategy is being prepared with a view towards having is assessed and endorsed by government and/or planning agencies.

By using such a checklist, it is much easier to ensure that important processes have taken place, such as sufficient community, consultation and endorsement, or to make certain that the structure and content of the document contains all the necessary information. This may include a regional background, identification of the regional vision, identification of issues, setting of management objectives , and evidence of accountability for management actions under the strategy.

Characteristics of effective Regional and Catchment Management Strategies

What type of information should the strategy include and/or identify?

VISION
- Is the regional vision adequately and clearly defined?
- Is there a timeframe identified in which to achieve the vision? (consider short, medium, long term)

VALUES
- Do the values identified reflect the social, economic, environmental and cultural significance of the region?
- Does the strategy identify the way in which these special values will be addressed and managed for?
- Has the significance of each value been clearly identified in relation to the local, regional, state, national or international values?

KEY ISSUES
- Have the key issues of importance within the region been identified? (issues should be defined according to the current regional situation and the desired situation, encompassing economic, cultural, environmental and social aspects)
- Have these regional issues been prioritised?
- Have specific limitations in achieving the objectives of the strategy identified and addressed, if they exist? (consider specific resource needs and availability)
- Is the timeframe for implementing the management strategy identified?
- Have the key regional issues and their management been related to similar issues at the state and national level?

OBJECTIVES
- Are the objectives clear and easily understood?
- Is it clear that the objectives work towards achieving the vision?
- Are the management objectives in agreement with the broader planning and management framework for the region?
- Have the objectives been prioritised appropriately?
- Do the objectives lead to the clear development of actions now and in the future?

PRINCIPLES
- Is the strategy consistent with the overarching principles of effective resource management (eg. ICM, ESD)?

STRATEGIES
- Have previously successful strategies to deal with issues been identified?
- Is there evidence that the necessary partnerships to deal with issues have been established?

What is an effective resource management strategy?

The following issues need to be considered in order to produce an effective management strategy.

PURPOSEFUL
- Are the reasons behind the strategy's development communicated clearly?

- Have the pressures for change been highlighted?

VISIONARY
- Is the vision held in common and supported by the majority of the stakeholders?
- Is the timeframe for implementation of the strategy appropriate for achieving the:
    *Vision
    * Goals
    * Objectives
- Does the strategy promote a proactive to achieving the desired outcomes?

INFORMATION BASE
- Have information gaps been identified?
- Has the opportunity to fill information gaps by utilising the knowledge of stakeholders as a resource been investigated?
- Has the integrity of the various data sources for economic, social, cultural and ecological processes been documented?
- Has the current understanding of processes been documented?
- Is there confidence in the integrity of the information contained in the strategy, and in information used in its development?

SYSTEMATIC REGIONAL APPROACH
- Have external impacts or flow on effects resulting from the strategy been identified?
- Has compromise been made between the social, cultural, ecological and environmental objectives to ensure acceptance by the community?
- Does there need to be a systematic and systematic perspective of the region?
- Does the strategy focus on a variety of regional issues?

INTEGRATED
- Have all other plans and strategies (all scales) appropriate to the management of the region been identified and their role integrated into the strategy?
- Has the hierarchy of the related plans been identified? (consider the priority of implementing the strategy in relation to other regional plans)
- What are the existing priorities and strategies within the organisations that are required to support the implementation of the strategy?
- Have the constraints, difficulties and limitations in linking this strategy with other plans been identified?
- Have possible resolutions to these been suggested?
- Does the NRM strategy conform to the statutory plans used by local and state government when dealing with development pressures?

SCALE
- Does the strategy address the issues at an appropriate scale to ensure effective management?
- Have mechanisms been provided to address issues across legal boundaries?
- Has the future role of the strategy in the management of the region been identified?

FOCUS
- Has the strategy aimed to achieve a balanced approach towards satisfying the rights of current and future generations of all stakeholders?
- Have the overriding foals of the strategy remained consistent throughout its development?

ACTION ORIENTED
- Does the strategy aim toward the identification of appropriate and 'do-able' actions?
- Do the prioritised objectives provide a good sense of direction for action plans to be developed from?

GENERATION & EVALUATION OF OPTIONS
- Have a variety of options and alternatives for addressing issues been identified?
- Have the positives and negatives of each alternative been documented and evaluated?
- Have the costs and benefits of each option (as they relate to environmental, social and economic resources) been considered?
- Have options been prioritised in an appropriate yet flexible manner?

ADAPTIVE
- Is the strategy adaptable to ongoing improvement and reshaping resulting from evaluation and feedback during all phases of the strategy?

COMMUNICATION
- Are the key messages clearly and effectively communicated to the reader?

STAKEHOLDERS
- Have all the relevant stakeholders been identified (eg. community interest groups, NGOs, Government agencies, Indigenous groups etc …)
- Was the stakeholder input reflective of the importance of developing a regional strategy?
- Have the responsibilities of the various stakeholder groups been clearly defined and endorsed (signed off) by them?
- Has a lead agent been identified and accepted by the stakeholders as responsible for coordinating and promoting the endorse strategy?
- Has the stakeholder involvement been consistent and facilitated through appropriate methods through all stages of the strategic plan (ie. planning, implementation, review phases)
- Do community members respect the creditability of organisations and agencies involved in the strategy?
- Have the stakeholder groups that already deal with particular issues (if they exist) been identified?

ENDORSEMENT SECTION
- Have written endorsements from all stakeholders supporting and committing to implementation of the strategy been obtained?
- Has the priority of implementing the strategy within the leading organisations been indicated, given prior responsibilities?
- Is there a process of conflict resolution to the alleviate concerns of stakeholders who may not necessarily be prepared to endorse the strategy?

COMMUNITY CONSULTATION
- Has sufficient and effective consultation been carried out throughout the planning, implementation and evaluation stages?
  Consider: appropriate time and resources committed, suggestion and promotion of mechanisms to facilitate feedback throughout the life of strategy.
- Was the method of community consultation appropriate for the various stakeholder groups involved?
  Consider: education and literacy levels, knowledge of topics, facilitation and promotion method, potential conflicts, objectives of consultation made clear from onset, local relevance of issues, representatives for stakeholder groups communicated outcomes effectively
- To what degree have the consultation methods fostered an atmosphere of community ownership and commitment? (Reflected in the stakeholder signatures in the Endorsement Section and in acceptance of responsibilities for carrying out actions)
- Has justification been provided for those issues where public participation was not used?

MONITORING AND EVALUATION
- Has a framework for monitoring and evaluation of the planning, implementation and review phases been provided and is it appropriate?
  Consider: does it provide feedback and confirmation to the stakeholders, satisfy decision-making needs and is it realistic given available resources?
- Have appropriate performance indicators been suggested to measure the effects of implementation of the strategy?
- Does the evaluation method provide a balanced mix of tools to determine the costs and benefits if management initiatives to be implemented?
- Is research encouraged throughout the strategy to fill information gaps and to facilitate ongoing sustainable development?

Evaluation and endorsement of Resource Management Strategies

A key element in the preparation and implementation of resource management strategies is the need to gain endorsement at a State Government level, which ideally involves a comprehensive and rigorous yet standardised evaluation process. The following set of evaluation criteria has been developed with the intention of addressing concerns and problems associated with the consistency and subjectivity of current evaluation procedures, and is intended to provide a useful tool for the evaluation of resource management strategies throughout the state. They are primarily for use by the LCMC in assessing management strategies, however, in the interests of transparency in the assessment process, it is seen as beneficial to make the criteria available to regional and catchment groups.

In order to further standardise and streamline the assessment process, the criteria also include a "Statement of Compliance", which is to accompany the completed strategy document upon submission. It provides a means for the groups to identify how and where in the document they have addressed each of the criteria, and to make any other comments that relate to getting their strategy endorsed.

The criteria are intended to complement 'Guidelines for the Development of Natural Resources and Environmental Conservation Regional Strategies' (Elliot 1998), prepared by the Queensland Department of Natural Resources. This document serves to guide the preparation of resource management strategies in a way that will facilitate not only more efficient endorsement of such strategies, but also general improvements in the preparation and implementation of resource management initiatives throughout Queensland.

These criteria are designed to be easily applicable and efficient in assessing the content of and processes undertaken in developing a management strategy. It is critical to note that these criteria represent a decision tool to aid in assessment and endorsement of regional strategies, but they are not the only indicators of an effective strategy. By providing strategy groups with these criteria, and explaining how they are to be used by the assessment panel, it is hoped that there will be greater understanding of and transparency in the assessment process.

How to use the Criteria

The criteria provide for the assessment of each strategy document based on the actual content contained therein, and on evidence provided of the processes that have been followed in developing the strategy. Key aspects of a strategy or steps taken in its preparation are listed in the far-left column. For each of these, one or more questions about the strategy are asked. These help to focus attention on to a particular topic or issue, and also help ensure that all of the people assessing the strategy are looking at it from essentially the same point of view.

For each of these questions, there may be one or two sets of possible criteria, spread across a range of scores, which in turn relate to the standard of the strategy in that area. Where one criterion is contained in its own cell, it is to be considered independently of all other criteria. Where two criteria are contained in one 'box', but separated by 'And/or', they may be considered independently or together. This allows for an assessor to allocate a score within a bracket: eg. meeting both criteria in the high bracket may result in a score of 5; meeting only one criteria in the same bracket may only result in a score of 4.

For example: The Introductory Section has two separate criteria in each of the high and low score brackets. These are to be considered independently. The middle bracket has two criteria separated by 'And/or'. A strategy may meet one or both of these criteria, and the degree to which this occurs will result in a score ranging from 2-4.

Each question on the criteria sheet, regardless of how many 'criteria' there are, receives only one single score (one box: one number). In this way, the score that the strategy receives for each question is based on the degree to which the strategy meets the range of criteria, as in the example above.

Each individual aspect of a strategy to be considered in the assessment is given a weighting or priority, according to its relative importance in the overall finished strategy. For instance, although it is a useful and necessary part of the physical document, the introductory section has a lesser priority with respect to endorsing the strategy than does evidence of adequate community consultation and acceptance. A high weighting requires that the initial score be multiplied by 3, medium by 2 and low by 1.

The weighted score for each criterion is therefore determined by multiplying that the initial score for each criterion by the appropriate weighting factor. The maximum score a strategy could receive is 250; the minimum score that is required for a strategy to receive interim, endorsement is 150 (or an unweighted score of 3 for each criterion). The last aspect, which is 'Readability of the document' involves a qualitative rather than quantitative assessment, and is simply an indication of whether the document is 'user friendly' and effectively communicates the message to the reader using a variety of written and visual communication methods (text with maps, diagrams, tables, etc where useful). However, it is not the final score, but rather the comments generated through the assessment process that serve the most useful role in determining the quality of a strategy.

Form 1: Strategy Endorsement Criteria - Version 4 March 1999

Endorsement Criteria	Questions	Little or no improvement required	Strategy would benefit from Improvement	Significant improvement required	Score	Weighting	Weighted Score Low (score x1) Medium (score x2) High (score x3)
Introductory Section	Does the introductory section provide a sound foundation for interpreting the strategy?	Document provides reader with a very clear understanding or the rationale behind strategy	Introductory section provides reader with general understanding of regional management issues - **And/or** Sufficient information is provided to give the reader a basic regional overview	Introductory section lacks adequate structure and is misleading to the reader		Low	
		Introduction presents a well-defined regional overview which is descriptive and relevant		Regional overview is of minimal standard or is completely missing			
Integration	Does the strategy integrate with other plans, strategies and resource management initiatives applicable in the region?	Effective multilateral integration with existing plans & strategies. Clear evidence of understanding of the hierarchy of other plans or strategies	Some attempts at integration with existing plans & strategies. Evidence/understanding of hierarchy of other initiatives is adequate	Weak integration. Hierarchy of plans not provided.		Medium	
		Constraints & limitations of linking with other strategies are clearly identified	Poor identification of constraints & limitations of linking with other strategies.	Constraints & limitations of linking with other strategies are not identified.			
Information Base	Is the information base documented?	Information base & integrity of data is thoroughly assessed & detailed and fully supports management objectives	Sufficient detail of information base & integrity of data provided to support management objectives	Little of any detail of information base & overall integrity of data documented		Low	
	Have opportunities to fill information gaps been investigated?	Comprehensive identification of information gaps (if they exist), with clear identification of information sources to fill these gaps	Some information gaps have been identified.	Few information gaps (if any) have been identified		Medium	
		Clear attempts to integrate scientific & community knowledge to achieve effective resource management	Information sources to fill these gaps identified but with limited integration of scientific and community knowledge attempted	Little knowledge of available information sources with little or no attempt to integrate scientific & community knowledge			

Endorsement Criteria	Questions	Little or no improvement required	Strategy would benefit from Improvement	Significant improvement required	Score	Weighting	Weighted Score Low (score x1) Medium (score x2) High (score x3)
	Is there an ongoing process of resource assessment and adding to the resources inventory?	Extensive and ongoing collection of information with excellent benchmarking of standard and extent of available information for use in review process.	Some evidence of ongoing improvement of resource and information inventory - Adequate use of benchmarking into requirements for future information capture	Minimal (if any) evidence of ongoing improvement of resource and information inventory. Little or no use of benchmarking techniques		High	
Vision/values principles	Is the vision clearly defined and based upon the values within the community?	Clear definition of regional vision, with strong evidence of community input.	Vision is stated, and shows evidence of community involvement.	Development of vision is not clearly apparent, with little evidence of community involvement		High	
	Does the strategy follow the basic principles of effective natural resource management (eg. Integrated Catchment Management, ESD)?	Overarching principles of NRM have clearly been considered and are evident throughout management initiatives.	The strategy shows evidence of consideration of essential principles of NRM.	Minimal evidence of consideration of essential principles of NRM		Medium	
	Does the overall strategy represent an Integrated and evenhanded approach to resource management within the region?	Thorough & unbiased consideration of social, economic, cultural & environmental elements specific to the region	Adequate representation of the social, economic, cultural & environmental elements of the region.	Clearly some elements of concern have not been considered		Medium	
Objectives/key issues/strategies	Do the objectives, issues and strategies work together to achieve the desired outcomes?	Objectives, issues & strategies are strongly related & complement the broader planning & management framework.	Moderate relationships evident between objectives, issues and strategies. Some conflicts present with the governing planning & management framework.	Little attempt to ensure consistency between objectives, issues and strategies		High	
		Objectives & strategies are realistic & achievable given timeframe & resources	Most objectives & strategies are achievable given timeframe & resources	Practicality of objectives & strategies is questionable			
	Are the issues, objectives and strategies prioritised with justification of method?	Issues, objectives & strategies are clearly prioritised **And/or** Method of prioritisation is clear, transparent, equitable and well documented.	Majority of issues, objectives & strategies are prioritised **And/or** Prioritisation methods and their justification are not easily understood	Little or no attempts made to prioritise objectives, issues and strategies **And/or** Little attempt to justify methods of prioritisation applied		High	

Endorsement Criteria	Questions	Little or no improvement required	Strategy would benefit from Improvement	Significant improvement required	Score	Weighting	Weighted Score Low (score x1) Medium (score x2) High (score x3)
	Does the strategy provide the necessary direction for resource management in the region?	Objectives address all key issues, and provide strong strategic direction for achieving planning outcomes and meeting the regional vision.	Objectives adequately address regional issues, and provide a good direction for achieving planning outcomes and the regional vision.	The document provides generally weak direction for achieving planning outcomes and meeting the regional vision		High	
Implementation/ Monitoring and review	Has a process and framework of monitoring and review been suggested for implementation?	Monitoring & review programs are realistic and suitable for the purpose of the strategy	Adequate monitoring & review programs suggested	Monitoring & review programs, if present are inappropriate for the strategy		High	
		Relevant and realistic performance indicators specified for all key outcomes detailed in the plan.	Performance indicators specified for the key outcomes are acceptable but their relevance is not clearly identified.	Performance indicators (are not) specified for key outcomes (and/or) have little relevance and lack realism		Medium	
	Has a reporting framework for signoff of actions during and after each stage of implementation been established?	Reporting requirements identified and framework clearly established.	Reporting requirements are identified, with some discussion of reporting mechanism.	Limited or missing identification and discussion of reporting framework		High	
	Has a synopsis or detailed set of action plans guiding the implementation of the strategy been provided?	Synopsis covering directions and guidance towards achieving on-ground results **or** Extremely clear & proactive set of action plans for guiding implementation	General synopsis explaining the guidance of the strategy to on-ground actions **or** Action plans outline in a general sense the direction of the strategies and some on-ground direction	Limited detail on how on-ground activities will be undertaken **or** Action plans, if present, provide minimal guidance for on-ground activities		Medium	
	Has the RSG identified its limitations and capabilities, and the future roles of agencies and groups?	Limitations and capabilities in implementing the strategy clearly identified - future roles of agencies and groups clearly spelt out.	Capabilities or limitations of group identified - some indication of future roles	Minimal identification of capability of group to implement the strategy		High	
Endorsement/ community consultation/ stakeholders	Are stakeholders identified, involved and committed to the strategy at the endorsement level?	Detailed list of stakeholders and their involvement - role of other groups and agencies clearly identified and endorsed through partnerships and memorandum of understanding	List of stakeholders is not comprehensive - role of other groups or agencies is identified with some indication/evidence of level of endorsement	Few if any stakeholders listed with little evidence of their support		High	

Endorsement Criteria	Questions	Little or no improvement required	Strategy would benefit from Improvement	Significant improvement required	Score	Weighting	Weighted Score Low (score x1) Medium (score x2) High (score x3)
	Has an appropriate method of community consultation been utilised to develop the strategy?	Clear processes of community consultation identified and strong justification for the methods applied **And/or** Very high degree of community consultation and involvement in the development of the strategy	Processes of community consultation adequately identified, yet lacks justification **And/or** Adequate degree of community consultation and involvement in the development of the strategy	Little or no identification and justification of community consultation methods applied **And/or** Insufficient degree of community consultation in the development of the strategy		High	
	Has a process been identified to address any need for conflict resolution during development and implementation of the strategy?	Clear process for resolution of conflict	Some evidence of thought into conflict resolution techniques	Little or no mechanism for resolution of conflict		High	
Process appraisal	Have appropriate processes been utilised and applied throughout the development of the strategy?	All processes used throughout the development of the strategy are suitable and justified with additional detail where necessary	Some faults present with the processes applied to the development of the strategy. Overall still acceptable	Major faults with the processes utilised throughout the development of the strategy		High	
Readability of document	Is the document clear and concise, and easy to read?	Very good format - use of variety of methods to convey message - effective use of visual communication aids (tables, diagrams, maps etc)	Useful format with general readability being sufficient for document to be useful	Extremely poor format, logic and development of ideas difficult to follow		Qualitative (No Score)	TOTAL SCORE

Note:
Except where indicated through the use of And/or as a separator, endorsement criteria should be considered independently of others
A minimum interim level of endorsement would be based on a strategy meeting the middle level (some improvement necessary), or receiving a total weighted score of 150 (maximum possible score = 250)

Statement of Compliance

The statement of compliance is intended to provide strategy groups with a means of showing how and where they have addressed key requirements in preparing their strategy, and for assessment panel members to provide any additional comments or feedback. The SoC is based on the assessment criteria, and provides a strategy group with a number of questions to consider which relate to each aspect of the strategy to be assessed. It also provides a means for the strategy group to 'sign off' that they have covered each issue, and to indicate where in the document they have done so.

Form 2: Statement of Compliance

Endorsement Criteria	Questions	Considerations	Statement of Compliance	Relevant Section	Assessors Comments (to be completed by assessor)
Introductory Section	Does the introductory section provide a sound foundation to interpret the strategy?	Is there adequate rationale to interpret strategy, with sufficient background information and regional overview to identify and justify regional issues?			
Integration	Does the strategy integrate with other plans, strategies and resource management initiatives?	Does the document demonstrate understanding of hierarchy of related plans and strategies, constraints of linking with other plans; coordination between broader government policies and local action plans; consideration of coinciding with other management initiatives and/or international treaties?			
Information base	Is the information base documented?	Is there evidence of integrity of qualitative/quantitative data having been verified? Is information comprehensive in coverage? Have information gaps been identified? Is the information base sufficiently up to date to account for current management needs?			
	Have opportunities to fill information gaps been investigated?	Have issues relating to resource condition and impediments to change been investigated? Have information sources and the need for ongoing improvement of resource and information inventories been considered? Consider ongoing improvement of information inventory			
Vision/values/principles	Is there a clear association between the vision, values and management principles of the strategy?	Consider the relationship between each aspect, and whether continuity is attained between sections in achieving outcomes.			
	Do the vision, values & principles reinforce an integrated approach to the management of the region?	Is the regional vision clearly defined in the eyes of all relevant groups and agencies? Is there evidence of broad cooperative involvement and agreement across sectors of government and the wider community? Consider inclusion of social, economic, environmental, cultural and technological aspects.			

Endorsement Criteria	Questions	Considerations	Statement of Compliance	Relevant Section	Assessors Comments (to be completed by assessor)
Objectives/key issues/ strategies	Do the objectives, issues and strategies work together to achieve the desired outcomes?	Have key issues and their local importance been identified and prioritised? Do objectives complement each other; do they complement the broader planning and management framework; and do they provide the necessary direction for NRM in the region? Are key issues defined in terms of both resource condition, and cultural importance to these resources?			
	Are the issues, objectives and strategies prioritised with justification of method?	Are the approaches to prioritise issues and the means to address them suitable for ongoing regional management? Is there adequate justification for the allocation of priorities on issues and the means to manage for them?			
Implementation /monitoring and review	Has a process and framework for ensuring accountability, and for ongoing monitoring and review been suggested as part of implementation?	Have appropriate performance indicators been suggested to measure the strategy's effect on the social, cultural, environmental and economic trends of the region? Have desired outcomes and performance indicators for each strategy been defined? Is the process realistic?			
	Has a synopsis or detailed set of action plans guiding the implementation of the strategy been provided?	Is there provision for future actions? Are the action plans/synopsis realistic? Is there strong guidance and direction in developing and implementing action plans? Is there provision for signoff on completion of actions by the relevant organisations?			
	Has a synopsis or detailed set of action plans guiding the implementation of the strategy been provided?	Does the strategy lead towards the development and implementation of action plans to deal with priority NRM issues in the region?			
	Has the RSG identified its limitations and capabilities, and the future roles of agencies and groups?	Does the strategy identify the role of the RSG through the whole process? Has the RSG outlined any limitations in their ability to implement the strategy? Has the strategy provided details of the roles of other stakeholder groups and agencies throughout the life of the strategy?			

Endorsement Criteria	Questions	Considerations	Statement of Compliance	Relevant Section	Assessors Comments (to be completed by assessor)
Endorsement/ Community Consultation/ stakeholders	Are stakeholders identified, involved and committed to the strategy at the endorsement level?	To what degree has community consultation been essential to the development of the strategy throughout the planning, implementation and evaluation stages? Are appropriate time and resources committed to facilitate feedback throughout the life of the strategy? Is there the necessary level of endorsement from the relevant government agencies and organisations, and other necessary groups?			
	Has an appropriate method of community consultation been utilised to develop the strategy?	Was the method of community consultation appropriate for the various stakeholder groups involved? Was there sufficient attempt to obtain a wide spread of community representation, in consultation? Was the method of obtaining information valid and suitable given the significance of a regional strategy?			
Process Appraisal	Have appropriate processes been utilised and applied throughout the development of the strategy?	Consider attempts collect necessary background information and other data; prioritisation of issues and objectives, adequate consultation and community involvement, degree of assistance/direction from government agencies, evidence of seeking required endorsements			
Readability of document	Is the document clear and concise, and easy to read?	Consider terminology, inclusion of glossary; flow and structure; correct grammar and appropriateness of style			

4.3 Progress

4.3.1 Catchment Coordinating Committees

In 1992 there were three Catchment Coordinating Committees (CCCs) which expanded to thirty-two CCCs in 1997. CCCS are not recognised under legislation however, the committees are encouraged to be incorporated and most are formally recognised under the State government's ICM initiative. Membership of the recognised CCCS is diverse and the CCCS also have at least one officer from DNR as a member and active members from other government departments as well.

Membership of all recognised CCCs is diverse. All CCCs have part-time or full-time coordinators or administrators, which originally were provided by the State government, but CCCs are increasingly employing their own staff. However, they have at least one officer from the DNR as a member, and most committees have active members from other government departments as well. (Rowland and Begbie, 1997: 3)

Support for CCCs comes from a variety of sources. All endorsed groups of access to grants for establishing and operating the committee, although not all CCCs utilise the grants. Other CCCs receive a limited cash support from local governments as well as representatives from the local governments. Support is also received in kind, for example office space and administration from

some local governments and producer organisations such as 'Canegrowers' (Rowland and Begbie, 1997: 3).

Over 77% of the state is covered by catchment committees, the major areas not currently involved in ICM are the upper Burdekin catchment area, areas in Cape York, and some areas on the coastal south east. (Rowland and Begbie, 1997: 3)

4.3.2 What are the goals of a Catchment Coordinating Committee and What does a Catchment Coordinating Committee do?

(extract taken from: Queensland Department of Primary Industries (DPI). 1994. *Integrated Catchment Management - Guidelines for the Formation of a Catchment Coordinating Committee.* Queensland Government, Department of Primary Industries, Brisbane, p.13.)

What are the goals of a Catchment Coordinating Committee?

All CCCs need to have goals to work towards. Each CCC will need to determine its own goals, which may include the following.

- Promote community understanding of the interactions between land, water and related biological resources, and the value of a coordinated, catchment-wide approach for managing these resources.
- Minimise detrimental environmental effects due to the use of land, water and related biological resources, within and beyond the catchment boundaries
- Provide for ecologically sustainable development of river catchments in a constructive and balanced way
- Develop practical solutions to complex and interrelated problems in land and water use and management through public and government participation.

What does a Catchment Coordinating Committee do?

Each CCC needs to consider the work it may perform/ The functions of a CCC should include the following.

- Provide a forum for public discussions on catchment management issues identified by community action groups, agencies or members of the public.
- Foster communication and interactions between landholders, community action groups, local governments and government agencies.
- Identify important catchment-wide problems, and initiate or coordinate action to address these problems through the development of catchment management strategies
- Promote and use sound land and water management practices
- Receive briefings and reports, offer advice to government and semi-government bodies, and provide a direct link between the community and the State government
- Identify, encourage and foster the coordination 9and where necessary the integration) of government and semi-government agencies for key catchment issues

4.3.3 Guidelines for Obtaining Endorsement and Support Funding for Catchment Coordinating Committees

(Extracts taken from Queensland Department of Primary Industries (DPI). 1995. Integrated Catchment Management - Guidelines for obtaining endorsement and support funding for Catchment Coordinating Committees. Queensland Government, Department of Primary Industries, Brisbane, p.2-3)

What does it mean to be endorsed as a CCC or RCCC?

Once a CCC or RCCC has been established it can apply for endorsement. This gives them formal recognition by Government under the Queensland Integrated Catchment Management (ICM) Strategy. Endorsement provides opportunities for committees to access specific support available from the ICM initiative of the Queensland Government. This includes public liability and personal accident insurance, operating grants and project grants. To obtain endorsement, CCCs and RCCCs need to have features described in the following sections.

Catchment Coordinating Committees

Catchment coordinating committees should have the following features to be eligible for endorsement under the Queensland ICM Strategy:

1. They should cover an entire named river basin or a major sub-basin covering significant parts of at least two local government areas.

2. Membership should reflect the interests of the major sectors of the community including:
    - Local governments
    - Key relevant primary industry organisations (for example, Canegrowers, Graingrowers, fruit and vegetable cooperatives, commercial fishing organisations)
    - Landholders in proportion to the range of land uses in the catchment (for example, cane, fruit, hobby, urban, grazing)
    - State Government agencies
    - Community groups and organisations (for example landcare groups and service clubs)
    - Recreation and conservation interests (including recreational fishing)
    - Secondary industry (for example, millers, processors, light and heavy industry)
    - Major stakeholders outside the catchment where relevant (for example the Great Barrier Reef Marine Park Authority, downstream users, out of catchment users,)
3. Membership should be determined by open election or through nomination by community groups, agencies and the general public.
4. Achievable objectives should be set that are consistent with the functions of a CCC as outlined in the *Queensland Integrated Catchment Management Strategy*.
5. A whole catchment perspective should be taken rather than being restricted to a single issues such as soil erosion or stream bank revegetation
6. A demonstrated ability to be accountable for the administration of funds and the management of projects is important. This can be indicated by the committee being incorporated and having an active executive.

It may not be necessary for committees to completely fulfil all these criteria to be endorsed under the ICM Strategy. While an eligible committee should ideally meet all criteria, the Catchment Management Coordinating Committee is able to exercise discretion in the extent to which a CCC needs to meet specific criteria

Regional Catchment Coordinating Committees

Regional catchment coordinating committees should have the following features:

1. They should cover an entire river basin. These basins include the Burdekin, Fitzroy, Burnett, Brisbane, Murray-Darling (Queensland) and Lake Eyre river systems. The RCCC should cover the area of interest of at least two CCCs.
2. A majority of members must be representatives or nominees of CCCs in the basin or region. Additional members should represent major industries, organisations and community, professional and government bodies with a major role or interest in the management of the whole basin or region. All CCCs in a region or basin must be represented on the RCCC.
3. Achievable objectives should be set that are consistent with the functions of a RCCC as outlined in the *Queensland Integrated Catchment Management Strategy*.

4.3.4 ICM Groups in Queensland July 1999

Table: Progress of ICM Groups in Queensland July 1999

Group	Catchment	Formation Steering Group	Incorporated	Endorsed CCC	Catchment Management Strategy
Annan & Endeavour Catchment Management Group	North East Cape York				Strategic Plan for the catchment areas
Barron River Integrated Catchment Management	Barron				Barron River Catchment Management Strategy.
Border Rivers Catchment Management Association	MacIntyre, Weir, Moonie rivers			Yes	Endorsed. Part of the Murray-Darling Basin. Full time coordinator.
Bremer Catchment Assoc. Inc.	Brisbane		Yes		Draft.

Group	Catchment	Formation Steering Group	Incorporated	Endorsed CCC	Catchment Management Strategy
Burdekin	Burdekin-Haughton, Don, Ross-Black	Burdekin Dry Tropics Interim Catchment Management Steering Committee			Regional ICM/Landcare groups are developing three sub-regional strategy plans
Burnett Catchment Care Inc.	Burnett-Kolan		Yes	Launched on 21st August 1996.	In progress. Public comment early March 99
Caboolture Shire Council	Burpengary Creek, Caboolture River, Stanley River	July 1992, Caboolture Catchment Advisory Committee			
Cardwell Shire Catchment Coordinating Committee	Tully and Murray Rivers			Interim CCC was organised and endorsed by the Minister	Draft Tully/Murray Rivers Management Strategy
Condamine Catchment Committee	Condamine River and tributaries above Miles			Yes	Condamine Strategic Plan Endorsed Dec' 96 Part of the Murray-Darling Basin. Full time coordinator. Full review of strategy to take place in 1999.
Dawson Valley Association	Dawson River	Formed in 1991	Yes November, 11 1992	Yes	Dawson Rover Catchment Strategy For Endorsement (released Dec 1998)
Douglas Shire Catchment Coordinating Committee	Mossman-Daintree				Interim.
Fitzroy Basin Association	Fitzroy River Basin	Interim CCC formed February 1993.			Central Queensland Strategy for Sustainability (CQSS)
Herbert River Catchment Coordinating Committee	Herbert River	March 1993		Yes	Interim Full-time coordinator.
Hodgson Creek	Hodgson Creek	Pittsworth, Bambooya and Clifton Landcare Groups			In Progress
Johnstone River Catchment Coordinating Committee	North and South Johnstone Rivers	Formed in early 1991.		Yes	Pilot Study. Endorsed. Full time coordinator.
Lake Baroon Catchment Care Group	Obi Obi Creek above Baroon Pocket Dam				Endorsed. Within the Mary River catchment. Financial and facilitation support provided from the Mary River Pilot Study Project.
Lake Eyre Basin Coordinating Group	Diamantina Georgina Thomson Bulloo	Formed in 1995			In progress. Issues papers published Sept 1997
Lockyer Catchment Coordinating Committee Inc.	Lockyer Creek - part of the Brisbane River system	Formed in early 1991.	Yes	Yes	Draft. Pilot Study. Land use planning guidelines strategy released 29/3/94 Full time coordinator.

Group	Catchment	Formation Steering Group	Incorporated	Endorsed CCC	Catchment Management Strategy
Logan River	Logan River catchment	Logan River Management Coordinating Committee, December 1988			
Maranoa/ Balonne Catchment Management Association	Balonne River, the lower section of the Condamine, the Maranoa River and associated creeks	Formed 28th February 1993	Yes Incorporated on 28th Feb 1995	Yes	Maranoa-Balonne Catchment Strategic Plan Endorsed. Part of the Murray-Darling Basin. Full time coordinator.
Maroochy – Mooloolah Catchment Care Network	Maroochy River		Yes		In progress.
Mary River Coordination Association Inc.	Mary River		Yes	Yes	Endorsed. Pilot Study. Full time coordinator.
Mitchell River Watershed Management Working Group	Mitchell and associated rivers	Formed in 1990.	Yes	Yes	Pilot Study. Draft. Part time coordinator
Murray-Darling Basin Coordinating Committee (Queensland)	Paroo-Wallam Creek Condamine-Balonne Border Rivers-Moonie		Yes, June 1998		Natural Resources Management Strategy for the QLD Murray Darling Basin April 1993
Noosa River Catchment Management Committee	Sunshine Coast Catchment			Launched on 30 August 1996	In progress. Complete draft Catchment Management Strategy by June 1999.
North & South Pine Rivers Integrated Catchment Association Inc. (NASPRICA)	Sunshine Coast Catchment		Yes	Launched on 11 Feb 1996	Draft.
Pioneer River Catchment Coordinating Committee	Pioneer River and Sandy and Bakers Creeks	Formed in September 1991, completing its report in May 1992.		Yes	Pilot Study. Catchment management strategy released March 1994. Full time Coordinator.
Pumicestone Region Catchment Coordinating Committee	Brisbane		Yes		Draft
Russell/ Mulgrave Catchment Coordinating Committee	Russell and Mulgrave Rivers			Yes	Endorsed.
South West Natural Resource Management Group	Warrego, Paroo Rivers and east to Wallum Creek	Warrego/ Paroo CMA Inc	Yes	Yes	Natural Resource Management strategy. Aiming for endorsement by the LCMC. Part of the Murray-Darling Basin.
Southern Gulf Catchments Incorporated	Eastern Gulf Flinders Western Gulf		Yes		Draft Regional Resource Management Strategy

Group	Catchment	Formation Steering Group	Incorporated	Endorsed CCC	Catchment Management Strategy
Weipa Catchment Coordinating Group	West Cape York		October 1996		Dec '98 - close to completion of draft strategy
Whitsundays Rivers Catchment Management Association	Proserpine		Yes		In progress.

This information was derived from a number of sources:

- DNR Internal Report on the "Status of Catchment Management Groups in Queensland." 13 January 1998. Available from Don Begbie, Mineral House, Brisbane City.
- The Map "Queensland Catchment Strategy Boundaries".
- A guide to ICM in Queensland, June 1993, The State of Queensland DPI, Brisbane.
- A guide to ICM in Queensland, January 1991, The State of Queensland DNR

5. REVIEWS OF ICM IN QUEENSLAND

At the time of writing, ICM has been running for a decade in Queensland. (1990-99). During that time it has been continually evaluated and improved. Reviews have conducted at regular intervals by state agency staff supporting the program, most notably the major 1993 review. That was a "watershed" review confirming the relevance and success of the program and ensuring its continuation indefinitely. It could have died. Extracts from that review are included here.

Given that the Queensland ICM was experimental and substantially dependent on bottom up interest and commitment, the reviews focus not only on the overall success of the program, but ways to make it work better. The program was adaptive to feedback from the reviews. There was a growing cadre of experienced facilitators and catchment coordinators who contributed to this effort. Since 1995, the Queensland ICM program has organised a number of conferences and forums – especially targeted at the chairs of committees and the catchment coordinators with first hand experience of the operation of the program. They reviewed achievements and shared experiences as a learning opportunity for those catchments representatives and facilitators without the same level of experience. These forums were held at Maleny (1995), Rockhampton (1994), Cairns (1998) and Mt Isa (1999), the latter two combined with Landcare. Summary notes from those forums are included here.

There have also been a number of external reviews. In 1995, AACM conducted a nationwide review identifying the strengths and weaknesses of ICM programs in each state. The Queensland section of that review is included here. McDonald and Shrubsole and then McDonald Bellamy and Fereia conducted surveys of chairs and coordinators in 1995 and then again in 1997. Those repports are elsewhere in this series. The Rowland and Begbie review (1997) is also an important statement on the progess of ICM and is included in Section 3 of this document.

Further Reading

AACM International and Centre for Water Policy Research, 1995: *Enhancing the Effectiveness of Catchment Management Planning. Final Report.* for the Department of Primary Industries and Energy. AACM International Pty. Ltd. Adelaide..

Rowland, P. and Begbie, D. 1997. "Integrated Catchment Management in Queensland - an overview and review." Paper presented to the *2nd National Workshop on Integrated Catchment Management. ANU*, Canberra, 29 September

Queensland, Department of Primary Industries, 1993: Review of the Catchment Management Iniative.

ICM Coordinators and Chairpersons Reviews

CCC Forum Rockhampton, 1994

CCC – Mini Forum Maleny 1995

Inaugural Landcare and Integrated Catchment Management Annual Conference – Cairns

McDonald, G., and D. Shrubsole, 1997: "What You Told Us – A Survey of the Views or Queensland ICM Chairs and Coordinators Part 2 ICM in Queensland: History and Intent

5.1 Review of Catchment Management Component of ICM Initiative

Department of Primary Industries, 1993
("Review of Integrated Catchment Management Initiative", Ch.2)

Introduction

The economic viability and lifestyles of present and future rural and urban communities depend on the maintenance of a balance between economic development and conservation of natural resources. However, the ability of these resources to continue to meet our needs in the future is under threat due to a number of issues including:

- The impact of land use on water quality;
- Soil erosion and sedimentation of watercourses;
- Instability of bed and banks of watercourses;
- Salinity induced through clearing of vegetation;
- Loss of habitat on land, in rivers and streams;
- Flood mitigation and floodplain management;
- The impact of land and water use on coastal and marine environments;
- Productivity decline due to the degradation of land and water resources;
- Spread of weeds by water; and
- Increasing demands on land and water resources for agricultural, industrial, residential, transport and recreational uses and environmental conservation

These issues involve a number of people and organisations, including landholders and other resource users, government agencies, local authorities, conservation groups and rural industry groups, each of which is responsible for a different part of a river catchment or specific activities within it. In many cases, fixing problems such as these is difficult and requires coordinated action by a number of people and organisation and also requires a supportive legislative framework.

To address these complex issues and to provide an overall framework for the better management of the inter-related land, water and biological resources, the Queensland Government in 1990 launched a Catchment Management program as the key element of its ICM initiative

The Catchment Management program initiative involved:
- Creating community awareness of catchment management principles;
- Conducting catchment management pilot studies;
- Establishing a policy and coordinating framework for addressing catchment management issues; and
- Fostering catchment management programs in priority river catchments

Outcomes Desired
- All resource users and managers aware of river catchments and accounting for the interrelationships between natural resource in management decisions.
- Common natural resource management goals, strategies and coordinated action by community and government with river catchments.
- Sustainable and productive land and water use and balanced ecosystems

Goals

The goals of Catchment Management Program were:
- To improve community understanding of the relationships and interactions between natural resources and the need to manage these resources in an integrated way to achieve their sustainable use.
- To increase cooperation and coordination between government agencies, community groups and individual resource users in the integrated planning and management of natural resources for sustainable use
- To increase community responsibility for planning the integrated management of land, water and related biological resources for the sustainable and balanced use
- To increase community ownership and responsibility for implementing sustainable land and water use and management policies and practices

Strategies Adopted

To achieve the goals for the Catchment Management program, four broad strategic directions were adopted.

Community Awareness and Education
The sustainable and balanced use of land and water resources depends on landholders and other resource users, the community in general and government agencies and authorities having a sound understanding of the interactions between land and water, and of the need for a coordinated approach for addressing issues affecting these resources. The broad community was targeted to develop awareness and understanding of catchment management principles. Key strategies included:
- Preparing a communication plan for ICM in Queensland;
- Establishing a corporate identity for ICM;
- Preparing and distributing information on catchment management;
- Preparing educational resource materials;
- Promoting action learning programs on natural resource management; and
- Developing communication strategies for priority target audiences

Catchment Management Pilot Studies

A key strategy of the Catchment Management program involved the use of pilot studies to trial and promote an integrated approach to the planning, use and management of land, water, forests, wetland and related natural resources. Key strategies included:

- Establishing pilot studies in key catchments;
- Forming community-based Catchment Coordinating Committees (CCC);
- Assisting CCC to prepare catchment management strategies for addressing key issues;
- Providing a catchment coordinator to assist the CCC;
- Coordinating technical support to develop the catchment strategies;
- Conducting local community awareness activities to foster and encourage community involvement in natural resource management

Policy and Coordination Framework

The pilot studies were designed to evaluate different approaches to the preparation and implementation of catchment management strategies. The results of the pilot studies and experience in other States were used to develop a policy framework and coordinating mechanisms to provide for the on-going development and implementation of the Catchment Management program. This involved:

- Preparing a State ICM Strategy to provide the framework for an integrated and community-based approach to catchment management;
- Establishing the Catchment Management Coordinating Committee to guide the development and implementation of the Catchment Management program;
- Developing guidelines for the establishment and operating of Catchment Coordinating Committees;
- Encouraging the development of communication networks for transfer of natural resource management information within the community;
- Reviewing existing legislation and establishing a legislative framework; and
- Consulting with the broad community in the development of policies, guidelines and strategies.

Catchment Management Support in Priority Catchments

While catchment level activity was focused on the pilot study catchments, the education and awareness strategies were designed to promote a catchment based approach to the planning, use and management of land, water, forests, wetland and related natural resources in all river catchments. As the education and awareness strategies stimulated community interest, the following strategies were employed to provide support in priority catchments at a lower cost than that of the pilot studies:

- Fostering the formation of community based Catchment Coordination Committees in priority river catchments to prepare and promote local natural resource management strategies;
- Providing operating and establishment grants to community based catchment management committees; and
- Providing project grants to community based groups and local authorities to undertake catchment management projects in accordance with an overall catchment management strategy

Budget Allocation

Over the three year period of the ICM Special Allocation, a total of $2 927 000 was allocated to the Catchment Management program. Approximately $442 000 was spent on awareness and education, $1 209 000 on pilot study activities, $701 000 on policy and coordination, and $575 000 on catchment management programs. A summary of expenditure for each of the three years is presented in Table 2.1

Table 2.1 Summary of expenditure for the Catchment Management program, 1990 to 1993

	1990/91 ($'000)	1991/92 ($'000)	1992/93 ($'000)	Total ($'000)
Strategy				
Awareness/Education	106	114	222	442
Pilot Studies	94	426	689	1209
Policy Coordination	111	239	351	701
Catchment Management Support		47	528	575
Total	311	826	1 790	2 927

Results Achieved

Community Awareness and Education
Progress Towards Objectives
A Principal Extension Officer manages and leads the development and implementation of the promotional campaign. A temporary Graphic Artist and a temporary Extension Officer assist with the production of materials and delivery of the program. Major achievements include:

- ICM corporate identity established with Catchment Care resource folders, stickers, banners, signs and logo, June 1991;
- Catchment care brochure released, June 1991 (30 000 copies);
- Audio-visual ICM display developed for the ABC Green Train, June 1991 and visited by more than 20 000 people;
- Catchment Care education kits including students books, teachers guide, catchment poster and catchment game developed June 1991 and distributed to all schools in Queensland;
- ICM display updated for the Brisbane RNA show, August 1991 and 1992;
- ICM Strategy printed and released, October 1991, together with a Strategy Summary brochure (10 000 copies);
- Major displays on local ICM themes developed for Expo 12 (Gatton), Farmfest (Toowoomba), Agrotrend (Bundaberg), other major regional events at Mackay, Emerald and Rockhampton and more than an additional 40 other regional and urban events;
- Corporate identity established for three pilot study Catchment Coordinating Committees – Johnstone, Pioneer and Lockyer;
- Newsletter – "The Source – ICM News and Views" produced three times per year with a circulation of 5 000 copies;
- Community Awareness brochures developed for the Lockyer and the Pioneer pilot studies;
- Land use planning display developed for the Lockyer Resource Management Group;
- Communication strategy developed for ICM in Queensland, January 1993, identifying key target audiences for detailed communication plans;
- Video titled "Everyone lives in a catchment" produced for the Mary River pilot, march 1993;
- Integrated display planned for ICM and Landcare at the Rocklea Research and Education Centre, April 1993;
- Condition of River Catchments in Queensland report published, May 1993; and
- Pilot Waterwatch program developed and trialed in the Pioneer River pilot catchment in 1993.

A list of publications (including awareness and educational material) is shown in Appendix Ia.

Client Interest and Satisfaction

Community awareness and understanding of ICM has been significantly increased, as evidenced by an increasing and on-going demand for information about catchment management, for example:

- More than 20 000 people passed through the ICM display on catchment management at the 1991 and the 1992 Brisbane RNA exhibitions;
- The ICM display has been solidly booked by local community based groups for local shows and public events from February through to the end of June 1993;
- Over 500 people brought water samples for testing at an ICM water testing station on World Environment Day 1992; and
- The video produced about catchment management in the Mary River has been well received by the community in that catchment. In the 3 months since it was produced, over 300 people have viewed the video at public meetings and 150 copies have been distributed to community based organisations within the catchment.

Catalytic Effects
The increased community awareness has led to increased involvement in catchment management activities.

- An ICM sponsored study tour in June 1992 by Prof. Bill Stapp, University of Michigan, USA, to examine the development of water quality monitoring as an action learning school and community activity, has led to a pilot Waterwatch project in the Pioneer River pilot study area involving local schools, industry and community organisations and local authorities. The project attracted financial support of $10 000 in 1992/93 under the National Waterwatch Program, with continuing support expected in 1993/94 and beyond.
- Numerous schools and community groups have indicated a desire to undertake a Waterwatch program in their local catchments. External funding through the National Landcare Program has been obtained to develop appropriate materials, resource kits and methods for a major Waterwatch initiative in Queensland.
- Promotion of ICM activities has resulted in local authorities, river improvement trusts and water boards in catchments such as Logan, Caboolture, Maroochy, Fitzroy, Barron and Tully-Murray Rivers, using and ICM approach to address local catchment management issues and incorporating ICM principles in planning schemes.

Coordination and Cooperation

- Inter-disciplinary and inter-organisational working groups have been established to develop and promote the Waterwatch program
- An integrated proposal is being developed for an inter-active, educational display at the Rocklea Research and Information Centre.
- ICM displays and promotional material were developed in collaboration with officers in appropriate Government departments.

Pilot Study Catchments

Progress and Milestones Achieved

The following lists progress in achieving milestones in the pilot study catchments. A timetable with the major milestones is shown in Figure 2.1.

- Community- based Catchment Coordinating Committees were formed in the Johnstone, Mitchell, Pioneer Rivers and Lockyer creek. A catchment management steering group was formed in the Mary catchment in May 1993
- A comprehensive draft catchment management strategy was produced for the Johnstone River catchment. Issues addressed include land and water management and environmental concerns.
- Four draft "Code of Practice" have been developed for the beef, dairy, horticulture and cane industries in the Johnstone Pilot study.
- A four part report on the status of stream banks in the Pioneer Valley was produced.
- In the Lockyer Valley, a detailed strategy for land use in the catchment was prepared and is in the final stages of redrafting following extensive community consultation. Recommendations contained in the strategy are being used in the preparation of the Gatton Shire Plan.
- All Catchment Coordinating Committees in the pilot study areas have the services of catchment coordinators employed by the Department. They also have substantial support from the DPI and other government departments and agencies.
- A Geographic Information System for the Johnstone catchment was established and a 28 map "Atlas of Resources" was produced.
- A school and community based educational program "The River" was produced and is being trialed in the Mitchell Pilot study catchment.
- Community involvement in ICM activities in all pilot studies has substantially increased.
- All Catchment Coordinating Committees have representatives from various government departments as active members of the committee.
- Officers from most business groups in DPI, officers from other departments and researchers and academics from a range of institutions have been actively involved in the studies.

Figure 2.1 – Milestones in the ICM Pilot Studies

1990	-	Formation of Mitchell River Watershed Management Group
	-	Formation of Johnstone River Catchment Management Steering Committee
1991	-	Formation of Lockyer Valley ICM Steering Committee
	-	Formation of Johnstone River Catchment Coordinating Committee
	-	Johnstone Catchment Coordinator appointed
	-	Formation of Lockyer Resource Management Group
	-	Lockyer Catchment Coordinator appointed
	-	Johnstone River Catchment Technical Advisory Group formed
	-	Formation of Pioneer Valley ICM Steering Group
	-	*The River* educational program produced for the Mitchell River catchment
1992	-	Pioneer Catchment Coordinator appointed
	-	Formation of Pioneer Valley Catchment Coordinating Committee
	-	Johnstone River Catchment Centre established
	-	Mary Catchment Coordinator appointed
	-	Reports on stream bank stability in the Pioneer River released
	-	Draft document outlining Principles and Guidelines for Land Use Planning in the Lockyer Valley released by the Lockyer Resource Management Group
1993	-	Mitchell Catchment Coordinator appointed
	-	A computer based catchment model of the Johnstone River completed
	-	Release of Draft Catchment Management Strategies in Johnstone and Lockyer studies
	-	*Waterwatch* program initiated in the Pioneer River Study

Outcomes from the pilot study areas have shown that there are three distinct phases in catchment management. These phases are shown in Figure 2.2. In Phase 1 community awareness of issues increases and a catchment coordinating committee was formed. Phase 2 involved the preparation of a catchment management strategy for key issues, while Phase 3 involved community and government action in response to the strategy. This model will be used to guide the management of future catchment studies

A list of publications from the pilot studies is included in Appendix Ia.

Figure 2.2 Model Program for ICM Catchment Studies

Phase 1. Formation of Catchment Coordinating Committee

Activities include formation of a steering committee, community education and awareness and establishment of a representative catchment coordinating committee.

Phase 2. Strategic planning exercise

Activities include preparation of a vision for the catchment, identification of issues and development of objectives and strategies

Phase 3. Implementation

Activities include the implementation of Catchment Management Strategies. Preparation of action plans and implementation by stakeholders

Client Interest and Satisfaction

- Members of catchment coordinating committees give voluntary of their time and wear the total cost of participating in the studies. Attendance of members at meetings and other activities has been high. Many members contribute substantially of their time and expertise.
- Industry and local government interests, particularly in the Johnstone and Lockyer study areas, have made major contributions to the ICM studies. Their involvement is an indication of the community support for the ICM approach to addressing important resource management issues.

Catalytic Effects

- Over 327 man weeks of effort have been donated by senior community, government, industry and agency personnel to undertake ICM activities in the pilot study areas. Many of the people making this commitment are the leaders of community groups, local authorities and managers in government departments
- Landcare and other community groups have formed or have been stimulated to action by ICM studies in the Lockyer, Pioneer and Johnstone River catchments.
- A $500 000 research project (predominantly externally funded) investigating the movement of nutrients in farming systems have been commenced by the DPI in the Johnstone catchment as a result of the pilot study.
- Issues like riparian zone management, water quality, stream bank stability and the off-site effects of non-point run-off have become more important to a better informed community in the pilot study areas.
- Community interest in catchment management has increased and this is reflected in a recent edition of "World Around Us" on Channel 7. This edition entitled "Waters of out Life" featured the health of Queensland rivers and the important role of catchment management. Catchment management activity in the Johnstone River was featured.
- Many members of the DPI as well as other departments have increased their knowledge of and skills in public participation and community consultation through their involvement in ICM.

Cost Effectiveness of Delivery

- The Catchment Management program, while government led, has adopted a participatory and "ground up" approach. Increased knowledge and awareness of issues has stimulated voluntary action which otherwise would have required costly legislation and regulation. For example, in the Johnstone River, the cane, dairy, beef and horticulture industries are working on "Codes of Practise" which will be adopted by the industry organisations. While not compulsory, the influence of these initiatives by the industries themselves will carry substantial weight. Many of the changes recommended by these "Codes of Practice" are not currently controlled by legislation and it would be very difficult to do.
- Improved land use planning which will reduce land degradation, provide for growth while minimising the adverse social impacts, and reduce land use conflict will result from the ICM study in the Lockyer Valley. Other regional planning process do not appear to have the same potential, and are much more expensive exercises.
- In the Pioneer and Mary River catchments, strategies produced to address stream bank erosion have the potential to minimise wasted effort by better focusing attention of priority areas. Also, revegetation and riparian zone management to prevent stream bank erosion will reduce damage and restoration costs caused by flooding.

Coordination and Cooperation

- In all pilot study catchments, catchment coordinating committees have provided the only community forum for the diversity of interest involved in natural resource management to jointly address important issues.
- Catchment coordinating committees have provided a constructive mechanism for dealing with issues. While conflict has been encountered in the pilot studies, it has been confronted and treated such that positive outcomes have resulted.
- Working relationships established in catchment coordinating committees have flowed on to other aspects of community and government interaction.
- Many agencies and organisation (for example, 24 in the Johnstone) have voluntarily cooperated in various aspects of the studies in all pilot areas.
- Pilot studies have proved a useful vehicle to coordinate work by departmental and other agencies in the pilot catchments. For example in the Mary Valley the University of Queensland, Griffith University and DPI are cooperatively providing GIS information on important catchment issues.

A brief outline of progress in each of the Pilot Studies is provided in Appendix Ib.

Policy and Coordinating Framework
Progress Towards Objectives

- Formation of a State Catchment Management Steering Committee to oversee the development of a State ICM Strategy;
- Development of the ICM Strategy for Queensland, released in October 1991;
- Appointment of a Catchment Management Coordinating Committee in August 1992, with representatives from Catchment Coordinating Committees (CCC), industry, community and professional groups, government agencies and river improvement trusts and water boards;
- Guidelines developed for the formation of Catchment Coordinating Committees;
- Guidelines development for the payment of establishment and operating grants to community based Catchment Coordinating Committees;
- Policy and procedure developed for the provision of the catchment management project grants to community based catchment management committees; and
- Review of the need for ICM legislation in Queensland commenced as part of a broader review of Natural Resource Management legislation; and
- Draft priorities for catchment management activity in the State have been prepared by the Catchment Management Coordinating Committee. These are shown in Appendix Ic.

A list of policy and coordination publications is included in Appendix Ia.

Client Interest and Satisfaction

- A call for catchment management project grants in February 1993 resulted in 33 applications for funding, indicating widespread community interest in catchment management activities.
- In the two months after March 1993 release of policy and guidelines on operating and establishment grants, seven (7) applications for these grants indicating a high level of community interest in the program.

Coordination and Cooperation

- A multi-disciplinary task force has been established to review Natural Resource Management legislation in Queensland. Officers from Water Resources, Forest Services and Land Use and Fisheries Business groups of DPI are working with officers of the Departments of Lands, Environment and Heritage and Housing, Local Government and Planning to prepare issue and discussion papers on different aspects of natural resource management, including catchment management.

- ICM principles and structures have been incorporated into policies and discussion papers presented by other documents, SEQ2001 and other regional planning activities. For example, ICM principles are required to be followed in the preparation of Environmental Management Operation Strategies (EMOS) for the operation and rehabilitation of mine sites.

Catchment Management Support in Priority Catchments
Progress and Milestones Achieved.

- A Pilot Catchment Management Project Grant Scheme was established in 1993 to support local action directed at the preparation and implementation of CMSs.
- Significant interest in and use of ICM has developed in areas other than the designated pilot study catchments. Catchment management activity is occurring in over 11 catchment outside the pilot study areas. Figure 2.3 shows the increase in catchment management groups, both within the pilot areas and in other catchments.
- A Catchment Coordinating Committee in the Herbert River (the first non-pilot catchment) was established in March 1993. Four committees are seeking appointment in the Dawson River, Border Rivers, Warrego/Paroo Rivers and the Logan River catchments. Figure 2.4 shows progress and proposed milestones in conducting ICM studies in the pilot areas and other catchments.
- A strategy for Management of the Murray-Darling Basin in Queensland was released in March 1993.
- 16 Catchment Management projects valued at $368 000 were initiated by community groups, industry organisations, and local authorities in 1993. The ICM special allocation contributed $188 000 to these projects through catchment management project grants.

Publications relevant to catchment management are included in Appendix Ia.

FIGURE 2.3 CATCHMENT MANAGEMENT GROUPS IN QUEENSLAND

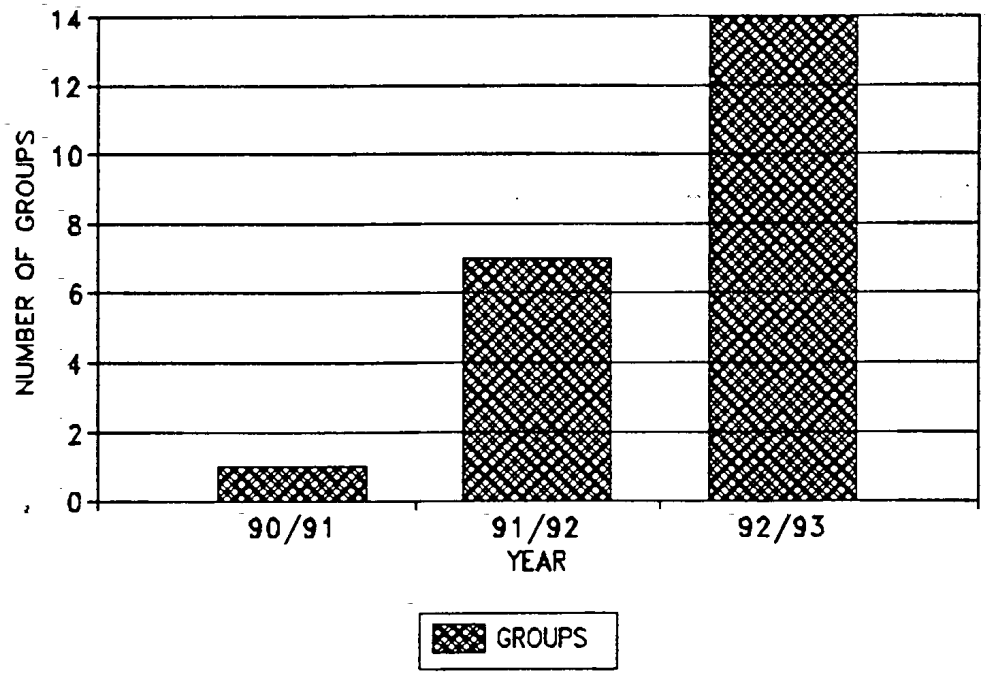
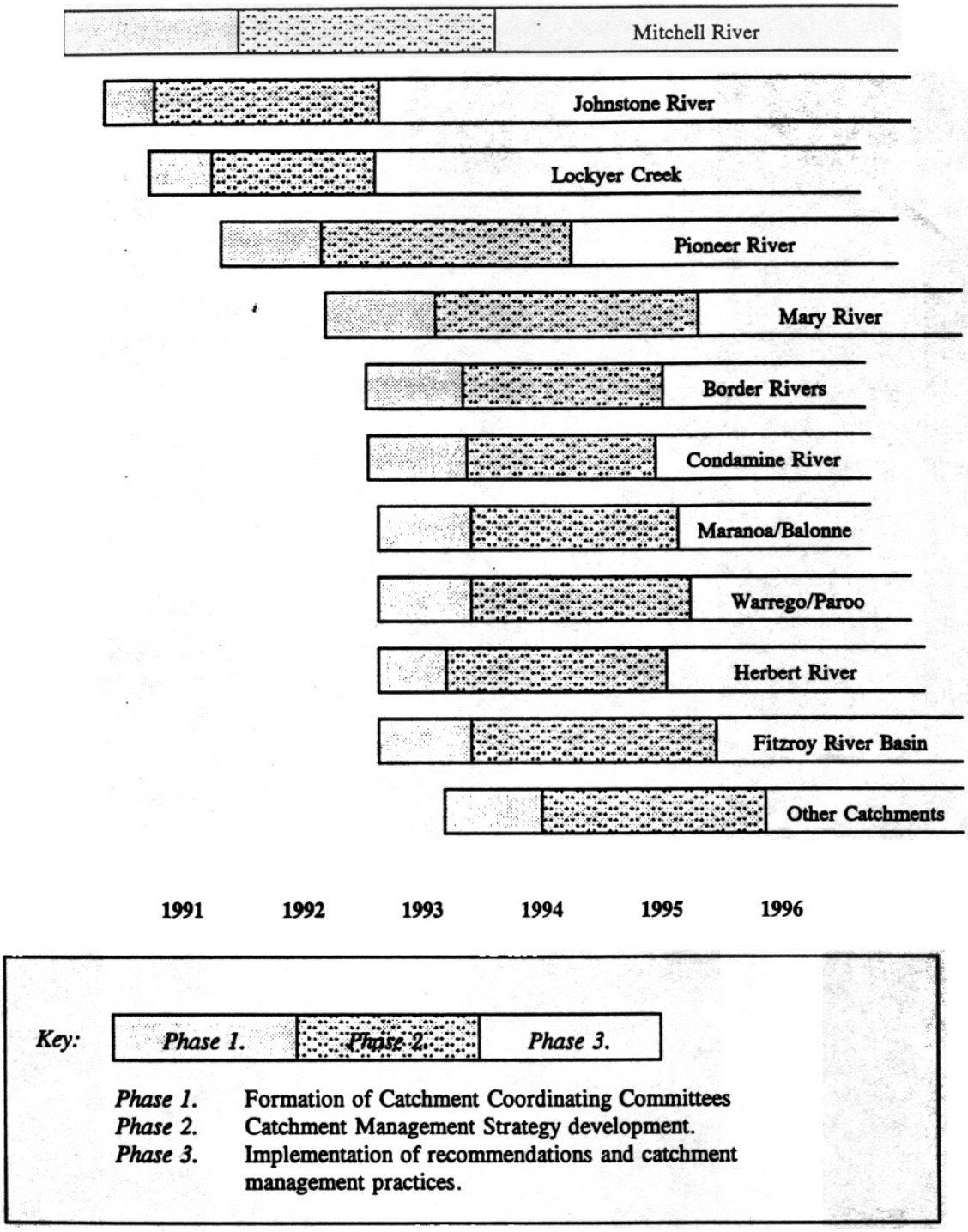


Figure 2.4 - Progress and proposed milestones in Conducting ICM Studies[1]



[1] **Note:** It is not possible nor practical to prepare catchment management strategies which address all significant issues in a catchment simultaneously. In a catchment, as significant problems arise, the planning and implementation cycle will be repeated a number of times.

Client Interest and Satisfaction

- ICM has proved a useful framework for many community based initiatives in natural resource management. For example, the Maroochy Catchment Area Network is using ICM to prepare a management strategy for the Maroochy River. The Dawson Valley Association is also using ICM to investigate possible development opportunities in the Dawson River catchment.

Catalytic Effects

Much of the activity in catchments outside the pilot studies has been initiated and largely resourced by community organisations and local authorities. DPI support and limited funding has provided the needed catalyst to stimulate considerable activity. For example:

- Caboolture Shire Council, through a catchment management group, is seeking (and getting) community endorsement of the need to retain key areas of remaining native vegetation as well as cultural and historical sites.
- A catchment management symposium on the Fitzroy River basin, held in November 1992, was organised by the local community. As a result of this symposium, an interim Catchment Coordinating Committee was formed in February 1993.
- The Queensland Branch of the Soil and Water Conservation Association of Australia organised a catchment management symposium and field tour in the Condamine River catchment in March 1993.

The availability of catchment management project grants has acted as a major stimulus for community based groups to seek external resources to undertake catchment management activities, for example:

- The Herbert River Catchment Management Coordinating Committee has obtained commitments from local authorities, industry organisation, statutory bodies and community groups to provided local contributions towards a catchment management project for their catchment. The Committee has also sought funds under the National Landcare Program to support this project.

Cost Effectiveness

- Catchment Management Project grants requires a 30% contribution by the submitting organisation. More often this ends up closer to 50%, making grants at least in terms of inputs, a very cost effective mechanism for achieving catchment management objectives. Many of these projects would require substantially more resources if they were conducted by the Department or by consultants. Local community groups are involving and obtaining input from a whole range of people and organisations who are not normally available to assists government departments to achieve common goals.
- It is difficult to value the local ownership that occurs as a result of project grants. For many ICM issues like stream bank re-vegetation and changes in land use, it is only through communities and individuals supporting a project that it is able to be conducted and achieve its goals.

Coordination and Cooperation

- In individual catchments, substantial cooperation and coordination between various interest sector groups has been achieved. For example, a catchment management group in the catchment of Baroon Pocket dam in the Sunshine coast hinterland has brought together dairy, conservation and urban interests. Jointly they are developing a catchment management plan to address blue green algae problems in the dam

Activities in catchments apart from the pilot studies are shown in Appendix Id.

Future Directions

The first stage of the Catchment Management program has focused on the formation of five (5) Pilot Study areas and the development of Catchment Coordinating Committees of catchment management strategies for priority issues in those catchments. Results from the Pilot Studies and initiatives in the first stage of the program have stimulated tremendous community interest and action in other key catchments.

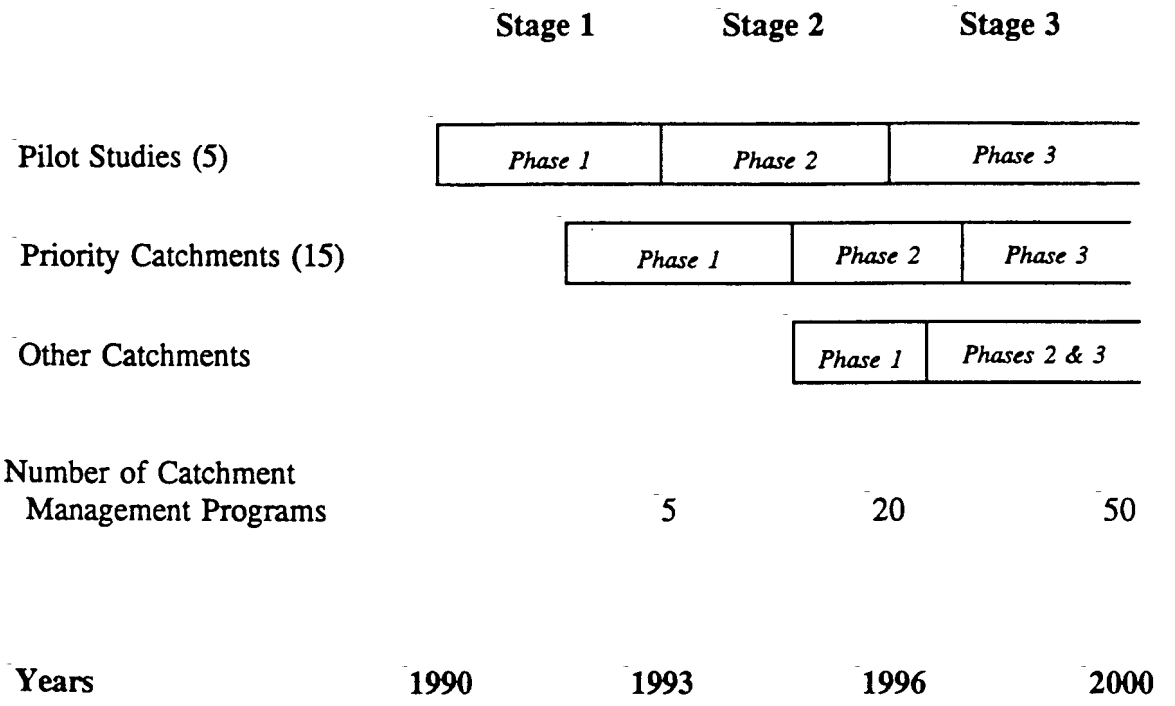
It is anticipated that Catchment Management programs will need to be adopted in approximately fifty (50) catchments or major sub-catchments to adequately deal with the catchment management issues currently identified. The Catchment Management Coordinating Committee has prioritised the river basins in Queensland as shown in Appendix 1c. These priorities will be used to guide the future direction of the program.

Based on the current funding allocation and community interest and support for ICM, the Catchment Management program will need to continue until at least the year 2000 to enable the program to be extended to all river catchments.

In the next stage of the program, emphasis needs to shift to implementation of the catchment management strategies developed in the Pilot Study areas and the development of strategies for key issues in fifteen (15) priority catchments. This includes the four (4) catchments in the Murray-Darling Basin and the Herbert River where catchment management program are currently commencing. This stage will take until about 1996.

The third stage of the program will then focus on strategies to encourage government departments and local communities, including local authorities, river improvement trusts, water boards and Landcare groups, to adopt a catchment management approach in undertaking activities to address key catchment management issues in the remaining catchments in the State. This will take until the end of the Decade of Landcare in the year 2000. An overview of the strategic directions for the Catchment Management program is presented in Figure 2.5.

Figure 2.5 - Strategic directions for the Catchment Management program



Key:

Phase 1	Community awareness, Catchment Coordinating Committee formation and catchment management strategy development
Phase 2	Implementation of catchment management strategies
Phase 3	On-going action planning, strategy development and implementation

During the next two stages, the DPI will continue to take the lead agency role for the Catchment Management program. However, local communities and industry organisations will play an increasingly important role in encouraging a catchment management approach and developing and implementing action plans.

Key Issues

- Community interest in the use of ICM to deal with a range of natural resource management issues is growing rapidly across the State.
- The considerable community effort expended in the development of Catchment Management Strategies has heightened expectations for action.
- Communities in the _Pilot Study areas have expended considerable energy in developing catchment management strategies and anticipate that Government support will continue for the implementation of these strategies.
- Local government planning and legislation controlling natural resource management are changing.
- Local authorities are playing an increasingly important role in controlling the use and management of vegetation and other natural resource as well as land.

- Valuable experience has been gained in the Pilot Study Areas and is available to be applied in other catchments.

In consideration of these key issues, catchment management in ICM will remain focused on the four existing strategic directions: Awareness and Education; Pilot Study Areas; Policy and Coordinating Framework; and Catchment Management Support.

Broad directions for the next three years
At the end of the next three years of the Catchment Management component of the ICM program, it is intended that the pilot studies will be essentially completed. Work will continue in the Pilot Study Areas particularly in the implementation of catchment management strategies but the level of funding through the ICM program will decrease.

Other catchment groups (in non-Pilot Study areas) will have made substantial progress in resolving significant catchment problems. These areas will become the primary focus of catchment management activity. Project grants and external funding sources will be used in the non-pilot areas to achieve outcomes similar to the Pilot Studies.

In three years the number of catchment coordinating committees will have increased significantly. Catchment coordinating committees will be operating with full policy and possibly legislative support. To complement this, it is planned that community and government awareness and understanding of ICM and their catchment will also have increased significantly. Funding support for Policy and Coordinating Framework and Awareness and Education will decrease as this is achieved.

Objectives for the next three years
The following objectives are proposed for the next stage of the Catchment Management program:

Community Awareness and Education
- Develop a communication plan for key target audiences.
- Increase awareness, understanding and support for ICM by local and state government and the community.
- Enhance community understanding and use of catchment management practices that address key issues identified in catchment management strategies.

Catchment Management Pilot Studies
- Prepare catchment management strategies for key issues in each of the pilot study areas.
- Evaluate catchment management activities in the pilot studies and highlight lessons learned in the planning and implementation of catchment management strategies.
- Initiate implementation of catchment management strategies for key issues by relevant government agencies, industry groups and the community.

Policy and Coordinating Framework
- For local authorities to implement suitable planning and regulatory conditions to assists in the achievement of objectives identified by catchment management strategies.
- Increase cooperation and coordination between government agencies, community groups and individual resources users in the planning and implementation of catchment management strategies.

Catchment Management Support in Priority Catchments
- Develop three catchment management strategies which focus on key issues each year for the next three years.
- Form effective and representative catchment coordinating committees in five catchments each year for the next three years.
- To have all relevant government agencies and industry groups actively involved in the implementation of catchment management strategies.
- Increase community ownership and responsibility for implementing sustainable land use and management policies and practices.

Strategies
Specific strategies designed to achieve the objectives for each strategic direction are:

Community Awareness and Education
- Promote ICM and specific issues in catchment management through the media and through public displays, newsletters and other methods.
- Assist Waterwatch activities in individual catchments by increasing community and government awareness of water quality issues.
- Develop and implement a statewide communication strategy
- Implement communication plans targeting the role of local authorities and state government in ICM.

Catchment Management Pilot Studies
- Facilitate and support the development of catchment management strategies for priority issues.
- Develop strategies and methods with catchment coordinating committees to enable the committees to obtain financial and technical support.
- Provide assistance in developing local and regional processes for the implementation of catchment management strategies.

Policy and Coordinating Framework
- Identify priority catchments for the development of catchment management strategies and facilitate the formation of Catchment Coordinating Committees.
- Provide technical support for Catchment Coordinating Committees through existing departmental and other agency personnel.
- Develop policies and procedures to ensure the implementation of catchment management strategies.
- Improve statutory mechanisms for the implementation of catchment management strategies through changes to existing legislation and by-laws and the production of new ones.

Catchment Management Support in Priority Catchments
- Provide project grants to community groups and local authorities to encourage catchment management activities and to enable their use.
- Formulate techniques and methods of community consulting to streamline the development of catchment coordinating committees.
- Provide training and educational opportunities for community groups to improve community ownership and responsibility for natural resource management.
- Lead and ensure the availability of resources for ICM activities in the Queensland section of the Murray-Darling Basin.

Outcomes
Application of the strategic directions are designed to produce the following outcomes.

Community Awareness and Education
- Substantial community and government understanding and support for ICM and catchment management strategies.

Catchment Management Pilot Studies
- Community based groups and organisations, industry organisations, government and statutory authorities will have commenced implementation of the strategies.
- Local authorities in catchments where catchment management strategies have been developed will have incorporated the strategies into their planning documents.
- Catchment Coordinating Committees will be self directed and less reliant on Department leadership and financial support.
- Significant improvement or resolution of the main issues identified in the catchment management strategies.

Policy and Coordinating Framework
- Planning and implementation activities of government agencies, community groups and individual resources users will be coordinated.
- Integrated policies and programs for the management of natural resources in catchments with catchment management strategies.

Catchment Management Support in Priority Catchments
- Catchment management strategies for key issues produced by Catchment Coordinating Committees within two years of formation.
- At least one significant catchment management issue resolved by each Catchment Coordinating Committees with two years of formation.
- Effective data bases on natural resources in catchments complied and available.

Milestones
The following milestones will be reached over the next three years:

Community Awareness and Education
- Waterwatch programs established in five (5) catchments by June 1994.
- Communication plan developed for key target audiences by December 1993.
- Communication plan implemented for local authorities by June 1994 and for key government departments by June 1995.
- Integrated educational display and program developed for Rocklea Information Centre by June 1994.

Catchment Management Pilot Studies

- Finalise draft land, water and fire management strategies for the Lockyer Creek pilot by June 1994.
- Prepare draft catchment strategies for the Mitchell, Pioneer catchments by June 1994 and for the Mary River pilot by June 1995.
- Arrangements made to implement the Johnstone pilot strategy by June 1994 and strategies for the other 4 pilots by June 1996.
- Review outcomes/approaches in the Johnstone and Lockyer pilots by June 1995.
- Review approaches used in all pilots by June 1996.

Policy and Coordinating Framework

- ICM statutory incorporated into Natural Resource Management legislation by June 1994.
- Guidelines for the formation and incorporation of catchment coordinating committees finalised by June 1994.

Catchment Management Support in Priority Catchments

- Additional five (5) Catchment Coordinating Committees each year.
- Catchment Management strategies developed by four (4) catchment in the Murray-Darling Basin and five (5) other priority catchments by June 1996.
- Training program for Departmental staff, community group leaders and Education Department regions developed by June 1994.
- Catchment management project grants provided for up to projects each year to eligible community based groups and local authorities.

Proposed budget 1993-96

Over the three year period, decreasing emphasis will be given to the pilot study areas as they complete the development of catchment management strategies. Emphasis will be given to the implementation of these strategies. This will be encouraged by the provision of catchment management grants to community based groups and local authorities.

Increasing emphasis will be given to priority catchments outside the pilot areas. This will be supported by the provision of operating and establishment grants and catchment management project grants. A relatively constant emphasis will be given to awareness and education to encourage the participation of key target audiences and the development of community based, action learning activities such as Waterwatch and resources for the Rocklea Research and Information Centre. An outline of the proposed budget is presented in Table 2.2. The anticipated level of contributions from external funding agencies and from local communities is also indicated in Table 2.2. Contributions from these sources are expected to increase over the next three years.

Table 2.2 Proposed budget for the Catchment Management program, 1993 to 1996

	1993/94 ($'000)	1994/95 ($'000)	1995/96 ($'000)	Total ($'000)
Special Treasure Allocation				
Awareness/Education	220	200	180	600
Pilot Studies	510	450	350	1 310
Policy and Coordination	300	270	270	840
Catchment Management Support	763	943	1 100	2819
Sub-Total – Special Treasury	1 793	1 863	1 900	5 569
Other Contributions				
National Landcare Program	500	620	700	1 820
Natural Resource Management Strategy (Murray-Darling Basin)	200	250	300	750
Waterwatch	90	90	90	270
Local Community Matching Contribution	350	450	500	1 300
Sub-Total – Other Contributions	1 140	1 410	1 590	4 140
Total	2 933	3 273	3 490	9 709

5.2 ICM Coordinators and Chairpersons Reviews

5.2.1 CCC Mini-Forum Maleny, 29 February 1995, Notes

Introduction

A meeting of representatives of interested CCCs was held on Sunday morning following the 'People Power in Catchment Care' Conference held at Maleny, 24-25 February, 1995. These notes constitute the minutes from the meeting. You are welcome and encouraged to use this material. The meeting, I believe, was worthwhile and some important learnings and concerns were shared.

Minutes

1. Achievements of CCCs – a brief description

Baroon Pocket Catchment Care Group – Peter Oliver
- 'People Power in Catchment Care' Conference
- Design and preparation of a joint project with Barung Landcare Group on water quality monitoring in Walkers Creek
- Demonstration of pasture management project

Mary River CCC – Steve Kelly
- working groups/sub-committees identified and formed
- Research forum to be held at Maryborough in April
- Cod forum this week. Workshop format to generate ideas for getting Mary River Cod back in the catchment. Recovery Plan being developed.
- Septic Tank Working Group is conducting a survey of councils in the catchment.
- Feedlot working group.
- Education and Awareness Working Group is holding Mary River congress. CCCs has written to councils requesting a $1 a ratepayer levy for Waterwatch Activities (Update: a meeting of Mayors of the council's in the catchment is to be held in late March to discuss this and other issues – meeting was initiated by the Mayor of Hervey Bay).
- MRCCC members reporting back to their industries has prompted several to generate policies on catchment issues.
- Catchment Management Strategies – is these a commitment to implementation?

Dawson Valley Development Association – David Barratt
- Office opened in Taroom as a resource centre.
- Draft strategy on water (including development options) is being prepared.
- Catchment Caravan to schools etc during March.
- Recent rain welcomed and has filled dams.

Lockyer Resource Management Group – John Atherton
- ICM coordinator re-appointed (70% time commitment)
- Pilot ICM Appraisal Study nearly complete.
- Fire Management Strategy nearly finished – need recommendations for various stakeholders (the stakes are probably a bit charred)
- Implications of guidelines of land use in local government plans being looked a through a project – consultant being sought.
- Kerry Hogan appointed to prepare water management strategy, includes Waterwatch program involving 200 bores.

  Operation Lockyer Revival Projects
  - landholder inventory of water related resource, 20 people collecting data; inventory and map to be prepared
  - Catchment Centre established in Hunt Street, Forest Hill. (Gaming Machine Benevolent Fund provided some $). Currently looking for a manager. Assured funding needed for proper administrative support.
- Chairman has done a lot of work (over 10hrs/week, 3 000km) over the 3 months without a coordinator

Condamine CCC – David Carberry
- Piggeries debate is hoting up
- Natural Resource assessment document being prepared.
- Landcare month – WIN TV promotion of catchment management

- Water Forum – March 15 – water requirements
- Wane in interest by some committee members. How can this be reversed?
- State of the Rivers study and RCS Hassall Sustainable technologies project completed. River Improvement Trusts doing a major scoping study. Interest from industry to take sustainable technologies project further.

Maranoa/Balonne CCC – Narelle Campbell
- Series of workshops held
  - kangaroo industry
  - weeds particularly parthenium
  - minerals and oil
- Work progressing on strategies
- 22 strong CCC – how incorporate?
- Phase 2 of the Lower Balonne Floodplain Management Program progressing
- Difficult for community members to remain motivated when there is insufficient operating funds for travel etc.

Herbert River CCC – Rob Hunt
- Mapping Consortium to prepare orthophotos and other projects
- GIS Consortium to use ARC INFO/ARC VIEW for a needs analysis
- Major cane expansion occurring
- Lot of time spent patching up problems caused by poor planning – problem with Department of Lands not consulting with other stakeholders.
- 5% catchment is cane, the rest is grazing
- Sub-group forming in the Upper Catchment

Pioneer River CCC – Grant Paterson
- Strategy in final throws – with referees
- Waterwatch going well
  - 1200 students/40 schools the aim for 1995/96
  - Plain Creek Project includes Sugar Mill, ethanol plant and sewage treatment
- Corporate support difficult to get
- Fine management strategy being prepared by DEH. Part-time person to be appointed.
- Fish re-stocking group (recreational) in six months has 200 members; $30 000 corporate funding; set up hatchery.

Warrego/Paroo – Lisa Herbert
- Lisa Herbert appointed coordinator; 3 weeks on the job
- CCC is 2 years old
- Meetings have stagnated recently; need to be social events
- Catchment tours were useful
- Working on pilot project for piping bore drains
- Local Radio Station has applied to MDBC for funding for publicity.

Border Rivers – Scott Sturgess
- Water Quality Monitoring project underway; tied to project in NSW.
- Common Qld/NSW catchment committee mooted; community support; bureaucratic difficulties.

Murray/Darling Basin RCCC (Qld) Scott Sturgess
- Draft strategy for CCC (Qld) prepared
- Action plans the focus at the sub-catchment level; driven by NRMS.
- Difficulties
- will strategies be taken seriously?
- collect data to avoid decisions
- Tour of Murray/Darling catchment being planned for later in the year.

2. Key Issues arising from reports/discussions
- Sourcing, interpreting and acting on data and information by CCCs and responsible agencies
- Administrative (including expenses) support for CCCs
- Departments and Government Agencies need to have stronger links with each other and CCCs.
- Keeping motivation of CCC members and preventing burnout
- Strategies and other documents – getting good comment and quality control.
- Government (Federal, State and local) commitment to recommendations of CCCs. (Focus particularly on federal and State government).

3. Revisit Rockhampton - Update

- Notes on the Rockhampton meeting have been prepared and circulated. Attention was drawn to the future achievements of CCCs working out at that meeting.
- Membership of the CMCC. Ken Stallman wrote to the Minister expressing concerns from the Rockhampton Forum over CCC representation on CMCC. A working party from the CMCC has been established to look at options and to solicit comments.

Legislation for CCCs. Two issues papers were circulated – ICM and NRM Statutory Bodies. These papers are to be considered by the NRM Policy Council on 28 February.

Considerable debate ensured and the following changes were recommended.

ICM

- Recommendation (3) that CCCs *'to be encouraged'* to prepare CMS; delete '*broad'*
- (4) 'CCCs *oversee* preparation of action plans etc'
- third dash; 'State government agencies and local authorities be required to formally *consider* CMS, etc' Note: Committees want feedback on why or why not their recommendations were/were not accepted.

NRM Statutory Bodies

- (3) 'That NRM Statutory bodies can be formed etc'.

Comments from the meeting were to be relayed by Philip Rowland to the Project Manager, NRM Policy and Legislation

The meeting recommended obtaining professional legal advice on the aspect of liability of members of CCCs

4. Strategies

Notes on catchment management strategies were distributed. Due to lack of time there was little discussion. However, there were a number of participants who spoke in favour of the preparation of strategies (although they may not be every keen about them) and could see some value in them. Concerns about implementation and the effort and resources needed to prepare strategies were raised.

Participants were asked to consider the notes and provide comments to Philip Rowland.

5. Implementation of ICM

A briefing paper prepared for the CMCC outlining a new initiative funding proposal for ICM was distributed.

The meeting was in general agreement with the proposal and the following arrangements were recommended.

- Groups and agencies develop action plans with support from CCCs.
- Funds to be allocated to CCCs for implementing action plans.

The meeting felt the credibility of CCCs would be enhanced by administering the funds. Concern was raised about the ability of CCCs to consider the environmental aspects of the impacts of the projects.

6. State Forum

It was recommended that a State Forum of all CCCs and RCCCs be held in September. Possible locations were Rockhampton or Emerald although no firm recommendations were made.

5.2.2 CCC Forum Rockhampton, 8 - 9 November 1994, Notes

Introduction

ICM and catchment coordinating committees have formally been under way in Queensland for four years. In this time substantial progress has been achieved, some mistakes were made and many lessons have been learned.

Ken Stallman, who has been involved in the ICM initiative in Queensland since 1991, suggested that there would be significant benefits in bringing many of those people actively involved in catchment committees together. The idea was canvassed with existing committees and the enthusiastic response led to a forum of catchment coordinating committees in Rockhampton on 8 and 9 November 1994.

While there is a very wide range of people involved in ICM, it was felt that more could be achieved by focusing on catchment coordinating committees – their achievements, aspirations and tribulations. The chair (or proxy) and the

coordinator of the 14 endorsed catchment committees in Queensland were invited. At least one representative from all committees attended.

These notes comprise the written output of the Forum. As many of the comments in the notes are brief, if you are interested in more detail please contact one of the participants or myself.

Overall, most participants considered the Forum worthwhile. I would welcome any comments from participants or others on the potential for future events of a similar nature.

Philip Rowland
State Coordinator, ICM

EXPECTATIONS OF ICM: What do you realistically expect ICM to achieve in the next 3 to 5 years?

SUMMARY
Horses for courses approach needed depending on catchment
Role in changing community (including government) attitudes
- is what I'm going to do going to adversely affect the catchment?
- what can I do to improve the catchment?

Maintain/enhancing ability to compete on world market (clean green produce)
Need to see that government agencies have picked up the paradigm of ICM and are running with it (Main Roads Dept. etc)
Governments need to talk to each other (inter-departmental)
A true working together between government and community
See catchment management groups in a self-sustaining base (not just the same 1 or 2 people putting in time)
- inherently self-maintaining

Taking long term view – government and politicians
CCCs provide the direction for the program
ICM groups do not have to be incorporate – liability covered by the State

ACHIEVEMENTS OF ICM: What do you realistically expect ICM to achieve in the next 3 to 5 years?

SUMMARY
- Credibility for CCCs through:-
  - performance
  - awareness and education
- Funding/resources for:-
  - implementation
  - group operation
- Awareness and Education of
  - ICM
  - Issues
- Implementing strategies
  - having a process
  - clear targets
  - monitoring – are we going in the right direction?
- Community ownership and involvement
- Government agencies (Local and State) incorporating ICM in their activities/planning
- CCCs have a clear direction and process for achieving their goals

CONSTRAINTS AND OPPORTUNITIES: What are the opportunities that can be built on the constraints to be overcome to assist CCCs meet their expectations?

SUMMARY

Constraints	Groups	Opportunities	Groups
Inter-agency communication	SG	Funding for operation of group - equity - value decisions	CCC SG LG FG
Alignment of policies	SG	Tap into educational initiatives of other players	CCC
Technical support for CCCs	CCC	Network with research/universities	CCC
Departmental boundaries (regions)	SG	Government wants ICM to work	SG
Elitist attitude of researchers/scientists	CCC	ICM can help community understand government policy	CCC
Resistance by Local Government – stifling community activity	LG	Need for ICM/Landcare to have input in government policy	CCC
NRM Discussion Paper	SG	Help agency with consultation	CCC
Blockers on committees	CCC	DPI community consultation guidelines	SG
Hypocrisy of government	SG	More Local Government involvement	LG
Apathy of interest groups	COM	Industry more on side	COM
Coordinators selling government policy	CCC	Network with other organisations	CCC
Varying visions of CCC members	CCC	NRM Education - Landcare - ICM	CCC
Community vs government	COM	Cabinet Support (political will)	SG
Environmental Protection legislation	SG	Group dynamics	CCC
Hidden agendas	SG		
Lack of government flexibility	SG		
Equity of funding amongst CCCs	CCC		
Incorporation	SG		
Lack of women involvements	CCC		
Time available for ICM by community members – recognition of input	CCC		
Who owns the process? (water or land)	SG		
Conflict of interest of government	SG		
Community not accepting technical information	CCC COM		
Invasion of 'turf' eg ICM – local government (Regional government)	LG		
Lack of shared responsibility for legislation	SG		

Key to Groups;
SG – State Government
CCC – Catchment Coordinating Committee
LG – Local Government
FG – Federal Government
COM – community/industry

Summing Up
In his introduction yesterday, Ken Stallman indicated that the objectives of the workshop were to share experiences and provide positive ideas that would set the future direction for:

- Catchment Coordinating Committees
- The CMCC and the State ICM Program
- The proposed NRM legislation

During the workshop, we have certainly shared many ideas which will help to set the direction for ICM in this state.

Achievements
In the first session on achievements by individual CCCs, the presentations indicated considerable variation in progress within individual catchments – some are still grappling with identifying issues and preparing strategies, while others have their strategies and are more concerned with implementation

A number of speakers made similar points:

- ICM in *community* driven
- CCCs must be credible
- CCCs have increased community awareness of catchment management issues and the catchments in which people live.
- CCCs are using different approaches (some adopt a single issue or piecemeal approach, other a comprehensive/multiple issue approach).

However, it was Bruce McCarthy's analogy which caught my imagination, when he likened ICM to the tributaries of a stream, with everyone eventually coming together. Bruce also mentioned the 80/20 rule, and stressed the importance of putting our limited time into the issues where 20% of out effort achieves 80% of our results.

Realistic Expectations
The two sessions dealing with realistic expectations of ICM and CCCs produced similar conclusions:
- Strong community awareness, involvement and ownership of ICM.
- CCCs with a clear direction and process for achieving their goals.
- Real progress with the implementation of catchment strategies (including funding for groups for implementation).
- Local and State Governments cooperating and implementing catchment strategies.
- Credibility for ICM and CCCs.

Action Plans
Key actions for achieving the realistic expectations were identified for the following sectors
State Government
- Clarify the process which exists for achieving coordination between government departments
- Recognise and consult CCCs about regional planning activities
- Align departmental regions on catchment/NRM boundaries
- Provide statutory mechanisms for overcoming difficulties with incorporation
- Provide equitable and adequate funding for CCC members

Local Government
- Encourage local governments to integrate ICM principles into their codes of practice and to refer environmental impact assessments and planning schemes to CCCs.
- Develop closer linkages between CCCs and River Improvement Trusts
- Issues a policy statement to resolve local government's concerns about regionalisation associated with CCCs

Community and Industry
- Involve industry organisations in CCCs and catchment management
- Establish clear linkages between government and community
- Develop mechanisms to enable community members to continue to participate in ICM and CCCs
- Involve more women in CCCs and catchment management
- Carry out more educational activities such as 'catchment crawls'

Composition of the CMCC
Consideration of the role and composition of the CMCC led to the following conclusions:
- That the composition of the CMCC is no longer appropriate, and greater representation from CCCs is needed
- That the use of the proposed catchment regions is a basis for CCC representation on the CMCC be referred to the CCCs for consideration

NRM Legislation
While time did not permit consideration of ICM requirements in the proposed legislation, it was agreed that the establishment of CCCs under the NRM legislation should be investigated to overcome the need for individual Committees to become incorporated.

Conclusions
The workshop has been a major milestone for ICM in Queensland.

In less than four years, 14 communities have established CCCs and many of these communities now have clear strategies, energy and are achieving results. They are now in a good position to influence and help set Government policy and the direction of the whole ICM program.

This workshop has demonstrated the ability and desire of CCCs to provide positive ideas and directions for ICM. Because of the positive approach and achievements, I am confident that this gathering of CCC representatives will evolve into an ongoing forum which will be a powerful force in ICM in Queensland.

5.2.3 Forging the Links
Inaugural Landcare and Integrated Catchment Management Annual Conference – Cairns, 29 June – 1 July 1998

1998 Conference Resolutions

Maroochy Landcare Group Inc

No.1
(a) *Governments establish a value for native vegetation. If it worth preserving it must have a value.* **Carried**
Speaker: Esma Armstrong, Secretary, Maroochy Landcare Group Inc
Seconder: Rick Templeton, Treasurer, Maroochy Landcare Group Inc

No.2
(b) *Landcare groups be exempt from certain bank chargers eg. account keeping fees.* **Carried**
Speaker: Rick Templeton, Treasurer, Maroochy Landcare Group Inc
Seconder: Esma Armstrong, Secretary, Maroochy Landcare Group Inc

Marlborough District Landcare Group Inc

No.3
That the government bodies responsible for funding the National Weeds Strategy and programs such as SWEEP be approached by Queensland Landcare and Catchment Management Council, to direct more funds to these and other strategic weed initiatives. **Carried**

Background
Weeds are among the most serious threats to Australia's primary production and natural environment. They reduce farm and forest productivity, displace native species and contribute significantly to land degradation. The cost of weeds to agricultural industries alone has been estimated at over $3.3 billion per annum (Combellack 1987), an estimate which does not take into account the reduction of conservation, aesthetic and recreation value, loss of biodiversity, or the impact on human health caused by weeds. Weed problems affect everyone through their adverse impact on economic, social and conservation values, which should be recognised when governments apply the 'beneficiary pays' principle.

The National Weeds Strategy provides the mechanism to reduce the impact of weeds on the sustainability of Australia's productive capacity and natural ecosystems, and will benefit the whole community.

Of the $1.25 billion Natural Heritage Trust, only $24 million has been directed at the National Weeds Strategy over 5 years.

Speaker: Sandy Paton, Boguntungan
Seconder: Lyn Kelman, Lake Maraboon Committee Inc.

No.4
That the bodies responsible for guidelines governing NHT funding be approached by LCMC, to make funding available for strategic, regionally planned weed control projects, especially in areas of Queensland where weeds have been identified as a regional priority.
Carried.

Background
As above, the costs of weeds on productivity and biodiversity is enormous, and the benefits of reducing their impact will benefit the whole community. Regional, strategic planning provides the most effective method of controlling weeds.

During the process of community consultation and discussion in preparing the CQ Strategy for Sustainability, weeds were identified as a high priority issues across the region. The Strategy will be used by RAP to guide NHT funding in the area, however projects addressing this high priority issue may be ineligible for funding:

- "Responsibility for weed and feral or pest animal control rests primarily with State and local governments and with landholders. Accordingly we provide only limited support for these activities" (98-99 NHT Guidelines, Q28, p.13)
- Ineligible activities "activities that are required by law, such as managing or destroying designated weeds or pests" (97-98 NHT Guidelines, p.12)

In the 1997-98 round of funding 10 Central Queensland projects which had weed control components were recommended by Regional Assessment Panel (on the basis of them being strategic and addressing broader issues), yet were denied funding by the Commonwealth.

This resolution is also in compliance with the Decade of Landcare Plan Priority Actions 1997-2000 document, where on of the high priority actions is:

*** Seek to have federal funding broadened to include on-property works with community benefit (eg. **strategic weed initiatives**, water management banks and drains). Chapter 10, action 3

Speaker: Sandy Paton, Boguntungan
Seconder: Viv Chase, Burnett Catchment Care Group

Both these resolutions are supported by the Morinish Landcare Group

Atherton Shire Landcare Committee

No.5
That the Natural Heritage trust system of grant applications be simplified and shortened to make it more user-friendly for community groups. **Carried**

Background
Simplification of NHT Applications

Members of community groups are volunteers and do not necessarily have accounting and computer skills. They are discouraged from making applications for NHT grants by the amount of detail required, particularly for grants over $10 000. The filling of application forms takes a long time. The need for accountability is understood, but this should not make the whole process too complex.

It is suggested that the application form from 1998-1999 should be simplified while retaining the same explanatory booklet form put together in Canberra as it was in 1997-1998.

An alternative would be that the DNR should supply enough extension officers to help all community groups complete the forms.

No.6
That during the Natural Heritage Trust grant award process, grass-roots community groups are accorded a priority with sufficient fund allocation to ensure they are enabled to work effectively. **Carried.**

Background
Sufficient funds for Community Groups

In the press release concerning the allocation of NHT grants in the Kennedy electorate, considerable emphasis was placed on the benefit the grants would bring to the community and presumably to community groups.

On our analysis of the figures, community groups such as Atherton Shire Landcare Association and T.R.E.A.T. received only 24% of the money while departments and councils received 74%. Applications which were fully expected to succeed were not approved.

In order to be fair and to encourage community groups to continue to work effectively for the environment, more money should be allocated in future by Canberra to community groups which make good applications.

Community groups are the back-bone of the workforce for improvement of out environment. "Start-up projects" are needed to encourage groups to get going. The balance between funding for smaller groups, and departments and councils needs to be restored so that groups get a better proportion.

Speaker: Mark Knowles, Atherton Shire Landcare Association
Seconder: Joan Wright, Atherton Shire Landcare Association

Lower Burdekin Landcare Association

No. 7
That the Landcare and Catchment Management Council seeks assurance from DNR that:

1. *Management plans for habitat areas set aside within the BRIA will be developed and implemented as a matter of priority*
2. *Future land and water for irrigation projects development accords with the principles of sustainable development, in particular that:*
   - *Habitat retention and wildlife corridor planning precedes development activities*

- *Areas of appropriate size are retained; and*
- *That mechanisms are put in place to ensure that these areas are effectively managed.* **Amended and Carried .**

Background
During the development of the Burdekin River Irrigation Area (BRIA), planning for wildlife corridors and habitat retention was not initiated by the State Government Agencies concerned until significant amounts of clearing and other development activities had already occurred. This has resulted in well recognised limitations in the area of diversity of retained habitat areas particularly in the farm areas developed earlier where no wildlife corridors were retained. Further, all service corridors and road verges were left devoid of native vegetation in these areas.

It is acknowledged that during the BRIA development in more recent years, the wildlife corridors and conservation areas that have been set aside present one of the best examples of planned habitat retention within a cane growing district in Australia. However, no effective management plans have been developed or implemented for these areas and as a result they have deteriorated in environmental quality, have become pest and weed refuges, and present wildlife risks to adjoining cane lands.

If the Department of Natural Resources expects private landholders to follow their example in the retention of habitat areas and wildlife corridors it must provide leadership in the demonstration of best practice management for these areas.

Speaker: Terri Buomo, Secretary, Lower Burdekin Landcare Association
Seconder: Alan Barton, Chair, Townsville Thuringowa Landcare Association

Theodore Landcare Group Inc

No.8A
That the Queensland Landcare and Catchment Management Council convey to Government the need for collection and removal of unwanted farm chemicals and pursue a resolution of the matter. **Carried.**

Background
Old and dangerous chemicals are currently being stored on many farms with the onus of safe storage being on the farmer. Many farmers do not wish to have the responsibility (often inherited) of these chemicals and wish to dispose of them, however, there is currently no means by which they can legally do so.

Speaker: Claire Breckenridge, Coordinator, Theodore Landcare Group Inc
Seconder: Mick Alexander, Taroom Shire Landcare Group Inc.

Maranoa Regional Landcare Association

No 8B
That the LCMC strongly urge the Federal, State and Local Government to take immediate action to develop a workable strategy to dispose of the banned and illegal agricultural and veterinary chemicals such as organochlorines and arsenic etc held on rural properties and that such a strategy be implemented accordingly. **Carried**.

Background
A resolution requesting action on this matter was carried at the State Landcare Conference last year. However very little action seems to have resulted at the government level. The issue is still a very important one, because for the most part the problem chemicals are still out there.

Each year that passes means that containers are rusting away, allowing the deadly chemicals to seep out into the surrounding environment. The cost of collecting and disposing of the chemicals will be considerable; therefore many landholders might feel that the cost burden is too high. Because of the cost to the environment that would result from doing nothing, the disposal cost should be borne by the Federal and State Governments in the interests of environmental protection

Speaker: Bill Petrie, Maranoa Landcare Association
Seconder: Malcolm Topp, Maranoa-Balonne Catchment Coordinating Committee

Note: This matter was pursued at some length with added weight as the result of the resolution carried at the Roma Conference in 1997. See Annual Report. There is a plan but no funding from the Federal Government for collection of Organochloride Pesticides (OCP) nor from the States for other unwanted agricultural chemicals. Carriage of this resolution would add weight to follow-up letters from LCMC. John Tadman

Calliope Soil Conservation Association Inc

Funding for exotic grasses for rehabilitation

No. 9
That the Landcare and Catchment Management Council ask the Natural Heritage Trust for consideration to be given in future to on-ground projects that include finding for introduced species to combat existing soil degradation – especially those that have proved to be cost effective and beneficial to the environment. **Lost.**

Background
That the objective of Landcare is to reach outcomes that are sustainable both economically and for the protection of the environment.

Introduced species can at times be the most suitable species for obtaining these goals with minimum risk of them becoming weeds in the ecosystems.

There is a general feeling that anything introduced is not good for the environment.

The reluctance on the part of Landcare funding bodies to consider these applications seems very short sighted.

It is recognised that any grass will have been thoroughly tested for its ability to become a serious pest in the catchment in which it is proposed to be used.

Speaker: Robyn Leahy, Coordinator, Calliope Soil Conservation Association Inc
Seconder; Mark Forrest, Calliope Soil Conservation Association Inc.

Mary River Catchment Coordinating Committee

No. 10A
That the LCMC and the Department of Natural Resources acknowledge the role of Landcare Facilitators and ICM Coordinators. Further that integration of the previous bodies under the LCMC should not be used as an opportunity to spread scant DNR support resources more broadly across the existing community group network. This position should not alter the current role of ICM Coordinators to liase with Landcare groups with the aim to optimising opportunities for implementation of catchment strategies.
Amended and Carried.

Background
The Mary River Catchment Coordinating Committee has been made aware of suggestions for the multi-skilling of Catchment Coordinators and Landcare Facilitators. Based on its own experience it considers that it is important that catchment management and Landcare activities within a district are integrated. However its of the opinion that facilitation of Landcare groups to achieve on-ground outcomes, should be seen as a function distinct from coordination of the strategic initiatives of Catchment Coordinating committees. It is concerned that broadening the roles of Catchment Coordinators could result in a loss of momentum in the implementation of Catchment Strategies.

Speaker: Margaret Thompson, Mary River Catchment Coordinating Committee
Seconder: Esma Armstrong, Mary River Catchment Coordinating Committee

Johnstone River Catchment Management Association Inc

No. 10B
The LCMC take note that it be an absolute priority that ICM and Landcare committees be resourced with facilitator/project manager support with the necessary planning skills and focus to drive forward execution and implementation of their individual strategy plans.
Carried.

Background
Explanations:
- "facilitator" means ….. facilitator, coordinator, project manager, manager, mentor, extension officer, administrator.
- "necessary planning skills" means … Suitably qualified people equipped to be able to coordinated the activities of the community group and its stakeholder constituents in natural resource management … People with communication skills enabling them to network stakeholders within the group, and also assist the group in its communication with agency and administrative structures …. People with the ability to coach or train new members of community groups in the concepts and principles of natural resource management.

- "focus" means … people whose principle function is to understand and drive the implementation of the strategy. It may be that a group is involved in activities of sufficient scope to merit their own 'tame' facilitator on a part time or full time basis. It may be a facilitator is shared by geographically neighbouring groups, provided that this person's principal focus is the management strategies and is not distracted by a multiplicity of other duties.

Justification:

- Each management strategy represents a considerable public investment

Such investment is comprised of:
(a) taxpayer funds
(b) government agency time and expertise
(c) ratepayer funds and local government support
(d) industry time and commitment
(e) community time and commitment
(f) R&D Corps funds and commitment
This is our contention that without facilitators as described above this investment will be squandered or at best not realise the dividend it promises.

- We support this contention with the following reasons.

(a) Apart from exceptional circumstances if community groups are left to their own devices the quality of expertise contained therein will diminish with the passage of time. This is a simple consequence of the rollover of membership, and there being no mentor to coach new members.
(b) a suitably qualified and resourced facilitator will provide continuity of understanding and focus on the intent of the strategy.
(c) a strategy is a mobile document. The facilitator described bring expertise which helps to ensure that the strategy will neither stagnate nor develop in a manner which loses the plot
(d) with all the goodwill in the world it is unrealistic to expect community members to be able to supply all of the time and resources necessary to efficiently drive the implementation of a natural resource management strategy unaided.
(e) the notion that there are latent coordinators lurking around all the corridors of your local DNR office awaiting your phone call is a fantasy

Execution

We are neither empowered nor financially resource as community groups to appoint facilitators as our sole responsibility. We are most certainly responsible as partners in natural resource management to strive to ensure that the outcome we are seeking will deliver the dividend implied by the public investment made.
We respectfully suggest that the expenditure of a funding pool such as NHT without allocation of a portion of that fund for administration and management is very poor business indeed. We cannot conceive of any works program which does not budget a part of its cost for management and administration.

If, say, 10% to 15% of funds were budgeted as suggested then it follows that 85% to 90% will end up as works on the ground. Factor in the matching community contribution as required and 170% and 180% is a fair result, achievable in a respectable time frame. Remove the administrative component and we wager the result will be a 100% expenditure of funds but the quality of community contribution will be valued at a pittance by comparison.

Speaker: Sam Pagano, Chair, Johnstone River Catchment Management Association
Seconder: Ray Burns, Malanda Landcare Group

Mary River Catchment Coordinating Committee

No. 11

That the Department of Natural Resource endeavour to maintain base funding for the long term employment of ICM Coordinators to ensure security of tenure and continuity of support for Catchment Coordinating Committees as opposed to creating a system which is dependent on the vagaries of the Natural Heritage Trust grant system. **Carried**

Background

The merger of the Landcare and Catchment Councils at a state level has the opportunity to ensure that activities under the two programs are better integrated. Members of the Mary River Catchment Coordinating Committee who are also active landcarers consider that the benefits of the merger may not be related if the desired relationships between groups formed under the two organisations is not clearly enunciated. Development of succinct guidelines and an administrative structure based on desired communication channels between, and outputs from, Catchment Coordinating Committees, Landcare groups, and the LCMC will help to reduce duplication and enhance cooperation between groups - if based on the results of consultation with grass roots players

Speaker: Esma Armstrong, Mary River Catchment Coordinating Committee
Seconder: Margaret Thompson, Mary River Catchment Coordinating Committee

Waggamba Landcare Group

No. 13
Move that NSW irrigators cease irrigating from the GAB until it has been satisfactorily ascertained that the amount of water being taken out of the GAB, and intake area, is surplus to the requirements for the replenishment of the GAB and further that a full EIS be completed. **Carried.**

The Waggamba Landcare Groups wants LCMC to address this issue with the minister concerned and with the GAB Council.

Background
In 1995 the Waggamba Landcare Group (WLG) became aware that water from the Great Artesian Basin was being used in the North Star - Croppa Creek area of NSW for irrigation. This area is just to the south of Goondiwindi. The continued use of this water for irrigation is causing water pressure to drop in stock bores in the Waggamba Shire (particularly in the east of the shire where there have been reports of the water level dropping by 11 metres in the last 2 years). This water is a vital resource in this area as many farms rely completely on bore water, having no creeks running through them and an inadequate fall for dams.

The background information on this situation has been provided by DNR and NSW groundwater technical officers.

Groundwater licenses for the purpose of GAB irrigation first began being issued in early 1993. Approximately 60 licenses endorsed for GAB irrigation have been issued in total. Of these, 35 are currently active with others being in the process of installation. Allocations total 30 000 megalitres (ML). One licence per land title may be issued up to a maximum of 486ML. Bores are accessing the Mooga Sandstone (200-250m) and Piliga Sandstone (350-400m).

These facts were brought before the Queensland Landcare Council in December 1995. However, no progress was made on the issued as an officer from the Water and Catchment Management division of the then DPI stated and I quote:

> "The use of groundwater for irrigation in the North Star area of NSW should not have any effect on the Great Artesian Basin, as it comes from the intake area, not from the GAB itself. In the intake area there is a surplus above that which can move into the artesian parts of the GAB"

There is a fundamental error with this train of though, which was pointed out to no avail to the officer when he spoke to the WLG. No one yet knows whether this water being taken out is surplus to the requirements of the GAB. No studies have been done on this issue. Further, as later studies have shown some of the bores are not in the intake zone.

There was no environmental impact statement completed on the effects of these bores prior to issuing of these licenses. There was not even an obligation to advertise the proposed bores.

The Local Government Association, on the request of the Waggamba Shire, has raised these concerns with the Minister for Primary Industries in 1996 and were also met with the same response, ie. that the water is surplus to the requirements of the GAB.

We would like to point out the study on whether this water is 'surplus' to GAB requirements has still not been completed (May 1998). The NSW water authority agrees it is extremely difficult to quantify how much of the GAB flows in from this area. The fact that water pressure has been dropping at a constant rate for several years in the Waggamba Shire (due to the number of bores drilled, flowing bores etc), yet has dropped rapidly only in the last few years, would indicate that this irrigation is affecting our bores. The irrigation bores are drilled into the same Mooga Sandstone layers from which the Stock and Domestic bores on the Queensland side of the border attain their water. In the Yetman, North Star, Croppa Creek Area of NSW stock and domestic bores have ceased to flow and graziers are forced to drill new bores or deepen old ones at their own expense.

Speaker: Viv Cranney, Waggamba Landcare Group
Seconder: Mary Woods, Waggamba Landcare Group

Johnstone River Catchment Management Association Inc

No. 14
That the rules for election of one community representative (and one reserve) per DNR Region to membership of LCMC be altered to require preferential voting rather than 'first past the post' voting in all Regions for which there are more than two candidates for election. **Carried.**

Background
The history of the voting process is briefly as follows:
- The first combined postal/conference ballot for three positions for the whole of Queensland on the Queensland Landcare Council was conducted in accordance with a QLC resolution, and finalised at the Annual Conference at Gatton in 1994.
- The rules were arrived at after discussions between the Executive Officer of QLC and the Queensland Electoral Commission, and were adopted by the QLC.
- The decision to use 'first past the post' voting for the QLC ballot was based on advice that for the numbers involved, preferential voting would seldom alter the result, but would entail a longer and more involved (ie. electing three from up to ten candidates for 100-200 potential electors) counting procedure.
- When the need to elect one representative from each of five regions arose, the Landcare and Catchment Management Council (LCMC) agreed to use the old QLC rules, modified as necessary to suit the new requirements.
- The relative virtues of the various voting systems were not discussed, so the 'first past the post' system was retained and used in 1998.

In view of the relatively large number of candidates and the small number of voters in the changed scenario (eg. the 6 candidates and about 20 voters quoted for North Region), the preferential system would appear to be the better choice.

Any system is susceptible to 'politicking and lobbying', but a straight preferential system can guard against vote-splitting tactics. By this method, the successful candidate is usually the first or second choice of more than 50% of the voters.

Speaker: Sam Pagano, Chair, Johnstone River Catchment Management Association
Seconder: Dave McCarty, Johnstone Shire Council

North East Downs Landcare Groups Inc

No. 15
That Queensland Landcare and Catchment Management Council consider changing Landcare month from March to June. **Lost.**

Background and Reasoning

March is a bad month for Landcare month, for the following reasons -
- Many groups go into recess over the Christmas and school holidays and do not meet until February, leaving no time to organise activities for March
- The correspondence for Landcare Month does not get out to Landcare groups in time, again due to the holiday break
- Further to the above point, many Landcare groups only meet bi-monthly, which by the time the correspondence does reach many groups, Landcare Groups has come and gone

At the 1997 Landcare Conference, a resolution put by North East Downs Landcare, regarding the short notice given for activities such as Landcare Month, and urging QLCMC to endeavour to promote these activities earlier, was carried unanimously. Unfortunately, nothing has changed with promotional material being presented to some groups during March, and later.

Reasons for changing Landcare Month to June -
- All the above reasons against March
- June would be an ideal month, being in the middle of the year, and giving groups several months to prepare activities
- The month of June would be promoted as Landcare Month, to culminate in the Landcare and Catchment Management Conference. This would have the double effect of promoting Landcare Month and State Conference together.

North East Downs Landcare urges delegates to support this resolution

Speaker: Peter Crawford, Project Officer, North East Downs Landcare Groups Inc
Seconder: Sandy Paton, Boguntungan

West Moreton Landcare Group Inc

No. `16A
That every reasonable effort be made by LCMC to secure sales tax exemption for all (non-profit, community) Landcare, catchment management and Waterwatch groups. **Carried**

Background
- most groups receive a large part of their funding from government and give a proportion of is straight back in the form of sales tax
- sales tax exemption would reduce the amount of money for which groups apply, resulting in funds being more widely available (this situation would not be detrimental to NHT funded projects and beneficial to non-NHT funded projects)
- this reduced funding would encourage more groups to seek support from other sources
- tax deductions and sales tax exemptions are available for profit industries and businesses who support Landcare, yet non-profit groups are still required to pay sales tax

Support
- This idea was floated at a recent south east regional meeting and gained verbal support from almost every attendant
- In his 1997 annual report, National Landcare Facilitator Lachlan Polkinghorne stated in Recommendations, 4.1.2 Far, Business Viability, that 'Landcare groups are exempt from sales tax'

Speaker: Patti Semmens, Coordinator, West Moreton Landcare Group Inc
Seconder: Percy Manz, Atkinson Buaraba Landcare Group

Maranoa Regional Landcare Association

No. 16B
That the LCMC lobby the Federal Government to change policy to allow Landcare Groups to enjoy Sales Tax Exemption on all classes of items which, when purchased by a primary producer for Landcare purposes, would be sales tax exempt eg. fencing materials.
Withdrawn

Background Explanation
The items would be Sales Tax exempt when purchased by a primary producer for similar purposes, so why should Landcare Groups have to pay Sales Tax upon them?

Speaker: Bill Petrie, Maranoa Regional Landcare Association

No. 17
That the LCMC urge the State and Federal Governments to ensure that education of Landcare and catchment management issues be given a higher priority in funding allocations, without reducing other important funding allocations. **Carried**

Background Explanation
It appears that the positions of some Landcare Education officers have recently been axed. This would seem to be a deplorable situation in a society which desperately needs to increase public awareness of Landcare issues in the younger community because of the importance of maintaining the sustainability of natural resources for future generations.

Speaker: Bill Petrie, Maranoa Regional Landcare Association
Seconder: Mary Woods, Waggamba Landcare Group

5.3 Enhancing the Effectiveness of Catchment Management Planning

Activity Review - Queensland

AACM International Pty Limited

(Source: AACM with the Centre for Water Policy Research. 1995. *Enhancing the Effectiveness of Catchment Management Planning. Annex B: Activity Review.* AACM House, Adelaide, pp. 26-38)

Institutional Setting

In 1990, the Queensland government initiated an integrated catchment management program (ICM) in response to community interest in a river catchment approach to dealing with resource degradation issues. Five pilot study areas were identified - the Johnstone, Lockyer, Mary, Mitchell, and Pioneer catchments. The Johnstone and Mary are reviewed here.

Unlike New South Wales, ICM in Queensland evolved after the National Landcare Program, and so ICM committees were able to work with and complement existing community groups interested in natural resource management issues. There is some confusion about the place of ICM and Landcare within the state institutional hierarchy. Some Landcare groups see ICM as a threat which aims to control them - acting as an umbrella coordinating group. Other Landcare groups see ICM as a complementary activity. This is a strategically important issue which must be resolved quickly to avoid it becoming a barrier to implementation of integrated catchment management activities in Queensland.

Local authorities have widely supported Landcare groups in many areas of Queensland. DPI and other departments work with Town Planners and City Engineers in a collaborative but informal relationship. There are 12 shires in the Mary River Catchment, and a single regional association of local authorities. There are 2 shires in the Johnstone River Catchment.

Catchment resources are managed under a number of legislative instruments which,. Along with the policy setting, are reviewed in Annex A - Policy Review.

Mary River Catchment

Project Background
The Mary River Catchment is located in South East Queensland and runs parallel to the coast for more than 180 kilometres from the Conondale Ranges in the south to Hervey Bay in the north. The catchment comprises about 9 600 km^2 with a mean annual discharge of about 2 300 000 ML, and includes all or part of 12 local authority areas. There are 8 Landcare groups active in the catchment, three natural resource planning groups, the Mary River Catchment Planning Committee, the Mary River Catchment Coordinating Committee (CCC) and 20 or 30 other environmental special interest groups. The population of the area is approximately 80 000 and rising rapidly - with significant growth areas around Gympie, Maryborough and Hervey Bay

Project Assessment
An ICM coordinator has been appointed by DPI for the Mary River since early 1993. DPI provided $85 000 to the CCC in 1994 but that includes the coordinator and secretarial services provided to the committee.

The Mary River Catchment Coordinating Committee was established in November 1993 and is in the early stages of identifying its own philosophy and products. At the moment any CCC members have strong parochial interest which are a barrier to integrated resource management in the catchment. There are also some tensions between the Planning Committee and the CCC - although their interests largely the same and both groups represent partnerships between private sector and government interest, the Planning Committee is independent of formal government institutional structures.

The CCC considers its overriding focus to be to :-

- concentrate on causes not symptoms;
- take a whole catchment focus;
- emphasise a longer-term vision;
- take a balanced view from all aspects; and
- work towards an economically sustainable future for primary producers in the catchment

Since its formation, the CCC has established working groups for:-

- coordinating water watch monitoring of water quality in the Mary catchment;

- conservation of the Mary Cod;
- management of septic tank effluent; and
- survey of stream bank erosion

The CCC is working with DPI to prepare a State of the River report for the Mary River. The CCC has taken an active role in the contentious regional debate about water supplies for rapidly expanding residential populations in Hervey Bay, Maryborough and Gympie as well as along the Sunshine Coast. Several Landcare groups have been supported with funds and advice from the CCC. The CCC is also helping industry groups to develop Best Management Practices (BMP).

The CCC currently sees its role as a source of advice and consultation on current issues affecting the catchment - rural land subdivision policies, water supply, water quality, riparian zone management and biodiversity conservation in the catchment. Catchment planning, or development of a process for catchment planning, is not an early priority for the CCC.

The CCC does not have a developed strategy for working with Landcare groups. There are strong concerns in some Landcare groups about the ICM approach to natural resource management - that it is another layer of bureaucracy and another division of funds to administration rather than field works. Those Landcare groups which recognise the multi-disciplinary and political nature of natural resource management and integrated catchment management will successfully work within the ICM policy framework.

Strengths

- State guidelines for integrated catchment management *philosophy* based on integrated environmental management *product*
- Strong community leadership and vision across a range of sectors, pre-dating ICM and Landcare programs
- Land Use Plan and Future Forest documents provide initial targets for ICM activities in collaboration with Landcare and other community groups.
- Technical packages for solutions exist for many resource management problems
- Employment of journalist to promote and publicise CCC activities and the ICM *philosophy*.
- Diary Industry Group has self-regulation process to monitor and manage dairy effluent in catchment - the starting point for community monitoring strategies.
- Water quality and land use planning elements are understood and broad linkages between poor water quality symptoms and land degradation causes are clear.
- Waterwatch coordinator for whole catchment - leading to community generation of valuable water quality datasets.
- Project logically evolved from earlier activities (often supported by NSCP, Save-the-Bush, and NLP) which set information and community awareness foundation for successful implementation of catchment management project.
- Use of modified Rapid Resource Appraisal techniques by CCC to develop spatial extent of key degrading processes in whole catchment
- Several local authorities have existing environmental levees ($10 per property) which contribute funds to Landcare and ICM activities in the catchment.

Weaknesses

- Catchment is not recognised as basic management unit by any participating groups in CCC or government institutions.
- Lack of *process* for identification of priorities, integration of community and agency skills to design and implement activities, and monitoring and evaluation of program activities - especially within DPI and CCC.
- Very little whole catchment planning being considered or implemented - despite several local authorities preparing 'Town' Plans and Mary River Catchment Planning Committee preparing a Catchment Land Use Plan.
- Lack of established Landcare relationship or non-threatening process for integrating activities with Landcare groups.
- Strong pro-development lobby with influence on local authorities and little regard for long-term costs and resource requirements for rapidly increasing populations.
- Weak bio-physical data sets on which to base ICM planning activities - and little recognition of ability of community to generate much of these data for their benefit as well as ICM planning.
- Communication within and between government agencies remain a barrier - including state government and local government agencies
- Weak integration of skills and activities to solve catchment management problems - especially between DPI and Local Government.
- Poor identification of linkages between community priorities and catchment management priorities, and poor integration of technical resources from DPI and DEH to develop innovative solutions to community and catchment management problems

- No use of resource economic analysis to identify priorities and allocate costs and benefits between public and private sectors
- Weak and unimaginative use of cost benefit analysis is assess most efficient investment scenarios for supplying water to Hervey Bay, Maryborough and Noosa.
- Poor integration of native vegetation rehabilitation and management into riparian zone and upper catchment management strategies.

Opportunities

- Use ICM process and CCC institution to develop *philosophy* and *process* for planning and implementation of integrated catchment management activities in the Mary River catchment.
- Promote sustainable water supply as primary *product* from ICM as local authorities and developers recognise constraints imposed by limited water supplies.
- Use of resource economics and cost benefit analysis to identify potential benefits of increased quality and quantity of water harvested from Mary River Catchment - to quantify the investment which local authorities with growing residential populations would be justified in making as a contribution to the cost of implementing catchment management plans.
    - Negotiate a deal with landholders for fencing riparian zone and land slips, and with developers for a more sustainable approaches to subdivision, with cost share agreement for infrastructure capital costs, in return for minimum adoption rate in each sub-catchment necessary to have tangible impact on quality of water harvested from Mary River.
    - Build on DPI experience with Strategic Balance Sheet approach to incorporate resource economics into ICM and CCC activities.
    - Use Best Management Practices to develop linkages between landholder priorities, local authority practices and catchment management priorities.
    - Establish cost sharing arrangements related to co-management partnership with catchment community. In addition to encouraging ownership, this provides an opportunity for a stronger relationship between the CCC and Landcare groups in the catchment
    - Recognition that GIS is a useful tool for planning such a large catchment and that, if managed as a tool for community use, can be related to practical decision making.

Threats

- Parochialism and strong development and frontier approach of industry groups in CCC.
- Community perception of CCC as another layer of bureaucracy - require quick and successful run of activities to establish CCC presence in the political structure of the catchment.
- New land uses (for example alternative lifestyles, micro-industry) and socio-economic structures (for example semi-intensive rural residential developments) will have different impacts on catchment resources - many of which are not within the skills or mandates of DPI or local authorities
- Unclear linkages between ICM and Landcare groups could undermine activities in catchment.
- Many strong egos amongst community leaders - potentially leading to conflict if focus or momentum is not maintained.
- Short-term political issues diverting the attention of community leaders - especially in local authorities - from longer-term planning and vision to develop and implement ICM *process and philosophy*.

Johnstone River Catchment

Project Background

The Johnstone River catchment is a rich and diverse region supporting dairy and beef cattle grazing, intensive horticulture, sugar cane production, marine fisheries, wilderness and tourism enterprises.

The catchment covers more than 1 600km^2 on the wet tropical coast of Far North Queensland. The catchment has been divided into four broad physiographic regions - Tableland Area (30%), World Heritage Area (45%), Undulating Lowlands (20%) and Floodplain and Estuarine Zone (5%).

The catchment drains one of the wettest regions in Australia, with average annual rainfalls ranging from around 1 800 mm to in excess of 4 000mm. The Johnstone River Catchment contributes on average, almost 3 million megalitres of runoff each year, although annual variation is significant.

The natural and social resources of the catchment have been documented in a Johnstone River Catchment Atlas which was produced by the ICM program in conjunction with other government and community agencies. A Johnstone Shire River Improvement Trust has existed for many years under the *River Improvement Trust Act* (Qld., 1940). However, this institution has lacked leadership and a vision and is essentially superseded by the CCC.

The Johnstone River Catchment Pilot Study was the first attempt to implement the ICM concept in Queensland. The Pilot Study commenced in early 1991 with the establishment of a community based Catchment Coordinating

Committee (CCC) to direct and oversee the Study. Membership of the CCC is representative of a wide cross-section of the catchment community, covering agricultural, industrial, tourism and community interest. The CCC is supported directly by a Catchment Coordinator from DPI and indirectly by other technical services staff from DPI, DEH and DOL.

The Pilot Study operates from a Catchment Centre, separate from Government offices, located in a shop front office in the centre of Innisfail. This arrangement helped establish an independent and community oriented presence of ICM in the catchment. It also contribute to the effective functioning of the Coordinator and the CCC, particularly in relation to liaising with industry and community organisations, local authorities and Government agencies.

The major roles of the CCC in the Pilot Study identified by CCC members, were to:

- address complex natural resource management issues that involve the community and government;
- provide a forum for stakeholder input and discussion;
- prioritise issues; and
- develop and promote the adoption of catchment management strategies to address priority issues.

The CCC determine that it would carry out this role in the following manner:

- act as a coordinating agency to bring together people and organisations in the catchment who have responsibility for land and water use;
- consult, examine issues, identify solutions and agree on actions;
- encourage by publicity, demonstration and example, sound management practices to achieve long-term sustainable use of catchment resources;
- review the programs and activities of Government agencies and local authorities and offer advice on priorities as seen from a community point of view;
- provide the Minister for Primary Industries with an independent and broad industry and community view on the management of the catchment; and
- act as an independent arbitrator in assisting with the resolution of disputes involving the use of land, water and other natural resources in the catchment.

The CCC is also discussing succession strategies for changing membership of the committee. The current approach is re-election of one third of the CCC each year with a three year term and a maximum of two consecutive terms for each member.

The CCC is also assessing strategies for self financing, with the option for raising levees or fees to contribute the private share of committee costs. Several community groups have backed the ICM program with industry funds, provision of office space and other activities as part of their contribution to the operation costs of the CCC and other ICM activities. For example, the Atherton Tableland Cooperative Dairy Association has appointed an industry funded Environmental Officer in a Resource Management Centre at Malanda. This person works with the ICM and Landcare groups to help dairy farmers implement best management practices consistent with the ICM strategy on their properties.

Project Assessment

The Johnstone River Catchment Pilot Study has been well resourced because it was the first pilot project and because of personal commitment from the Minister of Primary Industries. However, community and government groups in the catchment - including the Johnstone River Management Trust - identified the need for integrated natural resource management in the late 1980s and were therefore prepared for the policy changes and opportunities which came with the new Government in Queensland.

The major focus of the Pilot Study in developing the ICM concept has been the preparation of a Management Strategy for the natural resource of the Catchment. This document was released by the Minister for Primary Industries on 13 October 1994. It builds on the Draft Management strategy which was released for comment in March 1993. The Draft Strategy was reviewed extensively by Government Institutions, local authorities, industry associations, community groups and research organisations. The Management Strategy focuses on four key issue areas - land management, water management, riverine management and habitat management. Lead agencies responsible for implementation of activities under each strategy are identified.

The implementation *process* developed by the CCC is one of the most advanced and well thought out in Australia. It has yet to be implemented, but it addresses many of the weaknesses identified in other ICM projects in Australia. Biannual meetings of the CCC are designed to set priorities, allocate resources, negotiate Memoranda of Understanding with relevant parties for implementation of activities under each strategy and monitor progress of implementation.

The three key process elements which the Johnstone River CCC have identified are:

- allocation of priorities as the first step for implementation of activities under each strategy;

- allocation of responsibilities for implementation; and
- negotiation of Memoranda of Understanding between different parties with responsibility for contributing to the implementation of activities under priority strategies.

These are the key elements of successful ICM programs in other countries.

The pilot project has effectively developed a process and a Management Strategy - reflecting the skills and background of the Catchment Coordinator. The ICM program has a high profile throughout the catchment but it now has to start implementing activities on the ground.

The CCC and DPI recognise this need. The CCC has appointed a part-time forester as a Strategic Revegetation Coordinator. She is working with the many community and Landcare groups in the catchment with revegetation and conservation activities. DPI has appointed an Extension Officer to focus on implementation of activities given priority in the Management Strategy. He is working with industry groups, local authorities workers and landholders to develop and implement field activities for land management and riverine management strategies identified in the Johnstone River Management Strategy.

Strengths

- Small size and compact nature of catchment with strong community leadership and vision across a range of sectors, predating ICM and Landcare programs
- First ICM catchment with strong support from DPI and Minister for Primary Industries.
- State guidelines for integrated catchment management *philosophy* based on integrated environmental management *product*.
- Process well advanced and logically through out - although not yet implemented
- Product and philosophy well documented and though out - with strong industry and local authority involvement.
- Independent ICM office location in main shopping precinct - away from DPI, Local Authorities and other agencies.
- Identification or priority activities and responsible institutions for implementation.
- Technical packages for solutions exist for many resource management problems.
- Performance based Shire Planning Strategy recently developed by Johnstone Shire and approved State Cabinet.
- Strong bio-physical data sets on which to base ICM planning activities.
- Appointment of Extension Officer and Strategic Revegetation Coordinator to support implementation of priority activities in the catchment management strategy.
- Development of Best Management Practice guidelines for each agricultural industry as a means of compliance with the Codes of Practice for Agriculture under the *Environmental Protection Act* (Qld, 1994).
- Recognition of the need to source funds from outside public sector, to share costs according to split of public:private cost benefit analysis
- Willingness of CCC to incorporate and operate as project manager and investment planner.
- Resolved the dispute between Landcare and ICM with clear and constructive role for both groups in the implementation process.
- Dairy Industry developing self-regulation process to monitor and manage dairy effluent in catchment - the starting point for community monitoring strategies.

Weaknesses

- ICM strongly pushed by DPI, although in Johnstone many community and institutional groups had identified the need for an integrated approach to catchment management.
- Catchment is not widely recognised as basic management unit
- Independent and uncooperative culture of Wet Tropics Management Authority - responsible for management of nearly half the catchment area.
- Emphasis on planning and consultation rather than action on the ground - community is now ready for some activity
- Expectations have been raised in the community - CCC and ICM credibility requires delivery of activities on the ground. This has been recognised.
- Communication within and between government agencies remains a barrier - especially within and between state government agencies.
- Under-resource and poorly focused DEH office in Innisfail.
- Poor identification of linkages between community priorities and catchment management priorities and poor integration of technical resources from DPI and DEH to develop innovative solutions to community and catchment management problems.
- No use of resource economic analysis to identify priorities and allocate costs and benefits between public and private sectors

Opportunities

- Implementation of Best Management Practice Guidelines for ICM as well as complying with the Codes of Practice for Agriculture under the *Environmental Protection Act* (Qld, 1994)
- Implementation of new Johnstone Shire Planning Scheme in close consultation with CCC to complement – and form an integral part of ICM activities.
- Use of resource economics and cost benefit analysis to identify potential benefits of improved resource management and habitat conservation – to quantify the investment which the public sector would be justified in making as a contribution to the cost of implementing catchment management plans.
- Build on DPI experience with Strategic Balance Sheet approach to incorporate resource economics into ICM and CCC activities.
- Use Best Management Practice guidelines to develop linkages between landholder priorities, local authorities priorities and catchment management priorities.
- Establish cost sharing arrangements related to co-management partnership with catchment community. In addition to encouraging ownership, this provides an opportunity for a stronger relationship between the CCC and Landcare groups in the catchment.

Threats

- Agricultural industries, feeling threatened by conservation impact from World Heritage and Forest Conservation, are motivated by fear rather than positive or educated responses to natural resource management.
- Declining public resources for implementation activities – may result in community expectations not being realised which would threaten current momentum towards widespread implementation of catchment management activities.
- Parochialism and strong development and frontier approach of industry groups in CCCs.
- Many strong egos and political undercurrents amongst community leaders – potentially leading to conflict if focus or momentum is not maintained.

5.4 ICM in Queensland: History and Intent

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(Source: "What You Told Us - A Survey of the Views of Queensland ICM Chairs and Coordinators and Herbert River Catchment Coordinating Committee Members" (Part 2) (This publication. Vol. 2 No. 1 pp ???

Integrated Catchment Management in Queensland

The quest for effective natural resource management has been pursued by governments worldwide. Often, water has been a prime focus of attention because a catchment provides a natural system from which the interactions among people, water and related land resources can be considered and the coordination of relevant public and private resource managers enhanced. To these ends, the State Government of Queensland, Australia released *Integrated Catchment Management* (ICM) in 1991 in order to:

> *integrate the management of land, water and related biological resources in order to achieve the sustainable and balanced use of these resources. It provides a framework for fostering cooperation and coordination between many landholders and other resource users, community groups and government agencies involved in the use and management of land and water resources* (Queensland, 1991: 1)

While it was recognised that other government initiatives such as the State Conservation Strategy, State-wide environmental programs (eg. Landcare) and broad regional strategies such as South East Queensland 2001 Growth Management Strategy and Coastal Protection Strategy would be important activities, ICM was perceived to be unique for two reasons. First, it was to involve all sectors of the community. Second, it was to be multiple, rather than single issue based.

ICM Principles

Five principles were to guide the ICM process. First, since land and water resources are basic and interactive parts of natural ecosystems, effective management was best achieved by using the catchment as the administrative unit. Second, since river catchment are continuously changing in response to natural processes and human activity, management strategies should anticipate, adapt and respond to these changes. Third, decision would be based on the best available information. Fourth, individual users and managers would be informed about water and land management issues and solutions. Fifth, ICM would provide for a 'balance between economic development and conservation of land and water must be maintained' (Queensland, 1990: 1). By using these five principles to guide the formulation of catchment strategies, the following goals would be achieved by promoting:

- community understanding, coordination and cooperation
- common goals and community action, and
- economic and ecological sustainability

Catchment Care Council and Catchment Coordinating Committees were to be the driving forces behind ICM. Supported by QDPI which would provide information, education and training services about ICM, CCCs and CCCs were to provide the following functions:

- foster coordination between landholders, community action groups and government agencies in their land and water resource management activities;
- promote community understanding of the interactions between land, water and related biological resources and the value of a coordinated, catchment-wide approach for managing these resources;
- provide a forum for community and government discussions on catchment management issues for resolving conflicting demands on natural resources;
- identify and prioritise interrelated land and water resource issues in the catchment;
- develop catchment management strategies that address priority issues;
- promote and foster voluntary implementation of catchment management strategies by landholders and other resource users through community action groups and government agencies;
- provide advice and recommendations to landholders and other resource users, community action groups and government agencies on catchment management issues;
- monitor, review and report to Government and the community on progress and performance of catchment management strategies and activities (CCCs must report annually to Minister of DPI); and
- recommend improvements in the administrative procedures and statutory requirements of government agencies to avoid duplication and conflicting requirements.

Implementation of ICM would foster a whole-of-government approach by providing a strategy which was consistent with policies and guidelines of all levels of government

ICM as a Process

ICM was to be a State-wide initiative. While the Queensland Department of Primary Industries (QDPI) would be the agency responsible for administering ICM, the important role of other agencies such the Departments of Environment and Heritage (QDEH), Lands (QDOL) and Housing and Local Government (QHLG) in supporting relevant aspects of ICM were recognised (Queensland, 1991). Collectively, State Government agencies would, within the scope of available resources, support and assist Catchment Care Groups (CCGs) and Catchment Coordinating Committees (CCCs). These two types of bodies would be formed in order to harness local and public agency involvement in order to formulate the catchment strategy document. CCGs would be less formal than CCCs and 'link the activities of landholders, community action groups and government agencies' on relatively simple issues which involve a limited number of participants (Queensland, 1991: 2). Providing a forum for community discussion and fostering the cooperative development of solutions are the major roles of these groups. The initial intent was to form CCCs under legislation to address complex issues involving a large number of participants. In practice, legislation was never enacted because of a significant perception that ICM could result in another and unnecessary level of government. Instead, the level of support provided through QDPI has signalled to it and is ineligible for the $500 establishment grant. CCCs receive these types of support. Where a catchment was divided among several CCCs, Regional Catchment Coordinating Committees (RCCCs) could be formed to coordinate individual CCC activities. RCCCs are also ineligible for the $500 establishment grant.

The State Government encouraged that CCGs and CCCs take a pragmatic approach which focused on 'manageable and resolvable issues of high priority to the community rather than all issues' (Queensland, 1991: 20). When completed, the strategy would identify and describe major issues; describe relevant activities, guidelines, policies and action plans; identify mechanisms to achieve objectives; and provide appropriate monitoring and review mechanisms. Unless special legislation were passed, the requirements of the strategy would not be legally binding on any landowner or government agency.

ICM as a Product

The primary final product of the ICM process is a Catchment Strategy which prioritises catchment issues and identifies appropriate implementation mechanisms. Three options for implementation were identified. The preferred choice would see the CCC seek the voluntary adoption of catchment management strategies by landholders and resource users, community action groups, and government agencies. Presumably, the strategy development process would educate resource managers about the need for specified resource management activities. Where voluntary implementation was jeopardised, CCCs could request the appropriate state minister (eg. QDPI, QDE, QDOL, QHLG) to have local and state agencies consider catchment management strategies in their routine operations. The final option would see the establishment of a catchment trust or similar statutory body for specified issues such as soil conservation, floodplain management or river improvement. This issue was considered in the 1994 document *The Sustainable Use and Management of Queensland's Natural Resources.*

The general intent of ICM may be summarised as follows. It is a voluntary approach which relies on local initiative to establish the need for the formation of a CCG or CCC. Both CCGs and CCCs and subsequent strategies lack legislative authority. Voluntary compliance by relevant private managers (landowners and corporate) and public agencies is the preferred method of implementation. Education of these managers through the exchange of information and the development of the Catchment Strategy is to facilitate the adoption of required actions. ICM Committees are to be composed of major stakeholders who have an interest or are influenced by significant resource management problems. Another dimension of this stakeholder approach, is the joint funding for relevant activities from both the State Government and relevant local participants. Catchment strategies are to focus on several important resource management issues operating on a catchment scale in order that an integrated consideration of problems and solutions is provided. While the State Government has identified a number of requirements for all catchment strategies, local groups must seek their own approaches in the formulation of that document. Monitoring is to be an important element of all catchment strategies.

Forming and Operating a Catchment Coordinating Committee

The State Government identified ICM principles, processes and products. Local communities are to consider the need for ICM, and if appropriate, pursue the formation of catchment coordinating groups or committees. In this matter, ICM in Queensland should merge 'top down' and 'bottom-up' management. Both CCGs and CCCs are comprised of 'representatives of the major sectors of the community and government which are involved in, or influenced by, the management of land and water resources in the catchment' (Queensland, 1991: 2). They are to work with state agencies and local groups in forming catchment strategies thus furthering the principle of partnership between state government and local government and groups.

CCGs and CCCs must encompass an administrative region of at least two local government areas and be catchment or sub-catchment based. The membership should 'reflect the interests of the major sectors of the community' including local governments, key relevant primary industries, landholders in proportion to the range of land uses in the catchment, state government agencies, community groups and organisations, recreation and conservation interests, secondary interest and major stakeholders outside the catchment (eg. Great Barrier Reef Marine Park Authority, World Heritage Parks)(Queensland, 1995: 2). The membership should be determined by open election or through nomination by community groups, agencies and the general public. Membership of RCCCs is drawn mainly from CCCs within the basin.

Once groups within a catchment have decided to form a CCC or CCG, they should apply for endorsement under the Queensland's ICM Strategy which provides them with access to operating and project funds, liability and accident insurance. Appropriate activities are funded from a number of sources. As the administering agency, QDPI provides seed funding for CCGs, CCCs and projects. A one-time $500 establishment grant if available to both CCCs and RCCCs. To cover the full costs of establishment, CCCs are to seek the financial and in-kind support from interested and member organisations. Operating grants are set at $2 000 per year for three years and $1 000 afterwards. CCCs west of the Great Dividing Range and in the Fitzroy and Burdekin Districts are eligible for an increased level of grant up to $5 000 per year for three years, and $2 000 thereafter. Applications for additional project funding could also be submitted to funding agencies such as Landcare and LWRDCC and other government and non-government agencies.

Review of State-wide ICM Activities (1991-1996)

By May 1993, 5 catchments - the Lockyer Valley, Johnstone River, Pioneer River, Mary River and Mitchell River - had been identified as pilot study areas. By October 1995, there were 13 CCCs and 1 CCG formed throughout the state, with most located along the eastern coastal catchments. There was initial concern that ICM and Landcare, which was launched in 1992 as a means of conserving natural resources and protecting the environment would be seen as overlapping exercises. However, QDPI saw these initiatives as complementary.

> *ICM is about the 'big picture' or the condition of the whole catchment on a broad scale. Landcare deals mainly with localised issues on a property or small catchment scale … Both are flexible and can be moulded to suit the needs of the community* (The Source, April 1991: 8)

Several conferences such as the Downstream Effects of Agricultural Pollution (DEAP) have been held. The role of local government in ICM was highlighted in a 1994 study (QDPI *et al.*, 1994). A newsletter titled *The Source* provide information to all ICM members, coordinators and interested participants. Between April 1992 and February 1996, 10 issues have been published.

The state government has also introduced a number of initiatives which influence the formulation and implementation of ICM strategies. These include the 1994 natural resource management discussion paper, environmental protection legislation and propose reforms to the *Local Government (Planning and Environment) Act*.

As mentioned earlier, new legislation was initially considered as necessary to support ICM. In 1994, it became clear that this alternative would not be pursued. In a 1994 discussion paper titled *Sustainable Use and Management of Queensland's Natural Resources* the State Government identified its preference to amalgamate existing legislation within existing administrative arrangements, rather than create new agencies (QDPI, 1994). The overall objectives of the new framework are to 'produce an integrated natural resource management (NRM) policy with non-regulatory strategies and a minimum of legislation' and to integrate the existing natural resource legislation administered by QDPI 'to see an effective planning and management framework in place that provides for ecologically sustainable development for natural resources' (QDPI, 1994).

Like implementation of ICM, the Queensland Government prefers voluntary compliance with its NRM requirements. However, if resource degradation was significant and effective community-based measures (eg ICM) were not forthcoming, QDPI could establish additional regulations and/or special statutory bodies under the NRM initiative. These would be in addition to and would probably supersede policies developed through the local planning and ICM process. If this situation is to be avoided, it is a community's interest to actively and effectively participate in the development and implementation of local plans, ICM strategies and Codes of practice. Non-involvement will detract from one's standing within the community and contribute to the possible imposition of QDPI regulations and special statutory bodies. Local control would be reduced.

The need to reform existing legal arrangements within QDPI was also recognised in the discussion paper. Legislative options to overcome the 'overly prescriptive', 'highly variable' and 'fragmented' nature of QDPI-administered Acts included: a single piece of legislation to replace the nine existing Acts and which incorporates Integrated Catchment Management (ICM); retention of the existing nine Acts with amendments, together with the preparation of an additional piece legislation for ICM; preparation of umbrella legislation that sits across the existing Acts and that for ICM and; amalgamation of the existing Acts introduces three broad category Acts of Land, Forests and Water.

5.5 Summary and Synthesis

The following is a *SWOT* analysis of ICM in Queensland by Rowland and Begbie (1997). It is not exhaustive, however it provides a basis for thought and discussion of the issues. It is presented in the SWOT format.

Strengths

- Broad and somewhat nebulous goals provide opportunities for a variety of ways of doing ICM and for tailoring the approach to suit the situation.
- Network of CCCs has been established and a mass of people have been exposed to, and had the opportunity for, some involvement in ICM.
- ICM has become institutionalised within DNR, and there is considerable support (at least at a policy level) for ICM in other government departments and local government.
- Both levels of government, the community and industry have responded to the philosophy of catchment management in a variety of ways. The broad goals of ICM provide for a range of interests to be involved and contribute to achieving these goals.
- The participative approach has been well received by most sectors of the community. It has assisted in making catchment plans and management activities consistent with local needs and goals.
- Most CCCs have used a representative model for membership of the management committee. This has resulted in a broad diversity of interests coming together on the committees – often for the first time – with generally very positive results.

Weaknesses

- Breadth of the program has resulted in the need for individuals and groups to gain an understanding of what s trying to be achieved and how to apply it. This is a costly and time consuming process (for example, it takes up to five years for catchment groups to become fully operational).
- Financial resources to achieve these broad but ambitious goals have been erratic and low.
- CCCs have no statutory powers or revenue raising capability.
- Participants are concerned that the linear planning then implementation approach to ICM has resulted in questions being asked about the availability of resources to implement once all the planning is completed.
- Complex planning processes are required, with no single process being used. Each catchment group has needed to invent its own.
- Absence of a 'whole of government' approach, commitment or involvement.
- Emerging problems like biodiversity conservation and nutrient enrichment of waterways (particularly in the estuarine and marine areas) are not well defined technically, and ICM groups have found it difficult to focus their priorities and activities where these are key issues.
- Implementation mechanisms for catchment strategies are non-existent or unclear.

- Funding guidelines and arrangements keep on changing, making the targeting of these resources difficult.
- The public generally has a low level of awareness of natural resource management issues.
- Only a small percentage of the public are active participants in catchment management activities.
- Lack of monitoring and feedback mechanisms to provide data on the impacts of ICM and the effectiveness of the approach.
- Representative model used to form management committees is not always effective in getting the right individuals involved. It leads to assumptions about the quality of communication between the group and the constituent member organisations. There is a need for all members to take a whole-of-catchment view of issues – to protect sectarian interests.
- Differences in perceptions between the chairs and coordinators of progress in achieving the aims and objectives of catchment groups.

Opportunities
- Clear technical solutions exist for many of the natural resource management problems in Queensland.
- A critical mass of people has been established with an understanding of ICM and skills in its application.
- ICM has challenged people to understand causes and respond to them through targeted action to get real changes (for example, much of the riparian zone management and rehabilitation activities.
- Local government is being increasingly involved in catchment management in a variety of ways (from stormwater management to rural residential design). Interest by local government continues to grow.
- Among those involved in, or at the fringes of groups doing ICM, there is a much greater acceptance of the need for a planned and strategic approach than seven years ago. The challenge is in translating this interest into practical action.
- The planning that has already occurred provides those groups with opportunities to tap into funding resources that require strategic and integrated solutions to problems (for example the NHT regional component).

Threats
- High expectations of what ICM can deliver by the community and government.
- Over-reliance on voluntary contributions by community and industry without commensurate rewards, particularly in the short term.
- The level and breadth of skills needed to actually implement the complex catchment management plans produced.
- Identification and establishment of the right implementation arrangements (structures, policy and resources) for it to go ahead.
- Ongoing resourcing of what are very large, voluntary-based organisations.
- Ongoing commitment to technical and administrative support by government agencies, local government, industry organisations and tertiary institutions is required for the partnership between these bodies and the community to work. Voluntary community people involved in catchment groups require this support. (Rowland and Begbie, 1997: 4-5).

6. Landcare and ICM

There is a strong relationship between the structure and linkages of ICM and Land Care. A clarification of the roles and functions of both ICM and Landcare was discussed in the discussion paper: Landcare and ICM Working Together. This clarification was required because the frameworks of ICM and Landcare overlap. There was confusion about the different roles and objectives of ICM and Landcare and the respective coordinators and facilitators. Additionally, there was confusion about the level of coordination and support, particularly at the regional level, which address resource management issues (DNR Queensland, 1997: 2).

ICM and Landcare have a complementary relationship. There are strong similarities in the approaches to natural resource management and use, which are community based and focused on sustainability and balance. However, the main difference between ICM and Landcare is that ICM deals with the condition of entire catchments, whereas, Landcare deals mainly with local issues on a much smaller scale, either property or small-catchment. (*The Source - Integrated Catchment Management News and Views*. April 1992. 1.Pg. 8.)

Nevertheless, ICM and Land care are both flexible and adaptable to the needs of individual communities. ICM and Landcare are both important approaches to natural resource management because each makes important and unique contributions to management. Together, ICM and Landcare can provide an effective way to achieving the sustainable and balanced use of natural resources. (*The Source - Integrated Catchment Management News and Views*. April 1992. 1.Pg. 8.)

Guide to Literature for Landcare and ICM

Catchment Management Coordinating Committee Meeting 94-2, Item 10, 29 July 1994. *Relationship Between ICM and Landcare.*

Landcare and Catchment Management Council. 1999. *Strategic Plan 1998 – 2001.* The State of Queensland, Department of Natural Resources, Cooparoo, Brisbane.

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Queensland, Department of Natural Resources. 1997. *Landcare & ICM Report and Recommendations Paper. Review of Integrated Catchment Management and Landcare Arrangements.* Department of Natural Resources, Brisbane.

The Source - Integrated Catchment Management News and Views. April 1992. 1

6.1 Landcare & ICM
Report and Recommendations Paper
Review of Integrated Catchment Management and Landcare Arrangement

Department of Natural Resources, 1997.

This paper outlines recommended arrangements which promote the objectives of natural resource management and the interlinking of ICM and Landcare within a simple framework.

List of Recommendations

Recommendation 1:
That separate but closely linked Landcare groups and catchment committees be retained; that catchment/landcare subregions be used as the basis for preparing integrated resource management strategies; and that Regional Resource Management Coordinating Committees be formed to coordinate natural resource management action across subregions and catchments.

Recommendation 2:
That roles and responsibilities of support staff be redefined to include both landcare and catchment management.

Recommendation 3:
That a combined body called the Landcare and Catchment Management Council (LCMC) be established to replace the existing Queensland Landcare Council and the Catchment Management Coordinating Committee

Recommendation 4:
That membership of the LCMC consist of an independent chairperson and 18 members comprising:
- 5 representatives of landcare and catchment management groups;
- 5 industry representatives (extensive agriculture, intensive agriculture, grazing, water industry and fishing);
- 4 State Government representatives (DNR, DPI, DoE, DLG&P)
- 1 representative each from the Local Government Association of Queensland (LGAQ), Queensland Conservation Council (QCC), Greening Australia-Queensland (GA(Q)) and the Great Barrier Reef Marine Park Authority (GBRMPA).

Recommendation 5:
That the chairperson and the 5 industry representatives be selected through advertisements calling for expressions of interest; that invitations be issued to DNR, DPI, DoE, DLG&P, LGAQ, QCC, GA(Q) and GBRMPA to nominate a member each to serve on the council; and that 5 landcare and catchment management representatives be elected annually by appropriate processes in each region.

Recommendation 6:
That the LCMC be established as soon as possible after 30 June 1997 and no later than 1 January 1998.

Recommendation 7:
That sitting fees be paid, in accordance with guidelines set by the department, to the chairperson and members of LCMC who are not already paid for their time, and that expenses be paid for reasonable costs of travelling, accommodation and meals in line wit Public Service Aware rates.

Recommendation 8:
That consideration of closer integration of the various resource management, environment and sustainable production advisory committees and possible incorporation into the Queensland Natural Heritage Council (QNHC) be deferred until the focus of the Natural Heritage Trust (NHT) and its operation arrangements become clearer.

Introduction

For some time there has been confusion about perceived similarities between Landcare and ICM. At the Landcare Groups Conference at Bundaberg in June 1996, the Minister for Natural Resources, the Hon. Howard Hobbs MLA, announced that a review of the structure and linkages between Landcare and catchment management would be undertaken at the State, regional and local levels.

The overall purpose of this review was to propose arrangements which promote the objectives if natural resource management and the interlinking of ICM and landcare within a simple framework. That framework should enhance the development of community and government partnerships in planning and implementing natural resource management policies and programs.

An ICM/Landcare Review Committee was formed to guide the review process. Members include the representatives of the Queensland Landcare Council, the State Catchment Management Coordinating Committee, and the Department of Natural Resources. Terms of reference and members of the Review Committee are listed in Appendix 1.

A Discussion Paper was released in January 1997 with the closing date for comments being 17 March 1997.

Extensive consultation was undertaken with clients, stakeholders, relevant government departments and agencies, landholders and departmental officers. Meetings were held with key clients in January and February 1997.

This document reports the outcomes of the review and outlines recommended arrangements that promote the objectives of natural resource management and the interlinking of ICM and Landcare within a simple framework.

Background

There is a general lack of understanding in many sectors of the community of the roles and functions of landcare and ICM. It is often perceived that both groups are competing for the same community members, community and industry support and the same funds. They are also often seen to be attempting to address similar or overlapping issues.

The need therefore exists to clearly articulate and effectively communicate the roles and functions of both landcare and ICM so that all parties have a clear understanding of both movements.

A need also exists for better integration and linking of the actions of landcare and ICM. In particular, a need has been identified to establish an efficient partnership to effectively harness industry, client and government input into these community-led approaches to natural resource management.

Issues

The following issues were raised as a basis for discussion:
- Confusion about the roles and objectives of landcare and ICM, particularly at the regional level;
- Confusion over the roles of landcare and ICM coordinators and facilitators;
- Inadequate coordination and support at the regional level to address resource management issues;
- The need for both landcare and ICM to exist as both have valid functions, however, the activities of each need to be clearly defined;
- Current structures reflect the present situation only in landcare and catchment management – the need for a visionary approach as we look to the future;
- The need for broad integrated strategies to be developed on other than a catchment basis where the areas of interest do not conform with catchment boundaries.

Consultation

Nearly 2000 copies of the Discussion Paper were distributed to key community groups, organisations, departmental officers and landholders. These included:
- Queensland Landcare Council
- Catchment Management Coordinating Committee
- Industry organisations
- Landcare groups
- Catchment Coordinating Committees
- The State Government departments of Primary Industries, Environment, Local Government and Planning and Natural Resources
- Local Authorities
- Landcare facilitators and catchment coordinators

A total of 63 responses were received. Table 1 indicates the number of responses from the various sectors of the community.

Table 1: Responses to the Discussion Paper

Respondent	Number
Landcare groups and catchment committees	23
Individuals	15
Landcare coordinators/project officers	3
Local Governments	8
Industry bodies and organisations	10
Government departments	1
DNR district officers	3

Summary of Responses

Vision for ICM and landcare for the year 2006

There was broad support for the vision stated in the Discussion Paper, which identified the following key elements as central to the vision for ICM and landcare for the year 2006.

- The community taking the lead
- Government focusing on policy and regulatory roles
- The community developing priorities and delivering actions through a regional approach with coordination at regional and State levels.
- Strong local action at both the catchment and landcare group levels working within catchment/regional strategies
- Landcare and catchment management retaining their identity with groups at the local, catchment and regional scales, but linked through a Regional Resource Management Coordinating Committee.
- The CMCC and QLC merging into one body at the State level to provide policy and advice to the Minister and to the community through regional groups/committees.
- The catchment/regional focus as the basis for setting priorities and actions, with action at the local level consistent with achieving the wider catchment/regional priorities.
- The Regional Resource Management Coordinating Committees and the merged State body assessing projects and determining priorities for funding.

Of the 37 responses to this issue, 14 specifically stated that they supported the vision for ICM and landcare. Supporting comments included:

- Desire to see successful amalgamation of ICM and landcare principles, ideals and philosophies.
- Vision looks great – is what people in landcare have been saying for a long time
- The vision meets the desired outcome of the maintenance of 'grass roots' actions on landcare/catchment management with better coordination on a regional/State basis
- Support for the vision, but stress the community, industry and government working in partnership to develop policy and deliver actions.
- Support for a concerted effort rather than ad hoc projects undertaken at the local level without real communication between interested parties
- While it was necessary to retain identity for landcare and ICM at the local level, they should be combined at the regional level.
- It is important to remember that landcare and ICM committees are community groups and as such need to be run and owned by local communities if they are to succeed.

Other relevant comments included:

- The vision is well thought out and presented. However, could see no reason for retaining separate identities for landcare and catchment management at any level – let the whole framework be integrated.
- The vision would depend on the option chosen, and that by putting up the vision, the cart was being put before the horse.

Roles and Responsibilities

Generally, there was agreement to the roles and responsibilities proposed for the modified landcare and catchment management framework. Of the 35 responses to this issue, 10 specifically stated that they supported the proposed roles and responsibilities. Comments included:

- Planned roles and responsibilities of the State, regional and local committees are appropriately focussed and complement each other.
- Current roles of QLC and CMCC tend to overlap and differences between them become blurred.
- Agreement with the proposed roles for Regional Resource Management Coordinating Committees (RRMCCs) – they would contribute to the attainment of landcare and ICM objectives in a strategic and resource efficient manner, possibly removing perception of duplication of services. They would be in a strategic position to prioritise projects and allocate funds according to priorities.

- The catchment level should not be involved in the assessment of projects – only with implementation, with assessment at the regional level. Issues should be identified at the catchment level and issues then prioritised at the regional level.
- Regional committees must foster community ownership of local groups initiatives.

Respondents also stressed the importance for landcare groups of planning and implementing on-ground action. Comments included:
- For continued success, landcare groups must be able to plan at the local level and have ownership of their projects.
- Landcare groups must be involved in implementation of on-ground works, not just planning, education and awareness.

Structure options at the regional level
There was support for the proposal to form informal Regional Resource Management Coordinating Committees as part of the modified landcare and catchment management framework. Comments included:
- A very workable and practical structure has been proposed
- Regional Assessment Panels (RAPs) should be retained in their present form for project assessment and evaluation. RAP boundaries should form the basis of the RRMCCs.
- Given the key roles of the RRMCCs, the lack of formal structure and informal meeting procedure is too vague.
- The proposed executive committee of the RRMCCs appears to be too heavily weighted with State government representation. DNR is the only department which should have representation on the executive. The other government departments could be coopted as and when necessary.
- It may be desirable to include local government on the executive of the RRMCCs.

Structure options at the State level
Of the 45 responses to this issue, 32 (or 73%) favoured a merged QLC/CMCC, i.e. options for a State resource Management Coordinating Committee (SRMCC) or Resource Management Advisory Committee (RMAC) Option B, with a direct reporting and advisory link to the Minister for Natural Resources.

A further breakdown of preferences is shown in Table 2.

Table 2: Respondent preferences for options listed in Discussion Paper

Option	Number of Respondents
State Resource Management Coordinating Committee	18
Resource Management Advisory Committee – Option A	4
Resource Management Advisory Committee – Option B	14
Community Advisory Committee	6
No Change	3
Total Responses	45

Comments in support of the merged QLC/CMCC included:
- The SRMCC looked the best of all options; a simplified structure is needed rather than making it more complex, and this looked to be the simplest solution.
- The structure was relatively simple compared with the other options and rightly emphasised the independence of landcare and ICM by amalgamating the peak bodies at State level.
- The name of the SRMCC should be changed to include the words 'landcare' and 'catchment', e.g. 'Landcare and Catchment Management Coordinating Committee' or 'State Landcare and Catchment Resource Management Committee'.
- RMAC Option B had the benefits of the status quo with the advisory committee responding to the Minister.
- RMAC Option B should improve coordination of both movements at the regional and State levels.

Regional boundaries
Of the 35 responses to this section of the Discussion Paper, 32 supported the concept of regions based on catchment and biogeographical boundaries. However, a number of respondents were concerned about the large size of some proposed regions, particularly those in the west of the State. There was also general support to further divide the Southeast region into probably three subregions due to the large population and wide diversity of issues. Comments included:
- The twelve regions appear fairly well thought out and could be reviewed if problems arise.
- Queensland Murray-Darling Basin should all be in the one region.
- Subdividing the State into regions is supported, and if possible, strategies should be developed in time for each of the regions.
- Support for boundaries, however because of the complexity and size of the North Region, question the logic of inclusion of Whitsunday in this region rather than the Central Region.
- South-east Regional boundaries are acceptable. However, there is a need for clearly defined subregions.

- Grouping Etheridge Shire into the North Region is Contradictory to the regional focus of the gulf Local Authorities.

Support structures required
Of the 27 who responded to this issue, 10 specifically stated that they supported the proposal for improved support structures at the local and regional levels. The support provided by local extension staff was highly valued and respondents felt it was essential to provide adequate permanent staff. Comments included:
- Fully support the proposal that permanency of staff be implemented
- Endorse support required at each level; local extension officers are a much needed asset; assistance provided to groups by government officers is highly valued.
- As strategies are implemented and landcare groups evolve, both organisations will have local community members employed and involved in natural resource management.
- Necessary support staff must be provided by government. However, if funded with NLP/NHT funds, it will mean less funds for on-ground works and grass roots activities.
- Reservations about excessive staff in administrative positions. The biggest percentage of money available to landcare and other conservation groups has got to be used for on-ground works.

Other general comments
Local Government
The matter of a role for local government was raised. Comments included:
- The role of local government in the delivery of services which are 'local' in nature, needs defining.
- A direct role for local governments had not been clearly defined other than being represented on the various landcare and ICM groups.

Funding
A number of responses indicated a concern about the proper use of funds. Comments included:
- The new structure should be cost effective to allow funding to get back to on-ground projects - structure not top heavy.
- The focus should be to get funding on the ground and not caught up in the bureaucratic system.
- Accountable structures must be delivered which can ensure wise investment of public dollars.
- Consideration needs to be given to some sort of remuneration for the time and effort the community members put in on these advisory councils.

Landcare and ICM roles
Comments on landcare and ICM roles included:
- Landcare and ICM essentially have the same objectives and purpose, and in the interests of more logical and cost effective administration, plans should be made for the two programs gradually to merge into one.
- It is necessary to have both landcare and ICM to achieve overall aims, and regular communication and liaison between both is necessary.

Timing of introduction
Comments on timing of introduction of any new arrangements included:
- The timing of the introduction of this new structure needs to be carefully considered in the light of elections to be held at Roma during the Queensland Landcare Conference in July 1997 for group representatives on the QLC.

Recommended Strategy

Following consideration of the responses to the community consultation program the Review Committee explored in detail the preferred future organisational arrangements for ICM and landcare.

Preferred local and regional arrangements
Arrangements proposed at the local and regional levels have been strongly supported. It is proposed to retain separate but closely linked landcare groups and catchment committees at the local level throughout the State with current roles and responsibilities and to form Regional Resource Management Coordinating Committees (RRMCCs).

It is recommended that the State be divided initially into twelve subregions based on a combination of catchment and biogeographical boundaries.

The need has been identified to further subdivide the proposed South-east Region into three subregions to better coordinate across the wide variety of issues and better cater for the large population base.

The need has also been established to re-examine boundaries in the Western and Gulf Regions to determine the most appropriate boundaries. For example, the Warrego-Paroo catchment is part of the Murray-Darling Basin

(MDB). Given Queensland's participation in the MDB Programs, there are logical reasons for the Warrego-Paroo to be included in with the other three catchments in the Queensland part of the MDB to form the one catchment/ landcare region. However, there are equally strong arguments for the Warrego-Paroo to be part of the West Region for project assessment and delivery of programs and activities such as the Southwest Strategy, which has a prime focus on rural reconstruction and natural resource management in the mulga lands.

Ultimately, the decision will need to be made by the local catchment community based on what makes best sense for that community. This is best done at the regional and local levels with the community groups concerned. If these proposals are implemented, this would lead to the formation of some 14 or 15 catchment/landcare subregions across the State. These subregions would be used as the basis for preparing regional resource management strategies.

RRMCCs will be needed to coordinate resource management action at the catchment/landcare and regional levels. The composition and level of formalised structure of these communities will be determined at the regional level. It will be influenced by operational arrangements for management of the Natural Heritage Trust. Different arrangements will probably be required for different regions and will be considered in the development of operational arrangements for the NHT.

Recommendation 1:

That separate but closely linked landcare groups and catchment committees be retained; that catchment/landcare subregions be used as the basis for preparing integrated resource management strategies; and that Regional Resource Management Coordinating Committees be formed to coordinate natural resource management action across subregions and catchments.

Guidelines and facilitation support may need to be provided from the State level to assist regions establish the RRMCCs. This task can be overseen by the proposed new merged landcare and ICM body when established.

Many groups now employ and manage their own project officers. This is seen as a cost-effective means of providing required support for groups. A network of extension staff in each region at the local level, supported by permanent DNR staff at the regional and State level, will be required to deliver the appropriate support on an on-going basis.

Local extension officers are highly valued by the groups. There was support for the roles of local extension staff to include both landcare and catchment management to reduce duplication of effort. However, this will depend on the particular circumstances in the subregion, such as the number of groups, size of catchment, etc. At the regional level, staff need to be experienced, with clearly defined roles, responsibilities and functions to ensure effective coordination across landcare and catchment management. In recognition of the very real constraints on funding, and the desire to maximise NHT funding for on-ground implementation, local and regional extension positions should, where possible, be filled by redefining responsibilities of current extension staff.

Recommendation 2:

That roles and responsibilities of current staff be redefined to include both landcare and catchment management.

Preferred State arrangements

There was wide support in favour of a merged ICM and landcare body at the State level (approximately 73% of responses). Consideration was given to the proposed organisational arrangement of a combined body, its name, linkages to other advisory bodies/committees and reporting arrangements, membership, functions and proposed implementation arrangements.

Title of combined body

All parties expressed a desire to adopt a title which was clearly identifiable with landcare and catchment management. The recommended name for a combined body is the "Landcare and Catchment Council". Other names were considered including "Queensland Landcare Council and Catchment Management Coordinating Committee", "State Resource Management Coordinating Committee" and the "Sustainable Resource Management Advisory Committee".

Recommendation 3:

That a combined body called the Landcare and Catchment Management Council (LCMC) be established to replace the existing Queensland Landcare Council and the Catchment Management Coordinating Committee.

Reporting arrangements and linkages to other advisory bodies/committees

The proposed Landcare and Catchment Management Council's (LCMC) principal advisory and reporting responsibilities would be to the Minister for Natural Resources. The LCMC would be represented on the Minister for Natural Resources' Ministerial Resource Management Advisory Council (MRMAC). The proposed structure for landcare and ICM is shown in Figure 1.

Linkages would be established and maintained with the Queensland Natural Heritage Council (QNHC), which is proposed to manage the administration and operation of the Natural Heritage Trust (NHT) in Queensland.

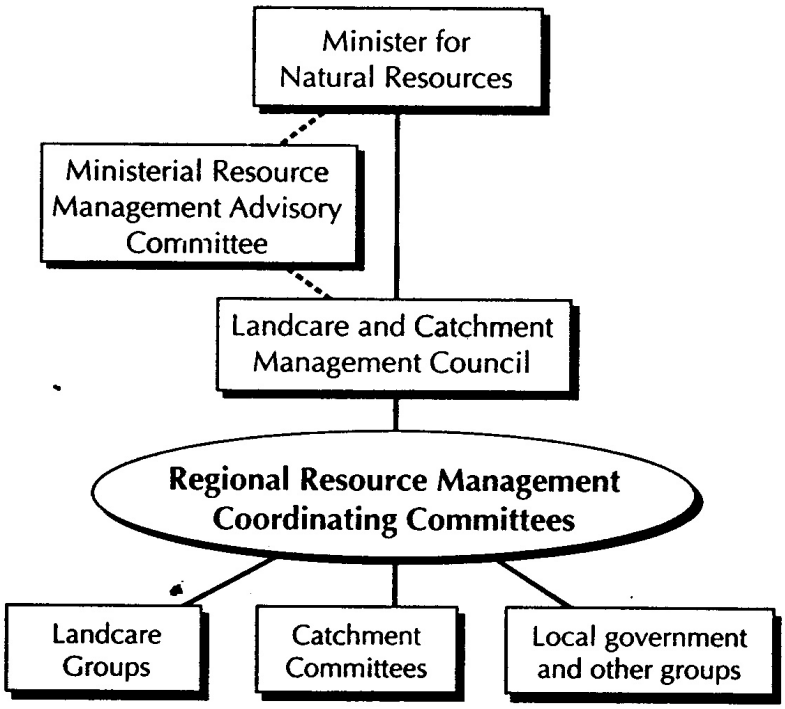


Figure 1: Recommended framework for the Landcare and Catchment Management Council

The LCMC would also link through the Minister for Natural Resources to the Ministerial Committee (consisting of the Ministers for Natural Resources, Environment, Primary Industries, and Local Government and Planning) proposed to be established to deal with issues relating to the NHT at a whole-of-government level. The Ministerial Committee would provide the means for better integration and coordination of effort at the State level across the broad areas of natural resource management, conservation, environment and sustainable agriculture. These linkages are shown in Figure 2.

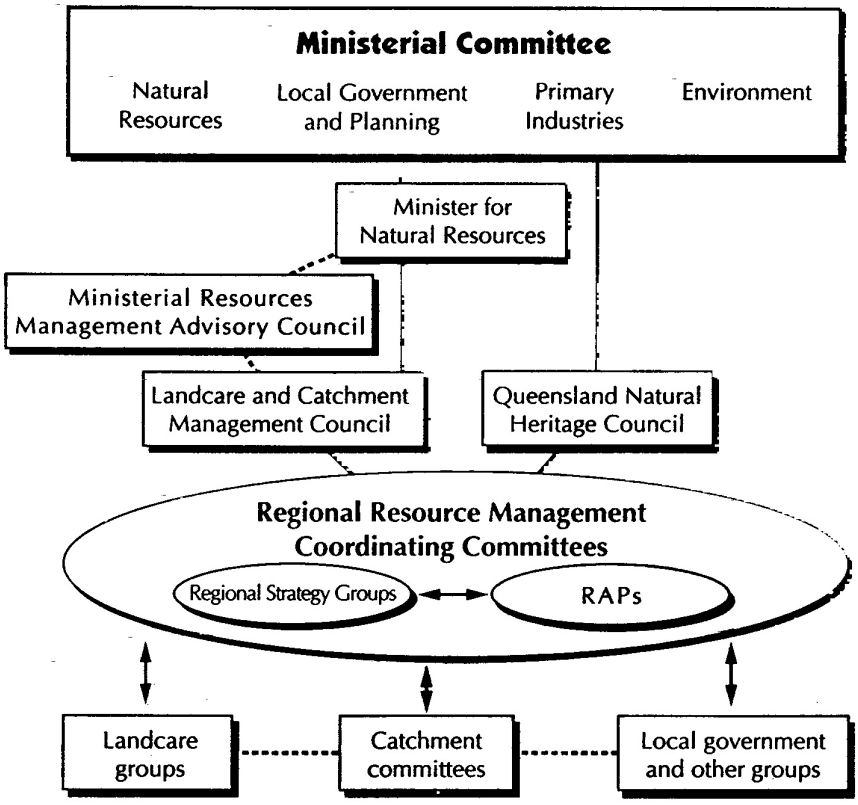


Figure 2: Links between the proposed Landcare and Catchment Management Council and the Natural Heritage Trust

It has already been argued that new arrangements need to be put in place to manage the NHT in Queensland. A separate Discussion Paper has been prepared outlining proposed arrangement for the operation of NHT in Queensland. It is proposed that the QNHC will take responsibility for endorsing regional resource management and environmental strategies. It would also set State priorities and strategies, oversee the assessment of project proposals and determine funding allocations across the NHT Programs. Five Regional Assessment Panels will assess project applications and State Assessment Panel will assess State-wide projects and report to the QNHC. Similar roles for the National Landcare Program were previously undertaken as responsibilities under either QLC and CMCC.

Membership

It is proposed that the membership of LCMC be composed of an independent chairperson and a committee of 18 members. The chairperson would be selected by the Minister for Natural Resources from nominations received through advertisement for people with broad expertise or experience in natural resource management. Committee membership is listed as per Table 3.

Table 3: Proposed membership of LCMC

Sector	*Number*	*Comments*
Landcare and catchment management groups	5	One from each NLP/NHT region, elected through appropriate processes in each region
Agricultural and fishing industries	5	Selected by the Minister for Natural Resources to represent extensive agriculture, intensive agriculture, grazing, water industry and fishing industries
State Government	4	One each from DNR, DPI, DoE and DLG&P
Local Government	1	Local Government Association of Qld
Conservation	1	Queensland Conservation Council
	1	Greening Australia-Queensland
	1	Great Barrier Reef Marine Park Authority

Recommendation 4:

That membership of the LCMC consist of an independent chairperson and 18 members comprising:

- *5 representatives of landcare and catchment management groups;*
- *5 industry representatives (extensive agriculture, intensive agriculture, grazing, water industry and fishing);*
- *4 State Government representatives (DNR, DPI, DoE, DLG&P);*
- *1 representative each from Local Government Association of Queensland, Queensland Conservation Council, Greening Australia-Queensland and the Great Barrier Reef Marine Park Authority.*

Proposed implementation arrangements

Arrangements will need to be put in place to establish the membership of the council. Advertisement could be placed, under the authority of the Minister, calling for expressions of interest for the position of chairperson of LCMC. Industry representatives would be selected by the Minister from nominations received through advertisement for people with expertise or experience in one or more natural resource-based industries.

The Minister would invite the four government departments, the Local Government Association of Queensland, Queensland Conservation Council, Greening Australia-Queensland, and the Great Barrier Reef Marine Park Authority to each nominate a member to serve on LCMC.

The annual Landcare Groups Conference currently elects three group representatives to QLC who could easily translate to members of any new Council. It is proposed that three catchment committee representatives would be selected in the first year by the Minister for Natural Resources by calling for expressions of interest. They would be appointed for a one year term. In subsequent years, one landcare and catchment management group representative would be elected in each region. Nominations could be announced at the annual groups conference.

Recommendation 5:

That the chairperson and the 5 industry representatives be selected through advertisements calling for expressions of interest; that invitations be issued to DNR, DPI, DoE, DLG&P, LGAQ, QCC, GA(Q) and GBRMPA to nominate a member each to serve on the Council; and that 5 landcare and catchment management representatives be elected annually by appropriate processes in each region.

The Landcare Groups Conference in July in Roma provides the ideal opportunity to launch the formation of the new council. Subject to Ministerial approval it is recommended that the new LCMC come into effect as early as possible after 30 June 1997 and no later than 1 January 1998.

Recommendation 6:

That the LCMC be established as soon as possible after 30 June 1997 and no later than 1 January 1998.

It is proposed that the LCMC would meet three times a year with a forth meeting being held in conjunction with the annual groups' conference.

The annual State Landcare Conference would continue but would broaden its focus to include catchment management. It would become known as the annual State Landcare and Catchment Management Groups Conference.

Functions
LCMC would have responsibility for fostering implementation of the Queensland Decade of Landcare Plan and the associated Priorities Actions 1997-2000 document and the Integrated Catchment Management Strategy. The Council will continue to deal with strategic priorities and policies for implementation of landcare and catchment management. Draft roles of the LCMC are presented in Appendix 2.

It is envisaged the LCMC will establish a series of committees involving council members to facilitate the business of council. As indicated above, the functions of State/regional assessment of NLP and related projects previously undertaken as a responsibility of QLC and CMCC, will become the responsibility of the QNHC. The draft roles of the LCMC may need to be modified when arrangements for the NHT are finalised.

Remuneration
Departmental policy on remuneration for consultative committees provides for the payment of sitting fees and expenses to chairs and members of consultative councils/committees which meet specific criteria. Daily fees would normally be paid to an agreed limit. However, an annual allowance may be paid at the discretion of the Minister where a chair (or other member) has a commitment averaging more than three days per fortnight. Sitting fees would be paid only to those members who are not already paid for their time.

The LCMC fits the criteria set for payment of sitting fees to chairs and members. Sitting fees would be paid for actual meeting days only, not for travel time, and expenses will be paid for reasonable travelling, accommodation and meal costs.

Recommendation 7:

That sitting fees be paid, in accordance with guidelines set by the department, to the chairperson and members of LCMC who are not already paid for their time; and that expenses be paid for reasonable costs of travelling, accommodation and meals in line with Public Service Award rates.

Possible future arrangements

With the establishment of the QNHC, consideration needs to be given to the future role of LCMC, QNHC and a range of other State committees with responsibilities for rural lands protection, Great Artesian Basin management, Property Management Planning and other resource management, conservation and environment protection roles. Linkages between these bodies are shown in Figure 3.

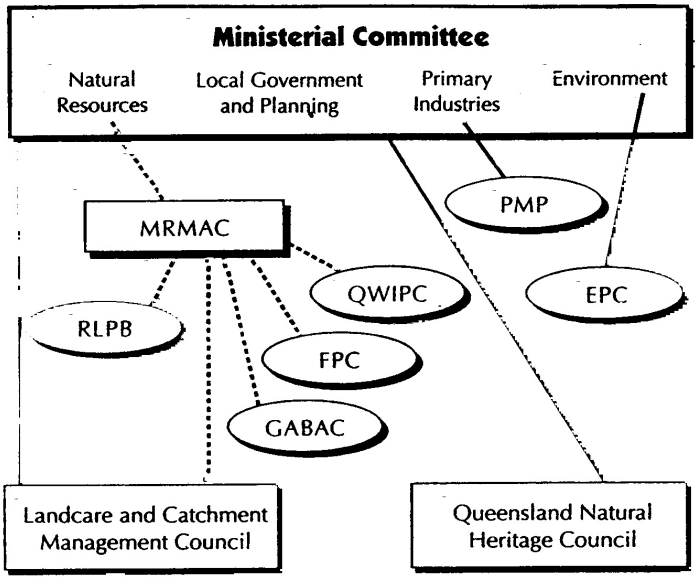
Each of these bodies has distinct functions that do not overlap. However, there is considerable scope for coordination of effort and a whole-of-government approach to maximise efficiency and effectiveness of client input to the advisory/consultative bodies.

A possible option to be considered in the future is for the LCMC and all the other natural resource and environment committees to become incorporated into the QNHC, as shown in Figure 4. A range of committees could be established under the QHNC to implement and investigate policies, priorities and actions for various elements of natural resource management, conservation, environmental protection and sustainable agriculture.

Investigation of this option needs to be undertaken at a later stage once the focus of NHT and its operational arrangements become clearer. Indications at this stage suggest that there may be adverse community reaction to further amalgamation of committees such as the Rural Lands Protection Board, State PMP Committee, etc and the incorporation of LCMC and QNHC.

Recommendation 8:

That consideration of closer integration of the various resource management, environment and sustainable production advisory committees, and possible incorporation of LCMC into the QNHC, be deferred until the focus of the NHT and its operational arrangements become clearer.



Legend: RLPB = Rural Lands Protection Board
MRMAC = Ministerial Resources Management Advisory Council
GABAC = Great Artesian Basin Advisory Committee
FPC = Forest Policy Council
QWIPC = Queensland Water Industry Policy Council
PMP = State Property Management Planning Committee
EPC = Environment Protection Council

Figure 3: Links between LCMC, QNHC and other State committees with resource management, conservation and environment protection roles

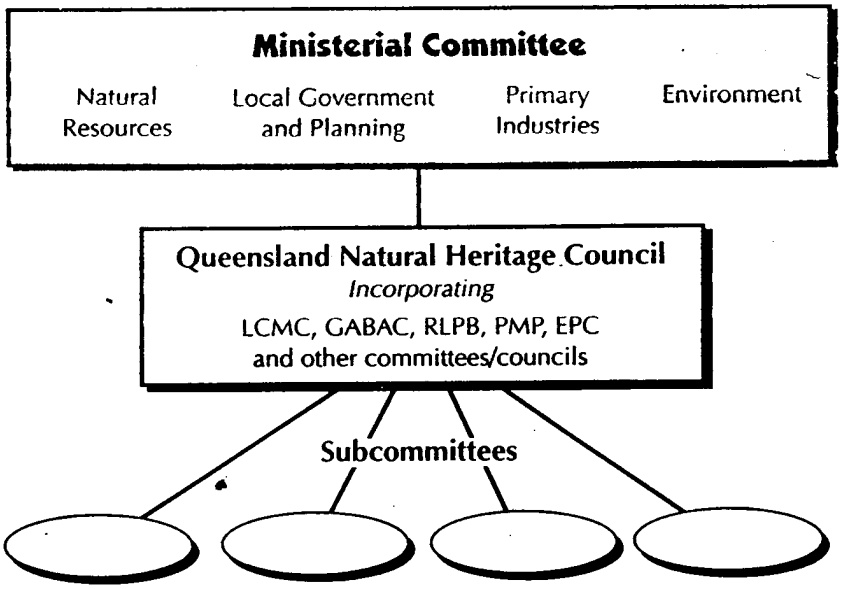


Figure 4: Possible future option for the incorporation of LCMC and other natural resource and environment committees into the QNHC

Conclusion

Following extensive consultation with a range of stakeholders, and considering a range of options as outlined in the Discussion Paper, the Review Committee has concluded that both the existing Queensland Landcare Council and the Catchment Management Coordinating Committee should be merged to form a new Landcare and Catchment Management Council (LCMC) to achieve better integration of landcare and catchment management strategies, priorities and policies at State level.

The new Council should be established as soon as possible after 30 June 1997 and no later than 1 January 1998.

Separate landcare and catchment management groups should be retained at the local level, with better integration and coordination being achieved through the establishment of Regional Resource Management Coordinating Committees and the preparation of integrated resource management strategies.

6.2 Interim Business and Operational Plan January 1998 – June 1998

Landcare and Catchment Management Council

Introduction

The Landcare and Catchment Management Council (LCMC) has produced the *Interim Business Plan and Operational Plan – January 1998 to June 1998,* to inform clients and stakeholders of its membership, structure, responsibilities, objectives and immediate order of business.

The business plan and operational plan are part of the LCMC's internal operations and are the responsibility of the Strategic Planning Committee. The purpose of the plans is to ensure that the LCMC's mission, objectives and specific roles are appropriate and realistic.

This interim version of the business plan will allow for all LCMC committees and working groups to finalise their roles and objectives. The LCMC will produce a final version of the business plan after a review in July.

Business Plan

Mission
The mission of the LCMC is:

To provide community leadership in partnership with government to achieve priority natural resource management, biodiversity conservation and sustainable production outcomes for Queensland.

Purpose
LCMC provides strategic advice to the Minister for Natural Resources on landcare, catchment management and the strategic direction for administration, management, operation, monitoring and evaluation of the Natural Heritage Trust (NHT) in Queensland.

Roles
The roles of the LCMC, as stated in its Terms of Reference are to:

1. Provide advice to the Minister for Natural Resources, either directly or through the Ministerial Resource Management Advisory Council or the Natural Heritage Committee of Ministers, on landcare, catchment management and NHT issues.
2. As part of the advisory role, identify State-wide priorities and develop policies, strategies and guidelines for the implementation of natural resource management, biodiversity conservation and sustainable production at a state and regional level in accordance with the principles of Ecologically Sustainable Development (ESD).
3. Maintain communication and landcare catchment management groups and encourage and support landholders and community groups to carry out landcare and catchment management activities.
4. Develop the framework and provide strategic direction for the operation, management and administration of the NHT in Queensland.
5. Foster co-ordination and integration between government agencies, industry and professional and community organisations, including appropriate national bodies, in resource management and NHT programs.
6. Co-ordinate the implementation of State-wide public awareness and education campaigns aimed at achieving an ethic of sustainable resource management in the community and widespread support for landcare, catchment management and NHT.
7. Co-ordinate development of regional resource management strategies and provide guidelines for their presentation and endorsement; ensuring that they advance and incorporate the implementation of national and state strategies and plans and other relevant regional and state planning studies.
8. Endorse regional boundaries for the efficient management of regional strategy development and project assessment and endorse regional/catchment strategies.
9. Develop guidelines for the membership and endorsement of Regional Strategy Groups (RSG), Regional Assessment Panels (RAP) and the State Assessment Panel (SAP), including the process and principles for selection of State and Regional Assessment Panels.

10. Develop guidelines to ensure open and accountable assessment of project applications by RAP and SAP; and ensure the monitoring, review and evaluation of the funded projects and the effectiveness of NHT Programs in Queensland.

Scope
The LCMC deals with landcare, catchment management and the delivery of the NHT in Queensland. As such, it has a primary focus on the delivery f natural resource management, biodiversity conservation and sustainable production programs in accordance with the principles of ESD.

Responsibilities
The responsibilities of LCMC (derived from the roles) may be regrouped under the areas of planning and advice to government, community leadership, and monitoring, as follows:

Planning and advice to government
- to advise the Minister for Natural Resources on landcare, catchment management and NHT issues
- to identify State-wide priorities and developing policies, strategies and guidelines for the implementation of natural resource management, biodiversity conservation and sustainable production
- to develop the framework and provide strategic direction for the operation, management and administration of the NHT in Queensland.

Community leadership
- to develop guidelines for the membership and endorsement of RSGs, RAPs and the SAP
- to develop guidelines to ensure open and accountable assessment of project applications by RAPs and SAP
- to provide guidelines for the preparation and endorsement of regional/catchment resource management strategies
- to endorse regional/catchment strategies and regional boundaries for the efficient management of regional strategy development and project assessment
- to foster support for landholders and community groups in carrying out landcare and catchment co-ordination activities
- to co-ordinate the implementation of State-wide public awareness and education campaigns
- to foster co-ordination and integration between government agencies, industry and professional and community organisations.

Monitoring
- to monitor, review and evaluate funded projects and the effectiveness of NHT programs in Queensland.

Reporting Relationships
LCMC will have the following reporting requirements:
1) LCMC will hold four meetings per year, one of which will be held immediately after the annual conference of landcare and catchment management groups.
2) LCMC will report to the Minister for Natural Resources after each meeting, and more frequently at the Chair's discretion.
3) LCMC will present an annual report to the Minister and to the annual conference of landcare and catchment management groups.
4) In order to fulfil its NHT roles, LCMC will liaise with RAPs, RSGs and the SAP (which will report to the Natural Heritage Committee of Ministers).

The reporting relationships of the LCMC in its NHT role as shown in Figure 1.

Structure
Membership
LCMC will have an independent chair, deputy chair and 18 members appointed by the Minister for Natural Resources, being:
- two members nominated by the Queensland Conservation Council, one with expertise in marine or in-stream freshwater habitat conservation.
- one member nominated by Greening Australia – Queensland
- three members nominated by the Queensland Farmers' Federation to represent extensive agriculture, intensive agriculture and grazing industries
- one member nominated by fishing interests
- one member nominated by the water industries
- one member nominated by the Local Government Association of Queensland
- four government representatives – one each from the Department of Natural Resources (DNR), Department of Primary Industries, Department of Environment (DoE) and Department of Local Government and Planning (DLGP)
- five community members, one elected from each of the five DNR regions

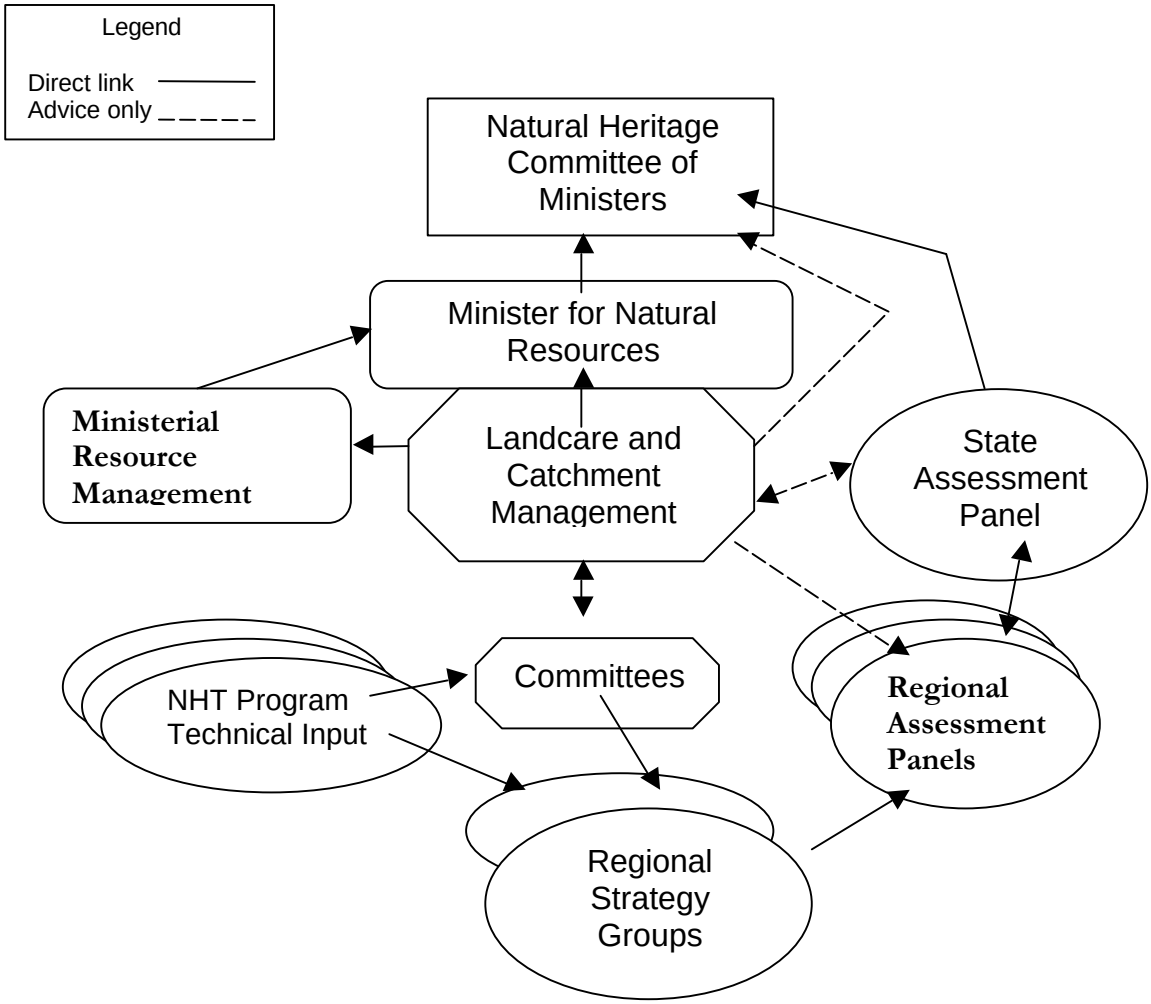


Figure 1. Reporting relationships of the LCMC in its NHT role

Operations
DNR will provide executive support for LCMC.

To reflect its various roles, LCMC has developed a committee structure that has been approved by the Minister for Natural Resources. LCMC committees may form working groups and co-opt expert advisors to progress specific issues.

The Executive Committee, consisting of the chair and deputy chair of LCMC, plus the committee chairs, may progress urgent matters between full LCMC meetings. LCMC committees may formulate policy recommendations for endorsement by LCMC (or in urgent circumstances, the Executive Committee).

Committees
LCMC will have four separate committees:
- Executive Committee
- Promotion and Education Committee
- Implementation Committee
- Strategy and Planning Committee

The structure of LCMC is shown in Figure 2.

Roles and working groups
Each committee will assume responsibility for achieving outcomes against the relevant roles of LCMC.

LCMC has recommended that each committee form working groups that have specific tasks and timelines (sunrise and sunset clause). Working groups are to report to the committees who in turn will make specific recommendations to full council.

Executive Committee

The Executive Committee is responsible for:

1. Dealing with urgent business of council between meetings
2. Carrying out the directions of council between meetings
3. Overseeing the implementation of LCMC policy between meetings.

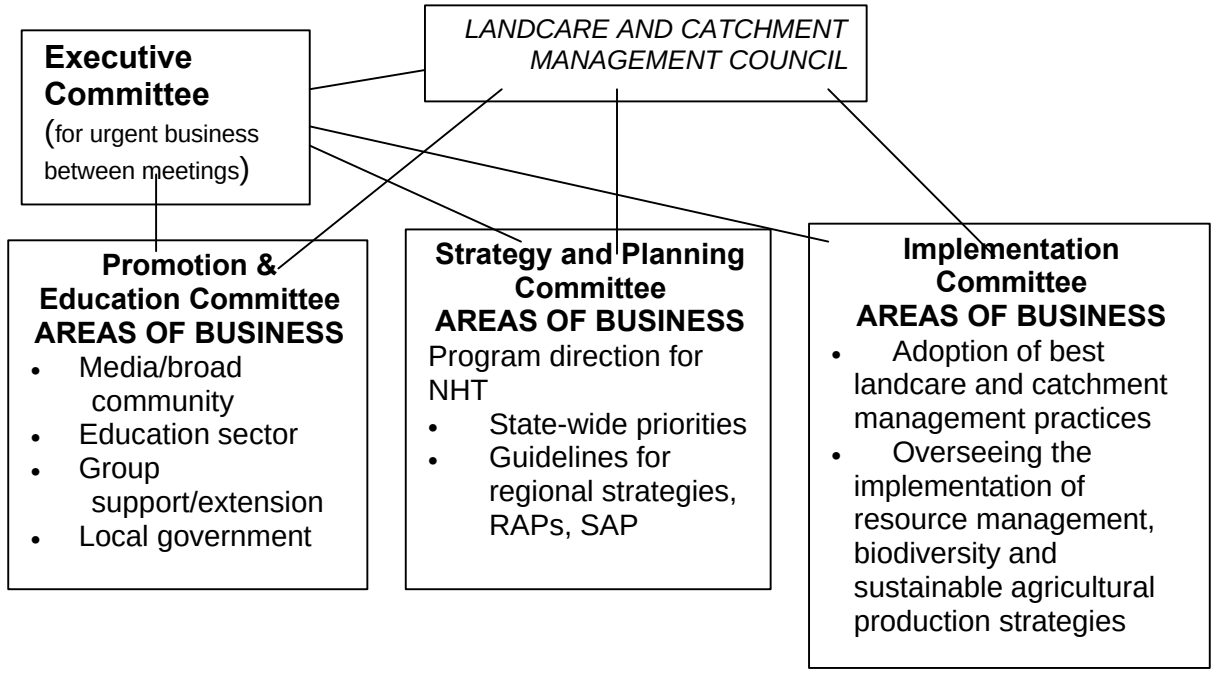


Figure 2. Structure of LCMC

Promotion and Education Committee

The Promotion and Education Committee is responsible for:

1. Maintaining communication with landcare and catchment management groups and encouraging and supporting landholders and community groups to carry out landcare and catchment coordination activities.
2. Fostering c-ordination and integration between government agencies, local government, industry, professional and community organisations, including appropriate national bodies, within resource management and NHT programs
3. Coordinating the implementation of State-wide public awareness and education campaigns for landcare, catchment management and NHT.

This committee will have several working groups including:

- Media/Broad Community Working Group
- Education Sector Working Group
- Community groups/Extension/Rural Industry/ Landholders Working Group
- Local Government Working Group.

Implementation Committee

The Implementation Committee is responsible for:

1. Overseeing the implementation of resource management, biodiversity and sustainable agricultural production outcomes as determined by LCMC by:
   a) liaison with groups and facilitator networks which are implementing resource management, biodiversity and sustainable production outcomes
   b) receiving, identifying and reporting on recommendations from these groups requiring LCMC actions; and ensuring that feedback occurs.

This committee will address a number of issues including:

- performance indicators for measuring progress against the partnership agreement
- reporting framework for LCMC
- internal operations and performance measures for the LCMC.

Strategy and Planning Committee
Taking account of Commonwealth interests, and in the context of the partnership agreement, the Strategy and Planning Committee is responsible for:

1. Setting priorities across the State
2. Reviewing the partnership agreement and recommending changes where necessary
3. Providing strategic advice to the Minister on implementation of national outcomes and state priorities
4. Providing guidelines for SAP/RAP and regional strategies
5. Overviewing and advising on regional arrangements
6. Endorsing regional/catchment strategies that comply with state guidelines

The whole committee is responsible for reviewing the partnership agreement and setting priority directions for the State. This committee will have a number of working groups, including:

- RAP/SAP guidelines and arrangements
- regional strategy guidelines
- catchment/regional strategy endorsement.

Support staff
Each committee will have executive support for organising, coordinating and conducting committee business. The departmental and work group responsible for executive support, or the committee members will provide administrative support. Each working group will have a convenor, who will be responsible for arranging appropriate administrative and executive assistance for the working group.

Executive Committee
The Executive Committee (EC) comprises the Chair of LCMC, Garth Ilett, the chairs (or nominees) of the three committees – Pat Fennell, Jennifer Marohasy and Ken Stallman. The LCMC Chair will chair the EC. DNR Manager (Landcare and Catchment Management) Don Begbie will provide executive support to the EC Chair. The LCMC Executive Assistant, Annette Leadbetter, (Landcare and Catchment Management) will provide administrative assistance to convene meetings, arrange meeting venues and provide minutes. A policy officer will provide policy support.

Promotion and Education Committee
The DNR Manager of the Community Education and Extension Support Group (CEES), Melva Hobson, will provide executive support to the Promotion and Education Committee Chair. CEES, Resource Sciences Centre, Indooroopilly, will provide administrative support.

a) Education Sector Working Group
   DNR Senior Education Officer Paul Hauenschild will provide executive support to the education sector working group convenor. CEES will provide administrative support.
b) Media/Broad Community Working Group
   DNR Senior Extension Officer Alison Moore will provide executive support to the Media/Broad Community Working Group convenor. CEES will provide administrative support.
c) Community Support Working Group
   DNR Acting State Coordinator (Landcare and Catchment Management) John Tadman will provide executive support to the Community Group/Extension/Rural Industry/Landholders Working Group convenor. The Landcare and Catchment Management Group will provide administrative support.

Implementation Committee
DNR Manager (Land Management) Mick Capelin will provide executive support to the Implementation Committee Chair. Land Planning and Management Group, DNR, will provide administrative support.

Strategy and Planning Committee
DNR Manager Don Begbie will provide executive support to the Strategy and Planning Committee Chair. The Landcare and Catchment Management Group will provide administrative support.

a) Strategy Review Working Group
   DNR Manager, Don Begbie, will convene meetings, arrange meeting venues and carry out the necessary endorsement procedures for the Strategy Review Working Group. The Landcare and Catchment Management Group will provide administrative support.
b) Regional Strategy Guidelines Working Group
   DLGP Officer Mike Bradby will convene and supply meeting venues and secretarial staff for minutes, etc., for the Regional Strategy Guidelines Working Group. DNR Manager Don Begbie, with assistance from DoE, will deliver the guidelines and the consultation processes.
c) RAP/SAP Guidelines Working Group

DNR Manager (External Funds) Brian Venz will convene meetings and arrange venues for the RAP/SAP Guidelines Working Group. The External Funds Group, Community Program Development, DNR, will provide administrative support.

Resourcing

LCMC will not employ its own staff. DNR will provide executive and administrative support for LCMC. Other departments will contribute resources to the effective operation of the relevant committees and working parties, principally through the in-kind contribution of personnel for technical and administrative support.

LCMC will prepare a three year business plan and an annual operational plan outlining its objectives and targets (together with timelines and performance measures necessary for reporting). The Minister for Natural Resources will approve the business and operational plans.

DNR will provide financial resources for the operation of LCMC, including executive and administration support for the Executive Committee. DNR and the LCMC Executive Committee will negotiate an annual budget that will be, subject to budget allocation, commensurate with the requirements for the delivery of the agreed business and operational plans of LCMC.

The annual budget will include sitting fees, members' expenses, costs of meetings and the salary and operating funds for executive and administrative staff. A budget of approximately $220,000 has been allocated for LCMC in 1997/98.

Figure 3 presents a model budget.

Statutory Status

The Landcare and Catchment Management Council is an advisory body to the Minister for Natural Resources. It is not recognised or constituted under any current State legislation and therefore does not have a statutory role.

6.3 Landcare and Catchment Management Strategic Plan 1998-2001

Landcare and Catchment Management Council

(Source: The State of Queensland, Department of Natural Resource, 1999)

Mission
To provide community leadership in partnership with government to achieve priority natural resource management, biodiversity conservation and sustainable production outcomes for Queensland.

Vision
By 2001 there will be enhanced natural resource management, biodiversity conservation and sustainable production outcomes being delivered through active partnering at State, regional and local levels between industry, governments, land-holders and the community.

Purpose
LCMC provides strategic advice to the Minister for Environment and Heritage and Minister for Natural Resources on landcare and catchment management issues. It also provides the strategic direction for the administration, management, operation, monitoring and evaluation of the Natural Heritage Trust (NHT) in Queensland.

A whole-of-government approach is achieved through Queensland's Natural Heritage Committee of Ministers for the Natural Heritage Trust. The committee consists of the Minister for Environment and Heritage and Minister for Natural Resources (as the lead minister), the Minister for Communication and Information, Local Government and Planning, and the Minister for Primary Industries.

At the Commonwealth level, ministerial responsibilities for NHT rest with the Minister for Agriculture, Fisheries and Forestry and the Minister for Environment and Heritage.

LCMC deals with landcare, catchment management and the delivery of NHT funding in Queensland. As such, its primary focus is on the delivery of natural resource management, biodiversity conservation and sustainable production programs. These programs are in accordance with the principles of ecologically sustainable development (ESD).

> *By 2001 there will be enhanced natural resource management, biodiversity conservation and sustainable production outcomes being delivered through active partnering at State, regional and local levels between industry, governments, land-holders and the community***.**

Achieving the Vision
LCMC's vision will be achieved through the pursuit of four strategies. Each strategy gives rise to multiple activities. These are as follows.

Strategies for Achieving the Vision

1 Coordinate and foster collaboration across governments, industry, land-holders and the community to achieve enhanced natural resource management, biodiversity conservation and sustainable outcomes.
2 Encourage the development of appropriate natural resource management and biodiversity conservation policies, strategies and plans at the State, regional and local levels and foster industry, government, land-holder and community ownership and commitment to these policies, strategies and plans.
3 Encourage the implementation, monitoring and evaluation of natural resource management, biodiversity and sustainable production strategies and plans across the State.
4 Foster an understanding of and a capacity to participate in natural resource management and biodiversity conservation by governments, industry, land-holders and the community.

The following key objectives are contained within the LCMC Business and Operational Plan

A Improved quality and timeliness of outcomes resulting from a greater cooperation between government, industry and the community.
B The development of strategic plans which demonstrate alignment and integration between State, regional and local activities.
C Outcomes which meet the requirements of funding bodies and the people of Queensland. The result of these outcomes will be increased levels of investment in natural resource management and biodiversity conservation.
D A growing community understanding of the value and benefits of participating in cooperative approaches to natural resource management and biodiversity conservation.

Strategy Overview

STRATEGY 1

Coordinate and foster collaboration across governments, industry, land-holders and the community to achieve enhanced natural resource management, biodiversity conservation and sustainable outcomes.

A clarification of and commitment to the roles of governments, industry, land-holders, community groups and individuals in the development and delivery of natural resource management and biodiversity conservation is critical to the strategy's success. LCMC will achieve this in the following ways.

A Clarify the roles of all levels of government, industry, land-holders and the community through the development of principles for natural resource and biodiversity management.

B Continue to inform industry, governments, land-holders and the community of the opportunities to participate and cooperate in the development and delivery of natural resource management and biodiversity conservation.

C Promote the effective delivery of natural resource management and biodiversity conservation programs at State, regional and local levels.

STRATEGY 2

Encourage the development of appropriate natural resource management and biodiversity conservation strategies and plans at the State, regional and local levels and foster industry, government, land-holder and community ownership and commitment to these policies, strategies and plans.

Understanding the issues, their priorities and how they will be addressed is a critical step in ensuring that commitment to action is developed and that any actions taken will deliver the outcomes required. LCMC will achieve this in the following ways.

A Coordinate the development of a natural resource management and biodiversity conservation framework for the State, forging a partnership between government, industry, land-holders and the community.

B Provide advice to government on industry and community concerns and expectations in relation to natural resource management and biodiversity conservation matters.

C Encourage the development of biogeographic regions and the identification of agreed priority natural resource management and biodiversity conservation issues, including research, which form the basis for operational activity for governments, land-holders and the community.

D Seek to ensure that there are linkages between strategies and plans developed by local, regional and State organisations and that these linkages optimise the efforts of groups involved in their development and implementation.

LCMC's vision will be achieved through the pursuit of four strategies. Each strategy gives rise to multiple activities.

STRATEGY 3

Encourage the implementation, monitoring and evaluation of natural resource management biodiversity and sustainable production strategies and plans across the State.

Attracting a commitment to actions and resources will be facilitated by a sound business approach. Defining the objectives and outcomes should also ensure that a realistic expectation of the results is established by investors and the community. LCMC will achieve this in the following ways.

A Encourage the development of best-practice guidelines for natural resource management and biodiversity conservation.

B Foster the development of a monitoring and evaluation framework that ensures that the results of programs and projects can be measured.

C Actively promote the benefits derived from actions taken and encourage investment and community participation at State, regional and local levels.

D Develop networks with groups involved in natural resource management and biodiversity conservation, and, where appropriate, seek to progress issues on their behalf at State and regional levels.

E Provide the strategic direction for the administration, management, operation, monitoring and evaluation of the NHT in Queensland.

F Influence the direction of research to ensure that natural resource management and biodiversity conservation best management practices are developed.

STRATEGY 4

Foster an understanding of an a capacity to participate in natural resource management and biodiversity conservation by governments, industry, land-holders and the community.

We all need to understand how best to access and manage information. We all need to develop the skills to be able to adequately participate in the planning and implementation of natural resource management and biodiversity conservation initiatives.

LCMC will achieve this in the following ways.

A Make appropriate representation to ensure that quality and timely information is available for stakeholder groups, and ensure that these groups have the necessary skills to make the best use of this material.

B Provide advice to government agencies regarding the need for extension services by community groups.

C Foster a better understanding of natural resource management and biodiversity conservation educational and training needs for the community, land-holders, industry and government agency staff.

D Develop an inventory of groups participating across the State and promote networking between groups.

E Encourage groups to share their experiences, knowledge and practices with each other.

F Contribute to the development of the capacity of industry, government and the community to effectively participate in natural resource management and biodiversity conservation programs.

Roles of LCMC

The roles of LCMC, as stated in its terms of reference, are as follows.

A Identify and influence State-wide priorities and develop policies, strategies and guidelines for the implementation of natural resource management and biodiversity conservation at State and regional levels in accordance with the principles of ESD.

B Maintain communication with landcare and catchment management groups and encourage and support land-holders and community groups to carry out landcare and catchment management activities.

C Oversee the development of the operational framework and provide strategic direction for the operation, management, evaluation and administration of the NHT in Queensland.

D Foster coordination and integration between government agencies, industry and professional and community organisations, including appropriate national bodies, in resource management and NHT programs.

E Coordinate the implementation of State-wide public awareness and education campaigns aimed at achieving an ethic of sustainable resource management and NHT.

F Coordinate the development of regional resource management strategies and provide guidelines for their preparation and endorsement, with the aim of ensuring that they advance and incorporate the implementation of national and State strategies and plans and other relevant regional and State planning studies.

G Endorse regional boundaries for the efficient management of regional strategy development and project assessment and endorse regional/catchment strategies.

H Provide advice to the Minister for Environment and Heritage and Minister for Natural Resources, either directly or through the Natural Heritage Committee of Ministers, on landcare, catchment management and NHT issues.

I Develop guidelines for the membership and endorsement of regional strategy groups (RSGs), regional assessment panels (RAPs) and the State Assessment Panel (SAP), including the process and principles for the selection of State and regional assessment panels.

J Develop guidelines to ensure the open and accountable assessment of project applications by RAPs and SAP, and ensure that processes are in place to effectively monitor, review and evaluate funded projects and the effectiveness of NHT programs in Queensland

LCMC will hold four meetings a year and report to the Minister and State and regional groups.

Reporting Relationships

LCMC will have the following reporting requirements.

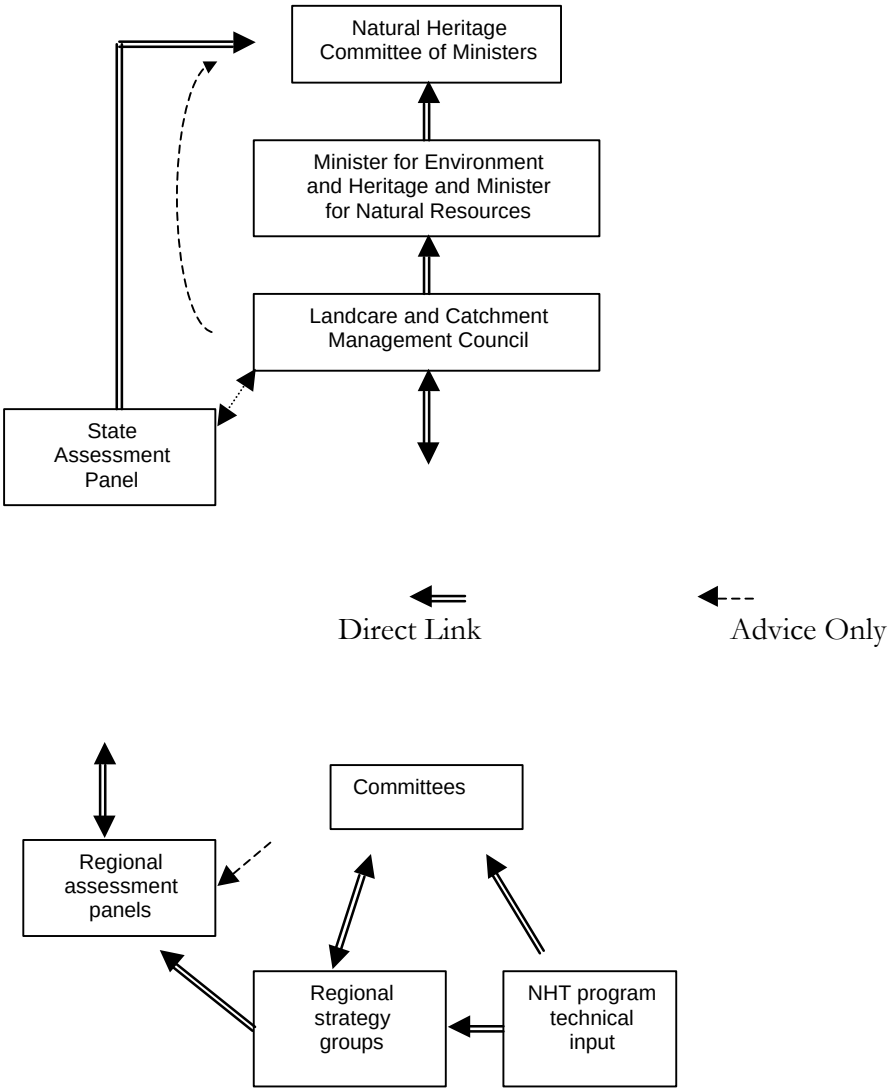
A Hold four meetings per year, one of which will be held immediately after the annual conference of landcare and catchment management groups.

B Report to the Minister for Environment and Heritage and Minister for Natural Resources after each meeting, and more frequently at the chair's discretion. Present an annual report to the Minister and to the annual conference of landcare and catchment management groups.

C In order to fulfil its NHT roles, LCMC will liaise with RAPs, RSGs and SAP (which will report to the Natural Heritage Committee of Ministers).

The reporting relationships of LCMC in its NHT role are shown in figure 1.

FIGURE 1 REPORTING RELATIONSHIPS OF LCMC IN ITS NHT ROLE



Structure

Membership

LCMC will have an independent chair, a deputy chair and 21 members appointed by the Minister for Environment and Heritage and Minister for Natural Resources, being:

- six community members elected from landcare and catchment management groups
- two members nominated by the Queensland Conservation Council, one with expertise in marine or in-stream freshwater habitat conservation
- one member nominated by Greening Australia Queensland
- three members nominated by the Queensland Farmers' Federation to represent the extensive agriculture, intensive agriculture and grazing industries
- one member nominated by fishing interests
- one member nominated by the water industries
- one member nominated by the Local Government Association of Queensland
- one member nominated by the indigenous community
- one member nominated by the Great Barrier Reef Marine Park Authority
- four government representatives - one each from the Department of Natural Resources (DNR), Department of Primary Industries (DPI), Environmental Protection Agency (EPA) and Department of Communication and Information, Local Government and Planning (DCILGP).

Operations

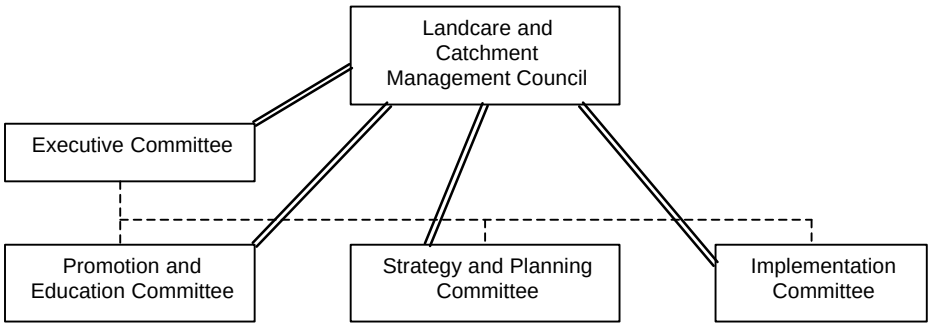
DNR will provide executive support for LCMC. To reflect its various roles, LCMC has developed a committee structure that has been approved by the Minister for Environment and Heritage and Minister for Natural Resources. LCMC committees may form working groups and co-opt expert advisers to progress specific issues.

The Executive Committee, consisting of the chair and deputy chair of LCMC, plus the committee chairs, may progress urgent matters between full LCMC meetings. LCMC committees may formulate policy recommendations for endorsement by LCMC.

Committees
LCMC will have four separate committees:
- Executive Committee
- Promotions and Education Committee
- Implementation Committee
- Strategy and Planning Committee

The structure of LCMC is shown in figure 2

FIGURE 2 STRUCTURE OF LCMC



Roles of Committees and Working Groups

Each committee will assume responsibility for achieving outcomes against the relevant roles of LCMC.

LCMC has recommended that each committee form working groups that have specific tasks and timelines (sunrise and sunset clauses).

Working groups are to report to the committees who, in turn, will make specific recommendations to full Council.

Executive Committee
The Executive Committee is responsible for:
- dealing with urgent business of Council between meetings
- carrying out the directions of Council between meetings
- overseeing the implementation of LCMC policy between meetings
- targeting investors

Promotion and Education Committee
The Promotion and Education Committee is responsible for:
- networking with groups involved in natural resource management, biodiversity conservation and sustainable production
- identifying needs and developing, delivering and promoting education and training in natural resource management, biodiversity conservation and sustainable production to raise community awareness, improve skills and increase the knowledge base
- fostering and promoting cooperation and integration among government, industry, professional and community organisations, including appropriate national bodies, within resource management and NHT programs
- coordinating the implementation of State-wide public awareness and education campaigns for landcare, catchment management and NHT, with links to national activities.

Implementation Committee
The Implementation Committee is responsible for:
- promoting good communications through networking with community groups and facilitator networks
- ensuring the maintenance of a two-way reporting framework which allows LCMC to identify successes and issues, and addressing concerns from community groups and facilitators which LCMC should progress
- ensuring that an effective monitoring and evaluation process is implemented to measure outcomes for reporting to investors and other interested parties
- acting as the Queensland Bushcare Reference Group as part of NHT program management
- identifying and establishing other reference groups to ensure that linkages are in place and progress is being made to meet natural resource and biodiversity outcomes
- providing oversight of and advice on regional arrangements for natural resource and biodiversity management participation and coordination.

Strategy and Planning Committee
Taking account of Commonwealth interests, and in the context of the Partnership Agreement, the Strategy and Planning Committee is responsible for:
- identifying and promoting action on the critical resource management and biodiversity priorities across the State
- reviewing the Partnership Agreement and recommending changes where necessary
- providing strategic advice to the Minister on implementation of national outcomes and State priorities
- providing policy and guidelines for SAP, RAPs and regional strategies
- reviewing regional/catchment and other strategies, and providing advice on alignment between State, regional and local issues and priorities and ensuring compliance with State guidelines
- making available information relating to the array of strategies, in place or under development, and the associated community group contact details.

Support Staff
Each committee will have executive support for organising and coordinating committee business. Support for the various committees will be provided by departmental officers as follows:
- Department of Natural Resources will support the Executive Committee and the Promotion and Education Committee
- Environmental Protection Agency will support the Implementation Committee
- Department of Primary Industries will support the Strategy and Planning Committee

Responsibilities for major tasks identified by committees will be negotiated at task development time. Any working groups established will have a convenor, who will be responsible for arranging appropriate administrative and executive assistance for the working group.

Resourcing
LCMC will not employ its own staff. DNR will provide executive and administrative support for LCMC. Other departments will contribute resources for the effective operation of the relevant committees and working parties, principally through the in-kind contribution or personnel for technical and administrative support.

LCMC will prepare a three-year business plan and an annual operational plan outlining its objectives and targets (together with timelines and performance measures necessary for reporting). The Minister for Environment and Heritage and Minister for Natural Resources will approve the business and operational plans.

DNR will provide financial resources for the operation of LCMC, including executive and administrative support fir the Executive Committee. DNR and the LCMC Executive Committee will negotiate an annual budget that, subject to budget allocation, will be commensurate with the requirements for the delivery of the agreed business and operational plans of LCMC.

The annual budget will include sitting fees, members' expenses, costs of meetings and the salary and operating funds for executive and administrative staff.

Statutory Status
The Landcare and Catchment Management Council is an advisory body to the Minister for Environment and Heritage and Minister for Natural Resources. LCMC is not recognised or constituted under any current State legislation and therefore does not have a statutory role.

7. Regionalisation

There are 13 regions in Queensland that are based on catchments, landscapes and vegetation types. The primary aim of defining the boundaries was to ensure the coverage of all areas in the State in a Regional Strategy and also to minimise duplication of effort from overlapping strategies. However, the boundaries were not intended to restrict local communities from developing a Regional strategy based on common community themes (DNR Queensland, 1998: 21).

The purpose of regional natural resources and biodiversity conservation strategy is to lay out clearly and concisely, the way sustainable management of natural resources and conservation is intended to be achieved in a long term commitment. Regional strategies aim to assist communities in working together to achieve the identified goals. The relationship between the process of the planning and the implementation is important because, experience with implementation contributes back into the planning process, to continually improve the strategies. (DNR Queensland 1998: 9)

Further Reading

Queensland Government Department of Primary Industries (DPI). 1993. *The Condition of River Catchments in Queensland.* Queensland Government Department of Primary Industries, Brisbane.

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Resource Sciences Centre of the Department of Natural Resources, Spatial Information and Mapping Group. Map of Queensland showing, *Queensland Natural Resource Regional Strategy Boundaries.* Queensland Government Department of Natural Resources, Brisbane.

Thorman, R. and Heath, I. 1997. *Regional Environmental Strategies - How to prepare and implement them.* Australian Local Government Association, Deakin

7.1 Interim Guidelines for the Development of Natural Resources and Biodiversity Conservation Regional Strategies

Queensland Department of Natural Resources

(Source: Queensland Government Department of Natural Resources. October 1998. Interim Guidelines for the Development of Natural Resources & Biodiversity Conservation Regional Strategies. Department of Natural Resources, Brisbane.)

What is a Regional Strategy:

A Regional strategy consists of a number of sections. The sum of these is a clear unambiguous statement describing a community's vision for the future of the region and the process by which this vision in implemented. A Regional Strategy therefore answers the question "WHAT" does your community want the region to be like in the future and "WHAT" issues need to be addressed to make the vision real. To achieve this requires answers to a number of other questions. These are; "WHICH" issues should be addressed an in what order, "WHERE" are the issues located, "WHEN" should these issues be addressed, "HOW" will your community go about addressing the issues, and "WHO" will do the work.

Before progressing to a description of the steps involved in developing a Regional strategy (later in these guidelines), a distinction needs to be made between the role of a Regional strategy and the roles of regional Business plans and Action plans.

A Regional strategy's role is to provide a long term logical framework for communities to work together and address issues on a regional scale. Regional strategies are not designed to provide detailed day to day answers. These answers are addressed through regional Business plans and Action plans. (p.8)

Regional strategies answer the question "WHAT" through the vision and values statements. It also answers questions 'WHICH", "WHEN" and "HOW" but only in the context of setting long term objectives, priorities and strategies.

Regional Business plans links the long-term view of a Regional strategy with the short term, day to day imperatives of Action plans.

Action plans are the on-ground detailed operating instructions which actually translate the vision into reality.

The implementation, and the monitoring and evaluation sections of the strategy ensure that the Regional strategy, the Business plans and Action plans achieve what the community first set out to do – that is to change its vision into on-ground results. The monitoring and evaluation process is especially important as it allows the community to review the validity of the vision in light of current events and the progress made towards its fulfilment.

Why Develop a Regional Strategy:

Environmental and natural resource management is complex and developing more sustainable ways of managing our land, native vegetation and biodiversity takes a long-term commitment. Because of the long-term commitment required it is worthwhile spending time laying out in a clear and precise way, how we intend to achieve the sustainable management of the natural resources and biodiversity conservation. A Regional natural resources and biodiversity conservation strategy fills this role.

Good strategic plan is as much about the process of planning as it is about producing a document. A strategy should assist a community to work together to achieve goals. The relationship between planning and implementation is important, as experiences gained through on-ground activities can contribute to the continual process of improving the strategy.

It should also be kept in mind that if your RSG wishes to seek NHT funding support it is in its best interest to see that it operates in accordance with the guidelines developed by the LCMC and that its membership meets the requirements of the LCMC.

A well-developed strategy will:

- ensure public investment is directed to the highest priorities in your region, based on the knowledge and experience of local land managers and community interests (p9)
- create the potential to save money by reducing wasteful duplication and avoid counter productive actions;

- ensure all the issues related to sustainable natural resource management, biodiversity and environmental protection are addressed through a coordinated effort; and
- inform others in the community about activities in their area so that they can tailor their efforts to contribute to an overall improvement in the local environment.

A properly thought out Regional strategy should expose and help to resolve the tensions and options for trade-offs between short and long term objectives. For example, the tensions that exist between short term "one off" financial returns and long term ecological sustainability.

A Regional strategy should assist all stakeholders in your region to identify the importance of natural resources, including environmental, economic and social values, and help them work out how best to manage these resources for the long-term benefit of everyone.

All projects submitted for funding under the NHT will be considered on their individual merit. However, where projects submitted for funding have clear linkages to a Regional strategy these projects will be given a high priority and are more likely to receive funding. Communities which have not yet commenced or completed a Regional strategy, will still be able to receive funding for high priority community projects but in the future funding will be increasingly directed towards implementing agreed regional strategies. (p.10)

Endorsement of Regional Strategies:

Regional strategies will be endorsed by the Natural Heritage Committee of Ministers (NHCM) on the recommendation of the LCMC. This process is usually undertaken by a RSG for the purpose of applying for NHT and other public investment. Regional strategies are subject to criteria for endorsement (p.13).

Who Develops the Regional Strategy:

Developing an effective Regional strategy involves the participation and endorsement of as wide a cross section of your community as possible. This process is designed to draw out and reconcile your community's many and sometimes conflicting needs and expectations. To achieve the development of an effective strategy may require the establishment of a dedicated working group. If an organisation already exists in your region, having State government endorsement and wide community support, and having the capacity to fulfil the requirements of the RSG it may be convenient to use this body.

An effective strategy that will receive formal NHCM endorsement through LCMC, must be produced by people with skills and experience covering:

- environmental protection (including biodiversity conservation), (p.14)
- sustainable agriculture,
- natural resource management,
- the management of land, water, marine, vegetation, mining and indigenous land management

A RSG may consist of representatives from key groups in the community, such as;

- primary and secondary industries and business and commerce groups;
- conservation groups,
- indigenous groups,
- indigenous groups,
- tourism and recreational industries,
- local governments,
- senior representatives, such as Regional Managers or Regional Service Directors from relevant government departments including Department of Natural Resources and Environmental Protection Agency
- Regional Organisation of Councils (ROC), Regional Economic Development Organisation (REDO) and Regional Framework for Growth Management (RFGM) (p.15)

The Role of the Regional Strategy Group:

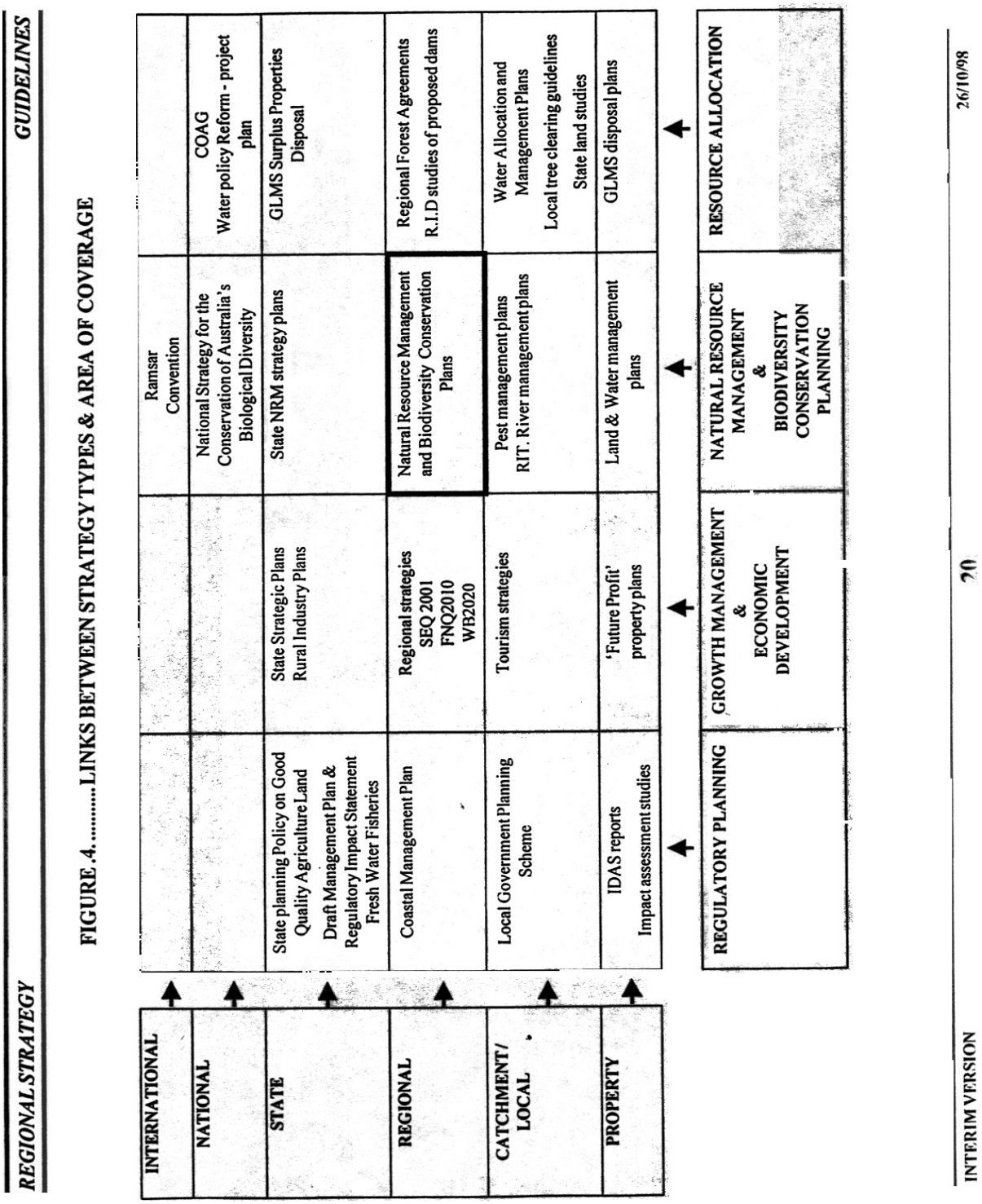
Once established the role of the RSGS is to:

- Develop a Regional Strategy within the framework of State and national strategies and in accordance with State guidelines
- Identify issues and potential issues and prioritise these issues, within the region
- Coordinate the implementation of these Action plans
- Commission projects, where necessary, to meet the requirements of the priority issues

- Monitor and report on the implementation of Regional strategy Action plans
- Provide the relevant Regional Assessment Panel (RAP) with information regarding local projects (p.16)

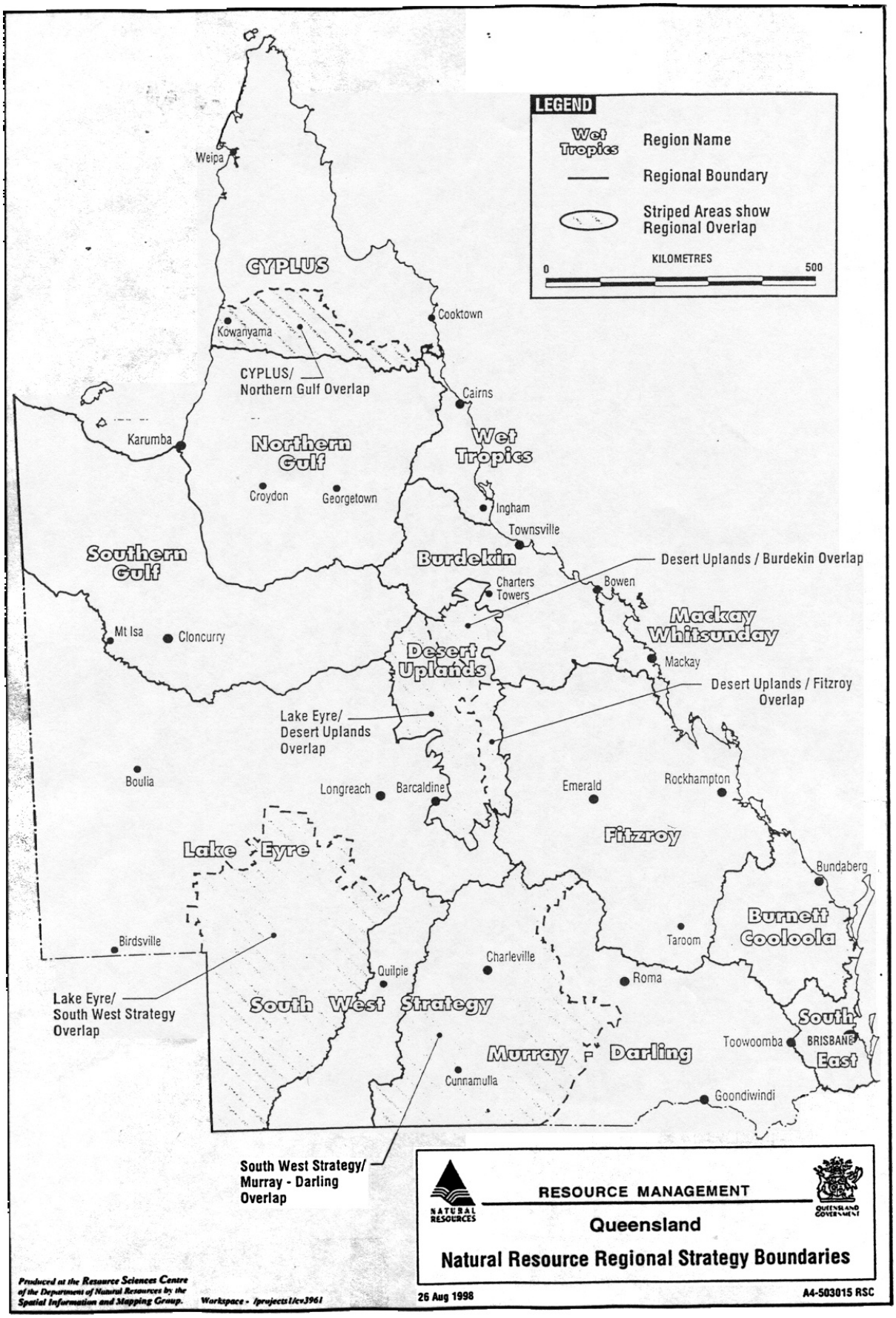
Figure 4 – Links between Strategy Types & Area of Coverage
Figure 4 illustrates how a Regional Strategy forms part of the continuous planning process being applied to natural resource management and environmental protection. It lies between individual resource planning carried out on a local scale and multi-national agreement between governments.

Figure 5 – The Six Components of a Regional Strategy
The components of a Regional strategy assists in clearly addressing the criteria for endorsement. This is not the only model capable of producing an acceptable result. Another approach that may be preferred in the RSG is the 'Pressure State Response' model utilised in the State of the Environment Reports.



(Extract taken from DNR Queensland, 1998: 7-25)

FIGURE .5. ..... THE SIX MAJOR COMPONENTS OF A REGIONAL STRATEGY


LEGEND
Wet Tropics
Region Name
Regional Boundary
Striped Areas show Regional Overlap
KILOMETRES
0
500
Weipa
CYPLUS
Cooktown
Kowanyama
CYPLUS/ Northern Gulf Overlap
Cairns
Karumba
Northern Gulf
Wet Tropics
Croydon
Georgetown
Ingham
Townsville
Southern Gulf
Burdekin
Desert Uplands / Burdekin Overlap
Charters Towers
Bowen
Mackay Whitsunday
Mt Isa
Cloncurry
Desert Uplands
Mackay
Desert Uplands / Fitzroy Overlap
Lake Eyre/ Desert Uplands Overlap
Boulia
Longreach
Barcaldine
Emerald
Rockhampton
Fitzroy
Lake Eyre
Bundaberg
Burnett Cooloola
Birdsville
Taroom
Charleville
Quilpie
Roma
Lake Eyre/ South West Strategy Overlap
South West Strategy
South East
Murray Darling
Toowoomba
BRISBANE
Cunnamulla
Goondiwindi
South West Strategy/ Murray - Darling Overlap
NATURAL RESOURCES
RESOURCE MANAGEMENT
QUEENSLAND GOVERNMENT
Queensland
Natural Resource Regional Strategy Boundaries
Produced at the Resource Sciences Centre of the Department of Natural Resources by the Spatial Information and Mapping Group.
Workspace - /projects1/cv3961
26 Aug 1998
A4-503015 RSC

8. Local Government

Local Governments play a fundamental role in ICM in Queensland (AACM & CWPR, 1995: 37). Their role is vital in the administration, coordination and implementation of natural resource management as a whole, as they have significant control and influence over planning and development activity and respond to social and economic change (DNR, 1996: 1). Additionally, the local authorities are responsible for the delivery of water and sewage service to urban areas, which confirms the local authorities' vested interest in water quality of delivery and discharge of the reticulation system.

However, the boundaries of local government areas and river catchments seldom correspond. River catchment boundaries are sometimes totally within a local government area and others extend over several local government areas for example the Condamine River Catchment. To ensure the success of ICM, the involvement and cooperation of local governments and the integration of local government activities is essential (DNR, 1996: 1). An example of cooperation of local governments is through the wide support of Landcare groups across many areas of Queensland (AACM & CWPR, 1995; 37).

Furthermore, the advancement of ICM in Queensland will be protected by the commitment of local governments to recognise and support the State's interests by cooperative action between mutually interested governments on matters of consequence to both governments (DPI, 1992: s5.3.3).

Further Reading

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Queensland Government Department of Natural Resources (DNR) 1996. *The Local Government and Integrated Catchment Management Communication Plan - A strategy for Greater Understanding and Involvement.* Catchment Management Unit, Department of Natural Resources, Brisbane.

Queensland Government Department of Natural Resources (DNR). *Integrated catchment management and local government: Warwick, Case Study.* Queensland Government Department of Natural Resources, Brisbane.

Unisearch Research Services. September 1994. *Integrated Catchment Management - A Survey of Local Governments.* Unisearch Research Services, Brisbane.

8.1 The Local Government and Integrated Catchment Management Communication Plan

Executive Summary

Catchment Management Unit, Department of Natural Resources

(Source: The State of Queensland, Department of Natural Resources. 1996. *The Local Government and Integrated Catchment Management Communication Plan. A Strategy for Greater Understanding and Involvement*. Brisbane. pp. vii-ix)

The Integrated Catchment Management (ICM) Strategy is a Queensland Government initiative which integrates the management of land, water, vegetation and biological resources of catchments. Through ICM, community, industry and government work together to develop and implement strategies for the better management of river catchments. The Department of Natural Resources (DNR) coordinates the ICM Strategy.

A state-wide committee of representatives from industry, government and the community oversees the implementation of the ICM Strategy. The Catchment Management Coordinating Committee reports directly to the Minister for Natural Resources. The Catchment Management Unit in DNR assists the CMCC in developing ICM guidelines and policies.

Local governments play a vital role in the administration, coordination and implementation of natural resource management planning. Because local governments influence local development and respond to social and economic change, they are key players in the success of ICM.

The Awareness and Education Sub-committee of the CMCC initiated a project to increase local government awareness and understanding of ICM. This project ran for 18 months and was jointly coordinated by the CMCC and the Local Government Association of Queensland and jointly funded by the Queensland Government and the National Landcare Program. The project, entitled 'Increasing local government understanding and involvement in ICM' determined the level of local government officers' awareness and understanding of ICM. Local government staff were surveyed in 1994. The survey results highlighted that a Communication Plan should increase the level of understanding of ICM concepts and provide 'best practice' information for local government officers to solve 'real life' catchment problems. The information gathered in the survey also provided the basis to evaluate improvements or changes in ICM awareness and understanding. One outcome of the project and its survey is this Communication Plan.

The Communication Plan identifies five important target audiences:

- planners
- engineers
- councillors
- chief executive officers
- the community.

The information needs of each of these target audiences have been addressed with a series of objectives. Using these objectives, 11 strategies were developed to address particular issues for each target audience.

The 11 strategies have been grouped according to the priority assigned to each by the CMCC. The three levels of priority are urgent, high and moderate.

The following table summarises the audiences, strategies and priorities of the Communication Plan.

Organisations may use the Communication Plan as a guide to undertake projects which support ICM objectives. Projects designed according to the recommended actions of the Plan's strategies will be supported by the CMCC, e.g. funding applications are more likely to be endorsed.

Many of the strategies will be conducted state-wide, using a key project officer to coordinate the actions across Queensland. In some cases, strategies may be run simultaneously across the State, using a different project officer for each regional area. In other cases, a strategy may be conducted in a single region, or even in a single catchment area.

Audience	Strategy
Planners	Planning and Development Assessment from an ICM Perspective *** ICM in Tertiary Education ** Increasing Awareness of Catchment Issues **
Engineers	Engineering Better Catchments *** ICM in Tertiary Education ** Increasing Awareness of Catchment Issues **
Councillors	ICM Saves Money *** ICM Presentations at District LGAQ Meetings ** ICM Workshop for Councillors ** ICM Awareness for New Councillors *** Communities and Councillors – Building Bridges * Targeting Local Government Forums *
Chief executive officers	ICM Saves Money *** ICM Presentations at District LGAQ Meetings ** Targeting Local Government Forums *
Community Groups	Communities and Councillors – Building Bridges * Community Networking *

Key: *** Urgent Priority Strategy ** High Priority Strategy * Moderate Priority Strategy

The Communication Plan shows local governments the 'how' as well as the 'why' of integrated catchment management.

It provides clear direction, coordination and implementation of future work with local governments. The Plan will be reviewed and updated very two to three years to ensure its strategies, actions and directions are still relevant to the changing local government situation.

8.2 Integrated Catchment Management and Local Government Information Bulletin of the ICM and Local Government Planning Schemes Project - No. 3 January 1991

Queensland Department of Natural Resources
Queensland Department of Communication and Information, Local Government and Planning
Local Government Association of Queensland
Landcare Queensland

Partners in Catchment Planning

This is the third information bulletin regarding the Natural Heritage Trust project titled 'Incorporating Integrated Catchment Management into Local Government Planning Schemes'. The aim of the project is to demonstrate how councils and catchment committees can successfully work together to identify catchment issues and implement planning solutions through local government planning schemes.

The NHT project in stages
There are three principal stages to the project
1. conduct and evaluation of four case studies in Queensland
2. preparation of a set of 'good practice' guidelines for councils and catchment committees
3. conduct of a training and education program for catchment committees, councils and other relevant organisations.

Stage 1 completed
All four case studies were completed during 1998. Representatives of the participating councils and catchment committees formed reference groups and:
- agreed on a catchment issue to address through the planning scheme
- developed the issue through workshops to assess current information
- contracted a consultant to provide a report on the range of planning options
- selected the preferred planning option
- presented the final report to Council for endorsement in principle
- monitored the public review process
- evaluated the success of the case study as a model to solve catchment issues.

Key findings from each case study
The following synopsis of each case study highlights some of the key findings identified in the respective ecological and planning reports.

Four River Case Study
The Bulloo ICM Reference Group's case study objective was to incorporate aspects of the management of intensive agricultural development within the catchments of the Bulloo, Paroo and Wilson rivers and Coopers Creek into the Bulloo Shire Planning Scheme.

The reference group established that the future land use management for the region:
- is contingent on the well-being and economic soundness of the Bulloo community
- ensures future development does not prejudice the continued natural/organic beef production industry
- seeks guarantees that water allocation from the river systems and the great artesian Basin will not impact upon the sustainability of these natural systems
- fosters a responsible tourism industry, with emphases on education and awareness of the region's values.

The ecological report found pressures on the environment needing future action were:
- over-grazing on native pastures
- visitor impact on popular camping sites
- exploitation of native fish
- uncontrolled flows from the Great Artesian Basin due to uncapped bores
- the need for additional input by the local community to regional development.

The Cooper Creek, Wilson and Bulloo rivers are generally in their natural state and contain only native fish species. The report identifies how cooperation action is successfully addressing contemporary issues such as pest management, the capping of bores and the establishment of water reticulation systems for grazing animals.

The amendments to the Bulloo Shire Planning Scheme are derived from the planning report. They are approved by Council and endorsed by the community and are presented in three parts:

- rural land management
- development requirements
- rural planning strategy

The scheme identifies grazing activities as 'of right'. All other rural activities are identified as intensive agriculture and require council consent. The planning amendments include new criteria for Council to assess future development applications and were approved in October 1998.

'The outcomes of the case study will significantly contribute to conserving the natural resources of this unique part of Australia,' said Scott Fraser, Mayor of Bulloo Shire council.

Condamine River Case Study

The case study objective was to incorporate aspects of the management of the riparian zone and flood plains of the upper Condamine River catchment into the Warwick Shire Planning Scheme.

The Warwick ICM Reference Group resolved that the priority issues to be investigated in terms of how they may be addressed in the planning scheme were:

- providing for a healthy stream and riverine ecosystem
- improving the water quality in watercourses in the upper catchment
- enhancing the physical and biological values of the riparian zone, flood plains and watercourses
- improving the biodiversity of riparian and flood plain fauna and flora
- integrating flood mitigation controls

A healthy Condamine River catchment is important because it is also the headwaters of the Murray-Darling Basin. The ecological report identified the following pressures upon the Condamine River:

- flood plain development
- requests for increases in water extraction
- poor management of stock access to watercourses
- stormwater run-off from urban areas and intensive husbandry sites.

The State of the Rivers report for the upper Condamine catchment (DNR, 1995) concluded that the overall condition of the river was good along 13%, moderate along 43%, poor along 41% and very poor along 3% of the river. Initiatives to address the pressures include:

- a water allocation management plan, using a whole-of-catchment approach
- Warwick Shire Council's environment management plan for waste including water, oil, packaging and refuse.

The planning report included planning provisions that are consistent with the *Integrated Planning Act 1997*. Five ICM-related desired environmental outcomes were prepared, each with performance indicators and measures to achieve the required success. These planning provisions provided the foundation for one of the four parts of the new Warwick Shire Council Planning Scheme.

The Warwick Planning Scheme will be available for public review from March to May 1999. 'The work undertaken in the Warwick case study will greatly assist in maintaining the integrity of the riparian area long the Condamine River', commented John Hasted, Executive Director of Eastern Downs Regional Organisation of Councils.

Herbert River Catchment Case Study

The Hinchinbrook ICM Reference Group sought to incorporate elements of the management of wetlands, riparian land and drainage systems within the Herbert River catchment, into the Hinchinbrook Shire Planning Scheme.

The reference group agreed that successful land use planning is a marriage between the conservation of locally important natural resources and the sustainable development of cane growing for the local economy.

The ecological report found that the shire is rich in natural fauna, but that many of the species are under pressure attributed to a range of human activities and natural phenomena. Findings include:

- 56 species of native animals, 13 of high conservation interest
- 47 resident species of water birds and 17 species of migratory birds, 24 under some level of threat
- 43 species of fish in the fish habitat areas, but declining diversity further up the flood plain.

The case study ecological report mapped the locally important wetland and riparian areas. The vegetation was mapped as being 'intact' or 'disturbed' or 'regrowth'.

The planning report provided a series of amendments to the Hinchinbrook Shire Strategic Plan and Planning Scheme. The effect of the amendments will mean that where a landowner intends to use land for intensive agriculture and where part or all of the land suitable for cane growing is considered Class 4 or 5, contains known wetland, fish habitat or abuts a fish habitat, is in an active coastal area, is below 3 m AHD, is a Wet Tropics area, or a known mahogany glider habitat, then a town planning impact assessment application and approval is required from the Hinchinbrook Shire Council.

The amendments were endorsed by the Hinchinbrook community in January 1999. The Mayor of Hinchinbrook Shire Council, Pino Giandomenico, said 'We are committed to ensuring there is a sustainable sugar industry for future generations in our shire. The outcomes of the case study contribute to this vision.'

Noosa River Catchment Case Study
The Noosa ICM Reference Group's case study aim was to incorporate planning solutions for the management of riparian lands within Noosa River catchment into the Noosa Shire Planning Scheme.

The ecological report identified that the pressures upon the riparian lands were attributed to increasing residential, industrial and agricultural activities in the shire, as well as some poor development practices which resulted in:

- increased sediment, nutrient and pesticide levels via stormwater run-off
- clearing of riparian vegetation, drainage of wetlands and building on flood plains.

A supplementary report by Noosa Landcare Group established the condition of riparian lands for each of the six sub-catchments:

- water quality – very good along all six sub-catchments
- bed and bank stability – moderate along Kin Kin and Noosa rivers, good along Lake Doonella and lower Noosa River, very good along Lake Cootharaba and Lake Cooribah catchments.
- riparian vegetation – very poor along Kin King Creek and lower Noosa River, poor along Noosa River and Lake Doonella, good along Lake Cooribah, and very good along Lake Cootharaba.

The planning report provided a range of complementary statutory and voluntary measures to address new development within the riparian lands of the shire. From a planning perspective the approach provides flexibility for Council by setting both general and specific objectives in place within the Noosa Shire Strategic Plan and Planning Scheme.

Noosa Shire Council commences stakeholder meetings in March 1999, prior to the public review in mid 1999. 'The case study successfully explored the mechanisms available to the Catchment Committee and Noosa Council, for addressing catchment issues through the planning process. The conclusions were excellent in adding value to the knowledge base of the Noosa River Coordinating Committee, in our endeavour to implement natural resource management in the region,' observed Colin Haste, Chair of the Noosa River Catchment Coordinating Committee.

Case study profiles
A profile has been prepared for each of the four case studies. The eight-page booklet is being published with the assistance of the Department of Natural Resources' Scientific Publishing Unit. The profiles will assist as an educational tool for the project's training program in June 1999. The profiles examine:

- the common ground between councils and catchment committees
- the character of each shire
- the important catchment issues
- the activities of each reference group
- the state of each catchment environment
- the community-endorsed planning solutions
- the agenda for further action

Monitoring and evaluation
Members of each reference group were asked to respond to a questionnaire to assist the Project Steering Committee in evaluating the four case studies.

The questions focused on the activities of the reference groups, their professional development and the achievements derived from the case studies.

There was a fifty per cent response rate to the questionnaire (i.e. 16 of the 32 members from the four reference groups responded to the survey).

Table 1 summarises the responses to the first four questions.

Table 1: Reference group responses to questions regarding the case study process and outcomes

Questions	Response options (a to e)	(a) needs significant improvement	(b) needs some improvement	(c) provides satisfactory outcomes	(d) was above average standard	(e) was of a very high standard	total responses
1. In terms of understanding the catchment issues selected, the case study process:		0	0	6	6	4	16
2. In terms of securing cooperation and agreement between councils and catchment committee, the case study process		0	2	7	4	3	16
3. In regard to the ecological report, planning report and mapping products, does the content support the planning solutions?		0	0	6	8	2	16
4. Are the issues and outcomes sufficiently informative to support the consultation process within the community, industry and government agencies?		0	0	9	6	1	16

Stage 2 – Good practice guidelines

Good practice planning guidelines based on the findings of the case studies will be published by the Department of Communication and Information, Local Government and Planning (DCILGP) around May 1999, and will include:

- guidelines on addressing ICM issues within planning schemes across Queensland
- a package of actual planning solutions for consideration by councils.

The good practice planning guidelines will be consistent with the Integrated Planning Act and will be available on the DCILGP Internet site. The guidelines will also be used as technical content in the proposed training and education program.

Stage 3 – Conduct of a training and education program

Reference group members have assisted the Project Steering Committee in determining the scope of the training and education program, which will be conducted throughout Queensland.

A training package will be developed by the Local Government Association of Queensland (LGAQ). The package itself will be designed for different audiences and their requirements. The range may vary from a short (30 minute) education and awareness presentation for specific audiences to a half-day workshop format. The training and education program will commence around June 1999 and conclude in November 1999.

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Chapter 5

Integrated Catchment Management in northern Australia From concept to implementation

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Abstract
In 1990, the Queensland Government initiated an Integrated Catchment Management (ICM) program in response to community concerns about the sustainability of the states' natural resources. This paper outlines the characteristics of this new policy approach and reviews the progress of ICM implementation in the Johnstone River catchment (JRC) on the wet tropical coast (WTC) of Queensland. Conceptual and process aspects of ICM are detailed and the technical, economic and institutional environment in which ICM operates in the JRC are discussed. Mechanisms are presented to facilitate the implementation of the institutional and individual change required to translate the ICM philosophy and its associated planning activities into meaningful outcomes for stakeholders.

EVALUATION OF INTEGRATED CATCHMENT MANAGEMENT IN A WET TROPICAL ENVIRONMENT: COLLECTED PAPERS OF LWRRDC R&D PROJECT CTC7

Compiled by Jennifer A. Bellamy

VOLUME 3

ICM AND PLANNING IN THE HERBERT RIVER CATCHMENT

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Chapter 1

ICM in the Herbert River Valley

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INTRODUCTION

Until recently, local government had a limited role in land use planning in rural areas and in the management of natural resources generally. Local government planning schemes applied mostly to urban areas and to the expansion of urban related uses into rural areas. Local government has always been a significant provider of rural roads and a key player in localised resource management matters such as drainage and water resources. But the development and management of rural natural resources for agriculture, forestry and other uses and the protection of environmental quality and nature conservation has been historically a state agency matter in Australia.

Local government in recent years is playing a much more significant role in this due to:

- the Integrated Planning Act and IDAS which increasingly give local governments the role of development manager
- delegation under state legislation such as the Environmental Protection Act and the Nature Conservation Act
- emergence of local community based programs such as Integrated Catchment (ICM) and Local Agenda 21 programs
- increased commitment to integrated resources management

The scope of local planning schemes in relation to rural areas is changing in quite fundamental ways - giving local government the opportunity and responsibility for resource management to an unprecedented level. The prospect is that local government could become the dominant force in managing local resources for example vegetation management on private lands, water use and waste water emissions, wetlands and coastal management within parameters set at other levels of government. Local government plans will thus be dealing with a wider range of activities than ever before including a direct relationship with agriculture.

Recent progress in the Herbert River basin, administered by two local governments, Hinchinbrook and Herberton Shires provides a good case study of the evolution of the role of local government in natural resources management. This paper is particularly concerned with the lower Herbert and the role of the Hinchinbrook planning scheme in relation to natural resources management. This area, largely the alluvial floodplain of the Herbert River, is one of the most intensively cultivated districts in the state, being a highly significant sugar producing region which produces approximately 20% of Australia's sugar. It has a set of chronic but not acute resource management issues, most important being those associated with water management, flooding, drainage, river system quality as well as nature conservation for remnant terrestrial habitat and wetlands.

Land use and resource management in the area is influenced, managed and controlled by a complex web of natural resource management programs most important of which are the caneland development and assignments process, Crown land administration and development (including subdivision and sale, forest and other reserve management), nature conservation including World Heritage National Parks, habitat conservation), Drainage Board, Hinchinbrook Shire infrastructure and town planning among others.

A Catchment Coordinating Committee was established in 1994 under the Queensland ICM program. Its activities and development are the prime focus of the project.

The research presented here is part of a five-year project in the CSIRO Division of Tropical Agriculture with cooperation from the Department of Natural Resources, Hinchinbrook Shire Council, the CSR and others. Funded by the (Commonwealth) Land and Water Resources

R&D Corporation. Recently this project has worked in cooperation with an NLP project in the Department of Local Government and Planing which is investigating the use of town planning in natural resource management in a number of rural local governments in Queensland.

The Natural Resources of the Herbert River Catchment

The Herbert River catchment drains an area of approximately 10,000 sq km of the wet tropical coast of far north Queensland with its major river outlet flowing into the extensive mangrove areas of the Hinchinbrook channel (Figure 1). The catchment has a dominantly summer rainfall with approximately 75% on average falling between December and March. The lower catchment encompasses the shire of Hinchinbrook and the upper catchment area the shire of Herberton. The population in 1993 was estimated at approximately 18,000 people with 75% living in the lower catchment. The catchment has a rural economy based dominantly on primary production (ie. sugar, beef cattle, forestry), but given its proximity to the wet tropical coast including the Great Barrier Reef Marine Park fishing and recreational activities are also important contributors to the local economy.

The catchment comprises three separate environments: the tablelands, the central ranges, and the coastal lowlands, which are each described briefly below.

The Tablelands: encompass the upper catchment of approximately 6000 sq km. It includes the driest parts of the catchment with annual rainfalls ranging from 750 mm per annum in the west to 3,000 mm towards the coastal ranges in the east. Land use is dominated by extensive grazing on native pastures, with some fodder cropping, small pockets of dairying and horticulture in the north, and a number of operational and abandoned tin mines. Land tenure is mostly leasehold or Crown land and some areas of freehold.

Central Ranges: encompass the rugged high rainfall areas with 1500 to 3000 mm of rainfall per annum that separate the upper and lower catchment, and surround the tablelands areas in the north and east and the coastal lowlands in the north and south. They are mostly protected areas such as the World Heritage Area, National Parks and State Forest Reserves.

Coastal Lowlands: comprise an active river delta with relatively fertile alluvial soils which have been extensively cleared and developed for intensive crop production (dominantly sugarcane) and some more limited areas of improved pasture for cattle. Rainfall in the coastal lowlands varies widely ranging from an average of 1500 to 2200 mm per annum. This area is subject to regular inundation by flooding with major flooding occurring on average every 3.5 years and minor flooding almost every 2 years.

Sugarcane production which is confined to the lower Herbert coastal plain is expanding its area under production at about 7% per annum. Currently approximately 75,000 ha of land is cultivated to supply the two mills in the region (Victoria and Macknade). Only about 5,500 ha of this area is licensed to be irrigated from surface supplies. The rapid expansion of sugarcane in recent years has largely occurred on the more marginal lands for production, that is on poorly drained coastal wetlands, and previous grazing lands.

Natural Resources Management Issues in the Herbert River Valley

At the commencement of European settlement in the late 1800s, the Herbert catchment was heavily timbered with extensive freshwater wetlands in the coastal lowlands. The catchment has since undergone significant modifications with nearly 40% of the coastal lowlands cleared for crop production or improved pastures, and clearing of rainforest and open woodlands for

extensive cattle grazing and some small areas of cropping in the tablelands (Johnson and Murray 1997).

Concern over flooding has been a community issue in the lower catchment since the 1880s. However flood mitigation works and the development of uncoordinated drainage systems have been the cause of considerable community conflict. Since the 1970s, there have been a number of major studies commissioned by the Herbert River Improvement Trust (HRIT) and the Hinchinbrook Shire Council in collaboration with state government agencies that have examined water management related issues with respect to flooding management, rural drainage planning, and stream management planning (eg. Gutteridge Haskins and Davey 1976a , 1976b; Cameron McNamara 1980, 1984; and Ian Drummond and Associates 1993).

Table 1 summarises the natural resource management issues identified in some of these reports and also by community members and other industry and government stakeholders at a workshop held in 1995 (Bellamy *et al.,* 1995*).* This shows that perspectives on catchment issues now encompass a broader range of issues including concerns for impacts on tourism and recreation, wildlife and habitat management, riparian zone management, and water quality, and calls for greater community involvement in decision-making. Most significantly at the 1995 workshop (Bellamy *et al.,* 1995), the lack of long term planning of water management and rural land development was identified across several participant groups as a major issue needing to be addressed.

Perceived impacts of these natural resource management issues have evolved from an initial focus on productivity and infrastructure impacts to encompass loss of alternative use opportunities and environmental and ecological factors. Perceptions of the key mechanisms for resolution have also evolved from an initial focus on "engineering based" approaches to include policy incentives and legislative controls or individual action. The key mechanisms for a more integrated planning approach to resource management and land development were seen as an effective ICM process with the support of state government to foster cooperation, the development of industry codes of practice, and the use local government planning and development controls.

Layers of Resource Management

Table 2 details the current resource management legislative and administrative framework within which the sugar industry operates. It reflects the maze of state agencies and their often conflicting statutory responsibilities. This complex arrangement combined with high expectations from the "public" for effective involvement in decision making suggests that the sugar industry will have to respond to, and indeed lead, the implementation of ecological sustainable development in cane areas.

ESD principles, to some extent, have been recognised and incorporated into the areas of the industry's operations. The environmental audit of the sugar industry sponsored by Canegrowers demonstrates a general concern for the environment. At a local level, many cane assignment boards have established a number of conditions on new assignments. While this trend is encouraging, effective establishment and implementation of assignment conditions relies on adequate information about the natural environment (eg hydrology, land suitability, flora and fauna). Without adequate information, local boards are unable to systematically determine the desirability and feasibility of assigning land for cane growing. Similarly, current arrangements do not allow for the adequate monitoring of either adherence to assignment conditions or the impact of conditions on the natural environment.

At the farm level, ESD principles have been recognised with the use of Property Management Plans (PMPs). The development and implementation of PMPs is one voluntary method that can play key role in minimising environmental degradation (Queensland Landcare Council, 1991). Supported by Landcare and ICM groups, PMPs can be developed with a high level of owner involvement. Hence, PMPs provide another facility by which cane growers can more actively participate in farm management planning with the assistance of government officials. While PMP is receiving widespread acceptance on new cane lands, the industry must foster a similar approach on existing cane lands. Its future is dependent not only on an increased acceptance by existing growers but also improvements in the quantity and quality of natural resource and other information to guide effective decision making.

River Management to Catchment Management

As previously noted (see Table 1), the major focus in the past in the Herbert catchment has been on river management issues, especially issues relating to flooding and drainage associated with the major river systems. Solutions have generally been seen to be engineering works.

Flooding: The Herbert Catchment experiences regular major floods. Flooding is recognised as causing major damage to crops and property, considerable inconvenience to the community, and river bank erosion. Local governments have been responsible for providing protection for urban communities and the HRIT addresses the needs of the broader region. However the approach to flood protection has often been piecemeal and reactive to some catastrophe.

Drainage: Expansion of caneland in the lower catchment since the early 1900s has extended progressively into soils of poorer drainage. The drainage system for these lands was developed in an ad hoc way with a series of ?5 separate voluntary schemes and gazetted drainage boards evolving over time. Efforts to improve farm drainage were uncoordinated and often with little regard to adequacy or the downstream impact of farm outfalls. This has caused significant environmental impacts with social conflicts resulting. Substantial conflicts have also emerged between upslope and downslope farmers regarding cost-sharing arrangements for maintenance of drains and levees, and property damage.

Integrated Catchment Management: More recently increasing community calls have been made for greater community involvement, better coordination of decision-making, and a broader more strategic perspective that takes a long term view and encompasses both water management and land development planning on a whole catchment basis.

ICM commenced in the Herbert Catchment in March 1993 with the establishment of the Herbert River Catchment Coordinating Committee (HRCCC) on a voluntary basis by local community interests. The impetus for its formation was the recognised need for better community participation in decision-making relating to river management issues. Current representation on the HRCCC includes Canegrowers, Cattleman's Union, Rare Fruit Council of Australia, Queensland Commercial Fisherman's Organisation, CSR Herbert River Mills, HRIT, Combined Drainage Boards, Hinchinbrook Shire Council, Herberton Shire Council, Landcare, conservation, Hinchinbrook Citizens Association. Currently of the 15 members there is no State or Commonwealth Agency representation, and only one representative from the upper catchment.

The HRCCC's stated objectives are to:

- coordinate government agencies and the community to pursue common goals
- seek community involvement in catchment management
- identify and rectify natural resource degradation

- promote ways to prevent and reduce natural resource degradation
- promote the wise use of all natural resources within the Catchment
- identify key indicators of biodiversity and monitor as a measure of catchment health
- encourage the retention of significant natural habitats within the Catchment. (HRCC 1996).

The HRCCC activities since formation have primarily focussed around:
(i) single-issue activities to get 'runs on the board' rather than issues of strategic importance (eg., promotion of owl boxes for pest control);
(ii) being a referral agency for proposed projects and other catchment activities by state and local government (eg., SIIP proposal, Hinchinbrook Shire Planning Scheme)
(iii) the formulation of a draft Herbert River Catchment Management Plan for public review and comment.
(iv) brokering funding for others to undertake natural resource management activities in the catchment (eg., for recent round of NHT funding).

The draft Catchment Strategy is seen to provide a framework for future management of the Herbert River Catchment. It was prepared by HCCC members through a series of working groups and internal workshopping. The key management and planning issues identified relate to land management, water management, stream management, and habitat management. The key issues relating to each of these are identified in Table 3. For each of these issues the strategy identifies a range of actions, and suggest which landholders, Government agencies and resource users are responsible for doing it.

At this stage in the development of ICM in the Herbert, key HCCC members perceive the strategic plan development more as a means of getting funding rather than a framework for ICM implementation in the Herbert. Their perception of their role also is evolving from one of delivering outcomes or solving natural resource problems on the ground, to one more of facilitating ICM principles as a way of doing business, or facilitating a strategic direction for the catchment.

Local Government Planning and ICM in the Herbert

The Hinchinbrook Shire Council (HSC) has been involved in resource development of their Shire since its foundation in 1933 in many and various ways. HSC is a partner in the Drainage Board gazetted in 1977, in a number of voluntary boards for sub-catchments and of the recently established the Herbert River Information Centre. HSC councillors have been on the HRCC since its inception a role which expanded considerably in 1996 with the appointment of the Shire Chair as Deputy Chair of the HRCC along with another councilor. There are many and various informal means by which the HSC as the elected local government have had on resource management in the Shire - lobbying, negotiation, advice etc.

In 1995, the Shire determined to revise its town planning scheme and in doing so to prepare its first Strategic Plan. Until this time the HSC relied on a traditional zoning scheme and by-laws which were totally focussed on the regulation of urban development in the Shire, admittedly a modest challenge in an area with relatively little population growth. The new town plan preparation began in mid-1995 and a draft went on public display in October 1996. It was prepared by Sinclair Knight Merz since, in common with many rural local governments, the HSC does not have a professional planner on staff. Planning issues are managed by the CEO in conjunction with the engineer and the Deputy Shire Clerk. Following public display and objections, the revised plan was dispatched to the DLGP for review and approval in March 1997. That is where the plan rests at the time of writing.

It is also relevant to note that there is an NLP funded project "Integrated Catchment and Local Government Planning Schemes" (See QLGA, 1997) involving the Queensland Local Government Association and the Department of Local Government and Planning selected HSC as one of the four case study shires. This arose directly out of the review document and communication plan prepared in the same project. (QDNR, 1996) The Hinchinbrook Shire identified four priority issues in relation to ICM for this project. They were:

- wetlands and mangroves
- riparian vegetation
- drainage
- local roads and railways (including light rail)

Overview of the New Plan including the Strategic Plan, Zoning Scheme and Performance Standards

The new planning scheme consists of the normal battery of planning instruments:

- a strategic plan as an overall framework for guiding land use change (preferred future land uses) through a set of objectives,
- a zoning scheme which defines a (conventional) table of zones (without consent, subject to conditions, consent and prohibited),
- a subdivision by-law,
- general and use specific development standards and
- a range of administrative provisions.

Each of these elements has relevance to natural resources management and ICM but only the highlights will be reviewed here.

The Strategic Plan and its Objectives

In the Strategic Plan HSC makes a specific and substantial commitment to rural resource management and to ICM. It signals the approach to implementation largely through its stated likely response to development applications as illustrated in the following edited extracts from the plan.

Rural Objective 2(iii)

"Where future expansion of agriculture is proposed through a development application, the Council will require the submission of a property management plan where it has determined first that adverse environmental impacts may result from such development. Of particular interest to Council will be applications for new cane assignments in the areas of drainage paths, ground water resources, wetlands, riparian vegetation and associated stream bank stability, remnant areas of native forests, rural views and quiet rural amenity. The Council will not support any development application for agricultural expansion where it has determined that unacceptable environmental impacts will be caused by the development" (p6)

Rural Objective 5

"To protect existing rural values such as surface water (drainage paths) and ground water resources (recharge areas), soil and other land resources, riparian vegetation and stream bank stability, remnant areas of native forests, rural views, and quiet rural amenity."

The Council will only support those development applications which will contain potential adverse impacts within the site so that the costs of any rural activity are not widely spread and are not unfairly borne by others."

ICM Objectives

1. To identify and designate the catchments and the sub-catchments of the Herbert River which lie wholly or partly within the Shire. The Council will "take into account" the catchment strategies and assess proposals on that basis.

2. To ensure that, as a result of the development and use of land no environmental impacts affect any lands elsewhere within a catchment designated in this Strategic Plan. Implemented by a commitment to having "regard for" and "shall implement the principles of ICM" and the "may refuse to support any proposal which will generate unacceptable effects upon any land …", and " may require the preparation of an EIA" where detrimental downstream effects or impacts are possible.
3. To promote sensitive and sustainable land use practices through the development process. Discussion of implementation includes "all development and land uses will be required to adopt sound management practices so as to minimise, …..."; "The Council may refuse to support any proposal …"; and "logging of privately owned timber shall not entail the removal of any vegetation within 50 metres of a known creek or watercourse."

The Zoning Scheme
The conventional zoning scheme has only five zones, namely, Rural, Town, Village, Public Purposes, Special Activities. The Rural Zone covers most of the Shire. The most significant innovation in this zone is that intensive agriculture is listed as a use which may be carried out in this zone subject to the notification of conditions. Intensive agriculture which includes most farming activities, is a prohibited use in all other zones:

Intensive Agriculture: "means the use of land for the intensive production of crops, such as but not limited to sugar cane, at rates or production beyond the natural carrying capability of the land whether or not the land is irrigated for such purposes. The term includes the establishment of any infrastructure necessary for the conduct of the use. The term does not include small-scale agriculture conducted on premises or a site less than 5 hectares in area."

The Performance Standards for Intensive Agriculture (7.7.2)

I. In considering an application for intensive agriculture the Council shall have regard to the following matters:

    A. the extent of vegetation loss and earthworks proposed
    B. the likely changes to hydrological regimes for both surface and groundwater reserves within the catchment of a site
    C. the proposed manner of environmental management including the containment of downstream effects such as excessive water demand, the quality of run-off water; the maintenance of environmental flows in steams; the management of water tables to prevent salinisation; and the alteration of ecological processes
    D. [sic] the likely access requirements to the land having regard to projected production rates and operational schedules, and the capacity of the existing road and tram network to respond to increases in traffic flows;
    E. any other matter of relevance to the application

II. The Council may require a development application for "intensive agriculture" to be supported by an assessment of any of the matters raised in considering the application pursuant to provision 7.7.1 above

This plan clearly reflects a strong commitment by HSC to natural resources management and given that this is HSC's first plan, is to be commended. What now needs to be done is to create the details that will make such a plan implementable. In the elements extracted above there are ample powers to intervene in a significant number of rural development decisions. The Plan raises many questions as to what is the "small print" in relation to the various steps involved in regulating rural uses in this way, some of which are:

- What are the designated uses requiring approval ? - the intensive agriculture definition which is critical, could create confusion unless unambiguously defined. The Pest and Productivity Board in a submission to the Plan proposed that sugar not be regarded as an intensive use !
- What is the minimum area threshold ? - clearly very small areas should not require regulation but setting the minimum threshold too high could allow many significant developments to go unregulated. For example a minimum of 5 hectares as proposed in the draft HSC plan which is equivalent to a square area with sides greater than 220metres, seems too large.
- What are the criteria for approval of regulated uses, for example the relevant environmental issues, natural resource protection, off-site effects water quality and quantity issues, habitat and nature conservation issues etc. What are allowable changes to water courses and riparian zones, impacts on drainage and flood regimes. This requires the introduction of guidelines and specific performance standards and hopefully examples of good practice. These conditions need to be specified in planning documents in such a way to give clear prior guidance as to desired developments.
- How will development applications be assessed against those criteria - for example what are significant habitat areas and where they are specified ? (on what maps), Will applicants need Property Management Plans ? Who will appraise the plans/proposals against the criteria (which agency by what process)? Will the applicants require impact assessments ?
- Will there be any monitoring provisions? What will be monitored and who will do it ?
- What sanctions are proposed ?
- Are there to be any concomitant effects on other land use planning activities for example cane land assignment, land valuations and rates?

These questions pose some new challenges for local governments and their rural planners. There has been some progress in addressing these questions in the Herbert.

Riparian Vegetation

Protecting riparian zone has been one of the most contentious issues in the Herbert indeed in most rural areas. The main planning issues are: Should there be a buffer along watercourses, what is a water course, how wide should the buffer be and what management requirements apply to the buffer zone ? Each issue is contentious and has implications for the environment and property rights (and politics).

The protection of streambank vegetation in the Herbert is believed to contribute to bank stability through the physical binding provided by the tree roots, reduction in bank water content as well as to provide habitat corridors. The technical questions arising from the planning issues are to define water courses, determining the width of the riparian buffer be and examining the impacts of various activities in the buffer (for example should any clearing or logging be permitted). As an HRCC initiative, streambanks were evaluated in a detailed study of the lower Herbert River by Andrew Petrokowski. The provisions of the *Water Act* requires conservation of the riparian zone of major watercourses within a 40 metre buffer. This controversial requirement is criticised on the grounds that it is insensitive to local circumstance and needs. The Petrokowski study recommended a more sensitive approach that defines the width of the buffer zone in terms of two factors: flood risk and bank erosion risk. Only in areas of high risk would the full 40 metres be required whereas in other areas lesser distances would be calculated on the basis of an index of these two factors.

Drainage
As previously discussed uncoordinated drainage systems on canelands has been a long term issue creating significant social conflict in the Herbert. The HSC in conjunction with the HRIT has undertake a number of major studies in the lower in the lower Herbert. A significant outcome has been the move to amalgamate all existing gazetted and voluntary drainage boards into a combined body in support of a more coordinated and consistent approach to the drainage. This has been a fundamental element of the Herbert submission for funding under the Sugar Industry Infrastructure Package for support to major infrastructure works currently under consideration by the Commonwealth Government. The HSC successfully lobbied DNR to appoint a technical drainage expert to provide interpretation and advice on drainage issues. This officer should be able to resolve technical issues associated with development approvals required by the town planning scheme

Wetlands and mangroves
The expansion of intensive agriculture has already made significant changes to the area's wetlands environments. The HSC in collaboration with the HRCCC and industry has supported initiatives with industry and private landholders to foster the development of artificial wetlands which have dual purposes of nature conservation and the redirection of water emissions from the CSR mill to create artificial wetlands rather than direct disposal into local drainage lines. On individual farms the HSC is encouraging the construction of artificial wetlands for nature conservation with benefits to production on adjacent lands arising from water management.

Current mapping and assessment programs will provide a firmer foundation for defining what ecologically significant wetlands and mangrove areas are to be included with the regulated area. Included here is concern about acid sulphate soils which can create substantial ecological and productivity effects off-site if they are excessively drained. A problem here is the erratic distribution of risk areas

Local roads and railways (including light rail)
The HSC has been involved in negotiations with QR and DOT on the design of road and rail bridges and embankments on local drainage networks on the floodplain. There is now an agreed referral process amongst these authorities to coordinate drainage and to minimise the flooding effects of such works.

CONCLUSIONS

The expanded role of local governments into rural environmental planning has many challenges for planners. It introduces a whole new set of technical and political dimensions to their work for which they may have little training, no experience and can not call on well-developed precedents to guide the way. It will therefore be a significant learning period for councils, their staff and advisors.

The underlining planning process will have some similarities with conventional urban based planning in terms of land use control and setting of performance standards and managing the development approval process. The differences will be partly technical in dealing more with ecological and land resources issues but also more complex in that the planning and management will need to be more site and local landscape specific than normally applies to urban planning matters.

There are serious obstacles too, not the least of which is the potential for councils to be in conflict with land owners over loss of use rights, injurious affectation and potentially the need for compensation. Some of the suggested processes lead councils into unexplored territory, for

example the reliance on Property Management Plans, the application of EIA to small land development proposals

Unfortunately regulating new developments only through the planning process will not be effective in dealing with existing resources management problems. To the extent that existing uses are unsustainable or that minor variations in those uses will not be affected by any planning provisions, this approach will not contribute to ESD.

Substantial progress has been made in a relatively short time - better coordination between authorities and in extending the reach of town planning. HRCC through the ICM philosophy has had a significant facilitating role and forum for the diversity of interests involved on a day-to-day basis. It has opened lines of communication between previously unconnected groups and to get a wider range of perspectives on resource management issues

The challenge is to develop effective contributions of local planning schemes in natural resources management in a situation of little previous experience here in Queensland. What can be achieved ? What is best practice ? What are the obstacles in terms of the capabilities of local government organisations and their staff and what training and development programs will be required to overcome these obstacles ?

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Table 1. Natural resource management issues identified in selected studies in the Herbert Catchment.

	Herbert Technical Studies 1976, 1980, 1984	Community Workshop August 1992	ICM Evaluation Project Stakeholder Workshop June 1995
Key Issues Identified	Lower Herbert Catchment focus: • flood mitigation • stream and river bank erosion • uncoordinated drainage on river floodplain	• flooding • sedimentation • bank erosion • major river course changes • rural drainage • tourism and recreation • biological issues (including wildlife habitats) • water quality and quantity	• lack of long term planning of water management and land development • lack of coordinated drainage strategies • conflict over flood protection works • riparian zone management • habitat management and protection • increased erosion and sedimentation in river • pest management planning • long term sustainability of agriculture • land development/conservation conflicts
Perceived Key Impacts	• economic consequences (e.g. major crop losses) • infrastructure and property damage	• loss of valued land • loss of production • infrastructure/asset damage • access difficulties • loss of recreational and tourism opportunities	• loss of crop production and profitability • land degradation • river aggradation • reduced stream capacity • stream bank destabilisation • habitat destruction/modification • water quality and quantity problems • localised flooding • conservation impacts • social conflicts • alienation of land for other uses
Key Mechanisms Identified for Addressing Issues	• a range of largely engineering-based studies to investigate stream processes/river morphology for flood management and rural drainage coordination • flood mitigation works (e.g. levees, floodgates, overflow channels, rock works) • removal of river vegetation	• a range of infrastructure and related works programs (eg. removal of river sediment, bank stabilisation; rationalisation of levee system; increased capacity of flood gates; stream bank revegetation) • review/reform of institutional structures and arrangements for river management ICM implementation to support a coordinated approach to decision-making and to facilitate community participation, community education and PR plan	• create a common understanding of ICM • foster and maintain a long term commitment to an ICM process which is seen as a "way of doing business" for government and the community • local government as action agency - use planning and development controls • state government to foster cooperation • use controls on leasehold land • industry codes of practice

Table 2. Some important legislative and administrative initiatives affecting natural resources management in Queensland

Initiative	Lead Agency	Resources Effected	Objectives	Processes	Outputs
Local					
Planning Environment and Development Assessment (Bill)	Dept. of Housing Local Government and Planning	All private sector development applications	Integrated planning, development assessment and approval including economic, social and environmental aspects	Local Development Management, community involvement, regional forums, state concurrence and referral	Statutory plans, Regional plans. State planning policies, integrated development assessment, approval and appeals
State					
Nature Conservation Act	Dept. of Environment and Heritage	State conservation reserves Habitat conservation	Flora and fauna conservation Endangered species, biodiversity conservation	Land acquisition Cooperative agreements	Regulations, management plans Voluntary agreements Guidelines
Environmental Protection Act	Dept. of Environment and Heritage	All air, land and water	Air, noise & water quality protection and waste management	Standards Guidelines	Environmental Protection Policies and Plans
Lands Act	Dept. of Lands	Crown Lands	Use and development of land	Leasehold conditions	
State Public Works and Development Organisation	Premiers Department	Prescribed (large) projects	Integrated development	Coordination	Infrastructure coordination and impact assessment
Natural Resources Management (Discussion paper)	Dept. of Primary Industries	State owned or controlled water and forests, privately controlled natural resources			NRM plans for water, forests, fisheries, private lands (critical areas), licences, codes of practice
Integrated Catchment Management	Dept. of Primary Industries	Defined river basins	Integrated natural resources management	CCCs, community involvement	Catchment management strategies
Coastal Management (proposed)	Dept. of Environment and Heritage	State controlled tidal and coastal lands	Coastal protection, habitat management		Coastal Plans
National					
National Landcare Program	Dept. of Primary Industries and Energy	All land and water in Australia	Community based land conservation	Facilitation community groups	Property management plans; Integrated resources management
Australian Heritage Commission	Dept. of Environment, Sports and Tourism	All significant natural, historical and cultural heritage	Identification and protection of heritage	Inventory which must be taken into account	Australian Heritage Register; Heritage Guidelines
World Heritage Properties Conservation Act	Dept. of Environment, Sports and Tourism	Australia's eleven World Heritage Areas	Conservation, rehabilitation and presentation of WHAs	Management Authorities, including joint management	Strategic Plans, licenses and infrastructure
Commonwealth Environmental Protection Authority	Dept. of Environment, Sports and Tourism	All of Australia (potentially)	Environmental quality protection	Environmental standards setting Assessment	Environmental standards; Impact Assessment
Rural Adjustment Scheme	Dept. of Primary Industries and Energy	All of Australia's agricultural and grazing areas	Integrated economic, social & environmental restructuring	Regional programs	Structural adjustment funds

Source: Adapted from McDonald (1995)

Table 3. Key management and planning issues

Key Issues	**Recommended Strategies**
Land Management • inappropriate land use allocation and its impact on resources and natural systems • impacts of land management on productivity • impacts on other values of land and adjacent land and water resources	(i) Coordinate land use planning to achieve balanced use of land, water and related natural resources (ii) Encourage best management practices in all rural industries (iii) Implement arrangements to reduce adverse impacts of agricultural drainage on natural systems and existing developments (iv) Reduce adverse impacts of non-agricultural land uses.
Water Management • Full and over-allocation of existing resources • increasing demands on finite surface and groundwater supplies • limited monitoring of water quantity and quality • threats to quality of surface and groundwater supplies	(i) Assess available resources and develop appropriate allocation policies in consultation with stakeholders (ii) Promote efficient use of water resources in the Catchment (iii) Promote the coordinated planning and implementation of water management schemes in the catchment (iv) Reduce contaminant inputs to surface and groundwater systems from point and diffuse sources (v) Establish and promote water monitoring priorities and standards for the catchment.
Stream Management • lack of awareness of stream values shown in development actions • stream bank erosion and stream migration • sedimentation • impact of uncoordinated levee banks and flood mitigation schemes • impacts of degradation of riparian zones • instream habitat degradation such as weed invasion and loss of water holes	(i) Continue implementation of a strategic approach to stream management (ii) Facilitate appropriate management of riparian zones throughout the catchment (iii) Ensure development and engineering works associated with streams take account of all stream functions and issues (iv) Identify and protect sensitive areas, to retain the function and health of our stream systems (v) Develop fisheries and habitat management plan for the stream systems of the catchment, involving stakeholder groups and the broad community
Habitat Management • threats to significant terrestrial and aquatic habitats and species • loss of instream habitat quality and subsequent impacts on fish stocks • fragmentation of remaining habitats through loss of connectivity (ie. corridors)	(i) Promote the values of habitat retention and restoration to the broader community through awareness, technical support and incentives (ii) Maximise the habitat values of existing protected areas (iii) Ensure the retention of significant habitat values outside protected area reserves (iv) Protect and rehabilitate wetland habitats on the Floodplain (v) Re-establish and manage riparian vegetation on watercourses throughout the catchment and ensure retention of existing riparian vegetation.

Chapter 2

Local Government Solutions to Mangrove & Wetland Conservation

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ABSTRACT Rural local authorities are responding to environmental concerns by expanding their role in land use planning and the in management of natural systems. The implications this has for planning is that for the first time agricultural activity is being regulated through the planning process. Rural environmental planning has some similarities with conventional urban based planning in terms of land use control, setting of performance standards and managing the development approval process. However in addition to this, rural based planning needs to address ecological and land resources issues and planning and management needs be specific to the local landscape. This thesis evaluates planning and conservation measures that can be used by Rural Local Governments to protect wetland resources. To achieve this the theses identifies some of the issues precluding the conservation of wetlands in Queensland and the role that local governments have in overcoming these issues. With particular reference to the Herbert River Catchment in North Queensland environmental pressures and the impact of current management arrangements on wetlands are investigated. From this planning methods that can be used to conserve wetlands are identified and described and evaluated to determine their effectiveness in overcoming management issues and for implementation in a rural context.

Chapter 1:

INTRODUCTION AND METHODOLOGY

1.0 INTRODUCTION

Local governments across Queensland are having to resolve competing claims over finite land and water resources. Competition is also increasing for resources in rural areas causing conflicts between existing and potential uses for agriculture, tourism and recreation, urban encroachment, mining, forestry and conservation (Johnson et al, 1996, p1). Rural local authorities are responding to this by expanding their role in land use planning and management of natural systems. Traditionally local governments have had a limited role in planning in rural areas and in the management of natural resources generally (McDonald and Bellamy, 1997, p1). This newly expanded role reflects the increasing demands from the community that environmental concerns and aspirations be acknowledged by land management authorities (Bates, 1995). The implication this has for planning, is that for the first time agricultural activity will be managed by local authorities and as a result desirable ecological outcomes can become part of the rural development process. The implication this has on wetlands, is that rural local authorities will have the power to regulate land use to achieve their conservation.

Wetlands have traditionally been regarded as a hindrance to human progress fit only for reclamation, drainage and development. Fortunately this attitude is changing and governments and the community are beginning to recognise their value (Claridge, 1994). Among other things, coastal wetlands, swamps, billabongs and waterholes are important wildlife habitat areas, being an integral part of the hydrological regime and act as important nursery areas for several species of commercially important fish (Johnson et al, 1996). Unfortunately many of the coastal wetlands along Queensland's coast have already been cleared and converted to other uses. Key sources of environmental pressure on remaining wetlands in rural areas are associated with agricultural expansion. This is resulting in the destruction of wetlands, reclamation for agriculture, or loss of wetland quality due to the off site impacts of agricultural management practices.

Thus the challenge facing rural local governments is to develop effective methods to conserve wetlands through their planning responsibilities. This thesis identifies some of the issues precluding the conservation of wetlands in Queensland and the role that local governments have in overcoming these issues. With particular reference to the Herbert River Catchment in North Queensland, planning methods that can be used to achieve wetland conservation are identified and described. They are evaluated to determine their effectiveness in overcoming current management issues and for implementation in a rural context.

1.1 A CASE STUDY: THE HERBERT RIVER CATCHMENT

The Herbert River catchment has been selected as the focus for the study for several important reasons. Firstly the Herbert River Catchment is representative of many other rural local Authorities in Queensland. The northern sections of the Catchment are identified as part of the Wet Tropics and the area is also well known for the offshore Great Barrier Reef (Shrubsole, 1997). Consequently, the results of this study may be appropriate for other councils with similar environmental characteristics.

Additionally, the Herbert is representative because agriculture is the dominant land use activity in the catchment. The sugar industry is the largest intensive industry in the catchment. This reflects many other catchments in Queensland as sugar cane is an important part of the landscape along the eastern coast of the Queensland and Northern New South Wales (Shrubsole, 1997). Moreover the Herbert is representative of many catchments in Queensland because the regulation of agriculture by Local Government has not occurred before.

In addition, the Herbert River Catchment has been selected for a number of other important reasons. The location of the catchment and the environmental conditions experienced have produced wetland resources that are of national importance. Additionally the sugar industry is

undergoing rapid expansion in the Herbert. Since 1991 the area has been one of the most rapidly expanding cane growing areas in the country. The Hinchinbrook Shire Council has realised the potential environmental impacts that this growth can have and is changing the scope of the planning scheme to regulate rural expansion. Finally the Herbert River has an extensive technical information base provided in the Herbert River Information Centre which is a computerised geographical information system. As a result, there are few informational constraints for this project.

1.2 METHODOLOGY

The purpose of this document is to identify planning solutions to address the management of wetland areas and to evaluate their appropriateness for inclusion into the Hinchinbrook Shire Council Planning Scheme. To achieve this, a number of objectives have been developed.

1.2.1 OBJECTIVE ONE: To determine the management problem

To develop provisions to achieve the conservation of wetlands it is necessary to determine the value of the wetland resources and current management problems. This was achieved by reviewing wetland resources, by determining current environmental pressures, and by identifying current management arrangements.

Reviewing Wetland Resources

First, the wetland resources of the Herbert river Floodplain were reviewed through secondary data sources. This information was collected as part of the literature review and consisted of a number of reports, tables and wetlands mapping obtained from State and Local government agencies; the Australian Nature Conservation Agency and CSIRO, as well as other journals and reports. Additionally several field inspections were made with the help of Canegrowers, the Council, the Catchment Co-ordinating Committee and the Department of Natural Resources. This facilitated the inspection of a range of wetlands types to gain an understanding of the distribution and quality of remaining wetlands resources. This information provided a description of the type, quality, value and distribution of wetlands in the Herbert River Floodplain.

Environmental Pressures on Wetlands

The environmental pressures on wetlands were identified through field inspections, consultation with major stakeholder groups and through additional literature analyses. Literature analyses were obtained from a range of sources including State Government Agencies, CSIRO, the Herbert River Catchment Coordinating Committee, as well as other sources. This information was focused on threats to wetland resources and the significant impact that the sugar industry is having on wetlands of the Herbert River Floodplain.

Current Management Arrangements

Current management arrangements were identified by answering the following questions which were developed by Duncan (1993):

1. How does the present form of land tenure affect wetland management?
2. What planning controls affect the wetland? How effective are they?
3. What problems are evident with the development control process?
4. How does the management system cope with cumulative impacts?
5. What is the likely outcome if management proceeds in the same way?

This was achieved by undertaking an assessment of literature documents and by interviewing major stakeholder groups. A structured interview schedule was used to analyse the effectiveness of the Draft Hinchinbrook Shire Council Planning Scheme for Integrated Catchment Management. Major stakeholder groups were interviewed, including: the Herbert River Catchment Coordinating Committee; Hinchinbrook Wildlife and Preservation Society; Ingham Canegrowers; Planning Consultant for Hinchinbrook Shire Council; Department of Local Government and Planning; Department of Environment; Department of Primary Industries and the Department of Natural Resources.

Question 1 aimed to determine the respondents' commitment to integrated catchment management and their knowledge of the planning process. Question 2 aimed at determining the involvement of the major stakeholder groups in the scheme preparation. Questions 3 and 4 sought to determine the respondents' opinion of the draft planning scheme, particularly their opinion of the proposed regulation of intensive agriculture. Additionally Questions 3 and 4

sought to determine the effectiveness of the draft scheme for achieving integrated catchment management. Finally Question 5 asked respondents to recommend ways in which the scheme could be improved to better achieve integrated catchment management.

1.2.2 OBJECTIVE TWO: Identify suitable instruments to implement planning provisions for wetland conservation

Once the values and management issues have been identified it is necessary to identify planning tools that will most effectively implement planning provisions for wetland conservation. Possible planning solutions were identified by analysing a range of planning documents from State and Local Government agencies in Queensland and New South Wales. These documents have a specific focus on land use planning matters.

Planning schemes from the three councils of Hinchinbrook, Johnstone and Cardwell were examined to determine ways of achieving wetland conservation. Johnstone and Cardwell Shire Council Schemes were selected because they experience similar environmental conditions and pressures on wetland resources as the case study, yet they have adopted different approaches to wetland planning.

Additionally conservation strategies and management plans adopted by Brisbane City Council, the Queensland Departments of Local Government and Planning and Environment, and the New South Wales Department of Land and Water Conservation were also investigated for their means of achieving wetland conservation. The provisions contained within these documents provided suggestions as to methods for achieving wetland conservation.

1.2.3 OBJECTIVE THREE: To determine the suitability of proposed planning options

The suitability of the planning options have been determined by assessing each one against the following criteria:
1. Ability to achieve desirable environmental outcomes
2. Administrative processes associated with planning provisions
3. Socio-Political acceptability of planning provisions
4. Cost

This information was derived from consultation with government and management agencies that had implemented or tested management alternatives. The evaluation was also based on an analysis of a range of planning documents that provided a description and analysis of conservation methods. Additionally consultation with stakeholders in the catchment also enabled the evaluation of alternatives within the context of the case study area.

1.2.4 OBJECTIVE FOUR: To determine suitable planning provisions for wetland conservation that achieve the resource management objectives of the ICM program and provide solutions to identified management problems

A framework for management has been developed to achieve desirable ecological outcomes and sustainable development based on the management issues and constraints identified, the significance of wetlands, environmental pressures, and the evaluation of planning options. This framework reflects the resource management objectives of the ICM program for the Herbert River and aim also to reflect the aspirations of the local community. These provisions will enable local governments to achieve conservation of wetlands in a rural context.

Chapter 2:

WETLAND CONSERVATION IN QUEENSLAND: AN INTRODUCTION TO THE ISSUES

2.0 INTRODUCTION

Wetlands are among the most productive ecosystems on earth and are possibly also the least appreciated ecosystem type. Coastal wetlands play an important role in the productivity of coastal waters, biogeochemical cycling and geomorphological stability. Among other things wetlands act as nurseries and feeding grounds for crustaceans, fish and birds, repositories for pollutants, nutrients and organics, and as protection against wave attack (Carter, 1988). Traditionally wetlands have been regarded as hindrances to human progress, fit only for reclamation, drainage and development. Therefore despite their intrinsic value, wetlands have long suffered from human impacts. These include the direct appropriation of wetland ares for development and through peripheral impacts of road building, drainage and stream canalisation. This has had a significant impact on wetland areas and as a result more than half of Australia's wetlands have disappeared since the time of the first European settlement (Claridge, 1994; Carter, 1988).

Fortunately this attitude towards wetlands is changing and governments and the community are beginning to recognise their values. The values of wetlands are identified in Table 1 below.

Table 2.1 (Sources: Claridge, 1994; Carter, 1988; Sharley and Huggan 1994)

BENEFITS PROVIDED BY WETLANDS	
WETLAND BENEFITS	**DESCRIPTION**
Water supply	Extraction for domestic, agricultural and industrial uses Groundwater recharge Supply to another wetland
Flood control and flow regulation	Flood height reduction Maintenance of dry season flows
Prevention of saline water intrusion	To coastal aquifers To coastal water bodies
Protection from natural forces	Shoreline and bank erosion protection
Sediment retention	Cleans water of sediments
Toxicant retention	Removes toxic materials from water passing through wetlands
Nutrient retention	Outflows have lower nutrient levels
Source of natural products	On site Off-site, eg: through nutrient export
Energy production	charcoal, peat and tidal energy harnessed from tidal flows in estuaries
Water transport	
Conservation	Habitat for life cycle stages of plant and animal species (including wildlife corridors) Habitat for rare elements of the natural environment
Recreation and tourism	Swimming, boating, birdwatching, duck shooting
Research and education	Site for specific research Type locality Site for education
	Landscape and aesthetic values

Sociocultural significance	□ Association with religions and spiritual beliefs □ Wilderness Values □ Historical Values
Maintenance of existing processes and natural systems	□ Ecological, geomorphological and geological processes □ Prevention of development of acid sulphate soils
Breeding site for useful species	□ Birds which feed on insects on agricultural land
Gene bank	□ Commercial exploitation (improvement of domestic stocks) □ Maintenance of wildlife populations
Intrinsic Values	□

2.1 GENERAL MANAGEMENT ISSUES

While wetlands are beginning to be recognised for their values, a number of issues are hindering the management and conservation of these areas. They include legal issues, legal issues, land use and land management , poor coordination, information and knowledge, political will and education and awareness

2.1.1 Legal Issues

Wetland conservation is impeded by a lack of statutory control over rural land management and the legal problem of defining wetlands. Rural planning schemes have not traditionally regulated rural activities. Consequently conservation and management of rural lands have been achieved through voluntary programs such as Landcare and partnership agreements such as Integrated Catchment Management (ICM). ICM aims at integrating the management of land, water vegetation and other biological resources on a catchment basis in order to achieve the sustainable and balanced use of these resources (Queensland Department of Primary Industries, 1993). ICM is a community based approach to natural resource management and as a result it works by fostering voluntary changes in the way people use and manage their natural resources (ICM/Landcare Review Committee 1997). However, there is no specific legislation for ICM and consequently it does not have the statutory power to legally implement management strategies. As a result its ability to conserve wetlands is limited. (Department of Primary Industries, 1993).

Further issues arise over the legal definition of wetlands. Problems arise when trying to distinguish between terrestrial environments and wetlands and between wetlands and aquatic and marine environments. Additional difficulties arise over the scope of definition which can have significant implications on the range of lands that can be included as wetlands. This can cause problems, especially in politically or legally complicated situations (Duncan, 1993)

2.1.2 Land use and Land Management

Until relatively recently rural local governments have had a limited role in land use planning and in the management of natural resources generally (McDonald and Bellamy, 1997). This limited role in the regulation of agricultural land uses by local government has impeded the effective conservation of wetlands. In the absence of land use planning by Local Authorities, the development of rural land is based on largely on agricultural land suitability and therefore desirable environmental outcomes have received little attention in land use decisions (Shrubsole, 1997).

2.1.3 Poor Coordination

Lack of co-ordination between government agencies, local governments and catchment co-ordinating committees has precluded the effective management and conservation of wetlands. At an administrative level a lack of co-ordination between environmental and economic agencies is a key causal factor of many environmental and developmental problems (Johnstone, Shrubsole and Merrin, 1996, p 303). There is a need for a single authority to assume the lead role in co-ordinating land management to achieve ICM objectives.

Local Governments are well positioned to achieve the implementation of ICM strategies. Halliburton (1995, p4) has identified several important reasons why local governments have a major role to play in ICM: they are the major regulatory agency controlling land use (and land use changes) and have a responsibility in ensuring that environmental impacts on catchments are considered when assessing land use changes; local governments are local and directly accountable to the community; they understand local environments; they undertake the day to day management of environmental assets; they are able to control many potentially environmentally damaging activities; they provide a more holistic approach to local area management and; they have access to more detailed local information.

2.1.4 Information and Knowledge

Local governments, through their planning schemes, can improve catchment management. However, planners have not always addressed environmental and catchment issues in schemes because of a lack of information (Department of Primary Industries, Communication Plan, 1996, p9). Technical knowledge and information is an integral part of finding solutions for natural resource management issues. It is vital for the identification and understanding of the problem and for identifying solutions that will achieve ICM strategies through the planning scheme (Young, 1996).

Technical knowledge must be relevant, readily available and easily understood in order to enable the effects of development to be measured (Young, 1996). "...it is important to understand: what types of activity are likely to cause an effect; when and how a development assessment should be triggered; what information is required to inform that assessment; and finally, how to measure the effectiveness of the controls (or conditions) applied to an approved development" (Young, 1996, p375). Policy and planning cannot be expected to achieve societal goals in the absence of adequate data relating to biophysical, economic and social factors that impinge on resource use (Johnstone et al, 1996, p16).

2.1.5 Political Commitment

The first requirement in the achievement of ecologically sustainable land use planning is to want to do it (Nobbs, Rush, and McGregor, 1995). Traditionally there has been far less control over rural land use and management and statutory land use controls tend to be regarded by farmers as an infringement of their property rights (Hollick, 199_). Additionally, as local governments are held accountable by way of election, the extent to which local governments will be prepared to intervene in development activity (ie: by imposing statutory controls on land use) will be guided by the willingness of the community to support that intervention (Young, 1996). The extent of intervention is the subject of much debate between planners, economists and politicians (Johnson et al, 1996).

This has constrained wetland management on rural lands in the past. Political commitment is influenced by community knowledge of wetlands issues. Additionally political commitment is vital for the implementation of wetland conservation and it helps provide a sense of local ownership of ICM strategies (Halliburton, 1995). If government is to intervene to overcome the constraint of self-interested behaviour in catchment management, it must first clarify the precise balance between the rights of the individual rural landholder to develop or use the land or other resources and those of the Government seeking to implement policies to achieve wetland conservation to protect the broader public interest by maintaining environmental quality (Synott, 199_; Bates, 1995).

2.1.6 Education and Awareness

Strongly linked to political acceptability is education and awareness which is the key to the effective implementation of wetland conservation. While people are beginning to recognise the

significance of wetlands further education is needed at a policy and a community level to improve awareness of wetland functions and benefits (Claridge, 1994). Education and awareness is an integral part of the ICM process because it influences the degree to which local planners, engineers, councillors, chief executive officers and the community understand and values their wetland resources (Young, 1996; Department of Primary Industries, 1993).

The ICM and Local Government Survey which interviewed Local Government Staff in 1994 showed that the level of knowledge about ICM is generally low throughout local governments in Queensland (Department of Natural Resources, 1996). Education and awareness of natural resource management problems can stimulate voluntary action (Department of Primary Industries, 1993) and can also provide the political support for local governments to mange wetlands. The extent to which a local authority will be prepared to intervene in development activity will be influenced by the willingness of the community to accept controls for wetland management (Young, 1996, p375). Consequently, for wetland strategies to be effective, natural resource users and managers need to know and understand the impacts their decisions and actions have on wetland resources (Queensland Department of Primary Industries, 1993).

2.2 ROLE OF LOCAL GOVERNMENTS IN LAND MANAGEMENT AND WETLAND CONSERVATION

Local authorities have a significant role in managing the land to achieve Ecologically Sustainable Development (ESD). Local authorities also have an important role in integrating Integrated Catchment Management Strategies into their land use plans.

2.2.1 Ecologically Sustainable Development

Ecologically Sustainable Development (ESD) is defined as "using, conserving and enhancing the community's resources so that ecological processes, on which life depends, are maintained, and the total quality of life, now and in the future, can be increased' (National Strategy for Ecologically Sustainable Development, 1992, p6). In 1992 the Inter-Governmental Agreement on the Environment (IGAE) was signed by all State and Territory Governments, the Commonwealth Government of Australia and the Local Government Association of Australia. The agreement establishes seven principles towards the achievement of ESD:

1. Decision-making processes should effectively integrate both long and short-term economic, environmental, social and equity considerations
2. Where there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.
3. The global dimension of environmental impacts of actions and policies should be recognised and considered.
4. The need to develop a strong, growing and diversified economy which can enhance the capacity for environmental protection should be recognised
5. The need to maintain and enhance international competitiveness in an environmetnally sound manner should be recognised.
6. Cost effective and flexible policy instruments should be adopted, such as improved valuation, pricing and incentive mechanisms
7. Decisions and actions should provide for broad community involvement on issues which affect them" (Johnson et al, 1996, p6)

Through the IGAE Local Governments are committed to pursuing the principles of ESD, through its decision-making processes. This includes the preparation of local planning schemes and consideration of applications for planning permission, including environmental impact assessment, and commitment of funds to technologically advanced treatment of sewage and minimisation of all forms of waste. (Bates, 1995):

2.2.2 Integrated Catchment Management

Local Government has a major role to play in implementing catchment management strategies as it is the major regulatory agency controlling land use and land use changes (Halliburton, 1995). Local governments have an important role in implementing sustainability-based land use planning as it is estimated that perhaps 85% of land use decisions are made by local authorities (Nobbs, Rush, and McGregor, 1995).

As a result local authorities have an important role in bridging the implementation gap of the ICM program. Halliburton (1995) has identified several important advantages of implementing ICM at a local government level. Firstly, local government has significant opportunities to influence land use and land management through planning schemes. Secondly, local government is local. This is important as local ownership of problems, processes and solutions is a key to successful adoption of good catchment policies by landholders. Thirdly, political commitment by Local Government to ICM is necessary and helps provide a sense of local ownership. Political commitment is partially dependant on community knowledge which can be fostered by Local Government. Finally, local government has a major role in information management and dissemination through involvement as a "clearing house" for research, through involvement in research design and in the production of information for catchment landholders.

2.3 LEGISLATIVE CONTEXT

Local Governments have significant opportunities to influence land use and management through the Local Government (Planning and Environment) Act and the proposed Integrated Planning Act.

2.3.1 Local Government (Planning And Environment) Act 1990

The Local Government (Planning and Environment) Act 1990, is an act to provide for town planning and related environmental maters in local government areas. The objectives of the Act are:

a) To provide a code by which Local Government or the Minister may undertake the planning of an area to facilitate orderly development and the protection of the environment; and
b) To provide an adequate framework for a person to apply for approval in respect of a development proposal and to provide appropriate appeal rights in respect thereof. (Local Government (Planning and Environment) Act 1990)

Administration of the Act

The Act is administered by Local Authorities and the Minister for Housing and Local Government. Local Councils can administer planning controls to meet the economic, social and environmental needs and aspirations of their community.

Town Planning Scheme

The Town Planning Scheme is the basic tool for the administration of the Act and is composed of planning scheme provisions, zoning and regulatory maps, strategic plan, development control plans, and amendments to the planning scheme. The planning scheme gives Local Governments the power to regulate development through zoning controls and the strategic plan. In addition, Local Councils can further place regulations on development with Local Planning Policies which provide detailed guidelines for development assessment on specific matters. Further restrictions can be placed on a development if it lies within an area controlled by a Development Control Plan (Brannock and Hutchinson, 1995).

State Planning Policies

The Act also provides the Governor in Council with the power to prepare State Planning Policies on issues considered to be of "State Significance" such as State Planning Policy 1/92 "Development and the Conservation of Agricultural Land. This policy requires that Councils take into account the value of agricultural land in all strategic and rezoning decisions.

Environmental Impact Assessments (EIA)

Environmental Impact Assessments are a tool employed by the act to provide advice to decision-makers with respect to the environmental soundness of a development application. This is expressed in s8.2(1) of the Act which sates that "a local government, when considering an application for its approval, consent, permission or authority for the implementation of a proposal under this Act or any other Act, is to take into consideration whether any deleterious effect on the environment would be occasioned by the implementation of the proposal, the subject of the application."

An EIS will be required if an activity is defined as a "designated development", outlined in the Local Government (Planning and Environment) Regulations 1991. Wetlands are defined in the schedule as requiring impact assessment procedures. Further an EIS may be required for activities specified by Council in a Planning Policy or for other designated developments if the activity is proposed for a particular area, such as Wet Tropics. These are also listed in the Regulations. When considering a proposal for a relevant development on land within or neighbouring the wet tropics area, a local government must consult with, and have regard to the advice of, the Wet Tropics Management Authority.

2.3.2 Integrated Planning Act

The proposed Integrated Planning Act (IPA) seeks to achieve ecological sustainability by coordinating and integrating local, regional and state level planning, managing the process by which development occurs, and managing the effects of the development on the environment (Queensland Department of Local Government and Planning, 1997, p24).

The proposed Act rationalises the existing complex and multiple approvals systems under the Local Government (Planning and Environment) Act, and provides for a whole of government input into land use and infrastructure planning. The proposed planning system will combine the current separate assessment processes for development including: planning; building; plumbing; transport; heritage; coastal development; environmental licensing; subdivision (Queensland Department of Local Government and Planning, 1997, 2).

Planning Schemes

Under the Integrated Planning Act, a planning scheme will be a single instrument. The IPA promotes a planning scheme that links the strategic and operational elements or functions of a scheme in a logical and coherent manner. For example planning schemes will need to identify the desired environmental outcomes for the shire, and include measures that enable the desired environmental outcomes to be achieved, such as codes or policy intentions for particular areas (Queensland Department of Local Government and Planning, 1997, 37).

The proposed legislation does not prescribe the structure of planning schemes, but identifies core matters that the strategic and operational elements of planning schemes must deal with, and coordinate and integrate with other Local, Regional and State plans. These core matters include development and transport, infrastructure, valuable features (resources or areas of economic, ecological, social, heritage or visual significance) (Queensland Department of Local Government

and Planning, 1997, 38).

The Integrated Development Assessment System (IDAS)

The Integrated Development Assessment System (IDAS) integrates all State and Local Government assessment and approval processes for development (Queensland Department of Local Government and Planning, 1997, 74). The IDAS will replace a large number of separate processes contained in many different Acts and will create a more transparent and logical system, eliminate duplication, enhance time efficiency, reduce costs, and produce more publicly accountable documents (Queensland Department of Local Government and Planning, 1997, 3).

The proposed Act contains a comprehensive definition of development which will ensure that IDAS can deal with a wide range of development controls. Additionally, the Act will not require all development that is potentially covered by the definition to be controlled, unless this is specifically determined (Queensland Department of Local Government and Planning, 1997, 3). Types of development that will require assessment are specified schedule 8 to the proposed Act and includes all development currently regulated by State Agencies. Local Government will also determine the types of development requiring assessment in their planning schemes (Queensland Department of Local Government and Planning, 1997).

Development will either be assessed against specified codes or be subject to impact assessment. Impact assessment will determine the effects of development on the environment and ways of dealing with those effects (Queensland Department of Local Government and Planning, 1997, p226). Under current legislation, environmental impact is addressed by numerous separate pieces of legislation. The proposed Integrated Planning Act will promote a mainstream role for environmental matters as part of the overall planning framework. In addition it removes the unnecessary administration and duplication featured in the current system of multiple assessment. This new approach will ensure that environmental and land use conditions of development approval and consistent and compatible (Queensland Department of Local Government and Planning, 1997, p4).

2.4 IMPLICATIONS FOR WETLAND CONSERVATION

Therefore the main tools available to conserve wetlands under the Local Government (Planning and Environment) Act are planning schemes, development assessment and Environmental Impact Assessment. This system of planning is limited because it incorporates separate approval systems, and does not integrate various levels of management and decision making into a hierarchical organisation covering national, state, and local planning issues. This impacts on wetland conservation because it facilitates an uncoordinated approach to wetland management. In addition the procedures established for development and impact assessment do not consider the cumulative impact of development on the environment.

Changes central to the proposed Integrated Planning Act include a comprehensive integrated development assessment system that combines State, Regional and local policies in planning schemes, establishes a forum to achieve co-ordinated approach to issues extending beyond a local authority area, as well as implementing a system that incorporates environmental considerations into the planning and design stage of a project (Corrs, Chambers, Westgarth, 1995). Additionally the proposed legislation improves the current method of environmental impact assessment by adopting a more sustainable and comprehensive approach to wetland management by facilitating the impact assessment within a broader strategic framework. Therefore the proposed legislation appears to be more effective for wetland conservation.

In both pieces of legislation, the key tools available for local governments to achieve wetland

conservation still basically remain the same, however the processes will change. As local authorities have not had a major impact on rural development in the past any form of planning will be more effective in achieving wetland conservation than the current system of land development. However as the planning tools set up under both planning legislation's deal with changes to land use they can not control the on-going management of wetland resources on private land.

In a rural context planning controls need to deal more with ecological and land resources issues and planning and management needs to be more site and landscape specific (McDonald and Bellamy, 1997). Therefore to effectively achieve sustainable wetland management and integrated catchment management, planning schemes and development assessment may need to be integrated with other conservation tools such as financial incentives, land acquisition and conservation agreements.

Chapter 3:

HERBERT RIVER CASE STUDY

3.0 INTRODUCTION

Mangroves and wetlands of the Herbert River Catchment are of national and local significance. However their distribution has been dramatically reduced since European Settlement. Conservation of wetlands and mangroves has been ineffective because of fragmented management arrangements, a failure to address environmental issues in the rural land development process and limited ability to control harmful land management practices. The greatest threats to these areas at present are associated with the rapid expansion of the sugar industry. Until now this expansion has not been managed by Local Government and thus the challenge facing the Hinchinbrook Shire Council is to regulate the continued expansion of the Sugar Industry and in doing so incorporate environmental objectives into rural land development.

3.1 DESCRIPTION OF STUDY AREA

The Herbert River Catchment drains an area of approximately 1,0000km^2 to the Coral Sea and is the largest of the river systems located in Australia's sub-humid to humid tropical north east (Refer Map 1). With its source 8km north east Herberton, (1070m asl) the Herbert River winds 340km to its mouth, 7km north of Halifax (Herbert River Catchment Coordinating Committee, 1996).

Topographically, the catchment can be divided into three distinct sections. The upper catchment (approximately 6,000km^2) is bounded to the north and west by the Great Dividing Range and to the east by the Cardwell Range. In the intermediate catchment (1,000km^2) below Gleneagle (179km downstream) the River changes direction and flows south east for 70 km through a deep gorge before entering the lower catchment. The lower catchment, (3,000km^2) is bounded on the north by the Cardwell Range and on the south by the Seaview Range (Johnson and Murray, 1997, p1).

The Lower catchment contains the Floodplain and delta of the Herbert River and is characterised by reworked alluvial soils. The floodplain consists of flat and relatively low lying terrain which is subject to regular inundation from flooding (Herbert River Catchment Coordinating Committee, 1996, p4; Department of Natural Resources, 1996, p2). The Herbert River Delta is a major feature of the Queensland coast. (Johnson and Murray, 1997, p15). This thesis is concerned with the lower Herbert River Catchment as mangroves and wetlands occur in

this section. The administrative boundary of the Hinchinbrook Shire Council is also contained within the lower section of the catchment.

3.2 PHYSICAL FEATURES

The mangroves and wetlands of the Herbert River Catchment have evolved as a result of the physical characteristics and environmental conditions experienced in the area. Additionally, these physical features have also produced a landscape that is well suited to other uses such as agriculture, tourism and recreation, forestry, and urban development.

3.2.1 Climate

The catchment experiences warm humid to sub-humid summers and mild dry winters. Significant rainfall and temperature gradients exist across the catchment and variability of rainfall is also very high. Rainfall is strongly influenced by the incidence of cyclonic activity in the November to May period (Johnson and Murray, 1997, p5).

3.2.1.1 Rainfall

Rainfall regimes differ widely across the catchment. Over short distances regimes vary considerably because of changes in local topography, such as the height and orientation of mountain ranges, and the direction of the coastline in relation to the prevailing moist south east air stream. The mean annual rainfall for the catchment is 1370mm, which ranges from in excess of 3000mm atop the Cardwell Range to 750mm in the extreme west of the catchment. In the lower catchment, the wide coastal plain shows a drop in rainfall from coast to foothills (refer map 2) (Johnson and Murray, 1996, p5).

3.2.1.2 Temperature

Mean monthly temperatures in the lower catchment (Ingham) range from 32°C-25°C during the summer months. Mean monthly minimum temperatures range from 23°C during summer to 13°C in winter, with July having the coolest average minimum (Johnstone and Murray, 1996, p5).

3.2.2 Geology

The geology of the lower catchment comprises Quaternary alluvium and beach sands., Cainozoic basalts, Carboniferous granites, Carboniferous acid volcanics and undifferentiated Paleozoic quartzite (Johnson and Murray, 1996, p12).

3.2.2.1 Soils

Mapping of soils and soil suitability of the floodplain at 1:100 000 indicates that alluvial soils vary according to their associated landform and position in the landscape. Soils of lower areas suffer drainage problems due to topography and poor internal structure. Hence substantial low, swampy areas do exist (Herbert River Catchment Coordinating Committee, 1996).

3.2.3 Geomorphology

The lower catchment contains seven different patterns namely, mountains, hills, rises, alluvial fans, alluvial plains, beach ridges and tidal flats. Alluvial fans are characterised by gentle inclines with low relief. They have been formed by the deposition of materials washed from surrounding hills by sheet flow or channelled stream flow. As a consequence soil types vary with parent material and position in the floodplain. Alluvial creek plains, levees, terraces and prior streams consist of loamy earth soils derived from granitic and volcanic hills. Alluvial River plains include the landforms elements of channel benches, levees, plains, prior streams, scrolls, stream channels and swamps and consist of the alluvia associated with the Herbert and Stone Rivers and their larger tributaries (Johnson and Murray, 1997, p12).

3.2.4 Hydrology

The Wild, Herbert and Stone Rivers are the major drainage systems in the catchment (Refer map 3). The Herbert River has a catchment area of 1 213 000 ha (the largest river catchment in the Wet Tropics Bioregion)(Australian Nature Conservation Agency, 1996, p 388). Streams carrying most of the local runoff into the Herbert River Upstream from Trebonne are the Stone River and Gowrie, Lannercost, Dalrymple, Wigwam, Cane, Elphinstone, Broadwater, Stoney and Garawalt Creeks. Streams carrying most local runoff into the delta area are Ripple, Cattle (upper part), Francis, Waterview and Waterfall Creeks. Abandoned streams in the delta are old courses of the Herbert River and include the Seymour River and Cattle (lower part), Trebonne, Palm, Victoria and Gentle Annie creeks. These interconnected, abandoned streams still carry significant amounts of water during floods (Johnson and Murray, 1997, p15)

The entire Herbert River Catchment has a mean annual discharge of approximately 3.7 million ML. Coastal streams to the south of Ingham which receive flood overflow water from the Herbert River contribute around a further 1 million ML. Flooding of the Herbert and Stone River is almost exclusively confined to the wet season, which generally occurs from December to March. Heavy falls are usually the result of tropical cyclonic disturbances. Major floods in recent times have occurred in 1927, 1946, 1967, 1977, 1986, and 1991(Johnson and Murray, 1997, p19; Herbert River Catchment Coordinating Committee, 1996, p5) (Map 3).

3.3 BIOLOGICAL INVENTORY OF WETLAND RESOURCES

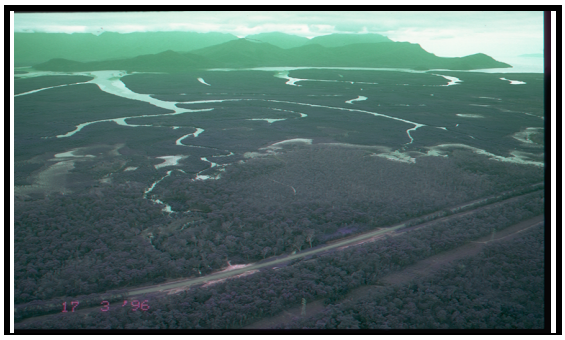
The climate, topography, geology, geomorphology and hydrological regime of the Catchment produce an environment that is favourable for mangrove and wetland development. The wetland resources of the floodplain include vegetation and fauna.

3.3.1 Vegetation

The natural vegetation of the Herbert River Floodplain has been dramatically reduced since European settlement. As a result, approximately 35-40% of the natural vegetation of the coastal lowland area has been cleared for crop production or improved pastures. (Johnson and Murray, 1997, p28). Approximately 12% of the floodplain is currently occupied by mangrove communities (Australian Nature Conservation Agency, 1996, p389). The range of mangrove species found on the floodplain form a complex mosaic and reflect changes in the hydrological regime. Approximately 2% is occupied by saline, largely treeless areas associated with mangroves. Four percent is represented by Melaleuca dominated swamp and riparian forests (consisting of *Melaleuca viridiflora*, *M. leucadendra*, *M. quinquenervia* and *M. dealbata*). Sedgelands (*Eleocharis dulcis*, *Lepironia* spp. and *Baumea* spp.) occupy approximately 0.4% of the floodplain with fresh or brackish lagoons also covering about 0.4% of the floodplain (Australian Nature Conservation Agency, 1996, pp389). Wetland communities including Melaleuca forest and woodland, Leichart (*Nauclea orientalis*) open woodland and sedgelands occur in poorly drained alluvials. Substantial areas of mangrove vegetation exist in tidally affected areas, bordered by salt water couch (*Spoorbolus virginicus*) and salt marsh species (Australian Nature Conservation Agency, 1996, pp389).

3.3.1.1 Values and Significance

The significance of the wetlands of the Herbert River Catchment is provided in the Directory of Important Wetlands in Australia produced by the Australian Nature Conservation Agency in 1996. The wetlands of the Herbert River Floodplain are a representative sample of wetlands in the Wet Tropics biogeographic region and are identified as nationally significant because:



1. "It is a good example of a wetland type occurring within a biogeographic region in Australia.
2. It is a wetland which plays an important ecological or hydrological role in the natural functioning of a major wetland system/complex.
3. It is a wetland which is important as the habitat for animal taxa at a vulnerable stage in their life cycles or provides a refuge when adverse conditions such as drought, prevail.
4. The wetland supports 1% or more of the national populations of any native plant or animal taxa.
5. The wetland supports native plant or animal taxa or communities which are considered endangered or vulnerable at the national level." (Australian Nature Conservation Agency, 1996, p2)

The seaward edge of the Herbert River delta is part of the most diverse and complex mangrove area in Australia (Missionary Bay-Hinchinbrook Channel-Halifax Bay) and is of international importance. The coastal edge of the delta along the shore of Halifax Bay towards Townsville provides a representative example of northern coastal wetland vegetation, which has become uncommon as a result of its location clash with human interests. The wetlands of the Herbert floodplain play a significant role in recharging groundwater and maintaining water quality in the river (e.g. by acting as filters and by supplying water to maintain flow during dry periods)" (Australian Nature Conservation Agency, 1996, p 389).

3.3.1.2 Distribution

The remaining wetland resources of the Herbert River Floodplain are small compared with the size of the floodplain (Australian Nature Conservation Agency, 1996). This is supported by Hogan and Graham who comment: "The first impression of the Herbert River floodplain we formed was the lack of freshwater wetland for the size of the floodplain. Obviously many lagoons and swamps had been drained and cleared or filled in" (Hogan and Graham, 1994, p2). Additionally they point out that the relatively flat nature of the topography has enabled the Herbert River to meander in the not to distant past, and consequently the floodplain should contain many remnant oxbow lakes and wetland areas. However reality, the amount of remaining freshwater wetlands is very disappointing (Hogan and Graham, 1994, p3).

Geographic data in the form of aerial photographs, other airborne imagery and mapping are among the most important information for both project specific or long-range environmental planning. Geographic data provide the basis: to calculate the distribution of mangroves and

wetlands in the catchment; to determine the impact of land use on wetlands; to formulate land use and coastal zone plans and to facilitate impact analysis using overlay techniques (Clark, 1996, p147). Mapping developed by the Department of Environment and CSIRO is useful to determine the distribution of remaining wetland habitats and as a tool for future planning and management.

C.S.I.R.O. Mapping

An analysis of the spatial and temporal distribution of wetlands within the Herbert River Catchment has also been undertaken by Johnson, Ebert and Murray. The study concentrates on coastal lowlands below 13m AHD (Australian Height Datum). A time series has been developed to demonstrate the spatial and temporal change in land cover for riparian and wetland areas (Johnson, Ebert and Murray, 1997, p10). To achieve this land cover of the lower Herbert River catchment was mapped from aerial photography taken in 1943, 1961, 1970, 1977, 1988, 1992, 1993, 1994 and 1995. 1996 land cover was mapped using SPOT Panchromatic and MSS imagery. From this land cover boundaries were mapped onto a geo-referenced digital base. Classification drew heavily on previous vegetation and soil surveys in the region. Classification of wetland areas was achieved using the method of Blackman et al (1992). Mapping units and mapped boundaries were ground truthed via vehicle and foot traverses. Classification of units and boundaries not inspected was undertaken by extrapolation form equivalent photographic units. Additionally an estimate of land cover prior to European settlement was produced through observed relationships between remaining stands of native vegetation and the known distribution of soils, topography, relief, hydrology and rainfall (Johnson, Ebert and Murray, 1997, p10).

This analysis found that prior to European settlement, the area was dominated by grassland, lowland rainforest and *Melaleuca* communities. By the 1940's extensive losses of riparian (rainforest patterns) and wetland (melaleuca dominated patterns; open water) areas had occurred and much of the native grassland had been converted either to grazing or sugarcane. Land cover remained relatively stable throughout the 1960's and early 1970's, however the period between 1977 and 1996 saw a dramatic expansion of sugar cane land. This resulted in a six fold decrease in the area of *Melaleuca* dominated patterns (four fold decrease between 1943 and 1996) and a 5 fold decrease in the areas of rainforest patterns when compared to pre European estimates of area. The distribution of mangrove communities has remained relatively stable since 1943(Johnson, Ebert and Murray, 1997, p14).

Department of Environment Mapping

Mapped information has been developed by the Department of Environment at a scale of 1:50 000. This information is recommended to be used at a scale of 1:50 000 for environmental purposes and at 1:100 000 for publishing. The purpose of this vegetation mapping was to provide up to date habitat and clearings information for lowlands habitat occupied by the Mahogany Glider and to provide a tool for conservation planning in the area. The vegetation units used for the project are based primarily on land type, with a strong emphasis on floristics. Structure further plays a part in the division of communities. Detail of mapping (ie: the smallest limit of polygon size) was determined by the smallest polygon physically possible to outline using a 0.3mm calligraphy pen on a 1:50 000 mapsheet. This equated to approximately 1mm diameter on the 1: 50 000 map or 50m on the ground.

3.3.2 Rare or Threatened Species

The Eastern Grass Owl occupies tall grass-tussocks in extensive swampy areas, grassy plains, swampy heaths, clumps of cane grass or lignum on floodplains and sedges. The only recordings in the catchment have occurred at Ingham. The Ingham area is an important bird habitat and

some 266 species of birds have been recorded. Reduction of habitat through clearing poses the greatest threat to the majority of rare and threatened species in the lower catchment is the loss of habitat due to clearing (Johnson and Murray, 1997, p35).

Several species of poorly known fish have been recorded in the floodplain of the Herbert River (Johnstone and Murray, 1997, p35). DPI fisheries biologists have conducted preliminary investigations into wetland habitats of the Herbert River Floodplain. Apart from this study there appears to be limited historical data available on the fisheries habitats of the catchment. The study found that the reduction in the total area of freshwater lagoons and wetlands is resulting in reduced catch rates (Hogan and Graham, 1994, p3; Australian Nature Conservation Agency, 1996, p288).

3.4 CULTURAL ASSETS

Five Aboriginal tribes, the Giramaygan, Bandjin, Wargamdygan, Njawaygin and Warunu, inhabited parts of the lower catchment. Aboriginal communities in the lower catchment still rely in part on the harvesting of natural resources. The National Register of the Australian Heritage Commission includes a number of sites and constructions within the lower catchment. Most sites are centred around wilderness areas, while the historically significant Gairloch Bridge and a historical stock route (Dalrymple Walking Track) also occur (Johnson and Murray, 1996).

3.5 CURRENT USES AND MANAGEMENT

Development has altered the condition of the Catchment (refer map 3). Most of the changes have been central to the economic development of the communities in the Catchment. The economy of the Catchment is based largely on primary production, principally sugar cane and beef cattle grazing. The principal land uses in the Catchment include beef cattle production; sugar cane production; horticulture and small crops; tourism and recreational use; urban and forestry (Johsntone River Catchment Coordinating Committee, 1996).

3.5.1 Beef cattle production

A substantial proportion (approx 696 000 ha) of the Catchment is dedicated to beef cattle production. Extensive pasture improvements have occurred in the lower Catchment however the area under improved pasture has been reduced to 2,000ha with the expansion of sugar cane production (Johnson and Murray, 1997, p40; Herbert River Catchment Coordinating Committee, 1996, p8). The present gross value of the grazing industry in the Catchment is estimated at 6 million. The vast majority of grazing takes place in the Tablelands section with some to the south and south-west of Ingham and is leasehold and crown land lining the foothills of the Hinterland. In the lower catchment most grazing take the form of small herds operated by cane farmers and occurs mostly on native pastures. (Johnson and Murray, 1997, p40)

3.5.2 Sugarcane Production

The sugar industry is the largest intensive agricultural industry in the Catchment (Johnson and Murray, 1997, p35). Raw sugar exports from the district was estimated at a gross value of $238 million (Herbert River Catchment Coordinating Committee, 1996; Shrubsole, 1997). Approximately 60 000 ha of land is devoted to cane and supplies the two sugar mills (Victoria and Macknade). Approximately 5420 ha is licensed to be irrigated from surface supplies. All sugar produced from the region is exported through a bulk sugar terminal located at Lucinda (Herbert River Catchment Coordinating Committee, 1996).

Cane farming is presently restricted to the Herbert Floodplain, although potential for expansion onto the Tablelands exists (Herbert River Catchment Coordinating Committee, 1996). At present cane is grown mainly in the area surrounding the two sugar mills and extending along the Herbert River to Abergowrie and the Stone River to upper stone and south from Yuruga to Crystal Creek (Refer Map 4). Sugarcane because of its many varieties, will grow on a wide range of soils (Johnson and Murray, 1996, p35).

Since 1991, the area has been one of the most rapidly expanding cane-growing areas in the country. The cane industry is presently expanding its area under production at around 7% per annum. It is forecast that approximately 70 000ha will be devoted to cane farming by the year 2000. (Johnson and Murray, 1997, p35; Herbert River Catchment Coordinating Committee, 1996; Shrubsole, 1997)

3.5.3 Horticulture and Small Crops

Other important crops in the Catchment include maise, sorghum, peanuts, and potatoes. Potato is the most significant crop (net value of $2.5 million). Large areas of the Catchment have suitable rainfall and climate conditions for timber production. There is significant potential for on farm forestry and timber production (Herbert River Catchment Coordinating Committee, 1996).

3.5.4 Tourism and recreational use

The lower Herbert Catchment provides a range of recreation and tourism opportunities including recreational fishing, nature based tourism, historical and cultural tourism based on sites from the early settlers, cattle and mining industries and the sugar industry. Nature based tourism takes advantage of National Parks and the Wet Tropics World Heritage Area which cover approximately 173 000 ha (Herbert River Catchment Coordinating Committee, 1996). Tourist visitation rates are relatively low compared to other wet tropical catchments. Lack of facilities and infrastructure and proximity to attractions are seen as the major factors limiting further development of this income source. Overall the Herbert River has the potential for greater recreation with a focus on wilderness experiences (Johnson and Murray, 1997, p43)

3.5.5 Urban

The Catchment supports a population of approximately 18 000 people. Major towns are Ingham (5100), Halifax (500), Lucinda (800), Herberton (950), Ravenshoe (880) Mount Garnet (380). Population expansion is occurring principally in beach townships to the east of Ingham and northern sections of the upper catchment around Ravenshoe. The lower Catchment is serviced by the Bruce Highway, arterial roads and Northern Railway (Refer Map 6).

3.5.6 Forestry

Large sections of the Catchment are developed for plantation forestry in both the upper and lower Catchment. Approximately 21500 ha are planned for developing exotic pines in the lower Catchment. The region has a large supply of crown land which is located close to outlets and markets and has suitable soils, topography and climate (Johnson and Murray, 1997, p39).

3.5.7 Management

Management of the Herbert River Floodplain is undertaken by a number of organisations

including: Sugar Cane Assignment Committees, Hinchinbrook Shire Council, Department of Primary Industries, Department of Natural Resources, Department of Environment, other Government Departments, Herbert River Catchment Co-ordinating Committee, Herbert River Improvement Trust, 6 local drainage boards, Landcare, Wildlife Preservation Society, Industry Organisations, and Individual Landholders (Herbert River Catchment Coordinating Committee).

Chapter 4:

ISSUES FOR WETLAND CONSERVATION IN THE HERBERT RIVER CATCHMENT

4.0 INTRODUCTION

Wetlands issues result form environmental pressures associated with new agricultural development and agricultural land management practices. Very closely related to this, is the current management framework which has also precluded conservation and is further contributing to wetlands issues. This chapter identifies the environmental pressures on the wetlands of the floodplain and describes the impact that current management arrangements is having in wetland resources.

4.1 ENVIRONMENTAL PRESSURES AND IMPACTS

The key sources of environmental pressure on wetlands are: the loss of wetland habitats associated with the expansion of the sugar industry; poor management within existing wetlands and poor management of land surrounding wetlands and for lands otherwise impacting on wetlands (ie: the off site effects of land management for example the alteration of drainage regimes, water quality issues, and the downstream effects of acid sulphate soils).

4.1.1 Loss of wetland habitats associated with the expansion of the sugar industry

The rapid expansion of the sugar industry is resulting in significant losses to the wetland resources of the Herbert River Catchment. As expansion is now occurring onto more marginal land, a higher degree of intervention is required before canegrowing is viable (Shrubsole, 1997). This is resulting in the destruction and drainage of swamps, billabongs and waterholes that provide important habitat areas and form an integral part of the hydrological regime (Johnson and Walker, 1997, p34). Rapid expansion also has the potential to cause erosion and sedimentation patterns, changes in freshwater runoff, the salinity regime and tidal flow patterns, the introduction of waterborne pollutants, destruction of submerged and fringing vegetation, inlet modifications, and loss of fishery habitat changes (Clark, 1996, p103). As recent expansions have occurred on relatively more marginal lands, resource managers need to ensure that only appropriate areas are developed for cane and that effective land management practices are adopted to achieve long term sustainability (Shrubsole, 1997).

4.1.2 Poor management of existing wetlands

Poor land management within existing wetlands has reduced wetland values. The largest threat is the destruction of wetlands for sugar cane production outlined above. Other threats include altered fire regimes associated with agricultural practices has disturbed the structure and composition of some wooded swamps (Australian Nature Conservation Agency, 1996). Infestation of wetlands by exotic plant species has also significantly degraded wetland quality by

outcompeting native species and eliminating them from some wetland areas. The Directory of Important Wetlands in Australia (Australian Nature Conservation Agency, 1996) identifies species posing the greatest threats to wetland quality. Aggressive introduced plant species common in some or most wetlands include Sensitive Weed *Mimosa podia*, Para Grass *Brachiaria mutica*, Blue Top *Ageratum houstonianum*, Salvinia *Salvinia molesta*, Water Hyacinth *Eichhornia crassipes*, *Urena lobata*, Rattlepod *Crotalaria incana*, Sicklepod and Yellow Guava *Psidium guavaja* (Australian Nature Conservation Agency, 1996, p389). Exotic plants impact on water quality by covering the waterhole in a thick mat. This stagnates the waterhole by preventing photosynthesis beneath the mat and increasing the accumulation of organic matter. Oxygen is depleted due to reduced photosynthesis and is consumed during the decay of accumulated organic matter (Australian Nature Conservation Agency, 1996). This has been linked to fish kills in the floodplain. (Hogan and Graham, 1994). Future large scale disturbance of mangrove and associated communities (especially melaleuca dominated communities) will increase the likelihood of invasion by exotic plant species (Australian Nature Conservation Agency, 1996, p 390).

4.1.3 Poor management of land surrounding wetlands and for lands otherwise impacting on wetlands

The management practices for land immediately adjacent to or otherwise impacting on a wetland area can significantly influence wetland quality. Runoff from agriculture may carry high nutrient and sediment loads thereby impacting on water quality (Australian Nature Conservation Agency, 1996). Additionally sediment from alluvial tin mining operations may be carried onto wetlands during periods of high flow.

The acidification of waters passing through or over disturbed acid sulphate soils negatively impacts on the water quality in wetlands, causing fish kills among other effects. Acid sulphate soils do not present a problem as long as they are sealed from the atmosphere, however, if they are exposed to oxygen (eg as a result of drainage works) chemical reactions take place that can reduce pH to levels as low as 2 or 3 (Australian Nature Conservation Agency, 1996; New South Wales Department of Land and Water Conservation, 1995).

4.2 CURRENT MANAGEMENT ARRANGEMENTS

Wetland conservation issues in the Herbert River Catchment are the result of current management arrangements. This has been determined by identifying the land tenure, planning controls, problems associated with the development control process, and the ability to cope with cumulative impacts, and the likely outcome if management continues in the same way.

Key features of the management system that are impeding wetland conservation include fragmented management arrangements and the failure to incorporate environmental considerations into the sugar industry expansion process. This is the result of limited ownership of wetland resources by the Crown or other management authorities, government policies, and also because of the limited role the Hinchinbrook Shire Council has had in regulating agriculture to achieve wetland conservation. Additionally the management system has no mechanisms to deal with cumulative environmental impacts. If current practices and management proceeds in the same way, wetlands of the Herbert River Floodplain will continue to be drained and filled for agriculture causing destruction of wetland areas and valuable mangrove ecosystems (Gutteridge Haskins and Davey, 1996, p6). This will have dramatic effects on the hydrology and ecology of the floodplain, river and marine environment.

4.2.1 Land Tenure

The tenure of wetlands effects conservation because it influences the planning and management controls that will be applicable, for example Crown land is not bound by the planning scheme.

Wetlands of the Herbert River Floodplain are contained within freehold land, leasehold land, Nipa Palms National Park, Wetland Reserves 033-018 and 033-019, and Fish Habitat Reserve 015-999 (part). They are surrounded by freehold and leasehold land, national park and state forest (Australian Nature Conservation Agency, 1996, p389). Currently the wetlands are being used for agriculture and conservation, and are surrounded by agriculture and conservation and state forest (Australian Nature Conservation Agency, 1996, p389) (refer table 4.1).

Table 4.1: (Adopted from Johnson, Ebert and Murray 1997, p7).

TENURE, LAND USE AND DISTURBANCE PROFILES FOR WETLANDS IN THE HERBERT RIVER CATCHMENT		
	ON SITE	**SURROUNDS**
Dominant Tenure	• Leasehold • Freehold • Water Reserve • National Park • Fish Habitat Reserve	• Leasehold • Freehold • National Park • State Forest • Marine Park
Dominant land use	• conservation • agriculture • recreation	• fishing • agriculture • conservation • recreation
Significant Disturbance/- Threats	• agriculture • weeds • runoff and drainage	• agriculture • weeds • runoff and drainage

4.2.1.1 Crown Land

Publicly owned wetlands are managed by the Department of Environment, and Department of Natural Resources. Potentially this facilitates increased planning and management for wetland conservation (Johnson and Cramb, 1992, Vol.6 p9). For example the lease of Crown land for grazing, and release of Crown land for agricultural expansion are both centrally planned activities that provide the opportunity to achieve effective wetland conservation. These processes permit a level of co-ordination that usually does not exist in areas where land fragmentation or alienation of land has occurred (Johnson and Cramb, 1992, Vol.6 p9).

Parts of the Herbert River delta have been declared as national parks by the Department of Environment. In addition, some mangrove and brackish wetland areas have been declared as wetland or fish reserves by the Department of Primary Industries. Some aspects of the Departments of Primary Industries' Sugar Industry Infrastructure Package for the Ingham region are aimed to maintain wetland values. The Department of Environment and Heritage's Sugar Coast Rescue Package and Mahogany Glider Rescue Package include acquisitions and conservation agreements that should, if implemented, facilitate the preservation of most of the remaining wetland habitat on the Herbert Floodplain. (Australian Nature Conservation Agency, 1996, p 390) These areas are regulated through management plans.

4.2.1.2 Freehold Land

The conservation of wetlands on private land has not occurred in the past. This is because authorities and agencies with the power to regulate freehold land have not incorporated environmental objectives into rural land development. The sugar industry through the cane assignment process and the Shire Council through the Planning Scheme both have significant powers to control land use for conservation purposes. The impact that of these two agencies on wetland conservation will now be considered.

Sugar Industry Expansion and the Assignment Process

The expansion of the sugar industry was partly stimulated by the *Sugar Industry Act 1991* which enabled a minimum expansion of 2.5% of sugar cane land (about 10, 000 ha) per year between 1991 and 1995, which has been exceeded. After 1995 the extent of further expansions were to be determined by the Queensland Sugar Corporation (QSC) based on an assessment of land suitability (Shrubsole, 1997). On granting assignments, conditions can be imposed on sugar cane development (refer Appendix 1) and it is through the conditioning of cane assignments that wetland conservation can potentially be achieved.

Traditionally land suitability has been the predominant natural resource issue considered in examining cane land expansion (Shrubsole, 1997). However expansion involves a whole range of environmental issues including wetland loss. To try and address these environmental issues through the assignment process, government agencies such as the Queensland Department of Natural Resources were to become part of the assessment process. However Shrubsole (1997) concludes that current institutional arrangements are ineffective in achieving this. In reality government agencies have not been informed about cane assignments through normal administrative channels. To solve this problem an *ad hoc* technical review committee was established in the Herbert River to evaluate proposed assignments (Shrubsole, 1997). However interviews with officers from government agencies in Ingham also suggests that this may be ineffective as assignments have been granted before assessment by referral agencies.

The Sugar Industry Assignment process provides the opportunity to influence freehold land development and provides a very useful management tool for industry planning to achieve wetland conservation. Unfortunately the assignment process has not maximised this potential. The cane assignment process can be more fully utilised to direct development away from key wetland areas and rationally plan farm development (Creighton, Dickenson and Golden, 1994, p1). "Property management planning involving the Cane Assignment Boards, assignees, Bureau of Sugar Experiment Stations, Department of Natural Resources, Department of Primary Industries and Department of Environment provides a means whereby farm development can be planned to maximise economic returns while minimising environmental impacts" (Creighton, Dickenson and Golden, 1994, p1).

However in reality the integrity of the assignment system is being questioned. Government policies are contributing to wetland loss by opening up marginal land for intensive agriculture. Growers have indicated that pressure from industry organisations to increase production has influenced them to utilise marginal land thereby draining wetlands, opening up saline areas and cutting down melaleuca swamps (Gutteridge, Haskins and Davey, 1996). Assignment boards are perceived by the community as acting too quickly, the Departments of Environment and Primary Industries have little real input into the outcomes of the system and there are no mechanisms to cease or address potential undue environmental damage (Gutteridge, Haskins and Davey, 1996)

Hinchinbrook Shire Council Planning Scheme

A rigorous environmental assessment by the Sugar Assignment Committee would facilitate complementary follow up action by Local Authorities. In the absence of this assessment the Hinchinbrook Shire Council needs to increase the regulation of rural development to achieve wetland conservation (Creighton, Dickenson and Golden, 1994). This expanded regulatory role has not been realised by Council in the past and therefore Council has had limited control over rural land use and management. Traditionally, statutory controls are regarded by rural landowners as an infringement of their property rights (Hollick, 199_) and the self interested behavior of Landholders has often makes it difficult to achieve landholder co-operation (Synott,

199_). This has been a major constraint in achieving wetland conservation on private property for community benefit (Crieghton, Dickenson and Golden, 1994). However this is gradually changing as pressure on land resources increases and the community values reflects greater concern about ESD.(Johnson et al, 1996, p11).

To overcome this the Hinchinbrook Shire Council is currently expanding their control over rural development through the Draft Planning Scheme for the Shire. This will be the first time that development will be controlled across the whole shire. The intention of the planning scheme is to provide Council with greater control over rural development. This is to be achieved through the Strategic Plan, regulation of agricultural uses and wetland conservation (McDonald and Bellamy, 1997). This will facilitate greater management of freehold land for nature conservation purposes. A detailed analysis of the implications of the draft planning scheme on wetland conservation is provided below.

4.2.2 Planning Controls Affecting Wetlands

The Local Government (Planning and Environment) Act 1990 provides the Hinchinbrook Shire Council with the power to control development through the planning scheme and impact assessment procedures. As has been outlined the Hinchinbrook Shire Council is in the final stages of preparing a scheme. This will influence the conservation of wetlands through the Strategic Plan, regulation of agricultural uses and wetland conservation (McDonald and Bellamy, 1997).

4.2.2.1 The Strategic Plan

Council clearly makes a strong commitment to natural resource management through the Town Plan. This is demonstrated through the Broad Aim of the Strategic Plan which seeks "To provide a framework to facilitate the continuing use and development of the Shire's resources according to sound environmental and catchment management practices, and, to promote the diversification of the Shire's economic base, for the long-term benefit of the community" (Hinchinbrook Shire Council, 1997). The overall thrust of the Strategic Plan, as reflected in the broad aim and the broad strategies, is to promote environmentally and economically sustainable development for the long-term benefit of the community and successive generations (Hinchinbrook Shire Council, 1997) (McDonald and Bellamy).

Council's obligation to wetland conservation is established through three broad Integrated Catchment Management objectives. The first is "to identify and designate the catchments and sub catchments of the Herbert River which lie wholly or partly within the Shire' (Hinchinbrook Shire Council, 1997). This is to be implemented through the assessment of planning and development proposals on the basis of the catchment system and potential impacts of development upon the natural resource of that system. Catchment management strategies and specific catchment data are to be "taken into account" in the assessment of any planning proposal (McDonald and Bellamy, 1997).

Objective two is "to ensure that, as a result of the development and use of land no environmental impacts affect any lands elsewhere within a catchment designated in this Strategic Plan" (Hinchinbrook Shire Council, 1997). This will be implemented by a commitment of having "regard for and shall implement the principles of ICM" and the "may refuse to support any proposal which will generate unacceptable effects upon any land...", and "may require the preparation of an EIA" where detrimental downstream effects or impacts are possible" (McDonald and Bellamy, 1997).

The third Objective is "to promote sensitive and sustainable land use practices through the development process" (Hinchinbrook Shire Council, 1997). This will be implemented by requiring and encouraging "all development and land uses... to adopt sound management

practices so as to minimise, mitigate and contain the impacts on the land, water and biological resources of the catchment system". Additionally "the Council may refuse to support any proposal which would prejudice the long-term values of the resources within the catchment system affected" (McDonald and Bellamy, 1997).

Implications for wetland conservation

The strategic plan establishes the broad intent to conserve natural resources and minimise the impact of development on the environment. This is to be implemented through the development assessment process, environmental impact process and by encouraging the adoption of sound land management practices. While the Strategic plan clearly establishes this intent the framework required to implement this has not been established in the scheme. The development assessment system does not specify the form that development applications will take, the criteria for approval or who is to appraise the plans or proposals against the criteria. Additionally the plan does not specify how proposals will be appraised against planning criteria, whether property management plans or impact assessments are required, or if monitoring provisions should be implemented (McDonald and Bellamy, 1997,).

4.2.2.2 Zoning Controls and Development Assessment
Hinchinbrook Shire Council has adopted a simple zoning scheme which divides the local authority into five zones these being Public Purposes, Rural, Town, Village, Special Activities (Hinchinbrook Shire Council, 1997). The planning scheme does not include any zone with the primary inent being to conserve natural resources. This limits the scheme's ability to protect core wetland areas.

REGULATION OF AGRICULTURAL USES

The draft planning scheme has sought to regulate agriculture to achieve Integrated Catchment Management objectives. The regulation of agriculture has been achieved by defining 'agriculture' and 'intensive agriculture' as separate land uses requiring different approval processes (refer table 1). This separation of the two rural uses could create confusion unless unambiguously defined (McDonald and Bellamy, 1997, p8), however it also has the potential to improve the conservation of wetlands through the planning scheme.

Table 4.2 (Source: Hinchinbrook Shire Council, 1997, p47)

Hinchinbrook Shire Council Planning Scheme Rural Purposes Definitions	
Agriculture	The use of land, and buildings on the land, for the purposes of producing primary products from cropping, grazing or stock, and horticulture including the use of the land for an ancillary activity necessary for the conduct of the principal use
Intensive Agriculture	The use of land for the intensive production of crops, such as but not limited to sugarcane, at rates of production beyond the natural capability of the land where the land is irrigated for such purposes and relies upon the regular and systematic application of fertilisers and other chemicals. The term includes the establishment of any infrastructure necessary for the conduct of the use The term does not include small-scale agriculture conducted on premises or a site less than 5 hectares in area ".

Designated Uses Requiring Approval

Agriculture is a "permitted development" in the rural zone. As a result, the land can be used for agriculture (as defined) and for small-scale agriculture conducted on premises or a site less than five hectares in area (as defined for Intensive Agriculture) without needing to apply to Council

for approval. This impacts on wetland conservation as sites of less than five hectares can possess wetland values that are worthy of conservation and in the case of small wetland habitats, can have an important role in the hydrological regime of the Herbert River Floodplain. However Council will have no control over the development of these sites. Clearly very small areas should not require regulation, but setting the minimum threshold too high could allow many significant developments to go unregulated (McDonald, and Bellamy, 1997, p8).

In the Rural Zone intensive agriculture is defined as a "permitted development subject to conditions". Consequently Council has discretionary power to assess an application for intensive agriculture and apply conditions where necessary (Bates, 1995). Council cannot refuse a permitted development subject to conditions. However it does have the power to impose conditions on development to achieve wetland conservation. Development assessment is initiated when the applicant applies to council if they propose to "use the land for the intensive production of crops, such as, but not limited to sugarcane, at rates of production beyond the natural capacity of the land where the land is irrigated for such purposes and relies upon the regular and systematic application of fertilisers and other chemicals. Additionally development assessment is initiated when an applicant seeks to develop infrastructure associated with intensive agriculture. This means that when an applicant wants to convert to sugar cane or establish infrastructure for the growing of sugar cane they need to apply to council for permission However this raises the question of what will be used for the definition of 'infrastructure'. Rural infrastructure differs from urban infrastructure and confusion may be created if this definition is not clear. As it currently stands, the definition could potentially include structures from farm sheds to access roads (even if they are dirt roads) and farm drains.

Neither agriculture or intensive agriculture require consent application under the planning scheme. Consent applications are different to permitted development applications in the application process and the options available to council in assessing the application. Firstly the proposal needs to be advertised to give the public the chance to comment on it. The range of issues that need to be considered by Council is greater including: whether the environment would suffer any unacceptable impact caused by the proposal; and if all objections which have been duly lodged within the prescribed time against the granting of consent by the Council. In accordance with the Local Government (Planning and Environment) Act, 1990, Council can grant consent; refuse to grant consent; or grant consent subject to reasonable and relevant conditions. Therefore unlike permitted development applications, Council can refuse to grant consent and therefore if a proposed development poses unacceptable effects on wetlands, it can be refused. Terms for refusal are also established in the scheme and those relevant to wetland conservation include if: flood mitigation, drainage of filling works required within the site would adversely affect surrounding land; the proposal will have an unacceptably long-term effect upon the environment; the proposal would be in conflict with any provisions of the Strategic Plan in effect in respect of the subject land.

Criteria for the approval of regulated uses

The planning scheme does not establish any criteria to facilitate development assessment or establish criteria for the approval of regulated uses. As a result it does not provide guidelines, performance standards or best practice for relevant environmental issues, natural resource protection, water quality and quantity issues. The planning scheme does not specify what changes can be made to drainage and flood regimes. These conditions need to be specified in planning documents in such as way to give clear prior guidance as to desired developments (McDonald and Bellamy).

Assessment of development applications against criteria

When determining conditions for intensive agriculture the planning scheme states that Council is to consider the character of the proposed development in relation to: the character of development on the adjoining land and in the locality; the adequacy of any proposed landscaping; the retention of existing vegetation and buffers to adjoining land and roads; the provision for storage and disposal of waste; the provisions of the planning scheme including the strategic plan and any Local Planning Policy of the Council, relevant to the application. However because no criteria has been established the scheme just identifies general considerations.

4.2.2.3 Wetland Conservation

The planning scheme has the potential to achieve the effective conservation of wetland resources, yet in reality this has not been achieved. Council's strong commitment to ICM and radical regulation of agricultural development is to be commended. The next step is to develop the details that will make this plan implementable (McDonald and Bellamy, 1997). Towards this end, the scheme needs to include performance conditions or development criteria that will assist development assessors achieve wetland conservation. It is particularly important that these tools are included in planning schemes, especially for Shires such as Hinchinbrook, where there is no professional planner on staff. Therefore it is imperative that the implementation framework reflect best practice and considers obstacles such as the capability of the Local Government (McDonald and Bellamy, 1997).

4.2.3 Problems of the Development Control Process

The suitability of the development control process to achieve wetland conservation is hindered by the inadequate regulation of rural development by state and local governments, poor co-ordination between management authorities and the influence of government policies.

4.2.3.1 Inadequate Regulation of Rural Development

Until now, the major problem with the development control process has been the inadequate regulation of rural activity by State and Local governments. The State Government through the assignment process and the Shire Council through the planning scheme both have the potential to regulate the expansion of the sugar industry and to achieve sustainable wetland development. Instead, current development appears to be based on direct economic comparisons (Johnson and Cramb, 1992, Vol.6. p14). Moreover, the development control process has failed to cope with incremental changes and the cumulative impact on wetland environments (Duncan, 1993).

4.2.3.2 Lack of Co-ordination Between Management Authorities

Fragmented institutional structures has precluded the effective implementation of measures to achieve wetland conservation (Johnson, Shrubsole and Merrin, 1996). At the strategic planning and administrative levels, a lack of co-ordination between those management agencies responsible for managing land and water resources has produced a complex web of policies, plans and approval processes. This, combined with a lack of communication and information sharing between government agencies, is a key causal factor of current wetlands issues. Integration is required between and within government agencies, the Hinchinbrook Shire Council and the Herbert River Catchment Co-ordinating Committee (Johnson, Shrubsole, and Merrin, 1996, p303).

4.2.3.3 Government Policy

State Government policies are inadvertently encouraging the loss of wetland habitats and causing subsequent soil and water degradation. Some growers have indicated that perceived pressures to increase production had influenced many growers to utilise marginal land, thereby draining wetlands, opening up saline areas and cutting down melaleuca swamps (Gutteridge, Haskins and

Davey, 1996, p20).

Policy decisions at the Local Government level are influenced partly by the relevant planning legislation and partly by the willingness of the community to support increased regulation. Support by the community is influenced by their understanding of and value of their natural resources (Young, 1996, p375). Poor understanding of wetland resources and their benefits in the past produced local government policies that afforded little protection to wetland habitats. Fortunately, an expanding understanding of the benefits of wetlands has caused a shift in policy direction resulting in the increased regulation of rural activity.

4.2.4 Cumulative Impacts

Current wetlands issues are the product of a tyranny of small decisions, the cumulative impact of which is the increasing degradation of wetland habitats. While planning schemes can provide a statutory basis for the achievement of Integrated Catchment Management, they are ineffective to deal with cumulative impacts on natural resources. Planning Schemes have limited scope in this regard because they do not apply retrospectively and are effective only when a development application is made. Each application is considered independently, and planning schemes have limited power to ameliorate impacts beyond the immediate site of the development (Young, 1996, p375).

4.2.5 Likely Outcomes if Management Proceeds in the Same Way?

If management proceeds in the same way there will continue to be losses in flora, fauna and fisheries habitats, serious environmental problems, greater conflict between landholders, increased expenses (to maintain drainage schemes) and long term productivity losses.

CONCLUSION

Issues for wetland conservation in the Herbert River Catchment include environmental pressures associated with the expansion of the sugar industry and poor land management practices in and surrounding wetlands. Additionally, the land management/development framework is also impacting on wetland conservation. Pressures are being placed upon the wetlands of the Herbert River Floodplain from surrounding agricultural development. These development pressures have caused, or have the potential to cause adverse environmental impacts on wetland benefits. Many of the current management problems affecting the Herbert River Floodplain are the result of a lack of coordination between government agencies and poor planning decisions in the past. Wetland conservation is also complicated by a lack of ownership by management authorities which restricts available policy options.

Chapter 5:

DEFINING WETLANDS AND DESIRED ENVIRONMENTAL OUTCOMES

5.0 INTRODUCTION

Towards the achievement of objective two, the identification of suitable planning provisions to achieve wetland conservation, several major components are involved. Firstly it is important to define wetlands requiring protection in a manner that could be included in the planning scheme. Following on from this, it is necessary to determine the ecological conditions of wetlands that must be maintained if they are to be conserved. Finally it is necessary to identify planning methods that can potentially be used to conserve wetlands. This chapter identifies a suitable definition of wetlands for the Herbert River Floodplain and determines the desired environmental outcomes for wetlands.

5.1 DEFINING WETLANDS

Actually defining a wetland is a very difficult task. The difficulty in definition arises when attempting to differentiate between terrestrial environments and wetlands, and between wetlands and aquatic and marine environments. Additional difficulties arise over the scope of the definition which can have significant implications on the range of lands that can be included as wetlands. This can cause problems, especially in politically or legally complicated situations (Duncan, 1993). From a land use planning perspective there are several benefits of defining wetlands through the planning scheme. Firstly, by clearly identifying wetlands they can be more effectively managed for conservation purposes. Secondly, identification will provide greater certainty for Governments, landowners, and the wider community by facilitating the easy detection of areas that will be subject to greater restrictions on land use. Thirdly, as planning schemes are statutory documents, definition in the scheme can be a valuable guide in legal or other challenges. Therefore to achieve their conservation, wetlands need to be defined and provisions need to be incorporated into the planning scheme.

Not all definitions of wetland are suitable for the conservation of wetlands on the Herbert River Floodplain. In determining a suitable definition, a range of current definitions will be evaluated. These include International & National Definitions, State Definitions, Regional Definitions and Local Definitions.

5.1.1 International & National Definition

The international definition of wetland established by the Ramsar Convention has been adopted at the national level. This is supported by the 'Directory of Important Wetlands in Australia (2nd edition)' which uses the Ramsar definition. It interprets wetlands as "areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres." (Australian Nature Conservation Agency, 1996, p2).

While the Ramsar definition is one of the most accepted definitions of wetland, its value in the Herbert River setting is limited. This definition is very broad and uses terms such as fen, which are not easy to define in the North Queensland context (Claridge, 1994). To be more effective the definition would need to reflect the environmental characteristics of the study area (ie: by specifying landform types, soil characteristics, and vegetation communities).

5.1.2 State Definitions

At the state planning level, wetlands are defined in the Local Government Planning and Environment Act and includes "Wetland, whether fresh, brackish or marine, including coral reefs, mangrove areas, mudflats, sandflats, sandy beaches, seagrass beds and tidal marshes" (Queensland Local Government (Planning and Environment) Amendment (No1), No118, 1994). This definition of wetlands is very broad and is based on landform type only. It does not refer to wetland indicators such as the permanency of the wetland system, the frequency of inundation, predominant vegetation type, or soil characteristics. The words "wetland, whether fresh, brackish or marine" open up the question of "what is a wetland?" to many areas on the Floodplain because of climatic and other environmental conditions. Consequently this definition, if it were to be adopted for the Herbert River Floodplain, could easily include lands that possess few wetland qualities.

5.1.3 Regional Definitions

Wetlands have been defined at a regional scale by the Department of Environment and CSIRO. Regional mapping undertaken by the Department of Environment covers the whole of Hinchinbrook Shire, northern parts of Thuringowa Shire and the Southern end of Cardwell Shire. The system defines a range of vegetation communities based on predominant vegetation

species, structure and composition, and soils and landform characteristics including frequency of inundation. From this information, it is possible to define communities that are wetlands or have a wetland affinity. This system provides a more suitable definition of wetland by including a number wetland values such as frequency of inundation, predominant vegetation cover, soil type and landform characteristics. Consequently the resulting wetland areas reflect the local characteristics of the Herbert River Floodplain

5.1.4 Local Definitions

Local Authorities often include a definition of wetlands in their Planning Schemes to allow the identification of these areas through the development control process. Unlike National or State Governments, Local Authorities can use specific definitions that suit local conditions. In doing so, the definitions adopted by Local Authorities will vary between government boundaries. Therefore, it is useful to consider the constitution of alternative definitions and the implications they might have for wetland conservation. Definitions included in the planning schemes for Hinchinbrook Shire Council, Cardwell Shire Council and Johnstone Shire Council will be examined.

5.1.4.1 Hinchinbrook Shire Council

The planning scheme for Hinchinbrook does not establish a definition of wetlands. Several "Wetland" and "Coastal Wetland" areas have been identified through the Planning Study, however this is not a statutory document under the Act and is therefore limited in its ability to achieve wetland conservation. Consequently the definition of wetlands established in Schedule 2 of the Local Government (Planning and Environment) Regulations for impact assessment procedures would be the sole consideration. However, as has been discussed previously this definition is not sufficient to afford protection to significant wetland environments.

5.1.4.2 Cardwell Shire Council

Neighbouring Hinchinbrook Shire to the north, Cardwell Shire defines wetlands as "areas whether permanent, seasonal or ephemeral, conceptually between terrestrial and aquatic environments that are subject to freshwater or saltwater inundation with sufficient frequency to support aquatic macrophytes and similar vegetation. Tidal wetlands are characterised by mangroves and saltmarsh, with Melaleuca (tea tree) species generally associated with freshwater wetlands. The term includes retention and detention basins, lagoons, swamps, sedgelands and billabongs" (Cardwell Shire Council, 1997).

This definition is more specific for the conservation of wetlands in a local area. It defines wetlands by differentiating between marine and terrestrial environments. The definition has been tailored to suit local conditions by referring to wetland characteristics including landform type and the influence of inundation upon vegetation characteristics. However this definition does not refer to predominant soil types or a map of wetland areas.

5.1.4.3 Johnstone Shire Council

The Johnstone Shire Council defines wetlands in the Draft Planning Scheme as follows:

"Wetland: means where:

(a) hydric soils are present
(b) where the water table is at, or above the soil surface for thirty consecutive days a year; and or
(c) the following vegetation conditions occur
    (i) the aerial extent of wetland and transitional species or any combination thereof, in the selected stratum (canopy, sub canopy, or ground cover) is greater than 50 percent of all the plant species for that stratum
    (ii) the aerial extent of the wetland species in the selected stratum is greater than 10 percent

of the aerial extent of all the plant species in that stratum

(iii) the aerial extent of the wetlands species in the selected stratum is greater than the areal extent of upland species in that stratum; as well as areas identified as wetlands on Regulatory Map R3, Wetlands, based on the vegetation communities described in the planning study" (Johnstone Shire Council, 1996, pB-18)

Again this definition is specific to Johnstone's local environment. The wetland indicators used are soil types, length of inundation and resultant vegetation conditions. Additionally, the definition refers to wetlands already identified through mapping and it addresses the issue of permanency by using an empirical qualifier which is relevant in the local context. By being very specific it increases certainty for landowners, the community and Council over the definition of wetland areas.

5.1.5 Conclusions

From the above analysis it is evident that Hinchinbrook Shire Council needs to include a definition of wetland within the scheme. To effectively do this a number of wetlands qualifiers are required that reflect the characteristics of the Herbert River Floodplain. Consequently desirable elements of a definition would include:

- landform characteristics of wetlands of the Herbert River Floodplain
- soil wetness or frequency of inundation
- soil types typical of wetlands on the Floodplain
- predominant vegetation communities for wetlands on the Floodplain
- wetland mapping to be included in the scheme and referred to in the defintiton.

It important that the Hinchinbrook Shire Council incorporate a suitable definition into the planning scheme for wetland conservation.

5.2 DESIRED ENVIRONMENTAL OUTCOMES

To manage wetland areas, conservation measures must address current wetland issues and pressures and should reflect principles of ecologically sustainable development. Additionally, conservation measures need to ensure that the functions of wetlands are maintained or enhanced. This can be achieved by identifying desired environmental outcomes for wetlands which will become the criteria for approval in the development assessment process and the criteria for evaluating the effectiveness of planning solutions. This may be as easy as identifying the key functions of wetland areas. Kent suggests that wetland functions can be used as a base for the establishment of regulations for a variety of land and water related planning issues(Kent, 1994, p56). Viewing wetlands as an ecosystem, their major functions can be identified as including:

- hydrology (volume, movement, properties and use of water)
- pedology (soils)
- morphometry (landform characteristics)
- biology (flora and fauna)

5.2.1 Hydrology

Water is a key element in all wetlands and includes water depth, flow rates, flow patterns flood attenuation for storm or flood waters, natural water quality improvement, groundwater recharge, shielding other areas from wave action, erosion, or storm damage, and storage for storm or flood waters (Kent, 1994, p57). The hydrology of the wetlands on the Herbert River Floodplain is influenced by the key elements of water quality and quantity.

5.2.1.1 Water Quantity

Water quantity is a key factor impacting on wetland habitats. The volume of water in a wetland

influences the resultant landform type, permanency of the wetland or frequency of inundation, resultant soil conditions, and dominant vegetation characteristics. Therefore the volume of water entering the wetland, the volume remaining in the system and the volume of water draining from the wetland has a significant impact on the function of wetland habitats.

Intensive agriculture can alter the hydrological regime of wetlands by reducing water flows into wetlands by modifying natural drainage paths to direct water elsewhere and reducing the water in wetlands by draining and filling them. Alternatively, agriculture has the potential to significantly increase the flow of water into wetlands by expanding the areas that drain into wetlands. Other effects on the hydrology regime include the use of dams and other structures to retain water in wetlands and altering water flows both in and out of wetlands over a short period of time (Hogan and Graham, 1994)

5.2.1.2 Water Quality

Water quality is important for the maintenance of the biological resources of the wetland. It is influenced by agricultural runoff which if, nutrient enriched, can lead to the eutrophication of wetlands. Additionally, chemicals and pesticides and other toxants from agriculture can pollute water, sedimentation can lead to the smothering of aquatic habitats and has been linked to fish kills (Hogan and Graham, 1994, p2)).

5.2.1.3 Desired Environmental Outcomes

- maintain water quality in wetlands
- maintain the hydrological regime of wetlands

5.2.2 Pedology

The quality of soil within wetlands and also from lands on wetland environments can have a significant effect on wetland functions. Wetlands soils are characterised by anaerobic conditions which are the result of permanent or periodic inundation (soil saturation) (Kent, 1994, p58). Acid sulphate soils are typically found in coastal lowland areas (eg mangrove tidal flats, salt marshes or tea tree swamps).

5.2.2.1 Acid Sulphate Soils

Acid sulphate soils are acidic soil horizons resulting from the aeration of previously waterlogged soil materials, rich in iron sulphides (primarily pyrite - FeS_2). When drainage or aeration brings oxygen into these previously waterlogged soils, the pyrite is oxidised to sulfuric acid. If the production of acid exceeds the neutralising capacity of the soils, so that the pH falls to below 4, these soils are known as actual acid sulphate soils (AASS). Potential acid sulphate soils (PASS) are waterlogged soils rich in pyrite that have not been oxidised. Any disturbance which admits oxygen will lead to the development of actual sulphate soil layers. Potential acid sulphate soils are completely innocuous to the environment if kept under water. However, when drainage or aeration brings oxygen into these previously waterlogged soils, they are oxidised into sulfuric acid and become acid sulphate soils (New South Wales, 1995, p 3).

Increasing pressure is being placed on lands containing potential acid sulphate soils, for agricultural production. If unmanaged, rapid expansion into wetlands can create acid sulphate soils and cause soil problems (New South Wales, 1995, p12). On site, the effect of AASS includes the lowering of the pH of the soil to extreme levels, at times less than three (3). Highly acidic conditions in the soil result in toxicities including increased solubility of aluminium, iron and sometimes manganese and nutrient deficiencies can be severe. Oxidisation of pyrite can also contribute acid salts to the soil causing a high degree of salinity. This causes real problems for farmers wanting to improve the agricultural productivity of an area (New South Wales, 1995). Off-site, heavy rains on AASS following dry periods causes the flushing of extremely acid and aluminium-rich toxic water. This can have profound effects on the aquatic populations of

estuarine systems by causing massive fish kills and estuarine habitat degradation and impacting on commercial estuarine fishing (New South Wales, 1995).

5.2.2.2 Desired Environmental Outcomes
- minimise the impact of acid sulphate soils and other soil contaminants in wetlands

5.2.3 Morphometry (Landform Characteristics)
The surrounding landform characteristics also impacts on the functions and values of wetlands. Important landscape characteristics includes location, drainage area, surrounding land use, area, slope of surrounding land, and perimeter to slope area. As most wetlands are located in topographic depressions, the surrounding landscape can have a significant bearing on wetland functions (for example it influences sediment trapping ability) (Kent, 1994, p58).

The landform characteristics of the Herbert River Floodplain influence the form and function of the wetlands in the system. The landscape influences the location of wetlands, the depth of the wetland depression, the quantity of water that would naturally drain into the system, and the permanency of the wetland. In addition this influences the types of vegetation species typical of a wetland. For example very slight drainage depressions on creek and river alluvial plans will produce seasonal swamp/riparian Melaleuca woodlands, whereas depressions or deep sections of water courses of the alluvial plans may produce swamp sedgeland/herbfield (Department of Environment, 1997). The location of the wetland in the landscape and the predominant vegetation species will influence the type of fish and bird species present.

Large scale alteration of the landscape will impact on the form and function of wetlands. In the past this has occurred by changing the form of wetlands by digging deeper depressions, narrowing them and adding islands, and by changing the form of wetlands through siltation, producing shallower wetlands.

5.2.3.1 Desired Environmental Outcomes
- minimise structural changes to wetlands
- minimise disturbance to wetland morphology from off-site landform changes

5.2.4 Biology
Wetlands play a crucial role in the survival of numerous fauna and flora living within wetlands, as well as flora and fauna living adjacent to wetlands. Wetlands functions are frequently based on vegetation (species, coverage, survival), fauna (species, density, and habitat quality), sanctuary refuge value for fish, wildlife and waterfowl, and food chain production and production export to adjacent ecosystems (Kent, 1994, p57). Therefore to maintain wetland values, it is important that valuable wetland habitats be protected from clearing.

Many degraded wetland habitats on the Herbert River Floodplain have been infested with exotic plants. This can have a dramatic impact on the functioning of wetland systems, such as their ability to act as fisheries nurseries, and it is therefore important to minimise this impact on wetlands.

5.2.4.1 Desired Environmental Outcomes
- minimise the loss of wetland habitats
- preserve and enhance the quality of wetland habitats

Chapter 6:

PLANNING SOLUTIONS TO ACHIEVE DESIRED ENVIRONMENTAL OUTCOMES

6.0 INTRODUCTION

Following on from the definition of wetlands and the identification of desired environmental outcomes, it is now necessary to identify planning solutions that could be used to achieve these results. To do so, a range of planning and conservation techniques used by local authorities and management authorities across Queensland have been identified. They have been described in relation to their ability to conserve wetlands in a rural context. Collectively authorities utilise a suite of planning mechanisms for natural resource conservation, namely: regional planning programs; planning schemes (strategic plan and zoning and development control); performance standards and environmental monitoring; environmental impact assessments; financial incentives; retention of land through subdivision; bonus development/transferable development rights; vegetation protection ordinances; voluntary conservation agreements; land acquisition; property management planning; and best management practices.

6.1 REGIONAL WETLAND CONSERVATION PROGRAM

A regional wetland conservation program provides an overall framework for planning options or conservation methods to be incorporated into the planning scheme and additional conservation methods to implement strategies (refer figure 6.1). It can be achieved by developing a system of core protection areas surrounded by multiple use buffer zones. Noss (1994) concludes that this system offers the best opportunity for protecting sensitive species and intact ecosystems because it prevents the destruction of native biodiversity by changing land use allocations and management practices at a regional level. The basic components of a regional conservation program include core reserves, buffer zones and connectivity, and the most important considerations in the design and management of these systems are representation of all ecosystems, population viability of sensitive species and perpetuation of short term and long term evolutionary processes.

Table 6.1

REGIONAL WETLAND CONSERVATION PROGRAM
CORE WETLAND RESERVES Zone: Rural A: Conservation **Conservation Methods** • Land Acquisitions • Retention of Land through the subdivision process • Vegetation Protection Ordinances • Voluntary Conservation Agreements and Financial Incentives • Monitoring
BUFFER WETLAND RESERVES Zone: Rural B: Agriculture (Conditions - Agriculture remains an as of right use, however threshold to be reduced from 5ha) **Conservation Methods** • Voluntary Conservation Agreements • Bonus Development Rights • Environmental Impact Assessments • Performance Standards and Monitoring • Property Management Planning
Zone: Rural C: Intensive Agriculture (Conditions: Permitted Development Subject to Conditions) **Conservation Methods** • Performance Standards and Environmental Monitoring • Environmental Impact Assessments • Property Management Planning • Voluntary Conservation Agreements

6.1.1 Ecological Goals

Noss has defined several ecological goals of developing a regional conservation program to maintain the native biodiversity of a region. These are: to represent in a system of protected areas all native ecosystem types and stages across their natural range of variation; maintain viable populations of all native species in natural patterns of abundance and distribution; maintain ecological and evolutionary processes: maintain ecological and evolutionary processes (such as disturbance regimes, hydrological processes, nutrient cycles, and biology including predetation); allow for change (design and manage the system to be responsible to short term and long-term environmental change) and to maintain the evolutionary potential of linkages (Noss, 1994, p11).

Four approaches can be used to achieve these objectives and are identified in Table 6.1 below.

Table 6.2 (Source: Noss, 1994, p13)

Approaches to a Regional Wetland Conservation Program	
1	Identify and protect populations of rare and endangered species
2	Maintain healthy populations of species that play critical roles in their ecosystems (key-stone species) or that have pragmatic value as "umbrellas" (species that require large areas in to survive, and thus if protected will bring many species along with them) or "flagships" (charismatic species that serve as popular symbols for conservation)
3	Protect high-quality examples of all natural communities and
4	Identify and manage greater ecosystems or landscapes for both biodiversity conservation and sustainable human use

These four approaches to conservation must be pursued in concert if the full spectrum of biodiversity is to be protected (Noss, 1994, 13). Traditional strategies of protecting individual sites that support rare species or natural communities can work for plants and animals with small area requirements. However to conserve landscape mosaics, higher order expressions of biodiversity and to protect wide-ranging animals, small reserves conserved on a site by site approach are less effective because they often face greater external influences and often fail to retain the natural qualities for which they were set aside (Noss, 1994, p13).

6.1.2 Selection of Core Protection Areas, Primary Corridors and Buffer Areas

Selection of Core Protection Areas, Primary Corridors and Buffer Areas can be achieved through field inventory, remote sensing, and biogeographical research to determine the spatial distribution of biodiversity and wild areas, followed by an evaluation of which areas are most important to protect (Noss, 1994, p14). Core reserves and primary corridors in a regional network should enclose and link biogeographically critical areas in a continuous system of natural habitat wherever possible. Noss (1994) has identified critical steps in selecting core reserves and primary linkages and are identified in Appendix 2.

Mapping undertaken by the Department of Environment facilitates the division of the region into core and buffer wetland reserves. The mapping defines a range of vegetation communities based on predominant vegetation species, structure and composition, and soils and landform characteristics including frequency of inundation. From this information, it is possible to collapse the vegetation cover into a simpler set of units to guide planning. Two broad categories have been proposed: "wetlands" and land with "wetland affinity" and these can be translated into core and buffer wetland reserves. Core wetland areas ("wetlands") exhibit high wetland values (such as vegetation species, soil wetness, landform type, and frequency of inundation) and buffer areas ("wetland affinity") exhibit fewer wetland values. Division of habitat areas into these classes has been undertaken with the assistance of Ian Hisslop, Environment Officer, Bushland Management, Brisbane City Council. A list of predominant vegetation communities and their classification into core and buffer areas is provided in appendix 3.

By collapsing the vegetation into broad categories the accuracy of the maps will be reduced. As a result land may be defined as "wetlands" or "wetland affinity" when they possess no wetland values. Additionally simplification may result in the removal of areas possessing wetland values when they should be included. While this can be overcome through more detailed analysis and field truthing it is also important to remember that maps are produced as a tool to guide management and planning and will always be incorrect. Additionally, current pressures to develop planning guidelines now while there is a 12 month moratorium on sugar cane expansion requires maps to be developed quickly.

6.2 PLANNING SCHEMES

Local authorities are able to guide land use and development through local planning schemes. Planning schemes and policies regulate land in private ownership but has no power to bind the Crown (Bates, 1995). While planning schemes have historically been employed by urban authorities to manage development, they have typically had little effect in rural areas except to protect agricultural activities from other development activities (Johnson et al, 1996, p11). However, by providing local authorities with the power to control land use, planning schemes can be used to regulate agricultural activity and can also be used to achieve wetland conservation.

Planning schemes can be used to maintain core and buffer areas through the strategic plan, zoning plan and development control.

6.2.1 Strategic Plans

Strategic Plans are used by local authorities to guide future development in a manner that reflects the social, economic and environmental aspirations of the community. They establish the intent of the planning scheme and are usually expressed in terms of goals, objectives and implementation strategies (Johnson Shire Council, 1996). Strategic plans convert social, economic and environmental objectives into broad based spatial units to provide a framework for developer-led development approvals (Johnson et al, 1996, p11). In accordance with the provisions of the Local Government (Planning and Environment) Act, 1990 a Strategic Plan is to consist of the following three parts:

(1) A map identifying Preferred Dominant Land Uses for the Shire ;
(2) A statement of objectives for each Preferred Dominant Land Use (PDLU) for the management and progressive development of lands within the Shire. This statement is supported by criteria (eg: the type, scale or distribution of land uses) for the implementation of the Preferred Dominant Land uses and associated uses which may develop as an integral component of the dominant use; and
(3) Criteria for the implementation of the Plan (Local Government (Planning and Environment) Act, 1990) .

Therefore Preferred Future Dominant Land Uses (PFDLU) are the primary mechanism for the implementation of Strategic Plans. PFDLU's are not restrictions on use rights. They provide long term guidance for decision making on land use through the development control process (Johnson et al, 1996, p11). Core wetland reserves, primary corridors and buffer areas can be designated as a conservation preferred dominant land use on the strategic plan to guide appropriate development away from these areas in the future. This is not currently part of the strategic plan for Hinchinbrook Shire Council but it would improve conservation by providing an overall framework for the assessment of land use applications. The identification of areas where conservation is preferred provides a broad description of Councils policy and improves certainty for both council and the community as to the conservation framework. Without this individual development assessment would occur without regard to the cumulative impact they would have on wetlands.

6.2.2 Zoning

Local authorities control land use activity by 'zoning' land. Zoning plans divide the local authority area into a number of zones, define the intent of each zone, and determine what activities are permitted or restricted in each zone and on what general conditions. Land suitable for particular purposes is identified in a zone, inconsistent uses are prohibited and local authorities have discretionary powers to decide in particular cases if a proposed development is consistent or inconsistent with the purpose of that zone (Bates, 1995). In the case of discretional developments local authorities can place conditions on development approvals to preserve the intended character of a zone (Bates, 1995). The zoning process can be used to protect core wetland reserves, primary corridors and buffer areas by including wetland habitats in an environmental protection zone that incorporates several protection classes relating to the classification of wetlands as core reserves and primary corridors or buffer areas. Therefore the environmental protection zone can be divided into several categories which reflect the conservation value of the land and incorporate different land use requirements.

This system has been used by Brisbane City Council in the Non Urban Zone. Within the Non Urban Zone, three categories (A, B, and C) have been developed each providing different levels of control on land use. Category A is for land that contains prime habitats and places the greatest restrictions on use rights. Category B is designated for habitats that are not in prime condition but not in poor condition. Category C is used for land in poorer condition and enables the land to be rezoned to a higher intensity of use.

Category A can be used to protect core wetland reserves and primary corridors by placing the greatest limitations on use rights. The intent of this category would be to preserve land for nature conservation purposes and therefore uses in this category should be compatible with the sensitivity of natural resource values and should have minimal impact on the environment. Category B would be designated for habitats that are not in prime condition or have greater distributions and are therefore not considered to be as significant. While this category still emphasises the conservation of natural habitats, a greater number of activities are permitted. In this respect, Category B areas act as buffer to minimise impacts on Category A land. As a result it reflects a compromise between protecting the private property interest of the landowner and the public interest in the wetland. Category C is used for poor quality habitats and provides greater land use opportunities such as the rezoning of the land to a higher intensity of use.

The Hinchinbrook Planning Scheme currently does not incorporate an environmental protection zone. However the rural zone can be divided into three categories:
(1) Rural A - Conservation (for core wetland habitats)
(2) Rural B - Agriculture (for buffer wetland habitats)
(3) Rural C - Intensive Agriculture

Category A is to conserve core wetland reserves. As a result both agriculture and intensive agriculture would be prohibited in category A areas. Category B land may be able to support intensive agriculture , however planning approval would be needed to ensure the conservation value of the buffer is maintained. To ensure that wetlands are conserved, it is recommended that the maximum threshold for agriculture be reduced so that developments with potential to impact on the buffer reserves have to undergo development assessment. Category C land would be land that could be converted to intensive agriculture. Consequently, zoning can be used to achieve wetland conservation. To be most effective zoning would need to establish the framework for development assessment by specifying clearly the activities that require approval. In the proposed Rural B and C zones Intensive Agriculture would require a permitted development subject to conditions approval. Development applications would need to be accompanied by property management plans, and if the development proposes to modify a

wetland as defined in the scheme impact assessment should also accompany the application. Criteria for approval of development applications would be based on ensuring the desired environmental outcomes were achieved. Appraisal of development applications would be coordinated by Council and referred to technical experts for specific issues. Monitoring provisions should be implemented to ensure that the desired environmental outcomes are maintained through the life of the development.

6.2.3 Development Control

Strategic plans and zoning plans provide the framework for development control. The development control process is initiated when a person wants to develop, change the use of the land, or subdivide land (Bates, 1995, 193). Anyone wishing to undertake development must apply the local authority for permission. The criteria established in planning schemes are applied to proposals for specific development (Bates, 1995). Development control is the process of regulating rural uses to achieve wetland conservation. The process for development assessment within the rural zone has been discussed in Chapter Four. Briefly the draft Planning Scheme regulates primary industries by including it as a "permitted development subject to conditions" in the rural zone. This approach requires landowners to submit an application for approval by Council thereby providing the Council with the ability to condition intensive agriculture to achieve wetland conservation.

To be approved a development would need to demonstrate how it would maintain the quality of water in wetlands, maintain the hydrological regime of wetlands, minimise the impact of acid sulphate soils and other soil contaminants in wetlands, minimise sedimentation of wetlands, minimise the loss of wetland habitats and preserve and enhance the quality of wetland habitats. To achieve this allowable changes to environmental elements would need to be determined such as acceptable changes in water quality and the hydrological regime. They would take the form of guidelines and specific performance standards based on reflect sustainable management practices. These criteria need to be determined with the help of government agencies and local experts (McDonald and Bellamy, 1997).

6.2.4 Implications For Wetlands

Definition of core wetland reserves, primary corridors and buffer areas through mapping clearly identifies land subject to assessment against planning criteria. Mapping will also indicate those areas that require property management planning and those areas that require impact assessment. Council should be the lead agency for the appraisal of the applications, however for technical or specialist assessment, applications should be referred to agencies with expertise in particular issues.

6.3 PERFORMANCE STANDARDS

Performance based planning schemes are proactive in the sense that they anticipate environmental issues and establish performance standards that need to be maintained by developments. Performance standards are environmental requirements for project design and construction and are usually applied through a permit system. It is recommended that performance standards define the maximum permissible impact of specific uses on particular resources. "Threshold levels" or "acceptable limits of change" are often used to set the permissible levels which govern performance standards (Clark, 1996, p374).

Once performance standards have been established, planning applications are approved with the understanding that specific properties and characteristics of the natural system will continue to function in a prescribed manner after development. The developer can proceed with the project only if it can be proven that the natural system will continue to "perform" according to prescribed "standards". As a result, the developer can use their discretion to employ any

approach that will guarantee full function of the natural ecosystem after the project has been implemented. Examples of performance standards include the quantity of fish a pond shall produce, the quality of water that passes from a parcel of land, the amount of water flowing through an estuary, or the uptake of pollutants by a wetland (Clark, 1996, p373).

6.3.1 Implications For Wetlands

To maintain the ecological functions of wetlands, criteria for the approval of intensive agriculture needs to be established. This can be achieved through the development of performance standards. To be approved applications for intensive agriculture developments would need to achieve the desired environmental outcomes for hydrology, pedology, morphology and biology. Therefore planning criteria would need to define:

- acceptable levels of water quality in wetlands
- acceptable changes to the hydrological regime
- locations or conditions in which wetland loss is not acceptable
- locations of acid sulphate soils
- acceptable rates of erosion and sedimentation

Criteria for the approval of regulated uses

Performance conditions for water quality would be based on local knowledge of the impact that pollutants have on wetland systems or in the absence of local knowledge the use of standard water quality classifications such as Australian and New Zealand Conservation Council (ANZECC) Criteria. Performance criteria for the hydrological regime could be based on water inputs, outputs and flow rates. Specific criteria may need to be supplied by people with expert knowledge of the impact that changes to the hydrological regime will have on wetlands as these conditions are likely to vary depending upon the location of the wetlands on the floodplain. The assessment of wetland loss can be made against mapping that identifies critical habitats and buffer areas. Critical areas would need to be maintained however compromises may be made in buffer areas.

The assessment of acid sulphate soils would be undertaken for areas identified through mapping. Finally, performance conditions for erosion and sedimentation can also be based on local knowledge or in the absence of local knowledge the use of standard rates. These criteria would become guidelines and performance standards used to condition development. In addition, they need to be clearly established in the scheme to provide prior guidance to desired developments (McDonald and Bellamy, 1997).

6.4 ENVIRONMENTAL MONITORING

The conservation of wetlands can also be achieved through the monitoring of environmental indicators. Environmental monitoring can be associated with performance indicators and can be used to ascertain that mitigation measures are being implemented as agreed. Additionally monitoring can be used to warn agencies of unanticipated adverse impacts or sudden changes in impact trends, to warn when pre-selected impact indicators approach the pre-selected statistical level and to ensure that legal standards are not exceeded. Further monitoring can be used to verify estimated impacts and evaluate the effectiveness of implemented mitigation measures (Clark, 1996, p73).

Environmental monitoring can be used in the development assessment process. If local authorities approve a project with possible environmental impacts, environmental monitoring is used as an oversight process to ensure that mitigation and other counter measures are carried out according to the environmental conditions of the development permit (Clark, 1996, p73).

Monitoring can take two forms, Strategic and Tactical. Strategic monitoring is the "retrospective" or "hindsight" monitoring, which is often the main focus of the monitoring program. The object is to compare measurements of certain key characteristics of the environment both before and after project work is done so that an "environmental audit" can be made of the projects effects. This of course requires that "benchmark" information be collected before the project starts, to provide a statistically sound "baseline" (Clark, 1996, p73). Tactical monitoring is the "real-time" or "oversight" monitoring that occurs in conjunction with environmental management programs (EMP). It monitors the construction operation day by day to detect whether any major negative impacts are occurring. If problems are detected construction is stopped until the impact is remedied (Clark, 1996, 151).

6.4.1 Implications for Wetlands

Monitoring can be undertaken to ensure that performance standards are being complied with. Performance standards for wetlands that lend themselves to monitoring include water quality, changes to the hydrological regime can be monitored through water inputs, flow rates and outputs or number of fish species in wetlands. The Johnstone Shire Council has adopted monitoring to maintain surface water quality. This will enable the Shire to maintain acceptable water quality levels within wetland environments. A surface water classification system is to be applied to all the Shire's surface water systems and development within the catchment will be required to meet the water quality standards for the relevant class (Johnstone Shire Council, 1996). The water quality standards applying to the surface water classification system will be the Australian and New Zealand Environment and Conservation Council Water Quality Criteria for Fresh and Marine Waters (ANZECC) until such time as the State government adopts water quality standards applicable to the Shire. Until better information is available on the Shire's surface water systems, all systems will be required to meet water quality standards required for the protection of aquatic ecosystems (Johnstone Shire Council, 1996).

6.5 ENVIRONMENTAL IMPACT STATEMENTS

Environmental impact assessment (EIA) is a means of evaluating development proposals so that possible environmental impacts may be identified and mitigated. They are a tool employed by Local Government (Planning and Environment) Act to provide advice to decision-makers with respect to the environmental soundness of a development application. An environmental impact statement may be required in several circumstances. Under the Local Government (Planning and Environment) Act 1990, the Chief executive of the Department of Environment may, after due consultation with relevant agencies and local authorities, require applications in respect of designated development, as prescribed by regulation or specified in a local authorities planning policy to be supported by an EIS. In respect of other activities which need planning permission, and EIS may be required if the local authority is of the opinion that a proposal is for a 'relevant development' on land within or neighboring the Wet Tropics World Heritage Area the Wet Tropics Management Authority must be consulted.(Bates, 1995, p163).

The Draft Integrated Planning Bill 1997 features an Integrated Development Assessment System (IDAS) which integrates all State and local government assessment and approval process for development. Activities defined under the proposed act as assessable development require a development permit from the local authority. For developments defined as self-assessable development a permit is not required but it must comply with applicable codes and for exempt developments a permit is not required and development need not comply with codes or planning instruments (Queensland Department of Local Government and Planning, 1997, p74).

Under the proposed legislation the EIS process in the Planning and Environment Act is integrated with other assessment processes. This is achieved by requiring that the local authority determine first what supporting information needs to be provided with the application. This is

achieved in the 'acknowledgment period' in which the development manager sends the applicant an acknowledgment notice specifying among other things: which aspects of the development seeks approval, the names of referral agencies; whether the development requires impact assessment or code assessment (or both) and public notification requirements for impact assessment; any information requests from the development manager; if the development requires referral coordination; and any other development permits necessary to allow the development to be carried out (Queensland Department of Local Government and Planning, 1997, p79). If the information is insufficient to enable the full environmental impact of the proposed development to be assessed, the development manager or referral agencies can make additional information requests to the applicant.

6.5.1 Implications for Wetlands

Impact assessment procedures could be used for activities proposed in core wetland reserves, for activities proposed on lands containing potential acid sulphate soils as well as for activities that propose significant changes to the landscape and hydrological regime with the potential to impact on core and buffer wetland reserves. Impact assessment assists in the development control process by determining the impact development has on wetland areas.

6.6 RETENTION OF LAND FOR COMMUNITY BENEFIT DURING SUBDIVISION PROCESS

Where the applicant proposes to subdivide the land Council has the power to secure 10% towards parks contributions (Local Government (Planning and Environment) Act, 1990). If an applicant wanting to subdivide land that had been identified through mapping as containing core wetland habitats as well as buffer areas they could be surrendered to the Council as the parks contributions. Many Councils are already using this tool to add land with conservation value to the Crown estate. This is useful for assets that are conserved for community interests and common property resources such as riparian lands and wetlands (Creighton, Dickenson and Golden, 1994, p3).

6.7 FINANCIAL INCENTIVES

Financial incentives are another mechanism that can be used by local authorities to achieve wetland conservation. A range of incentives are available, including grants for conservation works, tax concessions and rate relief/differential rating.

6.7.1 Grants for Conservation Works

Financial assistance for farmers in the form of grants for conservation works can help improve the quality of wetland areas by minimising the cost of managing private land for public benefit. Grants for conservation works could involve standard payments (ie: so much per square hectare of wetland), it may be on the basis of meeting a fixed percentage of the cost incurred, or it may be in support of drawing up a conservation plan (Colman, 1994, p228).

6.7.2 Tax Concessions

Tax concessions can be used in return for conservation agreements. To implement tax concessions, the nature and extent of rehabilitation works to be undertaken by landholders may need to meet a series of defined criteria (Creighton, Dickenson and Golden, 1994, p2). Tax exemption needs to ensure that the condition of the management agreement is upheld and also that conservation agreements are transferred to new owners if the land is sold, or passed to inheritors (Colman, 1994, p229). Creighton, Dickenson and Golden (1994) state that "Mining companies are allowed 150% deduction for rehabilitation work. A similar scheme could be implemented for landholders.

6.7.3 Rate Relief/Differential Rating

Rate relief and differential rating are other financial incentives that can be used to encourage habitat retention and wetland preservation on private land. It establishes a specific zoning with accompanying covenant on the land title for lands set aside for various environmental purposes (Creighton, Dickenson and Golden, 1994, p3).

6.7.4 Implications for Wetlands

Financial incentives provide a sanction for wetland conservation. Preventing development on land is often not enough to achieve wetland conservation. Therefore financial incentives can be used in core and buffer areas to undertake the management or rehabilitation of wetlands. This is particularly important for wetlands that are not owned by the Crown.

6.8 BONUS DEVELOPMENT RIGHTS

Bonus development rights enable a parcel of land to be developed to a greater extent than could otherwise be achieved in that zone. They allow a portion of the site to be formally protected for wetland conservation purposes in return for allowing a higher density of use on the remaining portion of land (Johnstone Shire Council). Bonus development rights have been employed by the Johnstone Shire council to assist the Council conserve valuable environmental resources for private lands that are not already protected for conservation purposes (Johnstone Shire Council, 1996, D-18).

Council exercises its discretion in awarding Bonus Development Rights. Assessment of Bonus Development Rights needs to consider: the capacity of the habitat system to withstand the impacts of the proposed development and maintain its integrity and the potential for the proposed development to enhance and protect the core wetland areas (Johnstone Shire Council, 1996, D-18). Conditions can be attached to approvals for Bonus Development Rights. Through these conditions council can require: the declaration wetland habitats as protected areas through Local Laws; conservation agreements between the land owner and Council; revegetation of a portion of the site to re-establish the habitat function or maintain the wetland system; or the dedication of the land to public ownership for conservation purposes.

6.8.1 Implications for Wetlands

Bonus Development Rights can be used in the rural zone to formally protect core and to protect buffer wetland areas. Council can exercise its discretion and allow some limited loss of habitat where it would achieve conservation protection for the balance of the parcel of land. To achieve this the area to be foregone will be of least value compared to the balance of the habitat (extending beyond the property boundary of the subject site). Applications for Bonus Development Rights can be accompanied by a preliminary environment report or environment impact statement

6.9 VEGETATION PROTECTION ORDINANCES

Vegetation Protection Ordinances (VPO's) protect vegetation on publicly and privately owned land. They enable the Council to better protect natural areas. Vegetation protection ordinances do not prevent development approved under the town plan. Rather they provide for negotiation regarding the retention of significant vegetation. One of the greatest benefits of the ordinances is the ongoing education of landowners through the objection/application to clear process, allowing on-site assistance from Council officers. Brisbane City Council has tried and tested VPO's (Brisbane City Council). Important reasons for making an order are outlined in table _ below.

6.9.1 Nomination of VPO's

A flexible nomination model can be adopted which applies only to the most significant natural

areas. By using this model the most valuable natural assets can be protected without straining the financial resources of the Council. Protected areas will benefit from improved environmental values and increased property values. Five categories of protection can be developed that respond to the specific needs of landowners. These categories are individual trees; groups/stands of trees; vegetation of a particular class; vegetation of a particular species and all vegetation.

Table 6.3 (Brisbane City Council)

Reasons for Protection
• The vegetation has distinct scenic and landscape value • The vegetation is a wetland remnant • The vegetation forms an important wetland habitat • The vegetation is rare or endangered or is a habitat for endangered fauna or flora species. • The vegetation forms part of the original plant community and is a valuable natural habitat • The vegetation is of particular historical or cultural significance • The vegetation forms a wildlife corridor and vegetation links between natural habitat areas (eg: along the Herbert River) • The vegetation is important for erosion prevention and slope or bank stabilisation • The vegetation includes known koalas food trees and is important for koala protection, feeding and movement between habitat areas, and • The trees are important as a seed source for natural regeneration

6.9.2 Implications for Wetlands

Vegetation protection orders can be used to protect wetlands on private lands in buffer areas. They can be included as a condition of development or as a condition of Bonus Development Rights. In this way, the balance of land can be used for agricultural uses, however significant wetland habitat areas can be protected.

6.10 VOLUNTARY CONSERVATION AGREEMENTS

A 'conservation agreement' is a contract between the Minister for the Environment and the landholder or between the Council and the landholder. Conservation agreements determine how wetlands are to be managed and outline types of activities that can occur within wetlands. Each agreement is tailored to suit the specific management needs of the particular wetlands for example, conditions could be comprehensive or simply be directed at protecting a particular species of plant or animal.

A conservation agreement can be for a certain length of time (as determined by the landholder) or can be permanent and registered on the land title. Nature conservation and future generations will benefit most if agreements are added permanently to land titles (Brannock and Hutchinson, 1995).

6.10.1 Implications for Wetlands

Voluntary conservation agreements can be used to maintain the quality of wetlands on private land. They can be used in the development control process to influence the management of private land to achieve conservation objectives. They are particularly useful for core wetland reserves that are held in private ownership. Conservation agreements can include performance standards and environmental monitoring to maintain acceptable thresholds of change. Additionally conservation agreements can be included as a condition for Bonus Development Rights. Conservation agreements can also be linked to financial incentives.

6.11 LAND ACQUISITION AND RETENTION FOR NATURE CONSERVATION PURPOSES

Conservation of core habitats can be achieved through the acquisition of wetlands and regulation by specific management plans. Wetlands can be acquired and retained for nature conservation purposes by the Queensland Department of Environment as well as the Hinchinbrook Shire Council. Acquisitions are an important part of conserving key habitat areas. While the rights to subdivide and build upon land are controlled by planning legislation, the right to manage the land is still largely unfettered, yet the management of land is crucial to sustain the long term productive activity and natural ecosystems (Bates, 1995, [2.1]). Therefore land acquisition is an effective means of protecting the local environment because ownership and management by state or local bodies with a credible record is the most secure way of pursuing conservation policies (Bates, 1995, [2.1]; Coleman, 1994, 227). To be most effective land acquisition needs to be implemented in concert with Voluntary Conservation Agreements to ensure that wetlands on private land are protected until they are secured in public ownership (Creighton, Dickenson and Golden, 1994, p3).

6.11.1 Implications for Wetlands

Land acquisitions would be used for core wetland habitats and primary corridors to ensure their conservation.

6.12 PROPERTY MANAGEMENT PLANNING

Property Management Planning is a process for achieving improved resource management through action learning and self development, so that landholders take a strategic approach to planning their property. Property Management Plans (PMP's) integrates the farmers personal goals and vision, sustainable agricultural production and conservation of soil, water, flora and fauna, as well as physical financial and human resource goals which are required to achieve these in a variable climatic, marketing and social environment. Property management planning enables individuals to take voluntary action following an action learning process (Dawson, 1996, p328). At the farm level, ESD principles can be achieved through PMP's through the use of best management practices. In the Herbert River local cane assignment boards require applicants to submit a PMP with their application for new assignment. This information is reviewed by the board and relevant technical experts from Queensland Department of Primary Industries and the Queensland Department of Environment and Heritage (Johnson, et al, 1996).

6.12.1 Implications for Wetlands

Property management plans are an important tool for wetland conservation. They can be included in the development assessment process by requiring applicants to submit PMP's with applications for intensive agriculture. This will enable Council officers and technical experts from government agencies to determine the extent of changes that are being proposed and what impact that the it will have on wetlands. PMP's will also inform development assessors of the types of land management practices undertaken by applicants to minimise the impact of development on wetlands.

Chapter 7:

EVALUATION OF PLANNING OPTIONS

7.0 INTRODUCTION

The effectiveness of conservation options can be determined through evaluation. The evaluation that follows is broad and is based on an analysis of the existing use of conservation

options. Effectiveness is based on the ability of the planning options o maintain the ecological functions of wetlands, socio-political acceptability, administrative needs and the costs of implementing the planning provisions.

7.1 EVALUATION CRITERIA

7.1.1 Ecological Functions of Wetlands

To achieve the conservation of wetlands planning provisions need to ensure that the functions of wetlands are maintained or enhanced. This can be determined by evaluating the proposed provisions against the desired environmental outcomes determined for wetlands in Chapter 5 and summarised below in table 7.1. This will ensure that planning provisions maintain the key ecological functions wetlands including the hydrology, pedology, morphometry and biology.

7.1.1.1 Ecological Evaluation Criteria

The ecological criteria for evaluation is based on the desired environmental outcomes identified in Chapter five. These are summarised in Table 7.1 below.

Table 7.1 Ecological Evaluation Criteria

DESIRED ENVIRONMENTAL OUTCOMES	
HYDROLOGY	maintain water quality in wetlands
	maintain the hydrological regime of wetlands
PEDOLOGY	minimise the impact of acid sulphate soils and other soil contaminants in wetlands
MORPHOLOGY	minimise structural changes to wetlands
	minimise disturbance to wetland morphology from off-site landform changes
BIOLOGY	minimise the loss of wetland habitats
	preserve and enhance the quality of wetland habitats

7.1.2 Administrative Processes Associated with Planning Provisions

In rural authorities the administrative requirements of planning provisions can be significant barriers to achieving conservation and sustainable land management. Administrative requirements include staff hours, technical knowledge and skill as well as information needs. Hinchinbrook Shire is a small rural shire without qualified Town Planning staff. Therefore the administrative processes associated with the planning provisions need to consider the staffing limitations of the organisation. Consequently provisions that require extensive time to be devoted to implementation will be impractical given current resources.

Additionally, the level of knowledge and skill required to implement conservation provisions is of prime importance. Planning options that require technical skills beyond the capabilities of the local government to administer and monitor and beyond the scope of landowners to implement will be ineffective for wetland conservation. Therefore planning methods need to be comprehensive and soundly based ecologically but at the same time simple enough to be of practical use in the field by rural local authorities (Hill and Koslowski). Information requirements of planning provisions can also be a significant barrier to implementation. Information requirements differ for the different management options but could consist of wetland mapping, baseline water quality information, the location of acid sulphate soils, and the impact of different land management practices on wetlands.

Administrative Evaluation Criteria

- Time
- Knowledge and Skill
- Information

7.1.3 Socio-Political Criteria

Planning provisions need to be politically acceptable by both governments and the community and should try to educate and improve awareness of wetlands issues as well as promote sustainable land management practices. As has already been demonstrated the political acceptability of proposed planning provisions has significant implications on their implementation. The acceptability of different conservation mechanisms will vary between local governments, landowners and the community (Colman, 1994). Ultimately however, the policy options endorsed by Council will reflect community understanding of wetland issues as local governments are held accountable through the election process (Young, 1996). Therefore there is a direct link between promoting conservation mindedness and achieving political acceptability of environmental policies at the farm level (Colman, 1994, 235).

Consequently, planning provisions that encourage voluntary conservation and sustainable land management practices will assist in improving awareness of wetlands issues. As Colman states "planning tools based on a more antagonistic, regulatory relationship with farmers is sometimes a cause of resistance" (Colman, 1994, 235). This is particularly important as the regulation of agricultural activity by Council is a new concept in the Herbert. As a result provisions which generate antagonism will not be well received by the community in the short term and may also lead to long term resistance. A Comprehensive analysis of the political acceptability would require community and stakeholder consultation. Unfortunately this is beyond the scope of the study.

Socio-Political Evaluation Criteria

- Political Acceptability
- Promotion of Education and Awareness

7.1.4 Cost

Economic criteria are inextricably linked to socio-political criteria. Cost considerations are difficult to evaluate, especially at a broad scale. Considerations of cost include the short term financial costs of conserving and enhancing wetlands and the long term cost of not conserving wetlands. Several important issues include the opportunity costs associated with conservation and the issues over the distribution of costs. Firstly there are opportunity costs associated with wetland conservation as he conservation of wetlands is the cost foregone of farming that land. On the other hand there is an opportunity cost associated with wetland loss. The wetlands of the Herbert River Floodplain are of national significance. Therefore use of this land for agriculture is the foregone cost of conservation. Once wetlands are lost it is very expensive to try to recover or rehabilitate these areas.

Moral and ethical issues also arise over the distribution of costs. These issues are centred around the question of who should pay for the cost of conserving wetlands for public benefit on private land. While it is generally agreed that the cost of rehabilitating degraded habitats should be borne by those who degrade them, the whole community also needs to take financial responsibility for protecting the environment when the costs of doing so cannot be recovered by the use of market mechanisms (Johnson, Ebert, and Murray, 1997, p23). Colman comments that where extremely high values are attached to conserving specific habitats monetary cost becomes less important, and instruments which guarantee conservation are more efficient (Colman, 1994, p233).

Generally cost analysis is typically limited to the determination of the most cost effective conservation method for achieving a certain level of management. This considers administrative costs of staffing requirements to undertake conservation measures such as: development assessment; the assessment of bonus development rights and the monitoring or performance standards. Additionally administrative costs include the cost of obtaining the information

required for council to implement conservation methods. Cost analysis also considers the real cost of implementing conservation methods. This includes the cost to the community of acquiring land and providing financial incentives (Colman, 1994, p234).

Cost Evaluation Criteria
- administrative costs
- real cost of implementation

EVALUATION

7.2 REGIONAL CONSERVATION PROGRAM

7.2.1 Ecological Protection
The ability of the regional conservation program to maintain the ecological functions of wetlands is high as it establishes a system based on conserving the most significant habitat areas. Additionally uses are managed in buffer areas to protect the quality of core reserves. By taking a regional perspective the program provides the broad framework for development control and land use decisions that considers the impact of agricultural development on the regional distribution of wetlands. Additionally the regional conservation program is linked the other conservation methods to better manage core and buffer areas. For example the regional conservation program integrates land acquisitions and vegetation protection ordinances to conserve core areas and uses conservation agreements and bonus development rights in buffer areas. Through this system wetland functions in core areas are conserved and activities in buffer areas and beyond that have the potential to impact on wetlands are controlled.

7.2.2 Administrative Processes
Substantial information is required to select core and buffer reserves in the regional conservation strategy. This information would include remote sensing and mapping, field inventory, and biogeographical research to determine the spatial distribution of biodiversity and wild areas, followed by an evaluation of which areas are most important to protect (Noss, 1995, p14). The analysis and evaluation of this information would need to be undertaken by highly skilled technicians to produce the conservation program. Fortunately for the Herbert River Catchment most of this information already exists and is accessible to the Shire Council through the Herbert River Information Centre. Additional information that has been developed by the Department of Environment is also be useful for this program. Consequently information sharing between government organisations undertaking natural resource management and planning at different levels would improve co-ordination and make management more effective. The sharing of regional mapping would ensure that information is consistent between levels of government. However information sharing is currently a constraint to developing the regional wetland program.

Additionally the knowledge, skill and time required to implement a regional program is high because, in addition to providing the broad framework for environmental management, the program uses other conservation methods to implement it.

7.2.3 Socio-Political
The acceptability of this program is assumed to be moderate to high. Generally the community is demanding that state planning institutions and local government authorities respond to their environmental concerns and aspirations and act as a cohesive environmentally responsive resource management system (Bates, 1995). As the conservation program provides a framework for management that encompasses core wetland habitats, primary corridors and buffer areas and uses alternative methods to secure the protection of these areas, it is a resource management system. Furthermore, the regional conservation program integrates local and state planning

mechanisms for wetland protection. For example, conservation agreements and land acquisitions can be pursued by either the state or local governments. Additionally the regional conservation program establishes the framework for this to be undertaken in a coordinated and integrated manner with local government having the lead role.

The regional conservation program also has a role in education and awareness facilitated by key conservation methods used to implement the regional strategy, such as conservation agreements and property management planning.

7.2.4 Cost

Overall the program presents administrative costs of developing the program and generating maps. Additionally, the implementation of the regional program will involve administrative costs of implementing other conservation methods such as the assessment of development applications, bonus development rights, conservation agreements etc. The program will also involve real costs of conservation such as the cost to the community of acquiring land and the cost to landowners of managing wetlands and lost revenues from agriculture. The cost of not implementing a regional conservation program would also be high, as the framework for controlled and coordinated action would not be established making other conservation methods less effective.

PLANNING SCHEMES

7.3 STRATEGIC PLAN (A)

7.3.1 Ecological Protection

Strategic plans are spatial representations of broad future land uses and act as a framework to guide daily decision making on land uses. They are designed to provide the framework for development assessment in the Shire by using Preferred Dominant Land Uses for wetland habitats. They provide a general indication of the location of areas that are to be conserved and this needs to be taken into consideration in assessing development applications.

In itself the strategic plan is limited for detailed management of natural resources because its designations are broad in scale. While at least potentially it can address a wide range of objectives, it is primarily a guidance mechanism for development control, especially rezoning (Johnson et al, 1996, p11). Because of its scale, many small and fragmented wetland areas that contribute to the hydrological regime of the wetland would not be represented on the Strategic Plan. Additionally while the plan can influence future land use through Preferred Dominant Land Uses it is unable to influence the way the land is managed. While strategic plans are potentially beneficial and better than a planning system relying on zoning scheme and subdivision controls alone, they do not integrate with other spheres of government or the Queensland Sugar Corporation and consequently fall short of being true strategic visions and plans for managing development in a local area (Johnson et al, 1996, p11).

7.3.2 Administrative Processes

Strategic plans do not require significant additional administrative resources because it is part of the development assessment process currently undertaken by council. The level of skill required to assess applications under the strategic plan is much the same as current development assessment procedures, and the only information requirement is the Strategic Plan itself. The current strategic plan would need to be amended to incorporate a conservation preferred dominant land use and this may require additional staff hours or technical expertise, however overall there are few administrative requirements of this conservation method.

7.3.3 Socio-Political

It can be assumed that the political acceptability of strategic plans for conservation would be fair. This is because strategic plan destinations are broad and are intended to guide future development assessment. Additionally Preferred Dominant Land Uses are not intended to confer land use rights. Strategic plans would not significantly contribute to the improved awareness and understanding of wetlands issues or conservation methods as they are statements of policy intents and are not designed for community education.

7.3.4 Cost

A strategic plan is a broad policy document and consequently no direct costs would be imposed on the community or the landowner. However a conservation designation may restrict the development that can occur on that land in the future. In this respect a cost may be imposed on the landowner.

B. ZONING AND DEVELOPMENT CONTROL

7.3.5 Ecological

Zoning schemes have more scope than strategic plans and they place greater controls and restrictions on use rights. Zoning plans consider every allotment and therefore wetland areas can be identified and protected. Council can allocate land for intensive agriculture based on land capability and its compatibility with neighboring land uses. In addition the classification of the rural zone into three categories enables controls to reflect the wetland conservation value of the land.

Zoning schemes enforces conditions that can to be tailored to the specific needs of each application to maintain the ecological functions of wetland. This increased regulatory role enables council to regulate development to maintain water quality in wetlands; maintain the hydrological regime of wetlands; regulate development on acid sulphate soils; control rates of erosion; prevent structural changes to wetlands; and prevent wetland loss. Additionally conditions can be modified to reflect changes in information, technology and land management practices.

Zoning controls do not provide Council with the scope to influence land management once planning approval has been granted, other than by being able to police original approval conditions (Bates, 1995). In urban areas this is not a significant issue because conditions on development applications generally relate to the structure proposed to be constructed (ie: size, density, height, setbacks etc), and works that are required to be undertaken as part of the construction period. Once an urban project has been approved and built to the satisfaction of Council planning responsibilities usually cease. In contrast rural activities differ from urban activities in the sense that rural development is related to the improvement of land for intensive agriculture (ie: clearing land, constructing rural infrastructures) and the long term management of land and water resources for agricultural production (ie: land preparation, planting, pesticide and fertiliser application, and harvesting). Therefore unlike urban land uses, the impact of rural activities extends beyond the construction phase and requires the continued management of land and water resources.

Zoning has a limited ability to regulate the ongoing management of rural lands once the application has been granted. For example a condition can require that wetland vegetation is retained, however once the agricultural activity is established, it does not have the power to specify how the wetland is to be managed. The *Local Government (Planning and Environment) Act 1990* specifies that zoning schemes have regulatory force to ensure that conditions on development are complied with otherwise the applicant is in breech of the scheme and is liable for prosecution. However this process is disadvantageous because it means that the wetland

damage must occur before legal action can be taken (Anon, 1994, p1-6; Bates, 1995).

7.3.6 Socio-Political

The zoning of land for conservation may be met with some resistance because the regulation of intensive agriculture has not been implemented in the Herbert before and farmers generally resist controls on use rights (Hollick, 1991). However, this control may also be met with acceptance from members of the community who already understand the need to conserve wetlands. Zoning controls have a limited role in improving awareness of wetlands issues. Because zoning controls are prescriptive by nature they do not improve understanding of wetland issues or provide clear links with conservation objectives and appropriate management solutions.

7.3.7 Administrative Processes

The proposed regulation of agricultural land use activities coupled with the rapid expansion of the sugar industry will increase the number of development applications that need to be assessed by Council. As a result, Council will need to commit greater administrative resources to development assessment. In addition, greater skill will be required to ensure that development applications are conditioned to ameliorate potential environmental impacts and also to ensure that ecological processes are maintained. Referral of technical planning provisions to government agencies and criteria for development assessment established in the planning scheme should assist Council staff in this regard.

7.3.8 Cost

Landowners will incur greater costs through zoning control and development assessment. Depending on particular circumstances these costs could including having to prepare an Environmental Impact Statement, preparing a Property Management Plan and developing land management practices that will achieve prescribed standards. Additionally the administrative cost to council will also increase as a result of increased time required to assess Environmental Impact Statements and Property Management Plans and also to police provisions once approval has been granted.

7.4 PERFORMANCE STANDARDS AND ENVIRONMENTAL MONITORING (C)

7.4.1 Ecological

Performance Standards and Environmental Monitoring can be used to achieve ecological objectives by defining maximum limits that cannot be exceeded and by using monitoring to ensure that pre-determined limits are not exceeded. It provides greater scope to influence land management because the use of performance criteria requires land to be managed in a certain way to achieve environmental outcomes. Performance criteria can be developed to ensure that the desirable environmental outcomes are achieved. Examples include the requirement that water quality is maintained at a standard that will allow the continued functioning of aquatic habitats, or so that wetlands produce a prescribed number of fish (Clark, 1996). Monitoring is used to warn when pre-selected impact indicators reach the pre-selected statistical level. It an also be used to build up information on the environment and evaluate in land use practices with changes in wetlands over time (Clark, 1996).

Performance criteria and environmental monitoring are limited by the fact that levels need to reach threshold levels or need to be exceeded before legal action can be taken. Maintaining the ecological functions for wetlands may also be limited by the ability of monitoring to measure development impacts (Clarke, 1996). Additionally most wetlands have multiple surface water inputs and outputs which may also be difficult to administer. Further, many wetlands on the Floodplain are affected by groundwater and therefore diffuse source pollution carried in groundwater may be entering the wetland undetected (Rasin and Mitchell, 1996, p221).

7.4.2 Administrative Processes

The use of performance standards and environmental monitoring has high administrative requirements. To implement them Council staff need to understand the management problems and have the knowledge and skill to ensure that proposed developments will meet prescribed standards. Performance criteria established in the scheme would act as a checklist for development control, however an understanding of the issues is still vital for Council officers to understand the wetland systems and the impact that development can have on wetlands. This method of conservation also requires that Council staff posses a high level of knowledge and skill to develop criteria that will solve potential environmental impacts and to monitor and report on wetland impacts. Additionally performance standards and environmental monitoring require greater time to provide assistance to farmers to determine land management strategies that will maintain land management strategies, to monitor land and to revise strategies if they are ineffective. Both council resources and resources from other government departments for technical and specific issues will be required to implement performance standards and monitoring.

Monitoring has greater informational requirements. Baseline information is required to measure the environmental conditions and status of resources before a project is commenced. This may be a constraint to maintaining some wetland functions as baseline information may not be available. For example there is a lack of water flow data in some areas preventing accurate assessment of surface water resources and the monitoring of water quality in the past has been limited (Herbert River Catchment Coordinating Committee, 1996). Additionally monitoring information is required to measure the changes, if any, that occur after a project begins operating (Clark, 1996, p150).

7.4.3 Socio-Political

While performance criteria regulate land uses to achieve certain outcomes, it can be assumed that they will be well accepted because they are not overly prescriptive in nature. By establishing thresholds and standards, they enable landowners to tailor land management to suit their particular needs while maintaining the ecological functions of wetlands. Therefore they are less likely to be met with opposition than blatant restrictions on use rights.

Performance criteria and environmental monitoring have a significant role in education and awareness of wetlands issues by requiring farmers to undergo a learning process to work through management options and design criteria to achieve prescribed standards (Anon, 1994). Therefore to produce effective results that achieve performance standards, landowners need to understand the problem and what can be done to solve it. Additionally through monitoring landowners will learn of the impact that land management practices have on the environment.

7.4.4 Cost

The high administrative requirements of performance standards and environmental monitoring also incorporate higher costs. These include the cost of staff resources to assess applications against performance criteria and the financial cost of obtaining baseline information and in monitoring environmental indicators. Through performance standards landowners also have the scope to use the most cost effective measures to achieve wetland conservation.

7.5 ENVIRONMENTAL IMPACT STATEMENTS (D)

7.5.1 Ecological

Environmental Impact Statements (EIS) cannot conserve the ecology of wetlands by themselves. Rather they are a tool used to determine the impact of agriculture on core and buffer areas. EIS are a method of ensuring that environmental considerations obtain equal

weight in the decision-making process along with other traditional factors such as the social and economic advantages of a proposal. Environmental Impact Assessments do not introduce an environmental 'veto' power into the decision-making process however they can be responsible for the amendment or rejection of development proposals (Bates, 1995). Terms of Reference can be required for all environmental indicators to show the impact that development will have on the ecological integrity of the wetland and the impact the development will have on the regional wetland conservation strategy.

Theoretically Environmental Impact Assessments (EIA's) under the *Local Government (Planning and Environment) Act 1990* appear to establish a process to consider development within the carrying capacity of the environment. Practically this process has been inefficient in considering the cumulative impact of development on the environment. This has occurred because EIA's are considered individually at the project level resulting in the failure to adequately consider environmental issues within the broader regional framework. The integration of Environmental Impact Assessments with the regional conservation program should solve these problems providing a broader framework of environmental assessment.

7.5.2 Administrative Processes

Environmental Impact Statements require a high degree of technical and specific information. The amount and type of information required may vary depending on the nature of the environment, the scale of the development proposed, and therefore the particular Terms of Reference. In this regard EIS's are useful because they provide information in situations where there is little local knowledge of environmental resources or the particular impacts of certain developments. This information is to be provided by the applicant at their own expense.

The assessment of Environmental Impact Statements is undertaken by Council and referral agencies. This requires time greater staffing resources to undertake the assessment and analysis of the EIS. A high degree of knowledge and skill is also required by Council staff to evaluate the impact of the development on wetlands based on the findings of the EIS and to make recommendations about conditions or performance standards that may be required in response to the impacts and issues identified.

7.5.3 Socio-Political

Political acceptability of EIS can be assumed to be fairly high because it involves the investigation of the impact of a proposal and reflects growing community concern about the impact of developments on the environment. Environmental Impact Statements have large scope for education and awareness for the individual landholder but would have limited impact on the knowledge of issues community as a whole. By having to prepare and EIS, the landowner will learn of the potential impacts of the development and, through performance criteria or by modifying the proposal, how to overcome these impacts.

7.5.4 Cost

The cost of the preparing the EIS is borne by the applicant. The extent of costs will vary depending on the size of the development and the types of impacts it is likely to generate as this influences the Terms of Reference that need to be addressed in the EIS. An EIS can be expensive if the applicant needs to undertake technical studies to determine particular impacts. The opportunity cost of not preparing an EIS is that the potential environmental effects of development may not be determined or understood and therefore land use decisions would not be based on a full consideration of the impact of the development.

7.6 FINANCIAL INCENTIVES (E)

7.6.1 Ecological

Financial incentives can be used to influence the management of wetlands on private land. By entering into an agreement for reimbursement or other financial aid the landowner can be required to undertake certain management works or maintain wetlands to prescribed standards. In this way ecological outcomes for hydrology, pedology, morphology and biology can be included as part of the agreement for financial aid. Little information exists on the effectiveness of financial incentives in conserving wetlands. However It is assumed that landowners are more likely to undertake improved management practices or conservation if the costs of doing so can be met wholly or partially by financial incentives.

7.6.2 Administrative Processes

These methods would need to regularly monitored to ensure that the incentives are being used for the purposes established in the agreement, and so that payments adjusted or terminated if these is a change in the cost of management. A fair level of knowledge and skill is also required to ensure that the conservation works being undertaken as part of the agreement are appropriate to achieve the desired ecological outcomes of wetlands.

7.6.3 Socio-Political

The political acceptability of financial incentives is difficult to determine. On the one hand the community may argue against financial incentives because it is felt that the cost of conservation should be borne by those who cause the problems. This may be further aggravated if a wetland levy is imposed across the community. On the other hand the community may accept the need to assist landowners in managing the land for long term community benefit.

Financial incentives play an important role in improving the awareness of wetlands issues among landowners and has an educational role by promoting conservation land management practices. In addition, by providing financial assistance the number of farmers that actively participate in conservation may increase. However financial incentives have a limited role in improving general community awareness of wetlands issues.

7.6.4 Cost

This conservation method redistributes the cost of conserving wetlands. The cost of conservation is borne by the community rather than solely by the landowner. However conservation agreements qualifying for tax concessions involve little publicity and as a result the public may be unable to benefit fully from aspects of agreements designed to provide public goods (Clark, 1996). The administrative costs associated with financial incentives includes the cost of monitoring incentive programs.

7.7 RETENTION OF LAND THROUGH SUBDIVISION (F)

7.7.1 Ecological Criteria

The retention of land through the subdivision process can enable the conservation wetlands. Ten percent of the land proposed to be subdivided can be given to the Council as parks contributions. Land to be transferred to the Council can be part of the land proposing to be subdivided or it can be other land proposed by the applicant and accepted by the Local Government. This can be used to conserve wetlands by securing core or buffer wetland habitats. This then allows the effective management of wetlands by Council (Creighton, Dickenson and Golden, 1994, p3).

To ensure that land transferred to Council is effectively conserved this method would need to be undertaken as part of a management system to ensure that development on surrounding lands

was appropriately managed (Creighton, Dickenson and Golden, 1994, p3). The Local Government (Planning and Environment) Act specifies that a maximum of 10% of the total land area can be given in parks contributions. Therefore this process may be insufficient to conserve wetlands if the total area of the site occupied by wetlands is greater than 10% of the total site area.

7.7.2 Administrative Requirements

The transfer of the land does not incorporate significant administrative requirements as it is part of the development process. The information required to determine which areas are to be retained would be derived from the mapping that identifies core and buffer wetland reserves.

However once this land is transferred, Council needs to management of it for conservation purposes. This involves administrative requirements such as the development of management plans and then the maintenance and upkeep of these areas in the future. A high level of skill and knowledge is required to ensure that the ecological functions of wetlands are maintained.

7.7.3 Socio-Political

This process is assumed to be acceptable as it is currently part of the development process. It would ensure that lands intended to be conserved for public purposes is publicly accessible and managed by the Council. This process is not designed to promote education and awareness of wetlands issues across the shire but it could have a role depending upon the methods Council would use to manage these areas. For example Council could use the land as part of a wider educational program.

7.7.4 Cost

The landowner faces the cost of loosing land thereby forgoing the opportunity meet parkland contributions financially and use the land for other uses such as intensive agriculture. However as contributions are part of the Local Government (Planning and Environment) Act, there is a financial cost imposed on the landowner regardless of the method of payment. The cost of managing wetland areas is redistributed to. the community.

7.8 BONUS DEVELOPMENT RIGHTS (G)

7.8.1 Ecological Criteria

Bonus development rights help to secure core wetlands areas that are not already formally protected. Protection of core wetland habitats can be achieved by linking bonus development rights with other planning methods such as conservation agreements or rezoning of the land to a conservation zone to protect the ecological functions of wetlands (Young, 1996). This potentially facilitates the achievement of desired environmental outcomes. Bonus development rights involve an increase in density on a portion of the block. Therefore unless they are integrated within a management framework they have the potential to impact on the integrity of wetland habitats for example through water quality impacts and erosion and sedimentation. Additionally because they involve trade-offs, such as loss of some wetland habitats for the protection of other habitats, bonus development rights can result in the loss of wetlands habitats.

7.8.2 Administrative Requirements

Bonus Development rights have high administrative requirements. They need to be assessed by council on a case by case basis to determine the impact of the proposal on the environment. To achieve this a high level of technical and other information, such as property management plans, would be required to determine the impact of the uses on the ecological functions on adjacent wetlands. In addition, technical expertise and skill is required for Council to determine the maximum intensity of use that is sustainable and to determine appropriate conditions for

sustainable management.

7.8.3 Socio-Political

May be met with mixed responses from the community. On the one hand they appear to be a compromise between the development rights of the landowner and the conservation interests of the community. On the other hand, the community may also be concerned over the increase in intensity of use adjacent wetland habitats. Bonus Development rights have a role for education and awareness for landowners through the conditioning of BDR's. For example the use of performance standards and environmental monitoring would require farmers to undergo a learning process to work through management options and design criteria to achieve prescribed standards.

7.8.4 Cost

BDRs incorporate administrative costs of assessing the application and then monitoring to ensure that the development does not have an adverse impact on surrounding wetlands. There is also an opportunity cost for the community associated with the loss of wetlands for agricultural development. Landowners benefit through increased revenues from more intensive land use activities.

7.9 VEGETATION PROTECTION ORDINANCES (H)

Vegetation protection ordinances do not prevent development approved under the town plan. Rather they provide for negotiation regarding the retention of significant vegetation. One of the greatest benefits of the ordinances is the ongoing education of landowners through the objection/application to clear process, allowing on-site assistance from Council officers.

7.9.1 Ecological Criteria

Vegetation Protection Ordinances (VPO) are able to protect the biological functions of wetlands by protecting significant wetland habitats. They provide for negotiation regarding the retention of significant wetland vegetation. Different categories of protection can be awarded depending upon the conservation value of the wetlands. For land covered by a VPO the landowner needs to apply to damage or interfere with protected vegetation. Where agricultural land uses or practices are involved a property management plan will need to be included. The Council would use the advice of the Department of Primary Industries when making a decision on these issues (Brisbane City Council, p13).

Vegetation Protection Ordinances are an important support mechanism for land acquisitions as they protect the wetland vegetation until Council or the Department of Environment can secure these areas for formal protection. However vegetation protection ordinances do not have the power to influence the way these habitat areas are managed in the interim. For example they can not require the landowner control infestation of wetlands by exotic plants. Consequently they have a limited ability to achieve the other desired environmental outcomes for hydrology, pedology, and morphology.

7.9.2 Administrative Requirements

Like the method used by Brisbane City Council, Vegetation Protection Ordinances in the Herbert can be assessed by a committee made up of representatives independent of the Council and the final decision can be made by Council. Consequently the Council would not face any administrative requirements for the assessment of applications for VPO's. Council officers will need to assess the applications to clear vegetation. Technical information requirements can be provided by referral agencies such as the Queensland Department of Primary Industry, and additional information required to assess the applications to clear vegetation can be provided through a PMP.

7.9.3 Socio-Political

Vegetation Protection Ordinances are unlikely to cause strong community opposition because the steps leading up to the making of VPOs allow maximum community input both through the notification of the proposal by the Council and the objection period (Brisbane City Council, 1997). Additionally, VPO's do not prevent land development as landowners can still apply to clear vegetation through the application to clear land process.

VPO has a significant role in education and awareness. By requiring that areas of significant vegetation are protected, landowners and the community will begin to recognise their value. Additionally it provides ongoing education of landowners through the objection and application to clear process, allowing on-site assistance from Council officers (Brisbane City Council, p5).

7.9.4 Economic

Council will face increased administrative costs in terms of assessing applications to clear wetlands. Landowners will not be able to use wetlands for intensive agriculture without applying to Council first.

7.10 VOLUNTARY CONSERVATION AGREEMENTS (I)

7.10.1 Ecological Criteria

A Conservation Agreement allows the achievement of desired environmental outcomes by specifying what types of activities can occur in a wetland reserve. Agreements are tailored to suit the management needs of the particular area and as a result conditions can be comprehensive to achieve the specific management of hydrology, pedology, morphometry and biology. Alternatively conservation agreements can be directed at protecting a particular species of plant or animal. Conservation Agreements can protect wetlands for a certain length of time or indefinitely if registered on the land title. Coordinated conservation areas can be declared to jointly protect wetlands owned by several landowners (Conservation Strategy Branch, 1995). Conservation Agreements may need to be linked within a broader framework of conservation methods to ensure that conservation was being undertaken in the agreed manner. For example, it may need to be met with monitoring or financial incentives.

7.10.2 Administrative Requirements

The nature and terms of the conservation agreement will need to be based on an individual assessment by Council officers or the Department of Environment. Assessment would need to consider the particular values of plants and animals, any rare or threatened species, unique landform features and the location of the wetland in the relation to the regional wetland management program. Specific information would be needed to undertake this assessment. Additionally, knowledge of the impact that development may have would also be required to ensure that appropriate activities and management actions are established in the agreement.

7.10.3 Socio-Political

Conservation agreements have a significant role in increasing levels of knowledge and understanding because it requires landowners to contribute to improved management of wetlands (Johnson, Ebert and Murray, 1997, p21).

7.10.4 Cost

The cost to the landowner is the time required to negotiate management objectives and then to undertake the management of wetlands as agreed.

7.11 LAND ACQUISITION (J)

7.11.1 Ecological Criteria

Land acquisition is an effective method of conserving core wetland reserves because it enables Council or the Crown to protect the most valuable wetlands from unsustainable development. Additionally it enables the formulation of management plans to ensure the conservation of key ecological functions. Once land is formally protected it can be managed by Council to maintain the hydrology, pedology, morphometry and biology within the wetland environment (Creighton, Dickenson and Golden, 1994, p3). Ownership and management of wetlands by state or local bodies with good track records is the most secure way of pursuing conservation policies (Colman, 1994, 227). Acquisition provides the greatest level of control over wetland use and management.

Desired environmental outcomes can be achieved by maintaining wetland habitats in their current state and by rehabilitating them, ie: by removing exotic weed species. The effective management of wetlands in public ownership would also need to be integrated with other conservation measures and land use controls to ensure that surrounding development does not impact on the ecological integrity of wetlands (Bates, 1995, [2.1]).

7.11.2 Administrative Requirements

Land acquisition needs to be based on an assessment of core wetland reserves to conserve those areas that are most significant or most threatened. This requires Council or State Agency Officers to evaluate the appropriateness of current conservation methods for a particular wetland and the impact continued management arrangements would have on the wetland. Following assessment are the administrative processes of acquiring the land. This process requires technical knowledge to: understand the impacts on and threats to wetlands; to ensure that appropriate habitats are acquired; that management plans overcome threats and achieve the desired environmental outcomes; ensure that other conservation measures are implemented for land impacting on the wetland. Information will be required at the assessment stage, before acquisition has occurred, and more detailed information on the pressures and values of the wetland will be required at the management plan stage.

7.11.3 Socio-Political

Land acquisitions are likely to be met with resistance from landowners because they are the greatest infringement on property rights. Issues may also arise over the price paid to landowners for acquisition and this is related to issues with the present system of land valuation. For example Council or the Department of Environment may acquire wetlands at the unimproved value of land. However this price would not reflect the value of the land in conservation terms. In addition it does not consider the value that could be added to the land by improving it for agriculture. As a result this is likely to generate conflict over land acquisitions.

Through community education programs, land acquisition has the ability to improve awareness of wetlands issues and make people aware of the need to conserve them. This could be further enhanced if acquired land were to be used for educational through nature based recreation.

7.11.4 Cost

The cost of acquiring and then managing land is borne by the community however the extent of these costs will vary depending upon the scale of the acquisition program. It reflects the argument that the cost of managing land for community benefit should be borne by the community as a whole and not individual landowners. However, as mentioned above, landowners may also face short term costs through the acquisition process.

7.12 PROPERTY MANAGEMENT PLANNING (K)

7.12.1 Ecological Criteria

At the farm level, ESD principles have been recognised with the use of Property Management plans (PMP's). Property management planning can be used to conserve wetland habitats on rural property by providing a balance of achieving a managed ecosystem in which native flora and fauna species are maintained with the long term productivity of the land (Carey, 1991, p50). Adequate conservation of wetlands requires more than pockets of formally protected areas and it is impractical to reserve all land that contributes to wetland conservation. Wetlands will only continue to function if conserved in conjunction with the surrounding landscape ie: with riparian zones, remnants and corridors of vegetation and partially cleared pastoral lands (Carey, 1991, p50).

The contribution to nature conservation of land directly managed for agriculture is significant because it can influence the ecological functions of wetlands such as: water quality; the hydrological regime; soil erosion and sedimentation and pollution by acid sulphate soils, chemicals and pesticides. The conservation of wetlands through property management plans also has an important role to play in maintaining sustainable agricultural productivity. For example the management of wetlands by replacing exotic grasses with local native species helps to improve bank stability and reduces harborage areas for cane rats (Canegrowers, 1997).

Property management planning is effective because it enables landowners to use local knowledge to achieve the conservation of wetlands. It is based on the premise that landowners know their land better than any adviser and can contribute this knowledge to improved management. Further, landowners are more likely to take ownership of the plan and implement it if they have been involved in the planning process and agree with all aspects of the proposed plan (Carey, 1991).

7.12.2 Administrative Requirements

Property management plans are prepared by the landowner and rely heavily on technical information (Dawson, 1996). Technical information is required to identify the: identification of the capability of the land; the value of the resources; the basis for decisions about the allocation, use and management of the resources (to achieve economic, social and environmental benefits) (Dawson, 1996). Ingham has extensive technical information in the Herbert River Information Centre. However assistance may need to be provided by Council or the State Government to translate this information into management needs and options. For example assistance in determining ways of minimising erosion or maintaining water quality. PMPs would need to be assessed by Council and referral agencies when submitted to Council as part of the development assessment process. The assessment of PMPs requires knowledge of land management practices, their potential impact on wetlands and also improved practices, to ensure that property management plans achieve wetland conservation.

7.12.3 Socio-Political

Property management plans are becoming more popular and the Local Assessment Boards require that applicants submit a PMP with their application for new assignment (Johnson, et al, 1996). The use of property management plans as the basis for sustainable agriculture is strongly supported by the sugar industry as well as government agencies.

PMPs have a significant role in education and awareness. Property management planning is an action learning process that improves landowners skills in planning to achieve sustainable development and also improves commitment to the implementation of their plans (Carey, 1991, p33). Traditionally, farmers have been expected to adopt recommended farming practices which provided few perceived benefits to themselves or the community. The use of property

management plans facilitates voluntary strategies and cooperation based on information (Johnson, et al 1996, p14).

7.12.4 Economic

The cost of preparing the management plan lies with the landowner. However preparing a management plan also enables farmers to manage the land to sustain long term productive capability. Therefore property management plans can be used to integrate the landowners personal goals with conservation objectives.

Chapter 8:

LOCAL GOVERNMENT SOLUTIONS TO MANGROVE AND WETLAND CONSERVATION

8.0 INTRODUCTION

Conservation methods that can be used for wetland conservation include: the Strategic Plan; Zoning and Development Control; Performance Standards and Environmental Monitoring; Environmental Impact Statements; Financial Incentives; Retention of Land Through Subdivision; Bonus Development Rights; Vegetation Protection Ordinances; Voluntary Conservation Agreements; Land Acquisition; Property Management Planning. The effectiveness of these planning tools for rural environmental management has been evaluated based on their ability to maintain the key ecological functions of wetlands, socio-political acceptability, administrative needs and real cost of implementation (Refer Table 8.1). Based on this key management tools can be identified.

Table 8.1 Summary Table: Evaluation of Planning Options for a Regional Conservation Program

Planning Option	Achievement of Desirable Environmental Outcomes	Administrative Requirements	Socio-Political Acceptability	Cost of implementation
A	moderate	low	high	low
B	moderate/high	high	moderate	moderate/low
C	moderate/high	high	moderate	moderate
D	moderate/low	medium	high	low
E	moderate	moderate	moderate	high
F	high	moderate	high	moderate
G	low/moderate	moderate/high	moderate	moderate
H	moderate/high	moderate	moderate	moderate
I	high	high	high	moderate
J	high	moderate/high	moderate/low	high
K	high	moderate/high	high	low

KEY

A: Strategic Plan
B: Zoning and Development Control
C: Performance Standards and Environmental Monitoring
D: Environmental Impact Statements
E: Financial Incentives
F: Retention of Land Through Subdivision
G: Bonus Development Rights
H: Vegetation Protection Ordinances
I: Voluntary Conservation Agreements
J: Land Acquisition
K: Property Management Planning

8.1 RECOMMENDATIONS

Following the evaluation of planning options it is evident that there is not one single instrument that can achieve all the desired environmental outcomes of wetlands that has few administrative requirements, low real costs and high levels of political acceptability. From the analysis it is also evident that regulating new developments only through the planning process will not effectively deal with existing resource management problems because planning controls have little power to control existing unsustainable land uses and minor variations in those uses. Consequently planning controls by themselves will not achieve Ecologically Sustainable Development (McDonald and Bellamy, 1997, p1). Therefore to conserve wetlands, a range of measures need to be implemented that deal with the sustainable long term use of land and water resources.

To do this a system of resource management can be implemented that utilises range of planning and conservation tools to solve wetland issues. These planning and conservation tools need to be organised in a manner that identifies and protects core wetland habitats, provides an anticipatory framework to guide future land development and integrates this with methods that achieve sustainable resource management. In a rural context this can be achieved by adopting a regional system of wetland management. The regional program provides the overall management framework for wetland conservation based on core and buffer habitats. It facilitates the use of planning measures to guide land use changes, combined with other conservation methods to implement sustainable land management (refer table 8.2). As a result core wetlands are protected and land use is restricted and managed sustainably in buffer areas and beyond to ensure that desired environmental outcomes are achieved.

Table 8.2

REGIONAL WETLAND CONSERVATION PROGRAM
CORE WETLAND RESERVES Zone: Rural A: Conservation **Conservation Methods** • Land Acquisitions • Retention of Land through the subdivision process • Vegetation Protection Ordinances • Voluntary Conservation Agreements and Financial Incentives • Monitoring
BUFFER WETLAND RESERVES Zone: Rural B: Agriculture (Conditions - Agriculture remains an as of right use, however threshold to be reduced from 5ha) **Conservation Methods** • Voluntary Conservation Agreements • Bonus Development Rights • Environmental Impact Assessments • Performance Standards and Monitoring • Property Management Planning
Zone: Rural C: Intensive Agriculture (Conditions: Permitted Development Subject to Conditions) **Conservation Methods** • Performance Standards and Environmental Monitoring • Environmental Impact Assessments • Property Management Planning • Voluntary Conservation Agreements

The expanded role of the Hinchinbrook Shire Council into rural environmental planning introduces a whole new set of technical and political dimensions for which they may have little

training, no experience and few well developed precedents to guide the way (McDonald and Bellamy, 1997, p1). Additionally the small nature of organisation limits the staff resources that can be devoted to wetland conservation. Consequently not all measures that are potentially suitable can be practically implemented by Council and therefore several key methods need to be identified. Through evaluation the methods which can potentially provide the best protection of the ecological functions of wetlands are: zoning and development control; performance standards and monitoring; retention of land through the subdivision process; voluntary conservation agreements; land acquisition and property management planning. Therefore it is recommended that these measures be implemented for wetland conservation.

8.2 CONCLUSIONS

In conclusion, the wetlands of the Herbert River Floodplain are being threatened by the rapid expansion of the sugar industry and agricultural land management practices. Conservation of these natural resources has been ineffective because of fragmented institutional arrangements and a failure to address environmental issues in the rural land development process. Therefore the challenge facing the Hinchinbrook Shire Council is to regulate the continued expansion of the sugar industry, coordinate planning and land management between government agencies and encourage best practice land management.

Conservation of wetlands can be achieved partly through the Local Government (Planning and Environment) Act 1990 and the proposed Integrated Planning Act which provides local governments with the power to regulate land development. The underlining planning process will have some similarities with conventional urban based planning in terms of land use control, setting of performance standards and managing the development approval process. However in addition to this, rural based planning needs to address ecological and land resources issues and planning and management needs to be more site and local landscape specific (McDonald and Bellamy, 1997). However to effectively manage wetland resources, planning schemes and development control needs to be integrated with other conservation measures to achieve the ongoing management of land and water resources.

Potentially this can be achieved through the Strategic Plan; Zoning and Development Control; Performance Standards and Environmental Monitoring; Environmental Impact Statements; Financial Incentives; Retention of Land Through Subdivision; Bonus Development Rights; Vegetation Protection Ordinances; Voluntary Conservation Agreements; Land Acquisition; Property Management Planning (Refer Table 8.2). However practically, for a small rural shire it is recommended that key conservation tools be used that provide the best protection of wetland functions (Refer Table 8.3).

The implementation of such measures in rural shires is hindered by: the administrative limitations of the Council; the cost of implementation; lack of political support; conflicts with landowners over loss of use rights, injurious affection and potentially the need for compensation (McDonald and Bellamy, 1997, p1). Education and awareness programs have a significant role in overcoming many of these issues and is important for the protection of wetlands generally. Education at a policy and community level is vital to improve awareness of wetland functions and benefits and to provide information as to how conservation can be achieved in practice. Some of the suggested conservation methods lead councils into unexplored territory, such as the reliance on Property Management Plans and the application of Environmental Impact Assessments to small land development proposals (McDonald and Bellamy, 1997). Therefore training and development has a major role in implementation. Additionally community education and awareness of natural resource management problems can stimulate voluntary action.

Therefore, through a combination of statutory planning, sustainable land management practices and programs for education and awareness, wetland conservation can be achieved in a rural context.

Table 8.3

RECOMMENDED WETLAND CONSERVATION PROGRAM
CORE WETLAND RESERVES Zone: Rural A: Conservation **Conservation Methods** • Land Acquisitions • Retention of Land through the subdivision process • Voluntary Conservation Agreements • Monitoring
BUFFER WETLAND RESERVES **Zone: Rural B: Agriculture** (Conditions - Agriculture remains an as of right use, however threshold to be reduced from 5ha) **Conservation Methods** • Development Assessment • Environmental Impact Assessment • Voluntary Conservation Agreements • Performance Standards and Monitoring • Property Management Planning
Zone: Rural C: Intensive Agriculture (Conditions: Permitted Development Subject to Conditions) **Conservation Methods** • Development Control • Environmental Impact Assessment • Performance Standards and Environmental Monitoring • Property Management Planning • Voluntary Conservation Agreements

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Appendix 1:
Conditions Imposed by Local Board Under Section 142(4) of the Sugar Industry Act (1991)

1. Any use of assignment on the land the subject of this authorised transaction shall be utilised on land categorised as classes 1,2 or 3 by the Department of Primary Industries' land suitability criteria.
2. Any use of assignment on the land the subject of this authorised transaction excludes those areas of land which are:
    (a) Land categorised as classes 4 or 5 by the Department of Primary Industries' land suitability criteria.
    (b) Watercourse, natural drainage lines and preferential flow paths.
    (c) Wetlands, swamps, marshes, lagoons and lakes as defined by guidelines developed with QDPI and industry technical advisory agencies.
    (d) Mangrove areas and other areas naturally subject to tidal inundation. Areas below the 3 metre contour (Australian Height Datum) are unsuitable for the utilisation of assignment unless further advice and design in s provided by the QDPI Resource Management.
    (e) Riparian zones of 10 metres width along watercourses or, if applicable, such lesser width arising form the application of principles for riparian values adopted by the Herbert river Catchment CO-ordinating Committee. Adherence to QDPI Guidelines for sustainable Development on Floodplains is otherwise recommended.
3. (a) Any use of assignment on the land the subject of this authorised transaction excludes those parts of the land which do not have drainage works which comply with the Hinchinbrook Rural Drainage Plan (Cameron McNamara & Associates 1984), if applicable, or any other such standard as may be specified and/or approved by the BSES, CSR Technical staff, relevant Drainage Board and/or Water Management scheme in respect of the area in which the land is situated. (Copies of the Cameron McNamara report are available form the advisory agencies:- Hinchinbrook Shire Council, Herbert River District CANEGROWERS Executive, CSR Technical Field office, BSES, Herbert River Catchment Centre, and QDPI Resource Management).
    (b) Drainage works on, or associated with the assigned land are to be in accordance with the plan submitted at the time of application.
4. Any use of assignment on the land the subject of this authorised transaction excludes those parts of land where any works within or connecting to a watercourse, lake or spring have not been authorised by a relevant licence or permit under the Water Resources Act 1989 prior to any works, pursuant to the assignment, being undertaken.
5. Areas of the land the subject site of the authorised transaction which are known or identified to have acid sulphate characteristics shall not be used for the purposes of the assignment.
6. Where the slope of the land is 3% or steeper, the landholder must seek and adopt advice from the department of Primary Industries Land Use and Fisheries section on soil conservation measures for the land before it can be developed ans used for the purposes of the assignment.
7. A riparian zone of native vegetation of not less than 10 metres shall be maintained on each side of the existing watercourses and habitat corridor for mahogany gliders.

Appendix 2:
Process of Reconnaissance and Selection of Core and Buffer Areas in a Regional Land Conservation Strategy

The process involves field inventory, remote sensing, interpretation, and biogeographical research to determine the spatial distribution of biodiversity and wild areas, followed by an evaluation of which areas are most important to be protected. The next step, drawing lines on maps involves the identification of areas that are to be protected and areas to leave out. As not every hectare can be protected or restored, decisions must be made quickly about which areas are most valuable ecolgocially before they are altered irrevocably. Such decisions should not result in any area being trashed. Ideally all lands should be managed, at least in part for biodiversity. But some areas deserve and require more rigorous protection than others. This process of picking and choosing is called "conservation evaluation".

Core reserves and primary corridors in a regional network should enclose and link biologically critical areas in a continuous system of natural habitat whenever possible. Some critical steps in selecting core reserves and primary linkages in a land conservation network are as follows.

1. Select areas that, on the basis of field reconnaissance and interpretation of maps, aerial photographs or satellite images, appear to be roadless, undeveloped or otherwise in essentially natural condition. Centre proposed core reserve areas on these undeveloped areas. *A map of land ownership will show which of these areas are on public lands.*
2. Add roaded landscapes that are relatively undeveloped and restorable, expecially when adjacent to or near roadless areas. Addition of such areas is important to increase core reserve size and to link roadless areas into larger complexes or networks.
3. Map the distribution of rare species and community types in the region, *using state natural heritage program databases.* In some regions, mapping he destruction of rare species and communities might be the most practical first step in the network design process.
4. Draw polygons around clusters or constellations of rare species and community types. If not encompassed in core reserves proposed in steps 1 and 2, add these polygons to the system. Some wetlands will be naturally isolated and therefore linking them by corridors is unnecessary.
5. Obtain information (if available) to undertake a gap analysis on unprotected and under-protected vegetation types and centres of species richness in your region. The purpose of gap analysis is to provide information on representation of ecosystems and species in protected areas. Locate areas the contain vegetation types and centres of species richness that are not adequately protected in existing reserves. Add these areas to the network of sites if not already encompassed through steps 1-4.
6. The general locations of core reserves and some of the linkages have now been determined. The next step is to define boundaries more precisely, add more corridors so that sites that would be naturally linked would be reconnected and envelop the entire network in a matrix of buffer zones. To do this zoom in to the landscape scale (1:24 000 or larger) and refer to detailed road maps, landownership maps, land use information such as grazing allotments, proposed sugar industry expansion areas and wildlife maps such as Mahogany Glider Habitat areas and additional data, as available. This information will provide information as to the threats of wetland sites which need to be overcome. Using this information and knowledge of the land, based on field reconnaissance and maps, adjust proposed boundaries.
7. As part of the final proposal, indicate specific actions that must be taken to secure the system, including acquisitions, wilderness or other reserve designations on public lands etc.

Appendix 3:
Regional Wetland Program Core and Buffer Reserves

Vegetation mapping produced by the Department of Environment can be used to produce a regional wetland map. This involves division of the existing natural habitat in the region into Core and Buffer Wetland Reserves. This has been undertaken with the assistance of Ian Hisslop, Environment Officer, Bushland Management, Brisbane City Council. The following vegetation types have been classified into core and buffer reserves based on their wetland value. Vegetation marked with an "R" requires further investigation.

REGIONAL WETLAND CONSERVATION PROGRAM		
Vegetation Name (DoE)	**Category**	**Reserve Type**
Mangroves	**W**	Core
Mangroves (disturbed)	**W**	Core
Mangroves (regrowth)	**W**	Core
Treeless areas associated with Mangroves	**W**	Core
Strand vegetation	**R**	R
Melaleuca woodland associated with Mangroves	**W**	Core
Melaleuca woodland associated with Mangroves (regrowth)	**W**	Core
Melaleuca dealbata/euc forest	**WA**	Buffer
Melaleuca swamps	**WA**	Buffer
Melaleuca swamps (disturbed)	**W**	Core
Melaleuca swamps (regrowth)	**W**	Core
Melaleuca quinquenervia forest	**W**	Core
Melaleuca quinqunervia forest (disturbed)	**W**	Core
Melaleuca quinquenervia forest (regrowth)	**W**	Core
Open water associated with sedgelands	**W**	Core
Sedgelands	**W**	Core
Grassland on poorly drained depressions	**WA**	Buffer
Grassland on poorly drained depressions (disturbed)	**WA**	Buffer
Grassland on moderately drained alluvial plains and levees	**WA**	Buffer
Grassland on moderately drained alluvial plains and levees (disturbed)	**WA**	Buffer
Swamp Melaleuca ViriX quin woodland	**W**	Core
Swamp Melaleuca ViriX quin woodland (disturbed)	**W**	Core
Swamp Melaleuca ViriX quin woodland (regrowth)	**W**	Core
Melaleuca sp. swampy riparian woodland	**W**	Core
Melaleuca sp. swampy riparian woodland (disturbed)	**W**	Core
Melaleuca sp. swampy riparian woodland (regrowth)	**W**	Core
Melaleuca viridiflora woodland	**W**	Core
Melaleuca viridiflora woodland (disturbed)	**W**	Core
Melaleuca viridiflora woodland (regrowth)	**W**	Core
M. viri woodl. with euc overstory	**WA**	Buffer
M. viri woodl. with euc overstory (disturbed)	**WA**	Buffer
M. viri woodl. with euc overstory (disturbed)	**WA**	Buffer
Lophostemon suaveolens forest	**WA**	Buffer
Moist Lophostemon/Melaleuca forest	**WA**	Buffer
Moist Lophostemon/Melaleuca forest (disturbed)	**WA**	Buffer
Casuarine riparian forest	**WA**	Buffer
Casuarine riparian forest (disturbed)	**WA**	Buffer

Melaleuca/Eucalyptus riaprian forest	**WA**	Buffer
Vegetation on river sand bars	**R**	R
River (water)	**R**	R
Cleared/cultivated areas	**R**	R
Recently cultivated grasslands	**R**	R
Cleared between Dec 93 and Sept 94	**R**	R
Cleared after sept 94	**R**	R

Appendix 4
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Chapter 3

A review of ICM and local government planning schemes in Queensland with particular reference to the Herbert River Catchment.

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1. Integrated Catchment Management in Queensland

Since the inception of integrated catchment management (ICM) in Queensland, successful implementation has been largely impeded by the inability of catchment management groups to influence land use planning and management. Until relatively recently local governments have had a limited role in rural land use planning and in the management of natural resources generally (McDonald and Bellamy 1997). More specifically, ICM principles and catchment management issues have not traditionally been incorporated into or addressed by local planning schemes. Historically, local government planning schemes have been applied mostly to urban areas and to the expansion of urban related uses into rural areas. Local government has always been a significant provider of rural roads and is a key player in localised resource management matters such as drainage and water resources. The development and management of rural natural resources for agriculture and forestry, and the protection of environmental quality and nature conservation has been historically a state agency matter in Australia (McDonald and Bellamy 1997). Additionally the conservation and management of natural and rural lands has been achieved mostly through programs such as Landcare that foster voluntary changes in the way people use and manage their natural resources (ICM/Landcare Review Committee 1997). There is no specific legislation for ICM and consequently catchment management groups do not have the statutory power to legally implement management strategies (Queensland Department of Primary Industries 1993).

Partnerships between catchment management groups and local governments are beginning to be formed and as a result local governments are now beginning to take greater responsibility for the implementation of ICM principles and strategies. This is occurring through local government planning schemes and through locally funded ICM projects. These partnerships are the result of improved communication between catchment committees and local governments, a better understanding of the principles and objectives of ICM within local government and because of an improved recognition of the role of local government in the management of natural resources.

The use of local government planning schemes to facilitate the implementation of ICM strategies provides the focus for this report. The report reviews the evolution ICM planning by local governments and considers the advancements made by the Natural Heritage Trust (NHT) Project linking planning schemes with ICM strategies. It also reviews some of the key achievements of the Brisbane Waterways Management Plan. Specifically however the report provides a detailed consideration of the process for and outcomes of incorporating ICM into land use planning for the Herbert River Catchment in North Queensland. The Herbert River Catchment is selected as the focus for this review owing to its location in an area of great environmental significance, the impact that the rapid expansion of the sugar industry has had on the integrity of important environmental resources and the impact that future expansion may have on remaining resources. Furthermore, unlike most rural councils in Queensland, the Hinchinbrook Shire Council has begun to control rural development through the planning scheme to achieve more sustainable development outcomes. Additionally, the process of linking the planning scheme with the catchment management plan has helped to change the way key stakeholders view planning and environmental issues. In recognition of this important achievement the Hinchinbrook Shire Council was awarded the 1999 Landcare Local Government Award.

2. History of Local Government and Resource Management in Queensland

Local Government has a major role to play in implementing catchment management strategies as it is the major regulatory agency controlling land use and land use changes (Halliburton 1995). Local governments have an important role in implementing sustainability-based land use planning as it is estimated that perhaps 85% of land use decisions are made by local authorities (Nobbs, et al. 1995). As a result local authorities have an important role in bridging the implementation gap of the ICM program. Halliburton (1995) has identified several important advantages of implementing ICM at a local government level. Firstly, local government has significant opportunities to influence land use and land management through planning schemes. Secondly, local government is local. This is important as local ownership of problems, processes and solutions is a key to successful adoption of good catchment policies by landholders. Thirdly, political commitment by Local Government to ICM is necessary and helps provide a sense of local ownership. Political commitment is partially dependent on community knowledge, which can be fostered by Local Government. Finally, local government has a major role in information management and dissemination through involvement as a "clearing house" for research, through involvement in research design and in the production of information for catchment landholders.

2.1 ICM strategy and the role of local government

1991 Strategy for Integrated Catchment Management
In 1991 the Queensland State Government released an ICM strategy for Queensland that outlined the broad policy and structural arrangements. The strategy provides a framework for fostering cooperation and coordination between landholders and other resource users, community groups and government agencies from all levels (ie. federal, state and local) involved in the use and management of natural resources. It promoted ICM as a participative and consultative process with a strategic and planned approach to tackling important natural resource management issues (Bellamy, et al. 1998).

In identifying ways of implementing ICM, the 1991 strategy established the roles of relevant stakeholder groups including individuals, the community, local, state and commonwealth governments. The strategy determined that local government would play a key role in:

- Fostering community awareness and the formation of Catchment Care Groups;
- Contributing technical and financial support to Catchment Groups and Committees, on a voluntary basis and as resources permit;
- Participating in the development of catchment management strategies; and
- Contributing voluntarily to the implementation of catchment management strategies by considering incorporating relevant parts of these strategies in local authority plans, by-laws and administrative procedures and in their own field activities (Queensland Department of Primary Industries 1991).

1994 Natural Resource Management Discussion Paper
In 1994 a discussion paper on natural resource management (NRM) was released by the Queensland Department of Primary Industries (QDPI). It defined the policy position for NRM and established both regulatory and non-regulatory strategies to guide planning processes for the allocation and management of natural resources consistent with the principles of ecologically sustainable development (Queensland Department of Primary Industries 1994). The paper's objective was "to produce an integrated NRM policy with non-regulatory strategies and a minimum of legislation, and to integrate the existing natural resource legislation administered by DPI". The intent of the discussion paper was to provide the basis for the development of the Natural Resource Management Act. However a change in government stalled the development of this Act.

The strategy also highlighted the need to closely link and coordinate NRM policy with other policies and approaches for environmental protection, nature conservation, local government planning, management of leasehold land and native title (Queensland Department of Primary Industries 1994). It identifies a preference to amalgamate existing legislation within existing administrative arrangements, rather than create new agencies (McDonald and Shrubsole 1996). Therefore to implement ICM, the discussion paper suggests linking catchment management strategies with the plans policies and action programs (both voluntary and mandatory) of state, regional and local governments and community groups (Queensland Department of Primary Industries 1994).

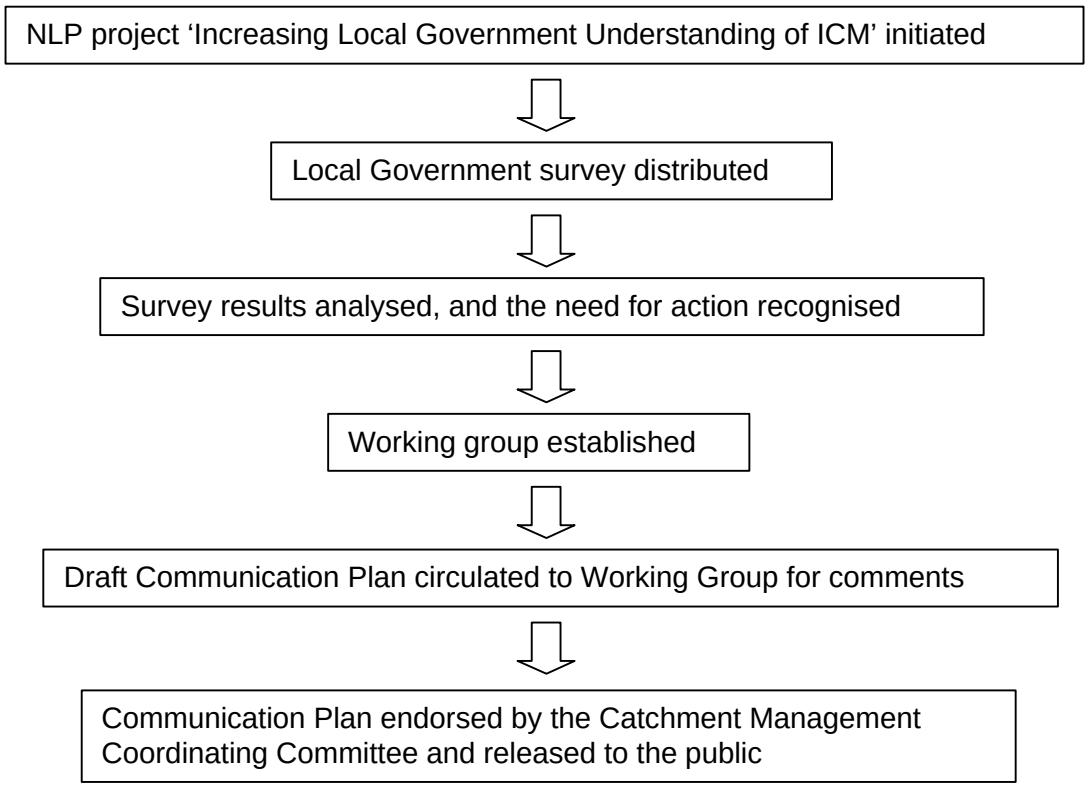
1996 Integrated Catchment Management Communication Plan

In 1996 the Department of Natural Resources produced the Local Government and Integrated Catchment Management Communication Plan. This plan further developed the government's 1994 policy position of integrating NRM within existing institutional arrangements and focused specifically on the important role of local government in the administration, coordination and implementation of natural resource management planning. The Communications Plan acknowledged that local governments are key players in the success of ICM because of their ability to influence local development and respond to social and economic change (Queensland Department of Natural Resources 1996).

The Communication Plan was developed as part of a project called 'Increasing local government understanding and involvement in ICM'. The plan development methodology is shown in Figure 1.

The Communication Plan sought to "increase the level of understanding of ICM concepts and provide best practice information for local government officers to solve real life catchment problems" (Queensland Department of Natural Resources 1996). It was targeted principally at local government due to their responsibility for tasks such as strategic planning, planning scheme preparation, development control, local area planning and provision of open space networks within local government areas (Queensland Department of Natural Resources 1996).

Figure 1. Process Used in the Development of the Communication



Source: (Queensland Department of Natural Resources 1996)

Achieving planning and development assessment from an ICM perspective is given urgent priority in the plan. The rationale being that local government planning schemes are the key to improving catchment management, yet planners have not always adequately addressed environmental and catchment issues through planning schemes. To facilitate the integration of ICM into planning and development assessment the communications plan confirms the need to:

- "show State and local government planners and elected representative involved in statutory planning and development assessment how to implement catchment management practices and policies
- identify and promote 'ICM best practice' guidelines for local government processes affecting land use
- enhance cooperation and coordination between CCCs and local and State governments through consultation and education
- improve catchment management processes (Queensland Department of Natural Resources 1996).

A specific action plan is developed in the Communication Plan to overcome these issues. Phase one involves a project officer working closely with CCCs landcare groups, industry and community interest groups to develop and implement ICM oriented local government planning schemes (Queensland Department of Natural Resources 1996). Critical tasks identified for this phase are to:

- identify and prioritise key issues which are identified by catchment management studies, catchment coordinating committees and local governments and which are addressed by local government through planning schemes;
- draft regulatory planning mechanisms that can be used by local government (particularly in planning schemes) to address ICM issues;
- review regulatory planning mechanisms for effectiveness and applicability to the issue and the area;

- negotiate incorporation of appropriate mechanisms in planning schemes; and
- develop and implement a monitoring and evaluation process for provisions incorporated in planning schemes (Queensland Department of Natural Resources 1996).

In Phase two , planning guidelines are prepared to resolve the issues and mechanisms and tools and implementation arrangements are researched. ICM policies are promoted and government officers are trained to apply and develop the policies (Queensland Department of Natural Resources 1996).

The outcomes of this project would therefore include:
- Local government planning schemes that effectively address catchment management issues;
- Land-use planners who are aware of and trained in, techniques to incorporate catchment management objectives into local government planning mechanisms;
- Catchment strategies and action plans that are more relevant to local government;
- Better acceptance, cooperation and coordination between CCCs and local and State governments;
- Improved and clearer recognition of the role of local government in ICM; and
- A training and education package for government planning officers and planning consultants (Queensland Department of Natural Resources 1996).

2.2 Linking Integrated Catchment Management and Local Government Planning Schemes: A Pilot Project

To overcome some of the implementation issues associated with ICM in Queensland and achieve planning and development assessment from an ICM perspective, a project was initiated in 1997 that aimed at linking catchment management strategies and local government planning schemes. It was based on the urgent priority strategy in the Communications Plan regarding improved linkages between local planning and catchment management. The project received National Heritage Trust (NHT) funding and was partnered by the Department of Natural Resources, Local Government Association of Queensland, Department of Communication and Information, Local Government and Planning, Landcare and Integrated Catchment Management.

The project "Linking ICM and Local Government Planning Schemes" sought to demonstrate how councils and catchment committees could successfully work together to identify catchment issues and implement planning solutions through local government planning mechanisms (Lusis 1999a). Implementation of this project has been via three stages. The first stage focussed on linking ICM strategies and planning schemes in four case study areas. The second stage involves the preparation of good practice guidelines for councils and catchment committees, and stage three, involves training and education programs for catchment committees, councils and other relevant organisations.

The Noosa, Warwick, Bulloo and Herbert River Catchments were the case study ares used for stage one. At the project conception stage, the local councils in all study areas were developing new planning schemes. For each case study area a reference group consisting of representatives from local government, the catchment coordinating committee and community stakeholder groups, drove the catchment management and local government planning processes. The specific roles of the reference groups were to:
- identify the ICM issues to be addressed by the project;
- develop the issues through workshops to assess current information;
- appoint consultants to provide information on the ecological issues and possible planning solutions;
- review the ecological findings and range of planning solutions;
- agree on preferred amendments to be made to the planning scheme and presented the final report to Council for endorsement in principle;

- monitor the public review process; and
- evaluate the success of the case study as a model to solve catchment issues (Lusis 1999a).

The Case study process was completed in 1998 bringing to an end the first of the three stages in this project. A brief description of the catchment issues and planning solutions for each of the case study areas is outlined below.

Four River Case Studies
The Bulloo ICM Reference Group's case study sought to incorporate aspects of the management of intensive agricultural development within the catchments of the Bulloo, Paroo and Wilson rivers and Cooper Creek in the Bulloo Shire Planning scheme (Lusis 1999a).

The reference group established that future land use and resource management for the Four River Region:
- Depends on the well being and economic soundness of the Bulloo community;
- ensures future development does not prejudice the continued natural/organic beef production industry;
- seeks guarantees that water allocation from the river systems and the Great Artesian Basin will not impact upon the sustainability of these natural systems; and
- fosters a responsible tourism industry, which emphases on education and awareness of the region's values (Lusis 1999a).

The ecological report identified the following environmental pressures requiring further action:
- over-grazing on native pastures;
- visitor impact on popular camping sites;
- exploitation of native fish;
- uncontrolled flows from the Great Artesian Basin Due to uncapped bores; and
- The need for additional input by the local community to regional development (Lusis 1999a).

However, the ecological report also found that the Cooper Creek, Wilson and Bulloo Rivers are generally in their natural state and contain only native fish species. The report identified how cooperative action is successfully addressing contemporary issues such as pest management, the capping of bores and the establishment of water reticulation systems for grazing animals (Lusis 1999a).

In terms of the status of catchment management planning in the case study area, progress is also being made towards forming a catchment coordinating committee for the Bulloo River, which encompasses part of Bulloo and Quilpie Shires. A steering committee was formed in September 1997 to create local awareness of and support for catchment management and to develop an issues paper which will highlight the needs of the catchment and possible directions the community may take with ICM. Steering Committee members have participated in landcare group meetings, shire pest management planning workshops, and developing media releases and posters (Lusis 1999b). A survey has been developed and circulated throughout the catchment to identify key stakeholder groups, identify the major issues in the catchment and to find out people's perceptions about and interest in forming a catchment coordinating committee (Lusis 1999b).

In terms of local government planning mechanisms, resource management and land use planning in the Bulloo Shire Planning Scheme is principally achieved through the provisions of the council's strategic plan and development requirements imposed on specific development proposals as conditions of approval (Lusis 1999b). The scheme also includes council's aims and objectives and associated provisions in respect of intended environmental, community and rural management outcomes (Lusis 1999b).

To integrate ICM objectives into the scheme, several amendments were proposed by the reference group. The proposed amendments to the Bulloo Shire Planning focus on rural land management, development requirements, and the rural planning strategy (Lusis 1999a). The planning scheme provisions for grazing and agricultural activities now include:

- permitting grazing as a right, but limiting grazing density to sustainable stocking rates;
- treating all other animal husbandry activities, including grazing beyond sustainable levels, as intensive animal husbandry, which requires the approval of council;
- defining "Intensive agriculture" as "…any agriculture in which water, chemicals and other productivity boosters are applied, and which has the potential to harm the environment or human health; and
- permitting agriculture as a right, provided it does not constitute intensive agriculture (Lusis 1999b).

This means that the scheme identifies grazing activities "as of right" and defines all other rural activities as intensive agriculture thereby requiring council consent. The amendments also include new criteria for Council to assess future development applications (Lusis 1999a). These amendments have been approved by Council and endorsed by the community.

Condamine River Catchment Case Study

The Condamine River Case study sought to incorporate aspects of the management of the riparian zone and flood plains of the upper Condamine River catchment into the Warwick Shire Planning Scheme. The Warwick ICM Reference Group agreed that the priority issues to be investigated in terms of how they may be addressed in the planning scheme included:

- providing for a healthy stream and riverine ecosystem;
- improving the water quality in watercourses in the upper catchment;
- enhancing the physical and biological values of the riparian zone, flood plains and watercourses;
- improving the biodiversity of riparian and flood plain fauna and flora; and
- integrating flood mitigation controls (Lusis 1999a).

The health of the Condamine River catchment is vital to the downstream health of the Murray-Darling Basin. The ecological report identified the following pressures upon the Condamine River:

- flood plain development;
- requests for increases in water extraction;
- poor management of stock access to watercourses; and
- stormwater run-off from urban areas and intensive husbandry sites (Lusis 1999a).

The State of the Rivers for the upper Condamine Catchment concluded that the overall condition of the river was good along 13%, moderate along 43%, poor along 41%, and very poor along 3% of the River. Initiatives to address the pressures include a water allocation management plan (using a whole of catchment approach), and Warwick Shire Council's environment management plan for waste (including water, oil, packaging and refuse) (Lusis 1999a).

The Condamine Catchment Management Association, is responsible for overseeing the implementation of its management strategy which was endorsed by the Catchment Management Coordinating Committee and DNR in 1997. The Committee has been involved in the recognition of issues and the coordination of technical support so it can help regional organisations achieve long-term management solutions. Its achievements include:

- implementing the priority actions of the Condamine Catchment Strategic Plan during 1998;
- publishing and promoting the Riparian Zone Management Manual for application throughout the catchment;

- initiating 10 soil conservation projects with the support of four local government authorities; and
- being closely associated with landcare groups based in Allora (which are addressing issues in Dalrymple Creek), and Glengallan and Rosenthall (which combine to address issues across the shire) (Lusis 1999e).

By the end of 1999, CCMA will have completed a comprehensive review of the Condamine Catchment Strategic Plan. It will also be working with local communities to develop sub-catchment action plans. The focus of the CCMA consultation is to encourage the community to write the action plans by considering local soil, water vegetation and fauna issues. It is anticipated that more than 30 sub-catchment action plans will have been prepared in the Condamine Catchment by October (Lusis 1999e).

The reference group has integrated catchment management into the planning scheme. Warwick Shire Council was one of the first Shires in Queensland to prepare a planning scheme under the Integrated Planning Act (IPA) of 1997. Therefore the planning provisions suggested in the planning scheme reflect the system of planning and management established under the IPA. One of the purposes of the IPA is to promote ecological sustainability by seeking to balance and integrate the protection of ecological processes and natural systems, and economic development and the maintenance of the cultural, economic, physical and social well being of people and communities. Similarly the Council has addressed ecological sustainability, economic development, shire image and cultural heritage, and community and physical infrastructure in the scheme (Lusis 1999e). Five ICM-related desired environmental outcomes were developed each with performance indicators and measures to achieve the required outcome. These planning provisions provided the foundation for one of the four parts of the new Warwick Shire Council Planning Scheme (Lusis 1999a). In 1999, Warwick Shire Council embarked on an extensive consultation program for the new Warwick Shire Planning Scheme with the local stakeholder groups (Lusis 1999e).

Noosa River Catchment Case Study

The Noosa River ICM Reference Group aimed to incorporate planning solutions for the management of riparian lands into the Noosa Shire Planning scheme. The ecological report prepared as part of the project found that the pressures on the riparian lands were attributed to increasing residential, industrial and agricultural activities in the shire as well as poor development practices. This has facilitated increasing sediment, nutrient and pesticide levels via stormwater run-off, as well as ongoing clearing of riparian vegetation, drainage of wetlands and building on flood plains (Lusis 1999a).

The planning report provided a range of complementary statutory and voluntary measures that could be used to address new development within the riparian lands of the Shire. From a planning perspective the approach provides flexibility for Council by setting both general and specific objectives in place within the Noosa Strategic Plan and Planning Scheme (Lusis 1999a).

The planning report influenced the development of Councils strategic plan. Following extensive government industry, and community consultation, Noosa Shire Council completed its strategic plan for the shire in 1997. The strategic plan has a life to 2005 and has three broad levels: strategic vision, strategic aims and implementation provisions by locality. It is also guided by four overarching principles: character and lifestyle, environment, economic principles and social principles (Lusis 1999d)

Noosa Shire Council will review its vegetation management local laws in 1999. The new provisions are anticipated to apply over the whole shire; currently local laws apply only to the coastal area, rural towns and a number of individual properties. Community consultation is preceding the preparation of the new system. The council has credited the case study as being instrumental in determining the suitable measures for assessing tree removal proposals in riparian locations (Lusis 1999d).

Noosa Shire Council has developed two maps to assist the community in identifying the riparian areas of the shire. The first map identifies the riparian areas of the Noosa River catchment and the following ecological characteristics:

- areas immediately alongside the river, creek and stream banks;
- areas surrounding the four lakes;
- wetlands linked to the river system; and
- vegetation communities which have clear links to the river system (Lusis 1999d).

The riparian areas in the first map are modified in the second map to illustrate how the planning scheme would be implemented. The following sites are excluded from the second map.

- areas where management is controlled by state agencies;
- areas where the effect of any new controls would be limited; and
- small and isolated areas (Lusis 1999d).

This approach has allowed the Council to focus on a workable range of issues that need to be addressed, identify the most appropriate statutory or voluntary measure to use to address each issue and set in place general and specific objectives to address each issue (Lusis 1999d).

The Noosa Shire is currently in the process of amending its planning scheme to become consistent with new provisions of the Integrated Planning Act. As these changes are completed, the council will commence consultation on likely policy changes to scheme provisions that affect land sues and earthworks in riparian areas. The council has used the case-study process and the planning report as the source on how the planning scheme can be used to address issues of riparian and land management (Lusis 1999d).

Noosa Shire Council commenced Stakeholder meetings in March 1999, prior to the public review in mid 1999. The case study successfully explored the mechanisms available to the catchment committee and Noosa Council for addressing catchment issues through the planning process (Lusis 1999d).

Herbert River Catchment Case Study

The Hinchinbrook Shire ICM Reference Group sought to incorporate elements of the management of wetlands, riparian lands and drainage systems into the Hinchinbrook Shire Planning scheme (Lusis 1999a). The reference group agreed that successful land use planning is a marriage between the conservation of locally important natural resources and the sustainable cane growing for the local economy (Lusis 1999a).

The ecological report found that the shire is rich in natural fauna, but that many of the species are under pressure attributed to a range of human activities and natural phenomena. Findings included:

- 56 species of native animals, 13 of high conservation interest
- 47 resident species of water birds, and 17 species of migratory birds, 24 under some level of threat
- 43 species of fish in the fish habitat areas, but declining diversity further up the flood plain (Lusis 1999a).

The planning report provided a series of amendments to the Hinchinbrook Shire Strategic Plan and Planning Scheme. The effect of the amendments will mean that where a landowner intends to use land for intensive agriculture and where part or all of the land suitable for cane growing is considered Class 4 or 5, contains a known wetland, fish habitat or abuts a fish habitat, is in an active coastal area, is below 3m AHD, is a Wet Tropics area, or a known mahogany glider habitat, then a town planning impact assessment application and approval is required from the Hinchinbrook Shire Council (Lusis 1999a).

The Hinchinbrook Community endorsed these planning scheme amendments in January 1999 (Lusis 1999a).

2.3 Brisbane Waterways Management Plan

While catchment management planning has been applied in many rural contexts in Queensland, there are few examples of catchment plans for urban environments. The Brisbane River and Moreton Bay Water Management Plan is the first Queensland example of an integrated catchment plan focussing predominantly on urban land uses. The 1998 Brisbane Waterways Management Plan presents an integrated framework for the management of the environmental, social, cultural and economic aspects of the waterways of the Brisbane River and Moreton Bay Catchment. Spatially, the Waterways Management Plan encompasses the Brisbane, Bremer, Pine, Caboolture, Logan, Albert, and Stanley Rivers and Warrill, Tingalpa and Lockyer Creeks, as well as the other creeks and ground waters that flow into these three rivers and Moreton Bay (Brisbane River Management Group 1998).

In the development of the Waterways Management Plan the Brisbane River Management Group (BRMG) worked closely with the Brisbane River and Moreton Bay Wastewater Management Study (BRMBWMS). The BRMBWMS was initiated in 1994 to produce a water quality management strategy for the Moreton Bay waterways including the tidal sections of the Brisbane, Bremer, Pine and Caboolture Rivers and associated creeks (Brisbane River Management Group 1998). The Waterways Management Plan is a joint publication of the two groups (Brisbane River Management Group 1998).

The Waterways Management Plan takes a regional approach to catchment management. It is linked to several priority actions of the 1998 SEQ2001 Regional Framework for Growth Management and it provides a model approach for waterways management and water quality performance criteria for south east Queensland. It is also linked to a range of regional or geographically based programs and projects undertaken by State and local government and other agencies which will influence waterways planning and management in the Brisbane River and Moreton Bay Catchment (Brisbane River Management Group 1998). Examples include:

- environmental and land use planning for the Port of Brisbane;
- the Brisbane Gateway Ports Area Strategy;
- the Regional Coastal Management Plan for South East Queensland Maroochy Shire to Gold Coast City);
- the Moreton Bay Marine Park Zoning Plan;
- the Queensland Fisheries Management Authority's management planning in Moreton Bay; and
- the natural Resource Management Strategy for South East Queensland (Brisbane River Management Group 1998).

The management strategies and actions developed in the Waterways Management Plan relate to four major outcome areas, namely water quality and ecological health, livelihoods and resources, waterways celebration, and livability and lifestyle (Brisbane River Management Group 1998). To achieve these outcomes, the plan identifies specific actions for developing coordinated waterways management, stakeholder consultation, communication and education (Brisbane River Management Group 1998).

The Waterways Management Plan also acknowledges that coordination with local and regional planning activities is essential to achieve catchment management objectives. At the planning level in South East Queensland, five layers of planning need to be linked for effective catchment management. These include:

- *1998 Regional Framework for Growth Management;*
- *Regional Management Plans*: for example the 1998 Waterways Management Plan, Regional Coastal Management Plan;

- *Specific Topic/Outcome Plans*: strategies and actions to deal with important outcome areas ie: Moreton Bay Catchment 1998 Water Quality Management Strategy and Implementation Program Plans;
- *Local Catchment Council Plans*: local strategies and actions for specific local government areas or catchments; and
- *Local Area/Site Plans*: specific detailed plans or actions that refer to a single location such as facility upgrade plans, or plans for improving a riverside park (Brisbane River Management Group 1998).

Formal linkage between the Waterways Management Plan and local government planning has already been established through the Brisbane City Council "City Plan". The City Plan is the new IPA planning scheme for Brisbane and is currently undergoing an extensive phase of public consultation. Council clearly makes a strong commitment to achieving catchment management principles and objectives in the City plan through:

- The *Vision*;
- *Desired Environmental Outcomes, performance indicators and strategies* for natural environment and waterways and the green space system;
- *General assessment processes* for greenspace areas including conservation, parkland, sport and recreation, environmental protection and rural areas;
- *Planning Scheme Policies* for acid sulfate soils, environmental impact assessment, management of urban stormwater quality, and natural assets;
- *Codes and related provisions* for acid sulfate soils, biodiversity, greenspace, outdoor sport and recreation, parks, stormwater management, waste water management, waterways, and wetlands; and
- *Local Planning Policies.*

3. Integrated Catchment Management and Local Government Planning in the Herbert

The Herbert River Catchment drains an area of approximately 1,0000km^2 to the Coral Sea and is the largest of the river systems located in Australia's sub-humid to humid tropical north-east (Refer Map 1). With its source 8km north-east Herberton, (1070m asl) the Herbert River winds 340km to its mouth, 7km north of Halifax (Herbert River Catchment Coordinating Committee 1996). Topographically, the catchment can be divided into three distinct sections. The upper catchment, (the Tablelands) is approximately 6,000km^2 and is bounded to the north and west by the Great Dividing Range and to the east by the Cardwell Range. In the intermediate catchment, (the central ranges, approximately 1,000km^2) below Gleneagle (179km downstream) the River changes direction and flows south-east for 70 km through a deep gorge before entering the lower catchment. The lower catchment, or coastal lowlands (3,000km^2) is bounded on the north by the Cardwell Range and on the south by the Seaview Range (Johnson and Murray 1997). The Lower catchment contains the Floodplain and delta of the Herbert River and is characterised by reworked alluvial soils. The floodplain consists of flat and relatively low lying terrain which is subject to regular inundation from flooding (Herbert River Catchment Coordinating Committee 1996). The Herbert River Delta is a major feature of the Queensland coast (Johnson and Murray 1997). The alluvial floodplain of the Herbert River, is one of the most intensively cultivated districts in the state, being a highly significant sugar-producing region that produces approximately 20% of Australia's sugar. It has a set of chronic but not acute resource management issues, most important being those associated with water management, flooding, drainage, river system quality as well as nature conservation for remnant terrestrial habitat and wetlands (McDonald and Bellamy 1997). The administrative boundary of the Hinchinbrook Shire Council is also contained within the lower section of the catchment.

Mahogany Glider Habitat, mangroves, wetlands, riparian lands and other important habitat areas of the Herbert River Catchment are of national and local significance. However the distribution of such environmental resources has been dramatically reduced since European Settlement. Conservation of many important environmental resources has been ineffective in the past owing to fragmented management arrangements, a failure to address environmental issues in the rural land development process and limited ability to control harmful land management practices. The greatest threats to these areas at present are associated with the rapid expansion of the sugar industry.

Until relatively recently this expansion was not managed adequately and consequently one of the key challenges facing the Herbert catchment was to regulate the further expansion of the Sugar Industry and incorporate environmental objectives into the rural land development process. Other issues that had hindered the management and conservation of these important areas in the past included the poor coordination of institutional arrangements poor information and knowledge about environmental issues and possible solutions and limited political will to take a stand against inappropriate rural development. Freehold land rights issues have also been a significant barrier preventing the regulation of rural land for environmental purposes. Traditionally there has been far less control over rural land use and management and statutory land use controls tend to be regarded by farmers as an infringement of their property rights. Additionally, as local governments are held accountable by way of election, the extent to which local governments are prepared to intervene in development activity (ie: by imposing statutory controls on land use) are guided by the willingness of the community to support that intervention. The extent of intervention is also the subject of many debates between planners, economists and politicians (Vella 1997). Consequently the major focus in the past in the Herbert catchment has been on river management issues, especially issues relating to flooding and drainage associated with the major river systems. Solutions have generally been seen to be engineering works for example, works to mitigate flooding and drainage issues rather than private land use controls and land management strategies (McDonald and Bellamy 1997).

Given these environmental and social issues, recent progress in the Herbert River basin, administered by two local governments, Hinchinbrook and Herberton Shires, provides a good case study of the evolution of the role of local government in natural resources management.

3.1 Catchment Management in the Herbert

ICM commenced in the Herbert Catchment in March 1993 with the establishment of the Herbert River Catchment Coordinating Committee (HRCCC) on a voluntary basis by local community interests. The impetus for its formation was the recognised need for better community participation in decision-making relating to river management issues. The HRCCC's stated objectives are to:

- coordinate government agencies and the community to pursue common goals;
- seek community involvement in catchment management;
- identify and rectify natural resource degradation;
- promote ways to prevent and reduce natural resource degradation;
- promote the wise use of all natural resources within the Catchment;
- identify key indicators of biodiversity and monitor as a measure of catchment health;
- encourage the retention of significant natural habitats within the Catchment (Hinchinbrook Shire Council 1997).

The HRCCC activities since formation have primarily focussed around:

(i) single-issue activities to get 'runs on the board' rather than issues of strategic importance (eg., promotion of owl boxes for pest control);
(ii) being a referral agency for proposed projects and other catchment activities by state and local government (eg., SIIP proposal, Hinchinbrook Shire Planning Scheme);
(iii) the formulation of a draft Herbert River Catchment Management Plan for public review and comment;
(iv) brokering funding for others to undertake natural resource management activities in the catchment (eg., for recent round of NHT funding) (McDonald and Bellamy 1997).

In 1996 a Draft Catchment Management Strategy was produced for the Herbert River.

3.2 Local Government in the Herbert River Catchment

Several local government areas have boundaries that overlap with the Herbert River Catchment. Hinchinbrook Shire Council is the only local government area that is completely within the Herbert River Catchment. The boundary of the Hinchinbrook Shire roughly corresponds with the alluvial floodplain of the Herbert River. The upper part of the catchment forms part of the Herberton Shire Council. Other Shire Councils with control over small sections of land include the Thuringowa Shire in the southern part of the catchment, and the Johnson Shire in the upper part of the catchment.

The Hinchinbrook Shire Council (HSC) has been involved in resource development of since its foundation in 1933 in many and various ways. The HSC is a partner in the Drainage Board gazetted in 1977, in a number of voluntary boards for sub-catchments and of the Herbert River Information Centre, which was established in 1996.

1984 Town Planning Scheme

The first planning scheme in Hinchinbrook Shire was gazetted in 1984. The 1984 Scheme did not include a strategic plan (Sinclair Knight Merz 1998) and its spatial extent was roughly aligned to the urban township of Ingham. Consequently the 1984 plan provided the Council little opportunity to facilitate natural resource management through planning mechanisms.

1997 Town Planning Scheme

In 1996 the Hinchinbrook Shire Council resolved to prepare a new planning scheme. Planning Consultants were appointed to the task and a draft scheme was made available for public consultation at the end of 1996. The Scheme was gazetted in 1997. The spatial extent of the new scheme was extended to encompass the entire Hinchinbrook Shire Council area, thereby providing Council with the ability to control development across the whole shire for the first time. This also provided Council with the ability to control natural resource management and rural development. The intention of the planning scheme was to provide Council with greater control over rural development. This was to be achieved through the Strategic Plan, regulation of agricultural uses and wetland conservation (McDonald and Bellamy 1997). The 1997 scheme facilitated greater management of freehold land for nature conservation purposes.

Council clearly made a strong commitment to natural resource management in the 1997 Town Plan. This is demonstrated through the Broad Aim of the Strategic Plan which seeks "To provide a framework to facilitate the continuing use and development of the Shire's resources according to sound environmental and catchment management practices, and, to promote the diversification of the Shire's economic base, for the long-term benefit of the community" (Hinchinbrook Shire Council 1997). The overall thrust of the Strategic Plan, as reflected in the broad aim and the broad strategies, was to promote environmentally and economically sustainable development for the long-term benefit of the community and successive generations (Hinchinbrook Shire Council 1997; McDonald and Bellamy 1997).

In addition, Council's obligation to catchment management was also established in the scheme through three broad Integrated Catchment Management objectives. The first was "to identify and designate the catchments and sub catchments of the Herbert River which lie wholly or partly within the Shire' (Hinchinbrook Shire Council 1997). This was to be implemented through the assessment of planning and development proposals on the basis of the catchment system and potential impacts of development upon the natural resource of that system. Catchment management strategies and specific catchment data are to be "taken into account" in the assessment of any planning proposal (McDonald and Bellamy 1997).

Objective two was "to ensure that, as a result of the development and use of land no environmental impacts affect any lands elsewhere within a catchment designated in this Strategic Plan" (Hinchinbrook Shire Council 1997). This will be implemented by a commitment of having "regard for and shall implement the principles of ICM" and the "may refuse to support any proposal which will generate unacceptable effects upon any land...", and "may require the preparation of an EIA" where detrimental downstream effects or impacts are possible" (McDonald and Bellamy 1997).

The third Objective was "to promote sensitive and sustainable land use practices through the development process" (Hinchinbrook Shire Council 1997). This will be implemented by requiring and encouraging "all development and land uses... to adopt sound management practices so as to minimise, mitigate and contain the impacts on the land, water and biological resources of the catchment system". Additionally "the Council may refuse to support any proposal which would prejudice the long-term values of the resources within the catchment system affected" (McDonald and Bellamy 1997).

Zoning controls and development assessment

The 1997 Shire Council has adopted a simple zoning scheme which divides the local authority into five zones these being Public Purposes, Rural, Town, Village, Special Activities (Hinchinbrook Shire Council 1997). The planning scheme does not include any zone with the primary intent being to conserve natural resources. This limits the scheme's ability to protect core wetland areas.

Regulation of agricultural uses
The draft-planning scheme has sought to regulate agriculture to achieve Integrated Catchment Management objectives. The regulation of agriculture has been achieved by defining 'agriculture' and 'intensive agriculture' as separate land uses requiring different approval processes.

'Agriculture' is defined in the scheme as:

> *"the use of land, and buildings on the land, for the purposes of producing primary products from cropping, grazing or stock, and horticulture including the use of the land for an ancillary activity necessary for the conduct of the principal use."*

Intensive' Agriculture' is defined in the scheme as:

> *The use of land for the intensive production of crops, such as but not limited to sugarcane, at rates of production beyond the natural capability of the land where the land is irrigated for such purposes and relies upon the regular and systematic application of fertilisers and other chemicals.*
>
> *The term includes the establishment of any infrastructure necessary for the conduct of the use. The term does not include small-scale agriculture conducted on premises or a site less than 5 hectares in area ".*

McDonald and Bellamy (1997) write that the separation of the two rural uses could create confusion unless unambiguously defined (McDonald and Bellamy 1997).

Designated Uses Requiring Approval
Agriculture is a "permitted development" in the rural zone. As a result, the land can be used for agriculture (as defined) and for small-scale agriculture conducted on premises or a site less than five hectares in area (as defined for Intensive Agriculture) without needing to apply to Council for approval. This impacts on wetland conservation as sites of less than five hectares can possess wetland values that are worthy of conservation and in the case of small wetland habitats, can have an important role in the hydrological regime of the Herbert River Floodplain. However Council will have no control over the development of these sites. Clearly very small areas should not require regulation, but setting the minimum threshold too high could allow many significant developments to go unregulated (McDonald and Bellamy 1997).

In the Rural Zone intensive agriculture is defined as a "permitted development subject to conditions". Consequently Council has discretionary power to assess an application for intensive agriculture and apply conditions where necessary (Bates 1995). Council cannot refuse a permitted development subject to conditions. However it does have the power to impose conditions on development to achieve wetland conservation. Development assessment is initiated when the applicant applies to council if they propose to "use the land for the intensive production of crops, such as, but not limited to sugarcane, at rates of production beyond the natural capacity of the land where the land is irrigated for such purposes and relies upon the regular and systematic application of fertilisers and other chemicals. Additionally development assessment is initiated when an applicant seeks to develop infrastructure associated with intensive agriculture. This means that when an applicant wants to convert to sugar cane or establish infrastructure for the growing of sugar cane they need to apply to council for permission However this raises the question of what will be used for the definition of 'infrastructure'. Rural infrastructure differs from urban infrastructure and confusion may be created if this definition is not clear. As it currently stands, the definition could potentially include structures from farm sheds to access roads (even if they are dirt roads) and farm drains.

Neither agriculture nor intensive agriculture required consent application under the planning scheme. Consent applications are different to permitted development applications in the application process and the options available to council in assessing the application. Firstly the proposal needs to be advertised

to give the public the chance to comment on it. The range of issues that need to be considered by Council is greater including: whether the environment would suffer any unacceptable impact caused by the proposal; and if all objections which have been duly lodged within the prescribed time against the granting of consent by the Council. In accordance with the Local Government (Planning and Environment) Act, 1990, Council can grant consent; refuse to grant consent; or grant consent subject to reasonable and relevant conditions. Therefore unlike permitted development applications, Council can refuse to grant consent and therefore if a proposed development poses unacceptable effects on wetlands, it can be refused. Terms for refusal are also established in the scheme and those relevant to wetland conservation include if: flood mitigation, drainage of filling works required within the site would adversely affect surrounding land; the proposal will have an unacceptably long-term effect upon the environment; the proposal would be in conflict with any provisions of the Strategic Plan in effect in respect of the subject land.

Criteria for the approval of regulated uses
The planning scheme does not establish any criteria to facilitate development assessment or establish criteria for the approval of regulated uses. As a result it does not provide guidelines, performance standards or best practice for relevant environmental issues, natural resource protection, water quality and quantity issues. The planning scheme does not specify what changes can be made to drainage and flood regimes. These conditions need to be specified in planning documents in such as way to give clear prior guidance as to desired developments (McDonald and Bellamy 1997).

Assessment of development applications against criteria
When determining conditions for intensive agriculture the planning scheme states that Council is to consider the character of the proposed development in relation to: the character of development on the adjoining land and in the locality; the adequacy of any proposed landscaping; the retention of existing vegetation and buffers to adjoining land and roads; the provision for storage and disposal of waste; the provisions of the planning scheme including the strategic plan and any Local Planning Policy of the Council, relevant to the application. However because no criteria has been established the scheme just identifies general considerations.

The planning scheme had the potential to achieve the effective conservation of wetland resources, yet in reality this was not facilitated by the words of the scheme. Council's strong commitment to ICM and radical regulation of agricultural development is to be commended. However, it did not take the next step and develop the details needed to make the plan implementable (McDonald and Bellamy 1997). The scheme did not include performance conditions or development criteria to assist development assessors achieve wetland conservation, yet it is particularly important that these tools are included in planning scheme, especially for Shires such as Hinchinbrook, where there is no professional planner on staff. Therefore it is imperative that the implementation framework reflects best practice and considers obstacles such as the capability of the Local Government (McDonald and Bellamy 1997).

Submissions to the Scheme
As previously mentioned, a draft scheme was made available for public consultation at the end of 1996. Submissions were received from the Herbert River Catchment Coordinating Committee, Herbert River Canegrowers, the Environmental Protection Agency (Department of Environment at the time) and the Department of Natural Resources. While the submissions generally supported the plan's commitment to ICM they also criticised the scheme for failing to provide criteria to guide the development assessment process and thereby achieve these goals. The submissions also criticised the scheme for not appropriately reflecting the policies, programs and plans of state government departments and local resource management groups in the designation of lands and for failing to bring them on board as referral agents for environmental impact assessment. Other recommendations made through submissions included the use of the geographic data held in the Herbert River Information Centre to

map suitable and unsuitable development areas and the suggestion that greater attention be focused on community consultation and education in the plan preparation process. Summaries of these issues and others raised in the submissions are included in Appendix 1.

3.3 The Linking Process

The Hinchinbrook ICM reference group had 14 members, bringing together a number of community stakeholders. The Group consisted of:

- five representatives from Hinchinbrook Shire Council;
- five representatives from the catchment committee;
- the senior planning officer of the North Queensland Department of Communication, Information, Local Government and Planning
- a CSIR project director
- the NHT project manager
- the ICM project officer.

Through the reference group, stakeholders were forced together to discuss and identify the issues that were of greatest importance to them and their constituents and also to the catchment as a whole. From this, four priority catchment management issues were identified. The project then sought for ways of dealing with these issues through the planning scheme. The four issues included:

- riparian vegetation management on all stream banks;
- addressing the filling of urban land for residential and rural residential development and rural wetlands for intensive agricultural purposes;
- establishing a farm drainage system;
- the need to develop a strategy for the future construction and maintenance of local roads (Lusis 1999c).

The reference group conducted most of its business between march 1997 and June 1998. A final meeting was convened in November 1998 to evaluate the success of the case study (Lusis 1999c).

Initial meetings included workshops to identify what issues could be encompassed into a package of solutions. Possible solutions to address riparian and wetland issues became more apparent although those for managing the drainage system and local road and rail network required further investigation and specialised skills (Lusis 1999c). The Hinchinbrook ICM Reference Group contracted a consultant to prepare, coordinate and complete the ecological and planning reports for all of the issues. The reference group endorsed the report's analysis and recommendations and presented these to the council for review. Hinchinbrook Shire Council approved in principle amendments to the shire planning scheme proposed by the reference group and in December 1998 and January 199 it advertised the proposed changes for public review. The community has endorsed these amendments (Lusis 1999c).

The Ecological Report

The recommendations delivered in the planning report were based on an inventory of pressures, conditions and responses outlined in the ecological report. The solutions developed in the planning report are targeted at these catchment issues. The ecological report found that the Herbert River Catchment contained areas of nationally, regionally and locally significant environmental resources including Wet Tropics World Hertiage areas, Manhogany Glider Habitat and important mangrove and wetland habitat areas. It also found that the integrity of these resources was threatened by natural and human induced environmental pressures, including:

- high rainfall and seasonal flooding;

- exotic flora and fauna species, which flourish in ideal growing and breeding conditions (ie a wet and humid climate and few predators);
- evidence of the expansion of agricultural land use, in contravention of best-practice guidelines;
- Exposure to acid sulfate soils, which may harm native fish species and which is costly to address (Lusis 1999c).

The condition of remaining environmental resources varies widely across the Herbert floodplain and is a direct result of the extent and severity of the pressures experienced. Of particular importance is the Wet Tropics World Heritage Area, located in the Northern extent of the Hinchinbrook Shire, which has the highest level of plant and animal biodiversity in Australia. In some areas this biodiversity extends onto surrounding freehold properties yet the importance of their contribution tends to be understated. Also of importance are the wetlands and mangroves in the catchment, which are of national, regional and local environmental significance (Australian Nature Conservation Agency 1996; Hogan and Graham 1994; Johnson, et al. 1997). In terms of their condition, the distribution of natural vegetation on the floodplain has been dramatically reduced since European settlement. Approximately 35-40% of the natural vegetation of the coastal lowland area has been cleared for crop production or improved pastures (Johnson and Murray 1997). Additionally, the State of the Rivers Report for the Herbert River concluded that the condition of the riparian vegetation was very good to good along 13% of the Herbert River, moderate along 29% and poor to very poor along 58% (Lusis 1999c). The ecological report also included a series of maps, that identified the condition of the wetlands and riparian lands in the Shire as being 'disturbed', 'intact', or 'regrowth'. The Hinchinbrook ICM Reference Group used this information to identify planning solutions to facilitate the protection of 'intact' or 'regrowth' wetland and riparian areas while ensuring the continued expansion of the cane-growing industry.

Several planning and land use management initiatives had been developed in response to current pressures on the environment prior to the linking project. The Catchment Coordinating Committee had responded by producing the Draft Catchment Management Strategy, and with demonstration projects including the development and restoration of wetlands and the establishment of owl nesting boxes. Other land use planning and resource management responses aimed at reducing environmental pressures included the cane land allocation process, and works undertaken by the Herbert River Improvement Trust and Local Water Boards. Despite the existence of such planning and management mechanisms, many of them were not being implemented with a view to minimising pressures on the environment.

1998 Amendments to the Scheme

Although the 1997 scheme was well advanced in its protection of natural resources, the review found that the planning provisions relating to intensive agriculture needed to be strengthened. The suggested changes to the planning scheme also reflected many of the concerns raised by state government, catchment and industry groups in the public consultation phase for the 1997 scheme (refer Appendix 1 for submission summaries). The Scheme amendments included:

- Altering the definition of a rural zone to require land-holders to apply for council approval for intensive agricultural activities under certain circumstances (eg. land designated as fish habitat reserve or mahogany glider habitat.
- Including a definition of intensive agriculture. Intensive agriculture is defined in the scheme as: 'The use of land for intensive production of crops, such as but not limited to sugar cane and horticulture, at rates of production beyond the natural capacity of the land, where the land relies upon the regular and systematic application of fertilisers and other chemicals, and includes the establishment of any infrastructure necessary for the conduct of the use. The definition does not apply to small-scale agriculture conducted on premises or a site less then two hectares in area' (Lusis 1999c)

The Hinchinbrook Shire Strategic Plan was also amended. Amendments included:

- Requiring land-holders, overseen by the council, to maintain conservation values on good quality agricultural land, so as to promote ecologically sustainable primary production; and
- Introducing other provisions to encourage the ecologically sustainable use of natural resources and the protection of environmental systems or features of local conservation value (Lusis 1999c).

The Hinchinbrook Shire Council has also incorporated State Planning Policy 1/92: "Development and the Conservation of Agricultural Land" into the decision-making processes. Consequently agricultural land in the Shire has been classified according to its suitability for agriculture. Land classes 1 to 3 represent land suitable for agriculture with varying limitations, class 4 is marginal land considered unsuitable due to severe limitations and class 5 is considered to be unsuitable due to extreme limitations that preclude its use for agriculture (Hinchinbrook Shire Council 1997). Planning provisions and approval processes now reflect these suitability ratings.

In accordance with the gazettal procedures established under the Integrated Planning Act, the scheme amendments were advertised for 30 business days between November 1998 and January 1999. Council received no submissions and consequently the amendments were gazetted in April of 1999 (Clarke 1999). The council is using its planning scheme to actively apply the ICM principles outlined in the strategic plan. The current planning provisions ensure that future land development or land use changes will be conducted in a sustainable manner (Lusis 1999c). Currently, applications for intensive agriculture trigger a three step assessment process. In step one impact assessment triggers are checked using the geographical data held in the Herbert River Information Centre. In step two, referral coordination triggers are assessed and information requests can be made to the applicant. The final step involves the assessment of the application using either a code assessment or impact assessment procedures. At the time of writing, Council had received 14 code assessment applications since December 1997 and 1 impact assessment application for intensive agriculture since April 1999 (Clarke 1999).

The Herbert River Catchment Management Strategy has been completed and is being reviewed for endorsement by the Queensland Landcare and Catchment Management Council. The strategy will be the framework for the management of the catchment, implemented through objective decision making by the community (Lusis 1999c). The HRCCC's plans include linking with the Hinchinbrook and Herberton shire councils and CANEGROWERS to design best practice drainage systems for new land development, and to promote fish-friendly culvert designs to improve the passage of fish in local creeks (Lusis 1999c).

The Impact of Scheme Amendments

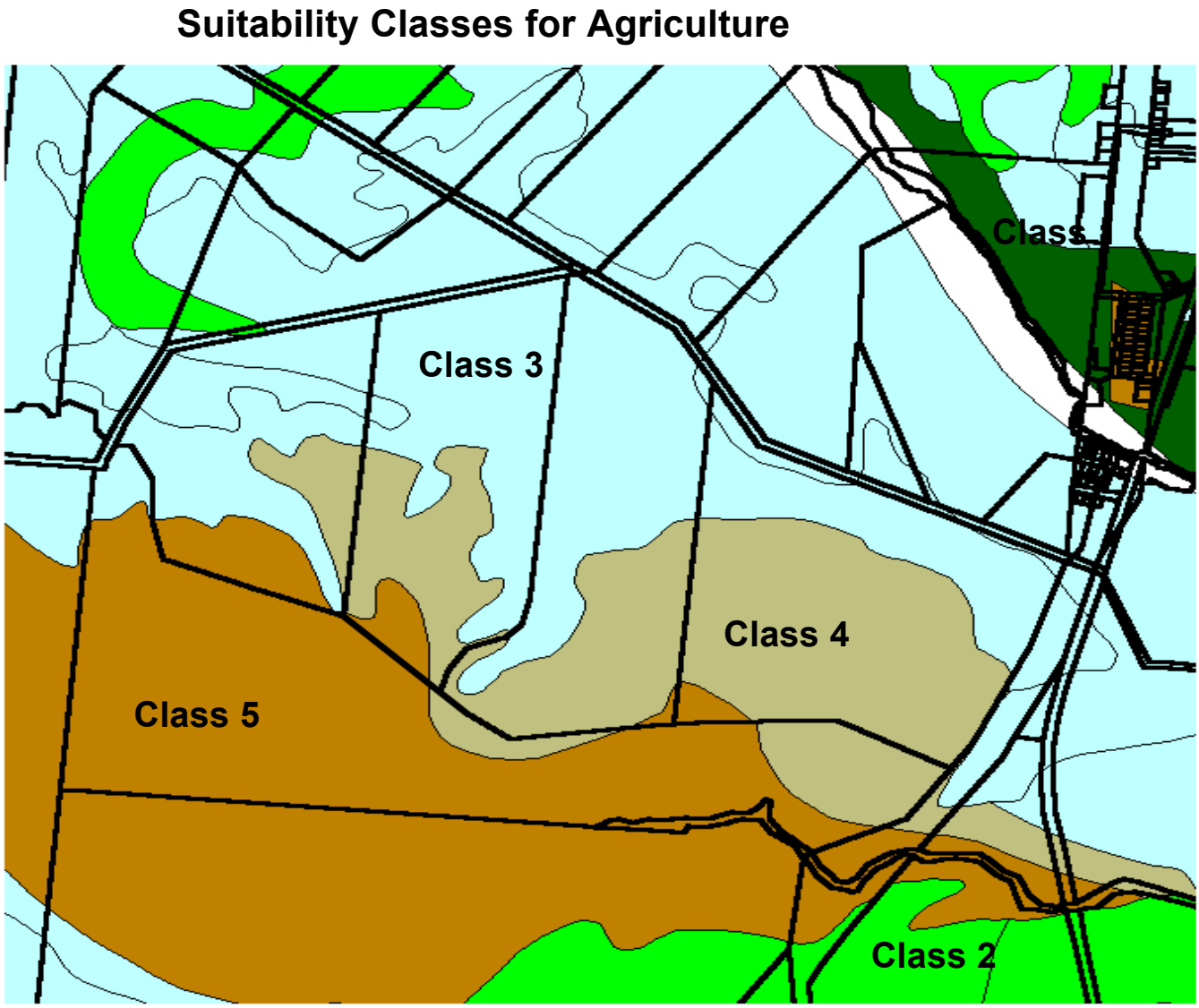
The full impact of the scheme amendments on the development of intensive agriculture in the Shire can be demonstrated using a real development scenario. The development of land for intensive agriculture at Pomona on the Herbert River Floodplain in 1994, 1995 and 1996, prior to the preparation of the 1997 Hinchinbrook Shire Planning Scheme is a particularly relevant example due to environmental issues involved and associated public and media attention. Freehold land at Pomona that had historically been used as a cattle breeding property was subdivided and sold for cane growing purposes (Fig. 2). This land contained known Mahogany Glider habitat, locally significant wetlands and riparian vegetation and environmental issues such as acid sulfate soils (Figs 3 and 4). In Interim Conservation Order was issued on the 25th March 1995 by the Environmental Protection Agency under the Nature Conservation Act. The Hinchinbrook Shire Council had no authority to prevent or condition this land use change given the limited nature of the scheme at the time and its application to the urban parts of the Shire only. Despite the Interim Conservation Order and advice that the land was unsuitable for sugar cane owing to environmental issues, the land was converted to intensive

agriculture. The outcomes of the Pomona land development were instrumental in facilitating the 1996 planning scheme review.

If the current Hinchinbrook Shire Planning Scheme was in place when Pomona was subdivided and developed Council would have had a role in assessing and deciding the application and it is hoped that the outcome would have been different. Under the current scheme the development of Pomona would require council approval, the application being triggered by changing the use of the land from 'agriculture' (cattle breeding) to 'intensive agriculture' (sugar cane growing). Further to this, the subdivision would have also required impact assessment procedures given that the land contains class 4 and 5 soils, a known wetland (identified in Fig 11 of the planning study) and a conservation/interim conservation Order. Referral co-ordination would also be required as the site contained prescribed lands (wetlands). This would have enabled the full impact of the development to be considered by Council and all relevant referral agencies prior to the issue of a decision.

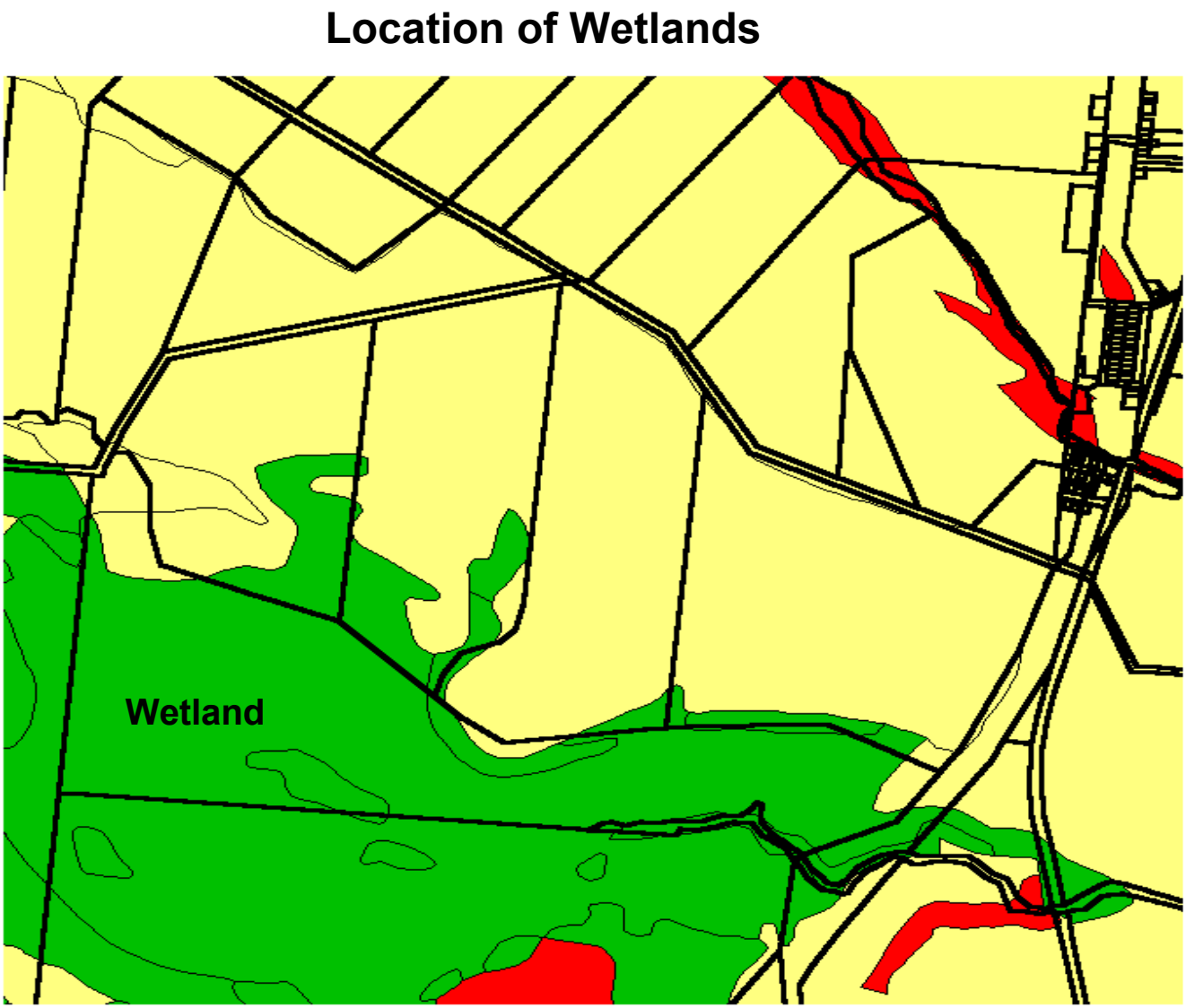
Figure 2: Pomona Subdivision
Source: (Clarke 1999)

Figure 3. Suitability Classes for Agriculture



Source: (Clarke 1999)

Figure 4. Location of Wetlands



Source: (Clarke 1999)

Given that future expansion of the cane industry is forecast for the shire and that in some instances expansion areas may impact adversely on environmental values, it is possible that there will be the refusal of some applications for intensive agriculture.

3.4 Agricultural Planning Process

In addition to achieving the implementation of specific land use strategies to achieve ICM objectives, the process of linking planning schemes and catchment management plans has also improved communication between local government, state government agencies and stakeholder groups within the catchment. It is now leading to the coordination of other separate administrative and organisational processes including the agricultural property development process in the Hinchinbrook Shire.

Work has been undertaken on the agricultural property development process which is a streamlined process led by the Hinchinbrook Shire Council and involving the Department of Natural Resources, the Department of Environment and the Local Sugar Board. (See Fig. 5). The purpose of this integration is to provide landowners with information on planning for a material change of use under IPA, and also to assist cane growers in planning for further assignment or roaming. It relates to the process of preparing property development plans required by both Council under the planning scheme and Local Boards for new cane land allocations. It also establishes a referral process to all relevant agencies at the local level including the Catchment Management Committee (Queensland Department of Natural Resources 1998).

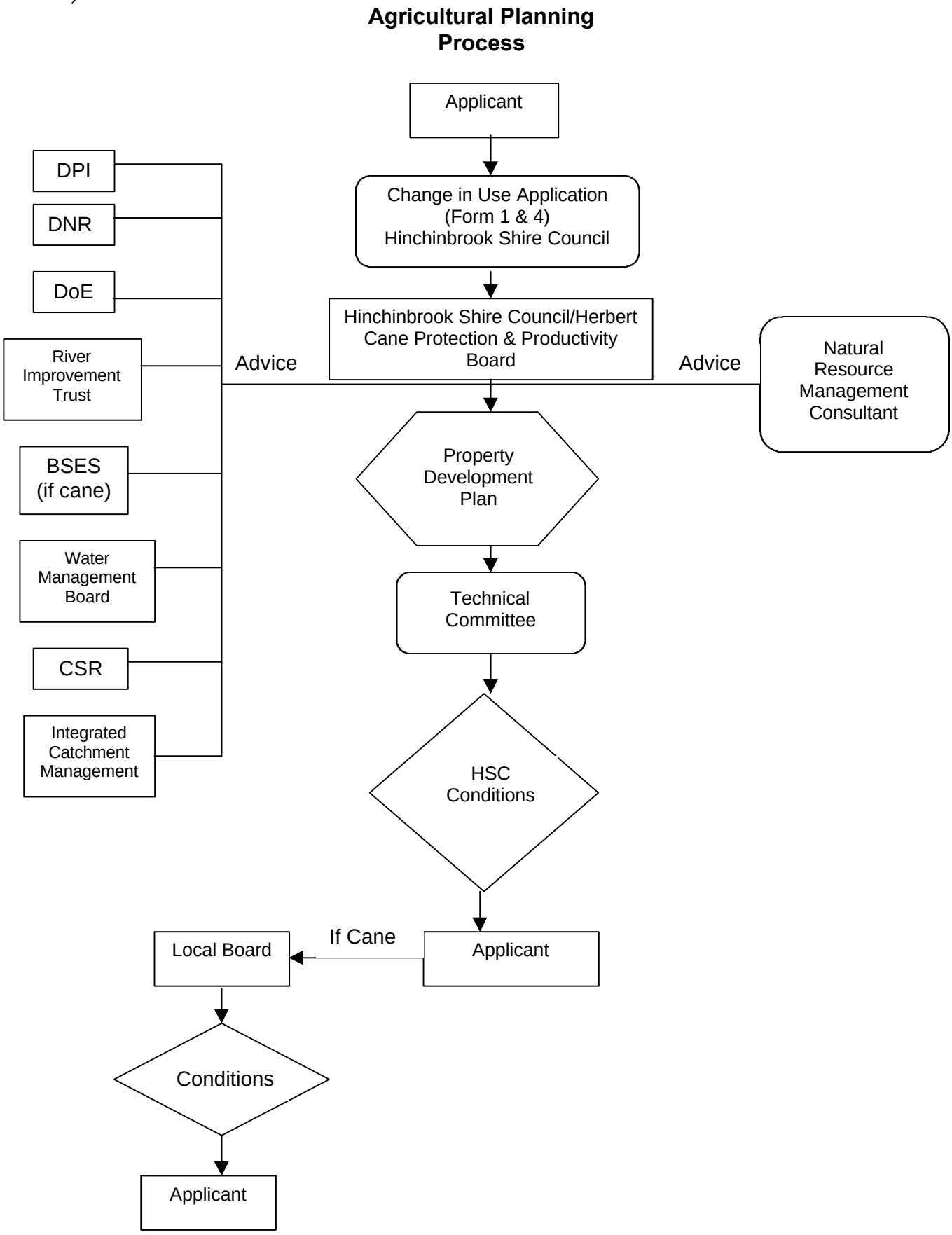
4. ICM Influence on Local Government

Integrated catchment management has had a substantial influence on local government in a relatively short period of time. Some of these changes include an improved awareness of ICM, better coordination between authorities in extending the reach of town planning to achieve ICM strategies as well as the actual implementation of ICM in local planning schemes. Positive benefits also include improved communication between local government and previously unconnected stakeholder groups to provide a wider range of perspectives on resource management issues.

The linking project facilitated many of these changes in four rural catchments in Queensland. The local governments in these catchments have responded by expanding their role in land use planning and management of natural systems. Traditionally local governments have had a limited role in planning in rural areas and in the management of natural resources generally (McDonald and Bellamy 1997). This newly expanded role reflects the increasing demands from the community that environmental concerns and aspirations be acknowledged by land management authorities (Bates 1995). The implication this has for planning is that for the first time local authorities are managing agricultural activities and as a result desirable ecological outcomes can become part of the rural development process. The implication this has for integrated catchment management is that local authorities are regulating land uses to achieve catchment management objectives.

While the linking project has produced improved land planning and management it has only achieved this for a single local authority rather than all local governments within a watershed. In the Herbert River example, the project outcomes have had no influence on the upper catchment to date. The upper catchment is significantly behind the lower catchment in terms of the understanding of planning and ICM issues, open communication between stakeholder groups and level of commitment to resource management. A new catchment management group is forming in the upper catchment. The planning scheme for the Herberton Shire Council is up for review in the year 2000. While there is no doubt that similar results could be achieved in the upper catchment, the results of the lower catchment certainly had the advantage of project faciliators, funding and an extensive geographical information base to prepare the ecological issues report and planning solutions. Without this assistance, achieving such planning and resource management objectives will pose even greater challenges for rural shires, many of which do not have full time planning staff.

Figure 5. Agricultural Planning Process for Hinchinbrook Shire 1998 (Adapted from DNR 1998)



Therefore the expanded role of local governments into planning for catchment management has many challenges for planners. It introduces a whole new set of technical and political dimensions to their work for which they may have little training, no experience and can not call on well-developed precedents to guide the way. It will therefore be a significant learning period for councils, their staff and advisers (McDonald and Bellamy 1997). The underlining planning process will have some similarities with conventional urban based planning in terms of land use control and setting of performance standards and managing the development approval process. The differences will be partly technical in dealing more with ecological and land resources issues but also more complex in that the planning and management will need to be more site and local landscape specific than normally applies to urban planning matters (McDonald and Bellamy 1997). There are serious obstacles too, not the least of which is the potential for councils to be in conflict with land owners over loss of use rights, injurious affectation and potentially the need for compensation. Some of the suggested processes lead councils into unexplored territory, for example the reliance on Property Management Plans and the application of EIA to small land development proposals (McDonald and Bellamy 1997).

5. Local Government Influence on ICM

The amalgamation of catchment management principles and local government planning schemes is particularly important for the achievement of natural resource management in Queensland. It is especially important given that integrated catchment management in Queensland fits into the spectrum of resource use and management models at the policy level. This lack of institutional support for ICM has been a significant barrier to the effective implementation of sustainable catchment management strategies in the past. As one author writes "..the catchment is rarely recognised as the basic unit of management and there are very few examples of truly integrated management of catchment resources in Australia" (Allan and Lovett 1997). As a result, the linkage between catchment management and planning schemes is one step closer to achieving integrated catchment management.

However local government land use planning is not the answer by itself. While it does have enormous scope in achieving catchment management objectives, it is limited by the fact that it can only implement these strategies when a development application is triggered by the planning scheme. The regulation of new developments through the planning process will not effectively deal with existing resource management problems because planning controls have little power to control existing unsustainable land uses or minor variations in those uses. Therefore to effectively achieve integrated catchment management planning schemes and development assessment may need to be integrated with other forms of institutional arrangements to deal with existing use rights.

It is also suggested that further work is required to rationalise the complex and often confusing array of Acts, programs, and policies that impact on resource management at the local, watershed, state and national levels. Examples of were this could occur through legislation at a State level include the River Improvement Trust Act, Water Resources Act, Nature Conservation Act, Environmental Protection Act and the Land Act. Further to this, ICM principles should be incorporated into these arrangements using a systems perspective.

Additionally, the link between local government and land use planning is also not able to solve many of the "bad practices" of resource management agencies with respect to environmental management. In some catchments these "bad practices" are not only preventing the amelioration of environmental issues, but they are in fact a major cause of the problem. Examples include the continued use of major rock wall infrastructures as solutions to flooding and drainage issues and failure of rural land development boards to address environmental issues when issuing rural development permits.

6. Conclusions

Since the inception of integrated catchment management (ICM) in Queensland implementation has been hindered by the inability of catchment management groups to influence land use planning and management. Traditionally ICM principles and catchment management issues have not been incorporated into or addressed by local planning schemes. Fortunately this is changing as partnerships between catchment management groups and local governments are forming and local governments are taking greater responsibility for the implementation of ICM principles and strategies. These partnerships are the result of improved communication between catchment committees and local governments, a better understanding of the principles and objectives of ICM within local government and because of an improved recognition of the role of local government in the management of natural resources. Considerable advances in environmental protection have been made in those shires that have sought to incorporate ICM principles into planning schemes. However Local government land use planning is not the answer by itself. While it does have enormous scope in achieving catchment management objectives, it is limited in that it can only implement these strategies when a development application is triggered by the planning scheme. Therefore to effectively achieve integrated catchment management, planning schemes and development assessment will need to be integrated with other land management arrangements that can deal more effectively with existing unsustainable use rights.

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Appendix 1: Summary of the submissions made to the 1997 Hinchinbrook Shire Council Draft Planning Scheme (Source: Interviews conducted with agency representatives December 1996 by K. Vella)

Theme	HRCCC	Canegrowers	DNR	EPA
Commitment and Policy Framework	Planning study failed to recognise the developing catchment management strategy[1]	Activity in connection with sugar cane growing also comes within the scope of industry self regulation.	The broad aim states environmental and economic considerations in a disintegrated rather than integrated manner as proposed by ESD	Plan does not adequately reflect the principles of ESD as described in the national strategy
	Recommends the use of referral agencies for PMP and early discussion of this initiative with relevant agencies to avoid duplication in implementation		The ICM Study should be incorporated into the planning scheme	Plan dids not recognised the legislative responsibilities of other agencies.
			Plan does not recognise State Planning Policies and planning guidelines that seek to protect Good Quality Agricultural Land	No recognition given to many important values[3].
			Environmental and economic costs and benefits of land management are not accurately reflected with respect to ESD	
			Objectives should commit to the sustainable use of natural resources	
Planning	Approves the need to assess development applications on a catchment basis but points out the need to consider cumulative impacts	Need for unsealed roads to be sealed in rapidly expanding cane areas and to improve other public infrastructure to reduce impact on shire roads.	Areas should be designated for rural land using state planning policies and land suitability guidelines.	No link between the plan and planning study
	Would like to see council as influencing future expansion rather than acting as a processing agency for development applications.	Require a flexible width of riparian zones, suggests a 10 metre zone and states unwillingness to support wildlife corridors and stream bank stability zones beyond 10m.	Intensive agriculture areas should not include areas with environmental constraints	Clearing of land must require Council consent
	Would like council to consider cumulative impacts in development assessment		A preferred sequence of development plan and map should be prepared for the town and village areas and for areas that impact on rural lands	Plan frequently uses terminology that is too flexible and open to interpretation particularly in an appeal situation

Theme	HRCCC	Canegrowers	DNR	EPA
Planning (con't)	How will council assess the potential for adverse environmental impacts? Intensive rural industry is not defined in document		Areas with significant conservation values and not protected as a National Park should be so designated on the strategic plan map	Attempts to incorporate ICM however the sections that detail how these will be implemented fall short on delivering on the aims. No reference made to the ICM committee or strategy, the River Improvement Trust or the Herbert River Management Plan.
	Encourages proposals to use PMP and suggest guidelines for the use of PMPs.		The plan should provide for the role of other state departments in determining environmental impact.	Rural zone is large and extends onto wetland areas. It should reflect the data in the HRIC and suitability should be reassessed.
	Tightening up of scheme provisions from "council may require" to "council will require" to provide more certainty to the public and developers.		The word sustainable needs to be included in the scheme in reference to rural industries	Some constraints to rural development have not been recognised [4].
	Would have liked council to engage in greater community consultation especially on some contentions issues and suggested a series of informative articles in the Newspaper.		All applications adjacent to watercourses should be subject to a 40m buffer on a major water course and 20m on a minor water course.	Not all forests are available for harvesting
	Conservation designation does not include most of the areas identified under the Mahogany Glider Conservation Plan, significant wetlands and other significant remnant habitat areas.		Riparian corridors and conservation areas should be included in a network of open space/conservation	Lack of development control in the villages of Lucinda and Taylors beach, which are surrounded by conservation zones.
				Industrial zone does not recognise the need for buffers esp. adjacent to conservation areas.
Implementation	Identify and map areas inappropriate for development.	Notes the Strategic Plan adoption of ICM and implementation through the appraisal of soils and agricultural suitability and suggests the use of the Herbert River Information Centre as a guide to assist in land use planning and decision-making.	Good quality agricultural land should be mapped and identified in the planning scheme.	Many objectives are not supported by implementation strategies.

Theme	HRCCC	Canegrowers	DNR	EPA
Implementation (con't)		Incorrect statistics on the value of the sugar industry and mill crushing capacity. In accurate references to the Sugar Industry Infrastructure Package (SIIP)[2]	Terms such as 'may' and 'should' and need tightening up to provide more certainty	Recognises attempts to conserve significant vegetation or habitat types and recognise and protect natural assets and resources however the sections that detail how these will be implemented fall short on delivering on the aims. Major focus is on public land, no commitment to protecting conservation values on public land.
		Could identify, map on GIS and advertise areas on the floodplain where development would be inappropriate.	Council needs to specifically state how it will assess applications, particularly with respect to the catchment system	
			Development Standards need to be made for particular uses	
			The use of the word 'encourage' in the plan needs to be supported by appropriate criteria.	
			Council should liase with DNR with regards acquisition for conservation purposes	
			Further clarification is needed between definitions of intensive agriculture, agriculture and other rural activities.	
Measurement and Evaluation			Development standards need to be set for particular uses	
Other		Canegrowers representatives on committee did not view cane growing as intensive agriculture		Strategic Plan Map filled with errors ie: land designated as rural was National Park, World Heritage boundaries omitted.
		Evidence of salt water intrusions to the ground water resource incorrectly referenced to Peter Sheedy.		

Chapter 4

Assessing the Institutional Arrangements for Sugar Cane Expansion and Environmental Management in the Herbert River District, Queensland, Australia

Part 1: Principles and Process

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FOREWARD: This draft report is provided to all respondents in the examination of how environmental issues are addressed in the expansion of sugar cane land in the Herbert River District. It is hoped that you can comment on the accuracy of the facts, and the desirability and feasibility of the initial conclusions and recommendations. Based on your comments, a revised and final document will be completed.

In 1994, CSIRO, Division of Tropical Crops and Pastures (DTCP) received funding from LWRRDC (project CTC7) to examine Integrated Catchment Management in the Herbert River Catchment. One component of that research initiative focused attention on the institutional aspects of resource management. In that regard, this review examines the sugar cane assignment process in the lower Herbert River catchment. It was not commissioned by any agency, but rather emerged from my ongoing interest in water and land-related management issues.

I am grateful to all respondents who took time from their busy schedules to share their thoughts with me. During the research, the staff at the Ingham CANEGROWERS office - Peter Sheedy, Allan Ancliff, Wayne Thomas, Gail Alloway, Sharon Fighera, Leona Gangemi, Natalee Agostinelli and Cathy Bowrey - made me feel very welcome. I also received comments from Jenny Bellamy, Allan Dale, Andrew Johnson and Dan Walker of CSIRO, and Geoff McDonald and Carl Smith of the University of Queensland. Let me stress, however, that the interpretations and conclusions are mine; I take full responsibility for them.

EXECUTIVE SUMMARY

This report considers the institutional context for the management of sugar cane land with a specific focus on how environmental considerations are incorporated into the process. It highlights the following:

(1) Integrated resource management in the sugar industry involves an understanding of at least three perspectives: (i) linkages among biophysical processes, (ii) linkages among society, environment and economy, and (iii) linkages within and among relevant institutional arrangements.
(2) Ecologically sustainable development (ESD) principles advocated by the 1992 *Intergovernmental Agreement on the Environment* and the CANEGROWERS *Caring for the Environment* (1995) share four resource management principles: balance, ecosystem, partnership and flexibility. These principles are the benchmarks used to evaluate the current assignment process in the Herbert River District.
(3) Relevant institutional arrangements which influence the cane assignment process, and that process itself are reviewed. The discussion concludes that since 1993 the Local Boards in the Herbert River District have incorporated environmental considerations into its decision making through: (i) forming an *ad hoc* technical review committee in 1995, (ii) requiring all applicants to submit a property management plan, and (iii) developing conditions of assignment.
(4) No radical changes to existing processes are recommended. However, improvements must be made. A set of recommendations are made on the basis of findings from the Herbert River District. Their applicability on a state-wide basis should be considered carefully. It is believed that more effective decision making can be achieved by enhancing the consistency among the four management principles - a balanced perspective, ecosystem management, developing partnerships and allowing for flexibility - and current decision-making processes. In addition, the breadth of principles should be broadened. In this context, the following preliminary recommendations are made:

To enhance **balanced** management, consider:

Recommendation #1: That the *ad hoc* technical review committee and Local Board members review how to improve the present referral process. Locally based conflict resolution mechanisms should be established and applied before the formal involvement of the Queensland Sugar Corporation or Sugar Industry Tribunal. These should be codified in the *Sugar Industry Act* and/or *Sugar Industry (Assignment Grant) Guidelines*.

Recommendation #2: Providing for the earlier consideration of environmental factors in the cane assignment process through existing mechanisms such as "Continuous Crushing Agreements" and corporate policies.

Recommendation #3: Reducing the perceived need for pre-emptive clearing by adjusting the timing of the assignment process. In the Herbert River District, this would see the announcement of assignment grants in the February-March period.

To enhance **ecosystem management**, consider:

> **Recommendation #4: Carefully reviewing the proposed Sugar Industry Infrastructure Package** (SIIP) projects to ensure that future management options are not unduly constrained.
>
> **Recommendation #5:** Immediately undertaking a catchment management plan for the entire lower Herbert River area. In evaluating alternatives, it should consider environmental, social and economic impacts on surface, ground, coastal and related land-based resources. It should consider both structural and non-structural alternatives and incorporate, wherever possible, natural channel design and restoration techniques. This study should also examine the establishment of a drainage board for the entire lower catchment.

To enhance **partnerships**, consider:

> **Recommendation #6:** Better informing the Shire of the assignment process and its outcomes. This should be done through the appointment of a shire representative to the Local Boards who shall have voting rights on expansion decisions.

To enhance **flexibility**, consider:

> **Recommendation #7:** Undertaking an audit within the next three years, which examines the compliance and enforcement of conditions of assignment. Effective and regular monitoring should be specified as a Queensland Sugar Corporation responsibility required under the *Sugar Industry Act*.

To **broaden the base of principles**, consider:

> **Recommendation #8:** Developing mechanisms, which place more responsibility on applicants and the industry for determining the nature and extent of acid sulphate soils before review of an individual application.
>
> **Recommendation #9:** Developing and applying an environmental impact assessment screening mechanism that identifies applicants who must more adequately consider farm management and environmental issues with the submission of their application.

And finally, to increase the legitimacy and credibility of ecologically sustainable development within the Queensland sugar industry and resource management agencies;

> **Recommendation #10:** Senior government, Queensland Sugar Corporation, corporate, CANEGROWERS, and non-government officials provide leadership in the formulation and application of ecologically sustainable development.

It is hoped these suggestions promote discussions which strengthen the practice of ecologically sustainable development in the sugar industry.

1. INTRODUCTION

This report describes how environmental issues are considered in the sugar cane assignment process in the Herbert River District, identifies strengths and weaknesses, and suggests alternative approaches in the future. This introductory section provides background to the report, the focus, the approach taken, and the organisation of the report.

1.1 Background

This report is an independent review of the environmental management and cane land allocation. As a faculty member in the Department of Geography, University of Western Ontario in Canada, my main research interests have concerned the institutional arrangements for water management in Canada, the conservation authority program in Ontario, the use of regulation in floodplain management and diffuse source pollution control, and impact assessment. Between 1 July 1995 and 30 June 1996, I held a Visiting Research Fellowship with the CSIRO, Division of Tropical Crops and Pastures which had a five-year LWRRDC-funded (project CTC7) program to assess the implementation of Integrated Catchment Management (ICM) in the Herbert River catchment.

A number of activities were associated with the research. In the first year, the research team formulated a framework to organise the design and conduct of subsequent activities (Bellamy *et al.*, 1995). One component of that framework focused attention on the institutional arrangements for resource management. This report considers the institutional aspects of cane assignment and resource management in the Herbert River District. It is believed that an understanding of present strengths and weaknesses will provide a solid foundation for improvements.

This review involved several stages. Initially, a review of water-related legislation and material about the Herbert River catchment was undertaken. These readings, and discussions with local and regional resource managers and CSIRO staff lead to a decision to concentrate on cane expansion and drainage issues. The support of the local CANEGROWERS office in Ingham was requested and received. Their support was conditional upon the research respecting the privacy and confidentiality of both applicants and interview respondents. They and many interview respondents expressed a desire to review the report in draft form. This preliminary document fulfils that request. All interview respondents are invited to provide their opinions on this draft report. On this basis, a final report will be prepared and circulated. This triangulation of sources should enhance the relevance and accuracy of information.

Notwithstanding my deep appreciation for all the cooperation and assistance received, I emphasise that this report represents an independent and personal appraisal of resource management and the sugar cane expansion process in the Herbert River District. It is hoped that it can promote debate about present practices which can provide for more effective management in the future.

1.2 Focus and Approach

Initially, the research goal was to examine the relationship between drainage problems and the cane assignment system within the Herbert River area for the period 1993 - 1995. However, a formal review of assignment applications by an *ad hoc* committee comprised of CSR Ltd., Bureau of Sugar Experiment Stations (BSES), Queensland Department of Primary Industries (QDPI), and Queensland Department of Environment and Heritage (QDEH) officials was introduced

into the 1995 review process (*i.e.*, the 1996 assignment grant). Extending the study period to include the 1996 award allowed for an examination of the perceived effectiveness of that review mechanism. A decision was also made to extend the breath of the issues covered by incorporating selected measures of economic, social and environmental factors. In this manner, the relative importance of the environment could be measured. It is also consistent with the legal definition of environment in Queensland (Duncan, 1993). Thus, this report embraces a wider range of issues for the 1993-1996 period.

The review was conducted between October 1995 and May 1996. In that period, the work had several components. Relevant literature and legislation were reviewed. The permit files located at the CANEGROWERS Ingham office for the period 1993-1996 were examined. This information was entered into a GIS database at the CSIRO Davies Laboratory in Townsville. The Queensland Sugar Corporation (QSC) provided computer-based assignment (Sugar Corporation Assignment Register (SCAR)) data which was also incorporated into the analysis. Interviews were held with over 30 people from relevant government, industry and non-governmental organisations, and selected local landowners. Interviews were conducted with individuals at both local and state-wide levels to place the activities in the Herbert River District into a broader context.

At the same time, research was also being conducted on Integrated Catchment Management in the Herbert River. In that regard, a questionnaire survey was developed with Prof. Geoff McDonald (co-investigator) of the University of Queensland, with the assistance of Jenny Bellamy, James Butterworth, Andrew Johnson, Geoff Syme and Dan Walker of CSIRO. In November 1995, surveys were distributed to all ICM Coordinators and Chairs within Queensland, and all Catchment Coordinating Committee members in the Johnstone and Herbert Rivers. That work is reported on in full in a separate document (McDonald and Shrubsole, forthcoming). However, relevant elements of this material have been incorporated into this present report.

1.3 Report Organisation

This report contains the main findings and conclusions regarding the context for, and the nature of, the existing process. During the interviews, a diversity of perceptions was expressed about the nature of integrated resource management, and the responsibilities of various government and non-government participants in sugar cane assignment. The second chapter examines relevant background material, particularly as it relates to the Herbert River District and the concept of integrated resource management. The similarities and differences between government and CANEGROWERS views of sustainable resource management are outlined in the third chapter. Chapter four describes the institutional arrangements for resource management which influence sugar cane assignment, while the actual assignment process is reviewed in the fifth chapter. Based on an examination of the current management principles (Chapter 3) and the decision-making process in the Herbert River District (Chapters 4 and 5), observations and recommendations are made in the sixth chapter.

2.0 BACKGROUND

2.1 The Problem in Brief

The sugar cane industry is an important element of the Queensland landscape. Since the 1990s, the amount of land devoted to cane farming has increased by approximately 20,000 ha per year, and in 1995 over 470,000 ha were used for that purpose (QDPI, 1995). Concern has been

expressed about this rapid growth and its potential environmental impacts (Johnson *et al.*, 1996). These impacts include erosion and sedimentation, loss of riparian vegetation, damage to coastal wetlands, and diffuse sources of nutrient pollution and heavy metals (Brodie, 1984; Bramley and Johnson, 1995; Johnson *et al.*, 1996). Since recent expansions have often occurred on relatively more marginal land, resource managers must ensure that only appropriate areas are developed and effective farm practices applied to ensure its long-term sustainability. There is also concern regarding the effectiveness of existing institutional arrangements to meet this challenge (Johnson *et al.*, 1996). Most cane is grown along the eastern coast of Queensland and northern New South Wales where soil and climate conditions are favourable. However, this area of Queensland is very well known for its wet tropical rainforest and the offshore Great Barrier Reef. There are floodplain issues and coastal wetlands that require careful management. In short, there is increased pressure for institutional arrangements to resolve these and other land use conflicts effectively, and to prevent environmental degradation.

Traditionally, land suitability was the predominant natural resource issue considered in examining cane land expansion (Belcher and Dalton, 1983; Dawson *et al.*, 1983; Capelin, 1987). In addition, expansion rates of the past were very modest compared with current levels. The 30% increase in the amount of land devoted to cane growing growth since 1991 has strained the capacity of both private and public agencies (QDPI, 1995; CANEGROWERS, 1995). For instance, Local Boards were created in the 1920s to, in part, control the level and location of sugar cane production, and to prevent the growing and commercial harvest of sugar cane (Industry Commission, 1992). It has achieved these objectives through regulating cane growing and harvesting through a regulatory mechanism called the 'assignment system'. Local Boards are now being asked to extend their traditional perspective and meet the environmental expectations, social responsibilities, and legal requirements of the 1990s.

The future demands placed on Local Boards and other resource management agencies are expected to increase. More frequent and possibly intense resource management conflicts may further test the ability of decision makers to provide equitable, efficient and effective processes and outcomes. QDPI (1995) predicts a 25% increase in cane land area between 1994 and 2003. Given the potential for and significance of environmental, economic and social impacts, and the high potential for resource conflicts in this coastal area, there is a need for integrated resource management within the sugar cane industry.

2.2 The Case Study Area - The Herbert River District

The Herbert River District has been one of the most rapidly expanding areas within the state. The following are selected facts and widely held perceptions of the Herbert River District which were contained in relevant documents, the Victoria and Macknade Annual Reports, provided through the Herbert River Catchment Coordinating Committee questionnaire responses, or offered during the interviews. The intent is to provide a 'snapshot' of key elements that have influenced sugar cane assignment. These include:

- Cane farming and milling have been longstanding and the dominant regional economic activities. Two CSR mills are in the area - Victoria and Macknade - each with its own Local Board. Since 1991, the area has been one of the most rapidly expanding cane-growing areas in the country (QDPI, 1995). QDPI (1995) predicts a further 36% increase will occur between 1994 and 2003 raising the assigned area from 46,730 ha to 63,360 ha. Soil surveys identify another 60,000 ha of land well suited and available for sugar cane growing (Wilson and Baker, 1990).
- The relationship between growers and millers throughout Queensland is often associated with conflict. The season length, division of proceeds from the sugar product, and transport

issues have been particular points of longstanding dispute.

- Technological innovation has played an important role in increasing productivity and decreasing harvest costs. Herbert River growers have increasingly used laser levelling rather than bedding on the paddocks. Based on anecdotal evidence, some respondents suggested that this shift, which has largely taken place during the study period, has increased the effective growing area by between 3%-8%. Green cane harvesting is used by over 98% of farmers in the region (QDPI, 1995). It reduces production costs, provides the return of some nutrients to the soil through trash blanketing, and reduces erosion. BSES, CSIRO and CSR Ltd. continue to develop varieties of cane to increase productivity.
- The area has a long history of drainage problems. Compared with the past, drainage problems in the 1990s have not been as significant for most growers due to below average rainfalls.
- In the Herbert River District, environmental issues related to sugar cane expansion became very prominent in 1995. In that year, assignment was granted in an area known as Pomona land holding. During land clearing, the area was found to be an important habitat for an endangered species, the Mahogany Glider (QDEH, 1995). A conservation order was placed on the site, and later a draft conservation plan was prepared. There was a significant level of uncertainty and conflict among industry, government and non-government participants concerning this development. At present, a drainage permit under the *Water Resources Act 1989* has been applied for by the proponents, and is under review by the Queensland Department of Natural Resources (QDNR).
- Ortho-photography, sponsored by a range of private and public agencies has just been completed. Before that time, only topographic and cadastral maps were easily available to most resource managers. A Herbert River Information Resource Centre is being established in Ingham as a shared GIS facility for public and private resource managers. When established, it should provide better information from which resource management decisions can be made (Johnson and Walker, 1996).
- Elections in 1996 saw new governments formed at both federal and state levels. Their commitment to ecologically sustainable development is unclear at this time. The federal government's intention is to reduce its overall spending by $8 billion over the next two years. The state government has reorganised the administrative arrangements for resource management. The new Department of Natural Resources (QDNR) reflects the amalgamation of the Natural Resources Section of the former QDPI and the former Department of Lands. The remaining QDPI focuses of production issues. Essentially the former Department of Environment and Heritage (QDEH) remains intact but its name has been changed to Environment (QDoE), as is the case with the former Department of Housing, Local Government and Planning (QDHLGP) which is now called Planning and Local Government (QDPLG). Given potential funding cuts and new administrative arrangements, the nature of integrated resource management, and the adequacy and role of future water and related land planning is unclear.

2.3 Integrated Resource Management and the Sugar Cane Industry

Integrated management must be considered in the context of geographic scale and the nature of the management issues. Interview respondents suggested at least three key perspectives from which 'integrated' resource management can be applied to the sugar industry.

2.3.1 Integrated Resource Management as Linkages among Environmental Resources

Integration may be seen as considering the interaction among water, land and other environmental resources (Mitchell, 1990). This perspective recognises that many water problems have their origins on the land, and many land problems have their causes in too little or too much

water. In the Herbert River District, longstanding resource issues have concerned inadequate land drainage which has limited crop productivity, and flooding which has inflicted damages to the town of Ingham and crop losses (Cameron McNamara, 1984). Emerging resource issues concern the impacts associated with the drainage of coastal wetlands, the management of known and potential acid sulphate soils, and the maintenance of riparian corridors for wildlife. Solutions to these problems require, in part, an adequate understanding of biophysical systems. Inadequate information could see decisions made which might lead to poor outcomes including the transfer of problems from one property owner to another, the inefficient expenditure of public and private funds, or significant negative environmental.

2.3.2 Integrated Resource Management as Environment-Economy-Social Linkages

A second perspective of integrated resource management was advocated by the Brundtland Commission. It considers linking natural resources to economic and social development aspects (Mitchell, 1990). The sugar industry is Australia's third largest exporting industry, with production in 1995 estimated to be 5.1 million tonnes of raw sugar, worth approximately $2 billion (Aus.). Australia continues to rely heavily on the agricultural sector to generate export earnings (Daniels, 1992). If Australians are to maintain their traditional high standard of living, there is a continued and increased need for export-generating sectors of the economy to raise foreign capital through trade. This need must be balanced against social and environmental considerations.

Economic and social factors must also be considered at a regional scale. The Queensland sugar industry supports over 6,350 growers and 25 sugar mills (CANEGROWERS, 1996). Sugar cane farming and milling dominate the regional economies of the smaller rural communities in which they are located (McGovern *et al.*, 1988). If farmers and mills were unable to be competitive in the global market, the resulting regional dislocation of people and economic loss could be substantial. Without appropriate alternatives to increase production, farmers could employ farm practices which degraded the environment (Epps and Crittenden, 1992). Alternatively, some farmers could sell their operations to other farmers or utilise their land for other enterprises. In this scenario, the future of the family farm is uncertain. Its maintenance is one basic tenet of the industry.

2.3.3 Integrated Resource Management as Effective Institutional Arrangements

The need for effective institutional arrangements represents a third view of integrated resource management. According to the Brundtland Commission, achieving sustainable development posed a problem for institutions, whether national or international, which were created on the basis of "narrow preoccupations and compartmentalised concerns" (WCED, 1987, 10). It maintained that since the interconnected nature between economic and ecological systems (like those associated with the sugar industry) was unlikely to change, policies and institutions must, if sustainable development is to be achieved. Such an adjustment is "one of the chief institutional challenges of the 1990s and beyond" (WCED, 1987, 10). These comments are relevant to resource management in Queensland where there is a complex web of laws, policies and agencies. In addition, there is separation between resource development and resource management activities as illustrated by the 1996 division of responsibilities between the former QDPI for agricultural production and the new Department of Natural Resources for resource management. Providing an integrated resource management approach from this fragmented arrangement is a longstanding challenge for governments world wide, and is a key theme in this report.

3.0 THE INTENT OF ECOLOGICALLY SUSTAINABLE DEVELOPMENT: GOVERNMENT AND CANEGROWERS PERSPECTIVES

3.1 Government View of Ecologically Sustainable Development

Historically, there has been inadequate regard for environmental considerations by public and private resource managers at Commonwealth, state and regional levels. With the publication of *Our Common Future (Brundtland Report)* in 1987, this situation is changing. For instance, all levels of Australian Government signed an *Intergovernmental Agreement on the Environment* (1992) to pursue the following principles:

(1) Decision-making processes should effectively integrate both long and short-term economic, environmental and equity considerations.
(2) Where there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.
(3) The global dimension of environmental impacts of actions and policies should be recognised and considered.
(4) The need to develop a strong, growing diversified economy which can enhance the capacity for environmental protection should be recognised.
(5) The need to maintain and enhance international competitiveness in an environmentally sound manner should be recognised.
(6) Cost effective and flexible policy instruments should be adopted, such as improved valuation, pricing and incentive mechanisms.
(7) Decisions and actions should provide for broad community involvement on issues which affect them (Australia, 1992, 8).

The Agreement commits all levels of government to ecological sustainable development (ESD) principles. These and other principles were endorsed at the 1992 Earth Summit (Grubb *et al.*, 1993).

3.2 CANEGROWERS' View of Ecologically Sustainable Development

The key participants in the sugar industry have responded to the need for ecologically sustainable development (Industry Commission, 1992; Senate Standing Committee on Industry, Science and Technology, 1989). Provisions within the *Sugar Industry Act 1994* and assignment regulations, which are administered by the Queensland Sugar Corporation (QSC), mention that environmental, social and economic aspects must be considered in determining the desirability and feasibility of applications for cane land expansion (QSC, 1991). Major sugar-related research and development is the responsibility of the Bureau of Sugar Experiment Stations (BSES). Financed by growers and millers, BSES approves cane varieties to be grown in mill areas, provides extension services to farmers, and conducts research into the growing of cane. It has encouraged farmers to adopt environmentally friendly practices and identifies sustainable resource use as an important principle (Briody, 1994).

Sugar cane research has tended to focus on biophysical aspects of the plant. CSR Ltd. has had an ongoing sugar cane varietal program. More recently, QDPI and CSIRO have intensified their sugar-related research, and a CRC for Sustainable Sugar Production has been established. The latter will devote some research effort into socioeconomic aspects of the industry.

CANEGROWERS and the Australian Sugar Milling Council are the two main industry associations. CANEGROWERS is a statutory organisation representing all cane growers in

Queensland and is financed by a grower levy based on cane supplied. It adopted an environmental policy in 1990. In 1995, this policy was revised in the document *Caring for the Environment* which embraced the following principles:

(1) Industry and farm management practices should enhance the efficient and sustainable use of soil and water, safeguard public health, help preserve natural resources and desirable flora and fauna, and combat feral animals such as wild pigs;
(2) Concerns about the environment should not be treated in isolation from economic and social considerations;
(3) Preservation of the environment is everyone's concern and the cost should be borne equally within the community;
(4) Individual land holders are best placed to address issues as part of voluntary publicly-funded programs as well as R&D projects;
(5) Where sensible precautions are taken and best technology used, farmers should be free of bureaucratic interference in the everyday running of their properties;
(6) Farmers should be active participants in an open consultation process between government, industry and the community;
(7) Primary producers have rights and obligations;
(8) Government has a role in providing information, education and incentives to encourage active and self-regulatory environmental management of farms; and
(9) Unacceptable behaviour by individuals should be discouraged.

These principles are of particular relevance to this paper because they represent a clear statement of intent from the growers.

3.3 Differences in Principles: Defining the Precautionary Principle and Bounding Management Strategies

While there are commonalities, there are at least three significant differences between the *Intergovernmental Agreement* and *Caring for the Environment* principles (Table 1). The first concerns agreeing on the breadth and depth of the balanced, ecosystem, partnership, flexibility principles. For instance, the *Intergovernmental Agreement* highlights the need for a global perspective in ecosystem management, while the CANEGROWERS are more concerned for providing efficient farm operations by controlling feral animals as well as a healthy environment. While these types of differences are important, it is more appropriate to consider differences and similarities in a broader context.

In general terms, the other two important differences pertain to the precautionary principle, and how management strategies should be bounded. During the interviews, a wide range of views was expressed concerning the nature of these concepts. The following discussion reviews their meaning and implications for the sugar industry.

3.3.1 The Precautionary Principle

The precautionary principle has been used by decision makers to consider the impacts of policies, programs, and projects. Although it has been applied since the 1950s in Germany, its inclusion as Principle 15 in the U.N.-sponsored Rio Declaration on the Environment and Development (Earth Summit) has raised its international profile and popularity. That document rationalised and defined the principle as follows:

> In order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation.

Table 1
Comparing and Contrasting Intergovernmental Agreement **and** Caring for the Environment **Resource Management Principles**

Principle	Specific Statement
Precautionary	*Intergovernmental Agreement* • where there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation
	Canegrowers • where sensible precautions are taken and best technology used, farmers should be free of bureaucratic interference in the everyday running of their properties
Balance	*Intergovernmental Agreement:* • develop a strong, growing diversified economy which can enhance the capacity for environmental protection should be recognised • decision-making processes should effectively integrate both long and short-term economic, environmental and equity considerations
	Canegrowers: • concerns about the environment should not be treated in isolation from economic and social considerations
Partnerships	*Intergover*nmental Agreement: • decisions and actions should provide for broad community involvement on issues which affect them • the need to maintain and enhance international competitiveness in an environmentally sound manner should be recognised
	Canegrowers: • preservation of the environment is everyone's concern and the cost should be borne equally within the community • farmers should be active participants in an open consultation process between government, industry and the community • primary producers have rights and obligations • unacceptable behaviour by individuals should be discouraged
Ecosystem	*Intergovernmental Agreement:* • the global dimension of environmental impacts of actions and policies should be recognised and considered
	Canegrowers: • industry and farm management practices should enhance the efficient and sustainable use of soil and water, safeguard public health, help preserve natural resources and desirable flora and fauna, and combat feral animals such as wild pigs
Flexibility	*Intergovernmental Agreement* • cost effective and flexible policy instruments should be adopted, such as improved valuation, pricing and incentive mechanisms
	Canegrowers • government has a role in providing information, education and incentives to encourage active and self-regulatory environmental management of farms • individual land holders are best placed to address issues as part of voluntary publicly-funded programs as well as R&D projects

The *Intergovernmental Agreement* fails to specify the use of "cost-effective measures". However, the document maintains that in applying the principle:

> public and private decisions should be guided by: careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment; and an assessment of the risk-weighted consequences of various options.

While this statement suggests a pragmatic use of the precautionary principle, the predominant view among interview respondents is that it should always prevent resource development. While this is a legitimate view, it is not necessarily the case.

The precautionary principle recognises the importance and the types of uncertainty in resource management (Table 2). The challenge is to apply appropriate management processes and decisions in the face of uncertainty which meet peoples' needs. Collingridge (1983) outlined two strategies, hedging and flexing, as ways of making decisions in the context of uncertainty and ignorance (Table 2).

Table 2. Defining Different Kinds of Uncertainty in Resource Management

Risk:	system parameters are well known. Range of outcomes and the odds are known and can be predicted.
Uncertainty:	major system parameters are known. Range of outcomes is known but the odds are not.
Ignorance:	scientists will be surprised by the outcomes because they do not know. Do not know what questions should be asked.
Indeterminacy:	scientific knowledge is inadequate. Causal chains are open. Understanding is not possible.

(after Wynne, 1992; Mitchell, 1995; Young, 1995)

Hedging involves avoiding the worst-case scenario. This popular and traditional strategy in the face of all types of uncertainty emphasises minimising damage when the worst possible outcome occurs. However, this strategy is likely to be inappropriate in cases of ignorance. In these situations, Collingridge (1983) suggested a strategy of flexing. Flexing assumes that under circumstances of ignorance, no decision can be known to be right or wrong with any degree of confidence. Therefore, it is prudent for managers to monitor these decisions, and be prepared to modify them. According to Mitchell (1995, 5), "if resource managers approach situations with a view to being flexible, and are prepared to monitor and modify decisions, then they can afford to take chances and do not have to follow the cautious approach encouraged by hedging."

Young (1995, 20) suggested that it meant "all options need to be explored when considering significant irreversible action with unpredictable future consequences. Further, such actions should only be undertaken when large social costs would otherwise be incurred by the current generation." Rather than stopping all resource development, applying the precautionary principle has more to do with changing the balance of decision-making power. It emphasises the responsibility of resource developers must take in either: (i) demonstrating that their initiatives will not cause harm, or (ii) providing the means to compensate potentially impacted communities or people (O'Riordan, 1995). These comments suggest that responsible decision making is an important element of the precautionary principle. Some mechanisms which can achieve this goal include: monitoring changes in resource capital, placing the onus of responsibility on proponents, developing safe minimum standards, enhancing community consultation and education, and providing anticipatory approaches to resource management. Thus, applying the precautionary approach is particularly relevant for those who view integrated resource management as effective institutional arrangements.

3.3.2 Bounding Problems and Solutions

It is important to consider how the scale of a problem can influence management strategies. The *Intergovernmental Agreement* favours community-based initiatives (largely through economic instruments) which are placed in the context of global initiatives and international competitiveness. CANEGROWERS places relatively more importance on individual farmers who voluntarily incorporate best management practices which are supported by communities and the government (Table 1). Both perspectives are essential for ecologically sustainable development.

In water management, most people would advocate the catchment as the most appropriate geographical unit to practice an ecosystem approach. However, the size of catchments varies according to one's perspective. They can be considered as the land area draining the entire eastern seaboard or a single catchment (*e.g.*, the Herbert River), or a subcatchment (*e.g.*, Cattle Creek). In Canada, a 'nested' catchment approach addresses the need to understand linkages among biophysical processes with the development of appropriate implementation mechanisms along a continuum of scales (Royal Commission, 1992).

A mix of reinforcing geographic scales and implementing mechanisms will most likely lead to effective management. For instance, water quality standards established on relative loads (*e.g.*, parts per million) fail to address the total amount of residuals entering the environment. While individual farmers or other potential contributors may be complying with relevant government regulations, an increase in the total number of farming operations could increase the total load to the environment and result in significant impacts. In short, a 'problem' does not exist at the block level, but is present at the ecosystem or community level. In this example, the nested ecosystem approach should consider both the total loads and relative contributions of individual operations. A second example pertains to drainage works. Increased productivity can often be best achieved through large-scale drainage works which are beyond the capacities of an individual farmer. However, the desirability and feasibility of these projects must consider the impacts on upstream and downstream landowners, the environment, and the economy. The nested catchment approach can be incorporated into integrated resource planning initiatives.

Integrated planning is one mechanism to guide the activities of both individuals and communities. The key issue is to recognise that many environmental problems transcend property and administrative boundaries. Effective resource management will likely require a mix of approaches involving the coordination of voluntary individual efforts, the establishment of community-based bodies such as Catchment Coordinating Committees and Landcare groups, the participation of non-governmental organisations, local and state agency planning efforts, and government incentives and regulations.

3.4 Similarities in Government and Canegrowers Principles

While differences in management principles exist, the *Intergovernmental Agreement on the Environment* and *Caring for the Environment* share some general elements (Table 1). These are the need for balance, ecosystem, partnership and flexible approaches.

A **balanced** perspective recognises the economic, social, and environmental aspects of resource development and management. However, a key concern pertains to the relative weight given to each element. Past management efforts have usually favoured short-term economic gains over long-term factors. In providing for balance, mechanisms should be in place to provide for compromise and tradeoffs among this legitimate mix of dimensions. Conflict resolution mechanisms should enhance management efforts. At what point in the planning process these mechanisms are utilised is also important.

Responsibility for environmental and resource management is often shared between private and public managers at international, national, state, regional, local and individual property scales. **Partnerships** respond to this reality and should ensure the equitable treatment of all these participants. People and groups who have a legitimate concern should have an opportunity to influence the formulation and implementation of resource management and development decisions. Information among participants can also be exchanged.

An **ecosystem** approach appreciates the complexity of relationships among and within environmental, social, and economic systems. Rather than focusing attention on one element of the environment, attention is often turned to considering how human health or other broad measures of quality are affected by the natural and social environment. To implement this approach, attention is often given to watersheds or bioregions. Environment and natural resource management is often ill-suited to administratively-based boundaries. While it is not feasible to form agencies exclusively based on 'natural' boundaries, it is appropriate to plan on the basis of ecosystems and incorporate this information into appropriate implementing documents (*e.g.,* policies, strategic plans, legislation, regulation). It is in this context where the nested catchment approach can enhance practice.

Our understanding of the environment and human interactions with it is continually evolving. Social and personal attitudes and behaviours are also dynamic. Political and economic circumstances can change almost overnight on the basis of the future's market in New York, an announcement from the central bank, or the results of an election. Since these types of changes must be accommodated in individual, community and government management strategies, there is a need for **flexibility**. Research and education can aid this process. Monitoring should be an important element of management, particularly in the light of ignorance (Table 2), so that progress can be assessed and appropriate modifications made.

3.5 Summary

While there may be some difference in specifically interpreting these general principles, it is important to identify and appreciate the degree of similarity. However, stating these four principles is one thing; translating them into appropriate planning and operational processes is another. The degree to which the sugar cane assignment process supports the implementation of these principles is used as a benchmark for this study.

4.0 INSTITUTIONAL ARRANGEMENTS FOR ENVIRONMENTAL MANAGEMENT INFLUENCING CANE LAND ASSIGNMENT

4.1 The Legacies of the Past

In making the transition to ecologically sustainable development, both the sugar industry and Queensland public resource management agencies must contend with how past efforts influence future activities. One member of a 1992 Industry Commission into the sugar industry described that industry as follows:

For all my working life I have been engaged in the examination of agricultural policy in Australia. I have found it harder to fathom what goes on in the sugar industry than to come to grips with any other rural industry.

> This is partly because there has been less information available on the sugar industry than on other rural industries. Traditionally the Queensland sugar industry and Queensland Governments have not been attracted to openness in providing information...But the difficulty in coming to terms with the sugar industry is largely the policy arrangements are so complex, and that there are interactions between elements of the arrangement [not easily understood] (Edwards, 1993, 1).

While I found both the industry and government respondents to be quite candid and open during interviews, many people are unfamiliar with this experience and maintain the perceptions of the

past. This legacy detracts from future initiatives which are based on the principles of partnership and balance.

The water management record of the Queensland government before 1989 emphasised a structurally focused, development approach (Fenwick, 1985). While many of these projects contributed to increased growth, many interview respondents questioned the efficiency and effectiveness of this approach. In this pre-1989 period, some landowners in the lower Herbert River built levees and other flood and drainage works which failed to comply with the requirements of the *Water Resources Act*. These landowners were not sanctioned for these violations. In the words of several government officials, senior managers and relevant ministers did not support assertive legal enforcement. An unfortunate legacy of this period is the perception held by some landowners that they can, in the future, alter surface water flows without government approvals and penalties. The scale of these individual works is inadequate and contributes to significant conflicts between neighbours. Any efforts to achieve effective partnerships must address this problem. People must know the 'rules of the game' and be assured that these will be followed and enforced.

The climate for the rapid expansion of sugar cane land was, in part, stimulated by the *Sugar Industry Act 1991* (amended in 1994). It required a minimum expansion of 2.5% (about 10,000 ha) per year between 1991 and 1995 which has been exceeded (QSC, 1995). After 1995, the QSC will determine the extent of any expansion. There was an awareness that this growth must be managed. To that end, the Minister for Primary Industries, who is responsible for the activities of the QSC, committed:

> officers of his department [to be] readily available to provide assistance and advice as required (Briody, 1992, 5).

There were no additional resources provided to QDPI or other agencies in the Herbert River area to specifically address this need. Thus, any government involvement in sugar cane expansion has been done with existing or fewer resources.

The need to incorporate these agencies into the assignment process has been emphasised by the QSC (1993, 7):

> Where the need arises, Local Boards should liaise with the Queensland Department of Primary Industries, Land Use and Water Resource Groups, Drainage Boards and the Bureau of Sugar Experiment Stations in respect of proposed new land and where necessary, are to attach as conditions of the grant assignment, any **land use restrictions** imposed by such authorities. The Corporation has informed relevant organisations of the expansion and requested them to make officers available for consultation with Local Boards as necessary.

Interviews with regional public agency officials suggested that they have not been informed about this request through normal administrative channels. In the Herbert River District, they perceive their lobbying of the Local Boards as the key factor which prompted the 1996 formation of the *ad hoc* technical review committee.

A more recent aspect of the management legacy pertains to the 1989 state election. At that time, a new State Government was elected and committed itself to providing more effective resource management. It focused attention on formulating new resource management policies, and adjusting administrative arrangements. In 1996, a new government was elected. While it has provided for new administrative arrangements, its commitment to the *Intergovernmental Agreement*

on the Environment is uncertain. The following sections discuss the basis and nature of government involvement which significantly influences the sugar cane expansion process.

4.2 Queensland Department of Primary Industries (QDPI)

In 1989, the new state government responded, in part, to the need to implement sustainable development by enhancing the institutional capacity to implement resource programs. The Department of Forests and the Water Resources Commission were amalgamated into the Department of Primary Industries (QDPI). During the study period, QDPI influenced sugar cane growing through legislation, programs, and policy statements. It administered the *Water Resources Act 1989* which provides for the:

- construction, control and management of works with respect to water conservation and protection, irrigation, water supply and drainage;...and
- protection and improvement of the physical integrity of water resources.

Drainage boards which have been formed in some portions of the lower Herbert River are guided by this statute. QDPI provided a rural extension services program which focused on the production, financial, and resource management aspects of farm activities. Interested cane farmers could avail themselves to this service on a voluntary basis. Policy statements, such as "Land Use Practices for Wet Tropical Floodplains" represent the third mechanism available to QDPI and other agencies (QDNR, 1996). The intent is to guide the drainage of agricultural land on the wet tropical coast; it is not legally binding. Management principles, land assessment, farm planning, drainage requirements and design, and implementation and management arrangements are discussed.

These legislative, farm extension and floodplain policy guideline functions were transferred to the newly created Department of Natural Resources (QDNR) following the 1996 agency reorganisation. The remaining QDPI maintained responsibilities for regulating mangrove clearing under the *Fisheries Act*. The Queensland Department of Lands (QDOL) was also merged into the new QDNR. Since 1991, the QDOL was required through an amendment to the *Lands Act* to consider the environmental implications of leasing and selling Crown lands (Duncan, 1993). Cane land expansion in the Herbert River District often involved the purchase or lease of Crown land. In selling and leasing Crown Lands, the Federal *Native Title Act* requires adequate consultation with an 'accredited' body. In the Herbert River District, this body is the Central Queensland Indigenous Land Council.

4.3 Queensland Department of Environment and Heritage (QDEH)

The Queensland Department of Environment and Heritage (QDEH - now Environment (QDoE) after the 1996 agency reorganisation) is charged with promoting the conservation, management and wise use of the environment for the long-term public benefit. That agency conserves vegetation and wildlife species by declaring public and private lands as protected areas under the *Nature Conservation Act 1992*. It may enter into agreements with private landowners to protect designated areas. Acquisition may be negotiated between the agency and a landowner. These areas are designated on the basis of supporting rare and threatened wildlife, critical wildlife habitat, a protected area (*e.g.*, National Park), or areas of significant nature conservation interest.

This legislation is relevant to the Herbert River District. In 1995, an interim conservation order under the *Nature Conservation Act 1992* was placed on the Pomona land holding because the clearing of the forest area for cane growing would "have a significant detrimental effect" on the Mahogany Glider. A *Draft Mahogany Glider Conservation Plan* was prepared (QDEH, 1995). It

outlined over 28,000 ha of critical habitat requiring protection. Much of this area is suitable for sugar cane growing, and some of it has already been assigned. Funding for this $6 million initiative was provided from the Sugar Coast Environmental Rescue Package Agreement (SCERP). That Commonwealth-State program was to provide a total of $16 million over a 3-year period for the acquisition of land, and the development of intergovernmental management initiatives, public education programs and landowner assistance measures. With the expected cuts to Commonwealth budgets and the potential impacts on state initiatives, it is unclear whether the announced total of $16 million will be secured. However, the adequacy of the $16 million is questionable given that 37.5% of the entire amount was dedicated to the Mahogany Glider program alone.

Some interview respondents maintained that QDoE could use the *Environmental Protection Act 1994* to influence land clearing and farming by placing a "duty of care" on farmers to protect the environment. The efficacy of this approach is unknown. On the one hand, the *Act* uses the term "environmental harm" to embrace a wide range of impacts, it refers to "contaminant" and excludes land clearing for agricultural development as a regulated activity. These provisions suggest that the development of land for agricultural production are not regulated by the *Act*. On the other hand, the court could view the storage of acid sulphate soils in farm ponds as a "contaminant" exclusive from land clearing activities. The final outcome of litigation will reflect, in large part, several issues: (i) if the activity causing environmental degradation was defined as a "land clearing activity"; (ii) if acid sulphate water is defined as a "contaminant"; (iii) if the relevant water quality criteria (yet to be defined under the legislation) has been violated; (iv) a demonstrable lack of due diligence by a landowner (yet to be defined in an Agricultural Code of Practice), and (v) the significance of environmental harm resulting from this activity.

There is no question that the *Environmental Protection Act 1994* will be more relevant in managing specified farming practices. Farming practices which create air emissions (*e.g.*, cane burning), discharge water which contravene stormwater quality standards, contaminate land or groundwater through the use of pesticides, or exceed specified noise levels could be prosecuted.

4.4 Local Government

The Queensland Department of Planning and Local Government (QDPLG) ensures that the requirements of the *Local Government (Environment and Development) Act* are met. Local governments are responsible for implementing the *Act* in a manner consistent with goals and objectives stated in its strategic plan.

The Hinchinbrook Shire adopted its first strategic plan in 1984. It identifies a "rural zone" which predominates all other land uses and promotes a climate for cane land expansion. Under law, permitted development (*i.e.*, consistent with the zoning) is considered "as a right" which precludes the shire reviewing proposals and initiating environmental assessments. Cane land expansion within the rural zone is not referred to the Shire. Therefore, it receives very little information and has very little influence regarding the cane expansion process and its final decisions. The development of sugar-related rail and road systems impact on shire drainage works. Roads will be maintained by the Shire. These developments are treated "as a right" which precludes their formal review through the impact assessment provisions of the *Local Government (Planning and Development) Act*. Other legislation related to transport development provides for Shire participation in these areas.

However, a key point concerns how cane land expansion affects changes to land valuation, drainage flows and road maintenance costs - all responsibilities of the Shire. Yet, local government is poorly informed of the assignment process and its outcomes.

The strategic plan is being reviewed at present. Many respondents believe that the new plan should protect riparian corridors and other significant biophysical features through zoning. While this might be desirable, it faces some practical problems. On the one hand, any rezoning of rural land which allowed alternate forms of development (*e.g.*, tourism, urban) could contravene Queensland's State Planning Policy on Agricultural Land. On the other hand, if existing rural areas were 'down zoned' (*i.e.*, precludes land development allowed under the former plan) to provide for nature conservation, compensation must be awarded to the landowner. Funding for this award is the sole responsibility of local government and could take the form of rate relief. Given the relatively higher concern for coastal areas versus inland water environments, the revised plan may give more importance to the former than the latter. These factors constrain the ability of local government to declare protected areas. It must consider these and similar initiatives in the context of other legitimate social and economic concerns.

The proposed *Planning, Environment and Development Assessment Bill* (PEDA) will streamline local planning. A 'whole of government' approach to the review of development proposals is to enhance the efficiency and effectiveness of responses from relevant state agencies. The general intent suggests that development applications submitted to local governments will be circulated to relevant agencies for comment. These responses, which will be required within specified time frames, will be reviewed, and more timely and appropriate decisions made. While that initiative is not being actively pursued by the present state government, interview respondents suggested that the intent of this legislation will be embraced through existing administrative mechanisms. The outcome will likely see more timely decision making and more decision-making responsibility will be placed on local governments.

The Herbert River Improvement Trust is essentially another arm of local government. Having a jurisdictional area embracing the Hinchinbrook Shire, this agency consists of two local counsellors and a QDNR representative. While it is primarily concerned with instream erosion and flood protection, it could play a modest role in water and related land management. In the Hinchinbrook Shire, a river improvement notice of 10 m adjacent to specified water courses has been applied to subdivision proposals on land. For $110.00 fee, this notice is attached on the land title which prevents alteration of the channel and the clearing of the adjacent corridor. This mechanism provides for secure land tenure under the Herbert River Improvement Trust and precludes clearing or development within the designated area. The primary objective is to ensure major water courses are maintained for rural and urban drainage purposes.

4.5 Integrated Catchment Management

The Queensland Government released *Integrated Catchment Management* (ICM) in 1991 as a means of considering

> the management of land, water and related biological resources in order to achieve the sustainable and balanced use of these resources. It provides a framework for fostering cooperation and coordination between many land holders and other resource users, community groups and government agencies involved in the use and management of land and water resources (Queensland, 1991, 1).

While it was recognised that other government initiatives such as the proposed State Conservation Strategy, State-wide environmental programs (*e.g.*, Landcare), and broad regional

strategies such as the Far North Queensland 2010 Growth Management Strategy and Coastal Protection Strategy would be important activities, ICM was to involve all sectors of the community and thereby achieve integrated and coordinated action. ICM was also to focus on several important issues, rather than a single issue base, in achieving an integrated perspective. The final product of the ICM process is a Catchment Strategy which prioritises catchment issues, and identifies appropriate implementation mechanisms. This catchment strategy could develop codes of practice or other mechanisms which could influence cane land expansion or related activities such as drainage or irrigation practices.

Implementation of ICM would foster a 'whole of government' approach by providing a strategy which was consistent with policies and guidelines of all levels of government. Three options for implementation were identified. The preferred choice would see the Catchment Coordinating Committee (CCC) seek the voluntary adoption of catchment management strategies by land holders and resource users, community action groups, and government agencies. Presumably, the strategy development process would educate resource managers about the need for specified resource management activities. Where voluntary implementation was jeopardised, CCCs could request the appropriate state minister (*e.g.*, QDPI, QDoE, QDNR, QDPLG) to have local and state agencies consider catchment management strategies in their routine operations. The final option would see the establishment of a catchment trust or similar statutory body for specified issues such as soil conservation, floodplain management, or river improvement. This issue was considered in the 1994 document *The Sustainable Use and Management of Queensland's Natural Resources* (QDPI, 1994b).

In 1993, a Herbert River Catchment Coordinating Committee (HRCCC) was formed and a coordinator hired. Sugar cane expansion has been one important issue identified by HRCCC members, and will be addressed in its forthcoming catchment strategy.

4.6 Other Legislative Requirements

The outcomes of the previously noted Hinchinbrook Shire Strategic Plan review and HRCCC planning are unclear. This uncertainty also extends to some other recent legislative initiatives in Queensland. The *Coastal Protection and Management Act* and the *Wet Tropics Management Act* will likely identify wetlands and riverine environments on a selected basis. Under the former, control districts, defined as the foreshore and up to 400 m inland or up to 1 km inland along estuarine deltas or all coastal wetlands or dune systems, will be formed in the future. The latter has seen the recent release of a *Draft Wet Tropics Management Plan* which proposes the protection of other sensitive areas (Wet Tropics Management Authority, 1995). When a local land use scheme is adopted, information from these and other relevant Commonwealth and State initiatives should be incorporated into relevant municipal planning documents. State agencies will also have to have regard for these statements.

The Commonwealth Government is involved through funding programs such as the previously mentioned SCERP. In 1992, it funded in cooperation with the State Government and the sugar industry a Sugar Industry Infrastructure Package (SIIP). Each mill area formed committees consisting of millers and farmers to determine which projects would be nominated for funding. The Herbert River District was successful in its application, and a preliminary engineering study has identified 8 drainage projects worthy of more detailed engineering design. That study also advocates the formation of a single drainage board to provide for an adequate level of maintenance. That single board would replace the existing fragmented arrangement, but would not extend to the entire cane growing area of the lower Herbert River.

Requirements of the *Endangered Species Protection Act 1992*, *World Heritage Properties Conservation Act 1983*, and the *Environment Protection (Impact of Proposals) Act 1974* may also influence the development of new cane lands.

4.7 Summary

The arrangements influencing the expansion of cane land and associated farming practices are fragmented. Concern has been expressed concerning the adequacy and effectiveness of these institutional arrangements to protect the special resources of the offshore Great Barrier Reef and the adjacent wet tropical rainforests, and the less publicised but important coastal wetlands and floodplain areas. This complex set of arrangements could also confuse a public who are unaccustomed to this high level of government involvement. It is this type of concern which prompts the suggestion for a 'whole of government' approach in reviewing the environmental aspects of development proposals. Providing for effective institutional arrangements from this fragmented resource management approach supports the four principles shared by government and the CANEGROWERS - balance, ecosystem, partnership and flexibility.

5.0 PUTTING INTENT INTO PRACTICE: THE INSTITUTIONAL ARRANGEMENTS FOR CANE LAND ASSIGNMENT

5.1 **The** Sugar Industry Act 1994

Before 1991, growth in the sugar industry was controlled through a series of international agreements and tariffs. In Australia, the Sugar Board provided a highly centralised decision-making structure. This arrangement changed in 1991 with the passage of the *Sugar Industry Act 1994*. That statute provided for annual minimum increases in assignment of 2.5% (about 10,000 ha) between 1991 and 1995, and greater flexibility in the administration of the *Act*. Some of this flexibility was achieved by delegating increased decision-making responsibility to Local Boards. However, the centralised administration of the Central Sugar Cane Prices Board meant that they were not that active. Under the tenure of the Queensland Sugar Corporation (QSC), this situation has changed.

A detailed review of the assignment system can be found in ABARE (1991) and Industry Commission (1992). In brief, sugar cane or land assignment was introduced in 1926 to control the level and location of sugar cane production, and to preclude the growing and commercial harvesting of cane (Industry Commission, 1992). Until 1991, cane land expansions were 'planned for' by the Sugar Board. Assignments were originally specified in terms of particular plots of land on a designated farm, and growers could not easily get permission to change assignments even within existing farm boundaries. This requirement was changed in 1991. Cane can now be grown on any part of an assigned area. While growing on unassigned land is not prohibited, mills are not obliged to accept it and the grower receives a penalty price of $1 per tonne.

Mill and farm assignments continue to control the size and rate of growth at state and local levels. At a local level, these regulations match cane production with a mill's crushing capacity and transport infrastructure, so that expansion does not penalise existing growers (Industry Commission, 1992). Improvements and expansion of the transport network and mill infrastructure occur regularly in response to market conditions, and provide opportunities for cane land expansion. At a state level, regulations should ensure markets for the sugar products.

5.2 Considerations in Granting Assignment

Section 12 of the *Sugar Industry Act 1994* identifies the principal objectives of the QSC as:

- ensuring that the policies for the Queensland sugar industry are successfully implemented;
- enhancing the efficiency, competitiveness and access to markets of the Queensland raw sugar industry;
- enhancing the long-term economy of the Queensland sugar industry
- enhancing the benefits flowing from the Queensland sugar industry to cane growers and mill owners and to the economy of Queensland; and
- encouraging initiative and innovation among cane growers and mill owners and others involved in the Queensland sugar industry (QSC, 1995, 4).

While the QSC is responsible for implementing the *Sugar Industry Act 1994*, it has delegated much of the responsibility for mill-area decision making to the 25 Local Boards in Queensland. These bodies are constituted under the *Act* with the objective of ensuring the efficient participation of mill owners and canegrowers in the production and milling of cane. As noted earlier, each Local Board comprises an independent chair, two mill representatives, and two mill supplier representatives. The *Primary Producers' Organisation and Marketing Act 1926* established CANEGROWERS as the formal grower body for sugar cane (excluding marketing functions) (CANEGROWERS, 1995). It is the Local Board which acts as an 'agent' for the QSC, and receives and determines applications for new and increased assignment (Briody, 1995). Powers to rescind assignment are reserved by QSC on the advice of the Local Board.

QSC's statutory objectives are oriented toward economic considerations, although the 'long-term economy' of the industry can be achieved, in part, through effective natural resource management. Direct reference to the environment in the *Sugar Industry Act 1994* is found in Sections 144(2)(c) and 147(4)(a)(iii) which require environmental issues to be part of the decision-making process. Reference to the environment is also found under the *Sugar Industry (Assignment Grant) Guidelines* which are established under Section 29(b) of the *Sugar Industry Act 1994*. The guidelines should be viewed as QSC policy which must be complied with by all Local Boards. All respondents from the Macknade and Victoria Local Board were keenly aware of their obligations under the *Act* and *Guidelines*. Section 6 of the *Guidelines* outlines general considerations in granting assignment, and includes the following implicit and explicit references to the environment.

(b) the principal objectives of the Corporation mentioned in section 12 of the Act; and
(c) any view expressed by the relevant Local Board on a relevant local matter; and
(e) the capacity of the proposed assignment's land for producing commercial crops of sugar cane when subjected to correct agricultural practices; and
(f) the prospects of preparing and using the proposed assignment's land without undue damage to the environment...

In addition, Section 8(1)(e) of the *Sugar Industry (Assignment Grant) (No.2) Guideline 1995* indicates that an application will be granted if the QSC and Local Board are satisfied that the proposed assignment land is:

> able to be prepared and used for the growing of sugar cane without undue damage to the environment.

The Local Board is also to consider the efficient and cost-effective delivery of sugar cane to the receiving mill. For applicants who do not hold an existing assignment, their willingness and capacity to develop the land in a timely manner (usually a 2-year period), and their place of

residence is appraised. Thus, environmental, economic and social factors are the basis of the final assignment decisions.

5.3 Cane Assignment Process in the Herbert River District

As noted earlier, there are two CSR mills operating in the Herbert River District - Victoria and Macknade. Each has its own Local Board and shared the same chairman during the study period. During that time, the cane assignment process has evolved continually in two significant aspects: (i) more responsibility for awarding assignment has been delegated from the QSC to Local Boards; and (ii) the formal consideration of environmental aspects has become more apparent. Table 3 outlines the most recent expansion application process and its timing for the 1996. To place the activities of the Local Board in context, the process has been divided into four stages (Table 3). Stage 3 is the formal assignment process as defined under the *Sugar Industry Act 1994*. However, important decisions made by corporations and governments (Stage 1), and by millers and growers (Stage 2) define the desirability and feasibility of any expansion activity. Successful applicants make the assignment effective in stage 4.

5.3.1 Stage 1: International and Corporate Contexts

The context for expansion reflects, in large part, perceived market opportunities and the corporate (miller's) perception regarding the desirability and feasibility of mill expansion. With regards to the former, a "World Market Prospects" report is prepared by the QSC's marketing agent CSR Limited. It considers the world demand for and supply of sugar, and significant world and national legislative initiatives (*e.g.*, GATT, U.S. Farm Bills, European Union Agricultural Policies) to identify market opportunities for Australian products. This report is circulated to local boards, millers, CANEGROWERS and other relevant organisations. The feasibility of increasing mill capacity will reflect corporate goals and capabilities, the opportunities for cane land expansion, and infrastructure needs (*e.g.*, rail lines, roads, bridges). Decisions to increase mill capacity are most often made a few years prior to implementation.

5.3.2 Stage 2: Continuous Crushing Agreement

In the Herbert River District, a "Continuous Crushing Agreement" between the CANEGROWERS and CSR significantly influences the regional industry's development. It establishes the harvesting period, production and crushing capacities, future growth, and transport planning for the regional sugar industry. This agreement has implications for expansion planning and resource management. Factors external to the industry which pertain to the availability of sugar cane land (*e.g.*, zoning in shire plan, national parks) can influence plans to expand cane farming.

The 1995 Agreement specifies the harvest season as starting on the Monday between June 19 and June 25 (unless extraordinary circumstances arise), with a target season length of 20 weeks and 3 days (*i.e.*, ending by November 15). This period is coincident with a high level of sugar content in the stalks (as measured by commercial cane sugar (ccs)), and before the summer rains prevent easy access onto paddocks. The average sugar content ranges from around 10 ccs at the beginning and end of the season to 16 ccs in the middle. After harvesting, ccs within the sugar cane quickly decreases. To reduce this loss, which is one basis for payment to growers, harvesting and processing must be effectively scheduled. This factor is particularly important in the Herbert River District since the mills are not centrally located in the cane growing areas. Like most cane growing areas, most cane transport is done on mill-owned and maintained 2' gauge railways. The "Continuous Crushing Agreement" guides railway development by tying it to cane assignment. Since the transport of the cane from delivery points to the mills via the rail system is the miller's responsibility, both CANEGROWERS and the mills must be confident that the transport

network can deliver the cane in a very timely manner. The implicit objective is to match sugar cane production with transport and crushing capabilities.

Table 3
Herbert River District - Cane Expansion Process: Stages, Timing, Key Decisions and Selected Significant Participants Which Influence Decision Making

Stage	Timing (1995)	Decisions	Participants and Means of Influencing Decision Making
Stage 1	2 - 5 years ahead	International Agreements National Trade Policies Corporate Goals QSC/CSR 'Prospects' Report	Governments and Corporations * international agreements * other sugar-producing nations * perceived market opportunities * corporate goals and expectations * export infrastructure (*e.g.*,terminals)
Stage 2	yearly	Continuous Crushing Agreement	Millers and CANEGROWERS * mill goals relative to corporate goals * mill capacity for growth * transport capacity for growth * existing grower expectations * availability of suitable land with agricultural zoning
Stage 3 (formal assignment process)	Aug. 1	Call for Applications through print media	QSC and Local Boards * *Sugar Industry Act*
	Aug. 31	Received by Local Board	applicant * goals, experience and capabilities
	Sept. 1-31	Refer to *ad hoc* Technical Review Committee and required field inspections	financial institutions/family sources * loan conditions (if required)
		Agreement on desired mill allocation	QDPI/QDoE/QDNR/QDPLG * *Water Resource Act* * *Fisheries Act* * *Nature Conservation Act* * *Environmental Protection Act* * *Lands Act* * *Local Government (Planning and Environment) Act* * *State Development and Public Works Organisation Act*
	October	QSC notified of total applicant demand and desired mill allocation	
		QSC consults with industry and QDPI Minister	
		Farm and Mill Allocations Determined	Hinchinbrook Shire: * strategic plan * River Trust
	Nov./Dec.	Applicants Notified	HRCCC: * strategic plan
Stage 4	within next 2 years	successful applicants make assignment effective	QDPI/QDEH/QDNR * *Water Resource Act* * *Environmental Protection Act* * extension services

Some biophysical properties of sugar cane present management challenges. When a sugar crop is planted, it may be 12 to 18 months before it is harvested. Over that time, loan payments must be made. In the Herbert River District, real estate agents suggested that existing cleared cane land could sell for $3,000 to $5,000 per hectare, while uncleared land demanded $2,500 to $4,000 per hectare. These costs can impose a heavy burden for new and rapidly expanding operations, and provide opportunities for financial institutions to influence the nature and extent of expansion.

Given the wide array of viewpoints which prevail upon the formal assignment process (Table 3), there is a need for effective institutional design.

Biophysical aspects of the sugar cane present other management challenges. Maximum sugar output can be achieved in the middle of the growing season when ccs is highest. However, the realisation of this objective requires enormous increases in existing mill crushing capacities to handle the crop before it deteriorates. For the rest of the year, the mill remains idle. Under present economic conditions, milling representatives suggested that this situation is not viable. To increase the productive use of mill facilities, CSR Ltd. has, since 1993, operated on a continuous basis - 7-days-per-week, 24-hours-per-day during the harvest season. The present June to November harvest period represents a tradeoff between benefits of spreading the cost of milling capital over a longer season and the reduction in sugar yield at the beginning and end of the season. This means that if cane production exceeds crushing capacity, the length of the harvest season must be extended when ccs is dropping. While the "Continuous Crushing Agreement" provides compensation to farmers in these circumstances, extending a harvest season can cause conflict. In the following year, a shortened growing season due to the preceding late harvest lends to smaller cane sizes which attract lower prices. Short cane is also more susceptible to flood damage which is most likely during the summer period (December - February). Thus, compensation must be seen in light of the potential economic losses to farmers and the ability of the mill to pay.

The "Continuous Crushing Agreement" provides a basis for long- and medium-term planning at the regional level. In the Herbert River District, it notes that over an unspecified period, the amount of assigned land could reach 100,000 ha (Agreement, 1995). In planning for forthcoming expansions, it was agreed:

> ... to work together to determine a forecast area of new land to be harvested in the following year by early July in each year. Based on this area and the cultivated area recorded for the current season, and using the five year average rotation for harvest, [which included the estimated area for harvest for the current season] the district forecast area for harvest in the next year can be determined; and that
> ... CSR undertakes that crushing capacity will be available for the processing of the whole district crop yielding up to 83 tonnes per hectare over the forecast area for the harvest determined ... at CCS levels of up to 14.0 units, within the target season length stipulated ... provided that the target season length may be extended [under specified circumstances] (Agreement, 1995, 3).

Expansion in the Herbert River District is based on CSR's ability to transport and crush sugar cane grown at an estimated yield of 83 tonnes per hectare. Existing growers must feel secure in the mill's ability to crush the crop, and CSR must be assured that farmers can deliver the agreed amount of cane.

5.3.3 Stage 3: Formal Assignment Process

International markets and "Continuous Crushing Agreements" set the context for increasing assignment. The *Sugar Industry Act 1994* outlines the requirements of the formal assignment process. The QSC places an advertisement in regional newspapers across the state and the CANEGROWERS magazine (Table 3). Interested readers apply to the relevant Local Board which receives and reviews the applications following the previously mentioned QSC guidelines.

During the study period, the application form required information concerning the:

- type of application (*e.g.*, new or increased)
- applicant's address

- new grower or current assignment information (*e.g.*, mill, existing assignment, increase sought, spare land available)
- location of increased assignment (*e.g.*, previously assigned or new land)
- land tenure (*e.g.*, lease or freehold)
- evidence of title and any land use restrictions
- land cover (*e.g.*, cleared, uncleared, partly cleared, under cane)
- development program (*i.e.*, when planting of cane will occur)

The state agencies and relevant statutes, programs, and policies described in the previous chapter influence individual applicants, and the decision-making process (Table 3). Before 1994, participation from government agencies and drainage boards was almost nonexistent. In 1994, QDPI with some informal input from QDEH provided some comments. A more visible and multi-agency mechanism was used in the review of 1996 applications. An *ad hoc* technical committee comprising representatives from QDPI, QDEH, BSES, and CSR Ltd. considered the environmental impacts of the application based on: (i) available 1995 ortho-photo mapping, (ii) soil surveys and other available mapping, (iii) local knowledge, (iv) information provided on the application, and (v) a property management plan which was required from all applicants for the first time in 1996. In preparing these property management plans, some applicants received detailed assistance from QDPI, others more informal assistance from BSES or CSR field staff, while others submitted rough sketches of their properties. All plans focused on land management issues.

Representatives from the Local Boards and *ad hoc* technical review committee conducted site inspections for properties of significant concern. Final recommendations were made by the *ad hoc* committee and were forwarded to the Local Boards. After considering which applications met the guidelines, the advice of the *ad hoc* technical committee and having reached agreement on mill capacity, the Local Boards advised the QSC regarding: (i) the total level of applications; and (ii) the amount of expansion it is prepared to approve (Table 3). This information for all mill areas was presented by the QSC to industry groups and the Minister for QDPI (as required by statute), and a final decision was made by the QSC. Applicants were notified in writing by the QSC.

Unsuccessful assignment applicants may appeal to the Sugar Industry Tribunal, or apply in subsequent years. Successful applicants have two years to make assignments effective (*i.e.*, delivering sugar cane to the mill) (Stage 4, Table 3). Twelve month extensions may be given. Farmers will be required to abide by regulations and codes of practice established under the *Environmental Protection Act*. If drainage works (as defined by statute) or irrigation waters are required, applications under the *Water Resources Act* must be submitted to QDNR for review. QDPI and QDNR provide extension services to farmers.

For the 1996 award, the call for applications was made on 1 August and decision announced by 31 December at the latest (Table 3). For the 1997 award, the QSC announced that applications must be submitted to Local Boards by 31 June 1996. Local Boards are to notify the QSC by 31 July of the total applicant demand and the desired mill application. Applicants will be notified in late September of final decisions.

6.0 INITIAL OBSERVATIONS ON THE CANE LAND EXPANSION PROCESS

Australian resource managers need to demonstrate clearly how their decision-making processes facilitate effective, efficient and equitable outcomes. To address this challenge, the Macknade and Victoria Local Boards have (i) formed the *ad hoc* technical review committee (in 1996), (ii)

required applicants to submit a property management plan with applications (in 1996), and (iii) developed an evolving list of conditions of assignment (Table 4). This list initially embraced drainage and soil conservation issues. It now encompasses wildlife and water quality issues. This evolution illustrates an appreciation of the functional aspects of resources, to one which embraces some ecosystem values as well.

Table 4. Evolution of Environment-Related Conditions of Assignment: 1993-1996

General Concern	Specific Condition	Applicable Year 1993	1994	1995	1996
Administrative	- failure to comply with any condition may result in assignment being rescinded	*	*	*	*
	- all requirements with all or any relevant State legislation applying to a particular location, development, proposal or project must be met				*
Drainage	- works must comply with the Rural Drainage Plan (1984) or other approved standards	*	*	*	*
	- growers may be required to cooperate in formation of community-based drainage or soil conservation schemes	*	*		
	- plans for works must be in accordance with the plan submitted at the time of application		*		*
	- any works within or connecting to a watercourse, lake, or spring must be authorised by a relevant licence or permit under the *Water Resources Act 1989* prior to the works being undertaken		*	*	*
	- areas known to be preferential flood overflow paths are excluded				*
Land and Water	- areas of acid sulphate soil may not be used for cane growing			*	*
	- development must comply with "Interim Guidelines for Development on Floodplains"			*	
	- following areas excluded: - mangrove swamps naturally subject to tidal inundation - areas below 3 m contour are excluded - areas below 9.5 m contour in Pomona Subdivision in Cattle Creek catchment - riparian zones of 20 m along water courses and drainage lines, and 40 m along major watercourse				* * * *
Soil	- land holders are encouraged to seek and adopt advice from DPI on soil conservation measures for slopes >3^{o}			*	
	- land holders must seek and adopt advice from DPI on soil conservation measures for slopes >3^{o}				*
	- areas of class 4 and 5 DPI land suitability excluded				*
Wildlife	- 20 m riparian zone of native vegetation must be maintained on each side of existing watercourses as a habitat corridor for the Mahogany Glider				*

Since the cane expansion process has been constantly developing, no radical changes to existing processes are recommended at this time. However, improvements must be made. One way of enhancing current performance is to provide greater consistency between the general intent of the four shared management principles noted in the *Intergovernmental Agreement on the Environment* and *Caring for the Environment* - balance, partnerships, ecosystem, and flexibility (Table 1) and the formal assignment process (Table 3). Inconsistencies can lead to frustration, confusion, and detract from public and governmental support. It is also appropriate to consider the broadening the management base from four to five principles by embracing the precautionary principle. Given the upcoming review of the sugar industry, it is appropriate to provide a wide and firm basis for discussion. Subsequent monitoring and research will better determine the need for additional modifications, or more radical reforms.

The following discussion highlights some initial key aspects associated with the assignment **process**. An evaluation of **practice** will be provided in a subsequent report. The five principles of balance, ecosystem, partnerships, flexibility and precautionary principle guide the following discussion and its recommendations.

6.1 Enhancing Balanced Management

Balanced management meant appreciating the environmental, social and economic dimensions of resource development and management. This issue is closely linked with the partnership principle. This paper distinguishes between these two concepts by suggesting that balanced management considers issues of how and when that goal is achieved. Partnership refers to who is involved in the management process.

6.1.1 The How: The Ad hoc Committee

The formation of the *ad hoc* technical review committee and the development of the conditions of assignment reflect the Local Boards' primary responses to changing circumstances. However, concern exists regarding the relative merit given to environmental considerations against social and economic concerns. While this issue will be examined in the subsequent report, it is appropriate to note that eleven applicants were denied increased assignment in 1996. However, none of these were among the six which were refused assignment by the Local Board. This discrepancy suggests that economic and social considerations are given relatively more importance in cane assignment than environmental aspects. It can also imply a lack of credibility and the high level of uncertainty, indeterminacy and ignorance in the technical aspects of resource management (Table 2).

This situation could suggest that the efforts of the technical review committee were ill-spent. On a more positive and cooperative note, the list of conditions recommended for the 1996 assignments by the *ad hoc* technical review committee was accepted by the Local Boards. Some members of the *ad hoc* technical committee were generally satisfied with the process, while others expressed some level of frustration. It is desirable and feasible to improve the process within the existing administrative framework.

It is suggested that members of the *ad hoc* technical review committee and Local Boards learn from this initial experience. A fundamental issue concerns the effective communication between the two groups. For instance, while the information provided from the *ad hoc* technical review committee identified the potential for negative impacts, perhaps their significance was not demonstrated clearly to the Local Boards. In particular, discussions should focus on: (i) how the assignment conditions effectively mitigate against significant environmental impacts and meet the

requirements of the *Sugar Industry (Assignment Grant) Guidelines*; and (ii) how final award decisions reflect an appropriate balance among environmental, social and economic factors.

Another fundamental aspect concerns enhancing the credibility of the *ad hoc* committee and providing more effective conflict resolution mechanisms. In six instances, assignment was granted against the advice of the *ad hoc* technical committee. The basis of these awards is unclear to members of the *ad hoc* committee, and fundamental conflicts between these groups remain unresolved. This situation may contribute to an escalation of conflict. Mechanisms to exchange views and resolve conflicts are absent from the existing process. The Local Board is not required to explain discrepancies between itself and the *ad hoc* technical committee.

Available conflict resolution mechanisms are channelled through the QSC in the form of: (i) administrative 'pressure' applied by the QSC; or (ii) a formal appeal by the Sugar Industry Tribunal. These approaches are inconsistent with the principle of partnership. Alternative dispute resolution and locally based administrative mechanisms should be incorporated into the *Sugar Industry (Assignment Grant) Guidelines*, or legislative changes to the *Sugar Industry Act*. If these locally based mechanisms fail, decisions can be made through existing mechanisms - the QSC and Sugar Industry Tribunal.

If the current situation is not addressed, these conflicts could prompt the need for more radical changes to the membership, responsibilities and powers of Local Boards, and their relationship with advisory bodies.

Recommendation: That the *ad hoc* technical committee and Local Board members review how to improve the present referral process. Locally based conflict resolution mechanisms should be established and applied before the formal involvement of the QSC or Sugar Industry Tribunal. These should be codified in the *Sugar Industry Act* and/or *Sugar Industry (Assignment Grant) Guidelines*.

> **Action required by:** QSC, CANEGROWERS, Local Board and *ad hoc* Technical Review Committee members.

6.1.2 The When: Better Late than Never ?

Prior to the formation of the *ad hoc* technical review committee, there were few opportunities for views outside of the sugar industry to be expressed. That committee's formation provides only modest opportunities to significantly influence decision making. This problem reflects two issues: (i) higher levels of decision making occur in the absence of meaningful stakeholder involvement; and (ii) as a result, environmental issues are considered only when assignment allocations are considered. In the context of the sugar cane assignment process (Table 3), there are limited opportunities for 'the environment' to be considered in Stages 1 and 2. Environmental factors are incorporated at Stage 3 through either the influence of state and local agencies, or the *ad hoc* technical review committee. This situation limits the influence of environmental interests over the cane assignment process.

At present, Stages 1 and 2 of the assignment process favour economic and corporate goals (Table 3). Once these goals are established, they tend to 'drive' the cane assignment process (Table 3). The outcome of this decision-making structure relegates the 'environment' to an accommodative or reactive position relative to these primarily economic considerations. Social issues such as the viability of the family farm and the impact of road developments on municipal operations are not systematically considered at any stage of the assignment process. In providing for balance management, it is appropriate to consider why, when and how this principle is achieved.

The sugar industry's recent experience with 'the environment' suggests that a 'crisis' (*e.g.*, Mahogany Glider), or an 'opportunity' (*e.g.*, SIIP) provide a need for intermittent interaction among a broad range of participants. Unfortunately, destructive conflict is often associated with a 'crisis' and frustrates balanced decision making. Funding opportunities often require the quick submission of a proposal which precludes raising a wide range of issues. In the Herbert River SIIP discussion, participants were essentially presented with a 1984 engineering study as the only feasible proposal which could feasibly meet Commonwealth and State Government submission dates. In both 'crisis' and 'opportunistic' circumstances, discussions essentially focus on addressing "what will be done". In these decision-making environments, it is difficult to raise issues which consider "what should or could be done".

In resource management, three levels of questions can be asked: (i) what should be done (normative planning); (ii) what could be done (strategic planning); and (iii) what will be done (operational planning) (Smith, 1993). The structure and practice of environmental management within the sugar industry suggests that 'environmentalists' who have limited input into assignment decisions will ask normative and/or strategic planning questions (Stage 1 and 2), while the industry is asking operational ones (Stage 3). This incongruity can lead to frustration and conflict. The *ad hoc* technical review committee provides little assistance in raising the level of debate because it is essentially concerned with operational rather than strategic issues. Social impacts are overlooked in the existing process. There is no representation from the Social Impact Assessment Unit (Queensland Department of Family Services) or shire on the ad hoc technical committee which could assist in this aspect of a balanced review.

The "Continuous Crushing Agreement" is the key strategic planning document which guides cane expansion in the Herbert River District. At present, it essentially matches projected increases in crushing and transport capacity to production capacity. When a conflict concerning assignment has occurred, "environmentalists" have sometimes questioned why the assignment was granted in the first place (i.e., strategic question). In contrast, the 'sugar cane industry' has asked how what mitigative measures might protect environmental values (i.e. operational question). This difference illustrates the difficulties in embracing environmental values late in planning processes. Once economic goals (*e.g.*, mill capacities) are established, it becomes difficult to raise other legitimate issues and perceive to be 'constructive'. In addition, these discussions are intermittent, rather than ongoing. If decisions are to be more balanced, there is a need for the cane allocation process to effectively consider the 'environment' as well as social aspects earlier in the decision-making process, and on an ongoing basis.

This situation could be addressed to some extent by broadening the foundation of the "Continuous Crushing Agreement". For instance, medium-term expansions could better incorporate environmental and social issues which identify both constraints and opportunities for growth. The recent establishment of the Herbert Resource Information Centre should facilitate this type of planning. In addition, through the CANEGROWERS, shire and the Queensland Department of Family Services, social issues related to the role of the family farm, as well as economic and environmental considerations could guide medium term expansions. This mix of issues could be incorporated into mill expansion and transport planning activities. In this manner, the Local Boards can better consider and communicate to potential applicants the relative weight that both the industry and existing cane growers give to specific decision criteria. In this manner, it could make an explicit statement that ensuring the viability of family farms would be given preference, or that future expansion would favour specific locations. At a corporate level, CSR could ensure that its corporate strategy embraces 'green' values. The

common element in these initiatives is to introduce environmental and social issues earlier in the cane assignment process.

Participation in the "Continuous Crushing Agreement" could be broadened to incorporate the views of relevant government agencies, local government, and the public. The desirability and effective management of cane expansion could be considered from economic, environmental and social perspectives. In this manner, the sugar industry would enhance the development of a balanced perspective in Stage 2 (Table 3), and ideally reduce current levels of frustration, time, and resources required to resolve conflicts.

Recommendation: Providing for the earlier consideration of environmental and social factors in the cane assignment process through existing mechanisms such as "Continuous Crushing Agreements" and corporate policies.

> **Action required by:** QSC, Local Boards, Local Mills, CANEGROWERS, Corporate Interests.

Related activities will be considered in the adoption of ecosystem and partnership approaches.

6.1.3 Altering the Timing of the Proces s

Decision making processes should not unintentionally provide for negative outcomes. Announcing final assignment decisions in the summer months as was done in 1995 (Table 3) can have such an effect. For many growers in the Herbert River District, land clearing is perceived to be most convenient, easiest, and cheapest in February - March while the harvest is three months away and the ground is moist. This period also provides sufficient time to plant a crop and harvest it in the next season.

Between 1993-1996, specific announcement dates have varied. They have primarily reflected administrative requirements rather than an applicant's needs and environmental conditions. This timing, when combined with a farmer's potential need to make payments on loans and a perception that Local Boards favour applicants who can provide cane to the mill quickly, often promotes land clearing and planting before the announcement of assignment grants (*i.e.*, pre-emptive clearing). This perception is created, in part, by the application form which asks the area of land which is cleared, uncleared, partially cleared and under cane.

The review of applications for the 1993-1996 period suggests that many applicants have substantial areas of partially cleared or cleared land (50%+), and some applicants (10%-15%) have some cane planted at the time of application. Pre-emptive clearing can negate or reduce the applicability of subsequent conditions placed on an approved assignment. If the application were refused, it places a farmer in more financial difficulty.

One adjustment would be to impose penalties for the pre-emptive clearing of land through the assignment system. However, this approach alone would not respond to the needs of applicants. The high level of enforcement required is beyond the capacities of existing public agencies to staff and would be contrary to the partnership principle (Table 1). A more consistent approach to reduce pre-emptive clearing is by announcing assignment decisions when farmers are most likely to undertake these activities.

It was noted earlier that 1997 applications are due 30 June 1996, and assignment awards will be announced in September 1996. While this adjustment could assist in reducing pre-emptive clearing, it is unclear how effective it will be in the Herbert River District. The majority of local

interview respondents specified that announcements should be made in the February period. Since soil moisture, precipitation patterns and farmer practices vary throughout the state, the most effective approach may require application and announcement dates to be based on a regional or mill basis. This represents a shift from the present practice which applies the same administrative timing across the state. Its feasibility should be considered in the context of essential administrative requirements.

Recommendation: Reducing the perceived need for pre-emptive clearing by adjusting the timing of the assignment process. In the Herbert River District, this would see the announcement of assignment awards in the February.

Action required by: QSC.

6.2 Enhancing Ecosystem Management

Ecosystem management pays particular attention to linkages among biophysical processes and how human activities affect them. One precept of environmental planning is to prevent problems rather than react to them. Conditions of assignment should address this goal by preventing and mitigating against the negative impacts associated with land clearing and subsequent farming activities (Table 4). The cane assignment process should ensure that: (i) proposed expansions do not significantly degrade the existing environment, and that; (ii) successful applicants do not cause off-site problems by interfering with the drainage of other properties, and degrade the natural environment. To achieve these ends, the assignment process should consider a broad range of environmental issues and mitigative measures.

The development of more conditions reflects, in large part, the participation of QDPI and QDEH in the assignment process since 1994, and the response of the Local Boards to demonstrate a recognisable duty of care. While these intentions are well founded, its effective delivery is difficult as illustrated by the management of drainage issues in the lower Herbert River.

6.2.1 Responding to Drainage Problems of the 1970s

The *Hinchinbrook Rural Drainage Study* (1984) has been consistently referred to in conditions of assignment granted between 1993 and 1996 (Table 4). That study's objectives were "to achieve a consistent standard of drainage which would increase rural production and to define required works, their location, cost and benefits to be achieved from the works, and subsequent management and operation leaving only detailed design and documentation necessary to implementation" (Cameron McNamara, 1984, 1-1). These ends were achieved by classifying the lower catchment according to the perceived need, scale and feasibility of structural drainage works. This categorisation, based on site inspections, interviews with relevant private and public resource managers, questionnaire responses from growers, public meetings and 1981 cane productivity data, was used to screen potential areas. Of the three categories established, only two were subjected to detailed drainage design and subsequent benefit-cost and environmental impact analysis, and review of institutional alternatives. The report provided economic analysis on 9 structural alternatives and recommended that a drainage board be formed under the *Water Resources Act*. Since these areas contain parts of catchments, it is unclear how adequately this delineation promotes effective drainage or catchment management. The use of the catchment has been a longstanding principle in water management.

At present, these recommendations form the basis of the more detailed drainage design and institutional analysis being conducted through the Sugar Infrastructure Improvement Package (SIIP). Initiated in 1992, this Commonwealth-State agreement is to enhance the sugar industry's performance. If sufficient landowner support is achieved within the lower Herbert River catchment, the desirability and feasibility of these proposed works and the formation of a unified drainage board can be considered.

Recommendation: Carefully reviewing the proposed Sugar Industry Infrastructure Package (SIIP) projects to ensure that future management options are not unduly constrained.

Action required by: SIIP Board, QDNR, Drainage Boards, HRCCC.

6.2.2 Responding to Drainage Problems of the 1980s and A voiding More in the Future
Much of the land assigned between 1993 and 1996 was not considered for detailed study in 1984 *Hinchinbrook Rural Drainage Study*. Since then, there has been no systematic assessment of the current needs and structural and non-structural drainage alternatives in the lower Herbert River catchment. While property management plans can use 'rule-of-thumb' guidelines to consider individual farm drainage problems, there is no effective plan which considers the cumulative impact of these individual land use changes. In addition, many applicants are only providing sketch maps of their planting intentions, and do not seek professional assistance. This is often not a problem. However, some areas will require drainage works which do not connect to water courses (and do not require a permit). Some successful applicants, such as those in the Pomona and Wharps land holding areas, will require drainage permits under the *Water Resources Act 1989*. Downstream landowners may be concerned that these works could significantly increase inundation of their properties. Increased drainage conflicts among landowners could occur without effective management processes. If drainage permits were denied, farmers would be unable or have some difficulty in recouping financial returns from their full assignment. This situation could promote the use of inappropriate agricultural practices to increase productivity.

If recent rainfall patterns which have been generally below average are maintained, this will not be a pressing issue. However, if precipitation patterns return to more typical distributions and amounts, landowners experiencing acute drainage problems could lobby for the extension of cost-sharing (*e.g.*, SIIP) initiatives to solve their problems. An alternative view suggests that effective cane land assignment should have precluded cane growing in these areas. Effective planning could avoid these difficulties.

Current Commonwealth Government activities (e.g., Coastal Management plans, Conservation plans) will not address the geographic area relevant to the Herbert River sugar industry. In addition, the shire plan will most likely provide more support to the protection of these coastal areas relative to riverine issues. The outcome and impact of the draft plan written by the HRCCC are unclear at present. However, it is primarily focused on operational rather than normative issues.

A proactive resource management document, which considers among other things the desirability and feasibility of cane land expansion, is required. The concept of the 'nested' ecosystem approach could be applied so that needs of the sugar industry at regional and other geographic scales are addressed, and a link between riverine and coastal resources made. This information could be incorporated into the "Continuous Crushing Agreement" and provide for more proactive resource management.

Recommendation: Immediately undertaking a catchment management plan for the entire lower Herbert River area. In evaluating alternatives, it should consider environmental, social and economic impacts on surface, ground, coastal and related land-based resources. It should consider both structural and non-structural alternatives and incorporate, wherever possible, natural channel design and restoration techniques. It should also examine the establishment of a drainage board for the entire lower catchment.

Action required by: CSR and Local Mills, Hinchinbrook Shire, QDNR, CANEGROWERS, Drainage Boards, HRCCC.

6.3 Enhancing Partnerships

There are many resource managers who are influenced by sugar cane assignment decisions. It is appropriate that their legitimate interests are considered so effective tradeoffs can be made and information shared.

6.3.1 Membership of the Local Board

Environmental issues are addressed through the *ad hoc* technical review committee. Mill and grower issues are effectively considered through existing mechanisms. However, an important level of government is essentially excluded from the process. Local rates should reflect land converted from other uses to cane growing. Expansion into new areas will often require road construction, which will eventually be maintained by local ratepayers. Roads and rail lines will affect drainage. All these items are of significance to the Hinchinbrook Shire. At present, no formal mechanism provide it with information concerning the list of applicants or final decisions.

As noted earlier, River Improvement Trusts can have notices placed on a land title when subdivision plans are approved. In the case of the Herbert River Improvement Trust, the shire is the only participating municipality. Given the concern over the maintenance of riparian corridors and the past legacy of individual and unapproved drainage works, it is appropriate to consider similar mechanisms for the assignment process. The impact on local rates would be negligible. Possible cross-sanctions with the *Water Resources Act 1989* and the *Transport Planning and Coordination Act 1994* could also be provided. The consideration of social and economic aspects could be broadened and deepened through the Shire's participation. More timely notices concerning rate changes can be provided.

Recommendation: Better informing the Shire of the assignment process and its outcomes. This should be done through the appointment of a shire representative to the Local Boards who shall have voting rights on expansion decisions.

Action required by: QSC, CANEGROWERS, Local Mills, Shire.

6.4 Enhancing Flexibility

While the list of conditions is a visible response, the effectiveness of its implementation will be unclear without effective monitoring. At present, enforcement is to be achieved primarily through the voluntary reporting of potential violations by individuals. This approach will be most effective for drainage and the maintenance of wildlife corridors which can affect adjacent landowners and are evident. However, failure to comply with elevation-based or soil-type based conditions is more difficult to detect. The recent introduction of the conditions makes it untimely to consider their effective implementation. However, this question must be addressed in the future.

Recommendation: Undertaking an audit within the next three years, which examines the compliance and enforcement of conditions of assignment. Effective and regular monitoring should be incorporated as a QSC responsibility required under the *Sugar Industry Act*.

Action required by: QSC, CANEGROWERS, mills, Local Boards.

6.5 Embracing New Principles: Shifting the Burden of Responsibility

It was noted earlier that applying the precautionary principle had more to do with shifting the burden of responsibility onto the proponents rather than stopping all forms of resource development. One element of the precautionary principle would support the previous recommendation to improve monitoring. However, more could be done to support the application of the precautionary principle through transferring more responsibility to proponents.

In the context of acid sulphate soils, government agencies have provided mapping at a scale of 1:100,000. However, more detailed field studies are required to determine the presence and nature of specific on-farm problems. Present circumstances provide little direction regarding appropriate actions to be taken by applicants in response to this problem. However, it is reactive rather than proactive, and does not place primary responsibility clearly on the applicant.

Recommendation: Developing mechanisms, which place more responsibility on applicants and the industry for determining the nature and extent of acid sulphate soils before the review of an individual application.

> **Action required by:** CANEGROWERS, mills, and BSES to determine: (i) need for industry sponsored surveys which further the existing information base; and (ii) the need for and basis of cost-sharing arrangements which support appropriate soil tests during the application process. Relevant government agencies (*e.g.*, QDPI, QDoE, QDNR) and research organisations (*e.g.,* CSIRO) should participate in these discussions. This could be an important research frontier.

At present, many applications ranging in size from less than 1 ha to over 1,700 ha are made with little consideration of environmental issues. Without an effective water management plan for the entire lower catchment, a screening mechanism should be developed which requires the submission of a detailed property management plan which addresses drainage and environmental considerations. This screen would identify those applicants who would be affected by this additional requirement, and could be based on such factors as location (*e.g.*, relative to specified habitats, soil types, water courses), area of existing assignment and/or area of assignment applied for.

Recommendation: Developing and applying an environmental impact screening mechanism that identifies applicants who must more adequately consider environmental and farm management issues with the submission of their application.

6.6 Concluding Comments: Dealing with the Legacies of the Past

The management of natural and economic resources represents one of the most intractable issues confronting public and private managers. Catchment boundaries and bioregions rarely coincide with the administrative boundaries of government agencies and mill areas. Many political units claim jurisdiction over particular aspects of a resource, and landowners claim rights of use. If

these multiple interests are to be accommodated effectively, it is important to legitimise a common set of principles in a clear manner. What appears to have been lacking in the past and to a lesser extent at the present, is demonstrable leadership regarding the management of both the sugar industry and the natural resources which support it.

The Queensland Sugar Corporation must accept full responsibility to ensure that all aspects of the *Sugar Industry Act 1994* are met. If the technological and administrative changes in the Herbert River District typify the activities of the other 23 mill areas, this will be a challenging task. It has provided for some positive action through its 1994-1995 review of bulk sugar terminal activities to ensure compliance with new Queensland legislation (QSC, 1995), and administering the environmental requirements of the cane assignment regulations.

However, while it has a specific set of legislative objectives and developed assignment regulations, a clear vision of its commitment to sustainable resource management is lacking. This vision could enhance the credibility and legitimacy of ecologically sustainable development. Once established, senior executives should mention these principles in speeches and annual reports. Since the QSC reports to the Minister of Primary Industry, it is appropriate that it embraces the ESD principles outlined in the 1992 *Intergovernmental Agreement on the Environment.*

The industry must take a leadership role if the difficult issues confronting the effective implementation of conditions of assignment are to be addressed effectively. Present conditions of assignment suggest that failure to comply with restrictions may see the award revoked. This places responsibility for enforcement on the Local Board and QSC. These are new roles for these organisations. Leadership at the QSC, CANEGROWERS and mills can establish an expectation that compliance is expected by all farmers. In this manner, farmers who operate without conditions on their assignment should address relevant considerations as though they were in place.

This type of widely based, voluntary action could engender very strong public support. In its absence, public support will be nurtured through compliance and enforcement data. The recommended audit should provide insight into both voluntary compliance and enforcement measures. Those findings will reflect on the leadership qualities of the sugar industry, and identify the need for evolutionary and revolutionary change in its management of natural resources.

Political leadership is also required. The recent change of government at State and Commonwealth levels has provided for some uncertainty regarding their commitment to ESD principles. Needed is strong and sustained political commitment. Such leadership may be provided through 'external' pressures such as the 1992 Earth Summit. It may also be generated from locally based initiatives such as ICM. A return to a tradition of not enforcing the legal requirements of the *Water Resources Act* and other statutes would be most unfortunate, and represent the unfair treatment of citizens.

Recommendation: Senior government, Queensland Sugar Corporation, corporate, CANEGROWERS, and non-governmental officials provide leadership in the formulation and application of ecologically sustainable development.

Many recommendations made in this report encourage and require an organisational culture, in both government and industry, where cooperation and collaboration can occur. However, another essential ingredient is required. Leaders from all relevant participating agencies - senior politicians and officials from government, corporate, and non-governmental sectors - must send

out signals that cooperation and collaboration are wanted and expected. Without this commitment, the most sophisticated arrangements to promote evolutionary change and improvement will fail. This leadership is also required to assist in forming effective community partnerships which overcome the legacy of remote and ineffective resource management by both industry and state government agencies. Without leadership, there is a danger that rather than providing for substantive and constructive change, ecologically sustainable development will be a thin coat of green paint masking the resource development practices of the past.

If the cane assignment system is to provide effective management in the years ahead, adjustments have to be made. It is hoped this report will contribute to that end.

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Chapter 5

Ecologically Sustainable Development In a Global Economy

Environmental Management in the Sugarcane Assignment Process Herbert River District, Queensland, Australia 1993-1996

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with
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Executive Summary

In 1994, CSIRO received funding from the Land and Water Resources Research and Development Corporation (LWRRDC) to examine the implementation of Integrated Catchment Management (ICM) in the Herbert River catchment of north Queensland, Australia. Support for related work was also provided by the CRC for Sustainable Sugar Production. A common component of these research initiatives focused attention on the institutional aspects of resource management in the sugar industry. In that regard, this report examines the sugarcane assignment process in the Herbert River district during the period 1993-1996.

Data and Information Review (Chapters 1-4)

Since the early 1990s, significant expansion in both growing area and milling capacity has occurred in the Australian sugar industry. In 1998 over 507,000 hectares of land were used for cane growing in Queensland. Despite the significant economic benefits of sugar production, there is a growing unease about sugarcane development because it is perceived to be a major cause of ecological impact. These impacts include erosion and sedimentation, loss of riparian vegetation, damage to coastal wetlands, and diffuse sources of nutrient pollution and heavy metals. Legislatively stipulated growth of new cane lands has fragmented the landscape and encouraged, in many cases, the use of marginal lands.

Changing circumstances have transformed the cane assignment process from what was once generally perceived as a 'routine' process with a 'predictable' outcome, to one characterised by conflict, uncertainty and complexity. The ability of stakeholders involved in cane expansion to effectively deal with 'environmental issues' remains problematic. All levels of Australian government have endorsed the principles of Ecologically Sustainable Development (ESD). Sugar producers have produced similar documents (*e.g.* CANEGROWERS' *Caring for the Environment* Statement) and support the use of Codes of Practice. There appears to be recognition of the problem and the need for solutions by all participants. However translating these documents into action has proven difficult and the industry's ability to effectively guide recent and future cane farm expansion impacts is unclear.

The purpose of our research was to evaluate the sugarcane assignment process in the Herbert River district from 1993-1996 in terms of its compliance with the principles of ESD. This required an explicit set of criteria against which judgments about performance could be made. While the definition of ESD has been popularised, it's meaning and measurement have been elusive. ESD principles advocated by the 1992 *Intergovernmental Agreement on the Environment* and the CANEGROWERS *Caring for the Environment* (1995) share five resource management principles: balance, ecosystem, partnerships, flexibility and the precautionary principle. These principles were the benchmarks used to evaluate the assignment process in the Herbert River district.

Assessing the Sugarcane Assignment Process in the Herbert River District (Chapter 5)

During the study period, 525 applications for assignment, covering an approximate area of 16,000 ha, were submitted to the Victoria and Macknade Local Boards for approval. It was feasible to link information from complete application forms with a companion spatial database for 472 applications (89.9%) of the total application pool. These applications encompassed an area of 15,013ha or about 94% of the total 15,994ha area applied for. During the study period, 472 applications were spatially represented and comprised an area of 15,013ha. From this total, 355 (75%) applicants were awarded their entire request, 92 (20%) were awarded less than their request, and 22 (5%) were denied. Of the 15,013ha applied for, 12,165ha were awarded, representing an 81% approval rate. 1,962ha were not awarded on the basis of an applicant being granted less than 100% of their request. In addition, 887ha were denied an award. All applications that were denied occurred in 1996 and represented an area of 2,736ha. Since the 1996 application pool contains applications that were denied, the analysis pays particular attention to it. These results are analysed in terms of each of the five resource management principles described previously.

Over 70% (8,655ha) of the awards granted during the study period occurred on land that both the Local Board and Environmental Advisory Committee (EAC) were deemed suitable by both bodies. About 7% (741ha) of the land was granted on land that both groups perceived as unsuitable. Of concern is the 2,768ha of development that occurred in the area of disagreement. This represented about 20% of

development during the entire study period. More importantly, in 1996, over 1,400ha of the total assignment of 3,601.5ha (38.8%) were located in this region. In the absence of an open and transparent decision-making process and effective conflict resolution mechanisms, cane expansion in these areas may alarm government officials (and interested members of the public) who are concerned with drainage and habitat issues. It is these considerations that the Local Boards and EAC disagree on.

These data and development patterns raise concerns about how effectively the sugarcane assignment process supports the principles of ESD. Changes to existing institutional arrangements are required if ESD is to be achieved. A set of recommendations is made on the basis of findings from this study in the Herbert River district. Their applicability on a statewide basis should be considered carefully. It is believed that more effective decision making can be achieved by enhancing the consistency among the five management principles - a balanced perspective, ecosystem management, developing partnerships and allowing for flexibility, the precautionary principle - and current decision-making processes. In this context, the following recommendations are made:

Enhancing Ecosystem Management
Recommendation: Legislative and voluntary initiatives be undertaken to reduce the clearing of valued habitats. Reduce the perceived need for pre-emptive clearing by adjusting the timing of the assignment process. In the Herbert River district, this would see the announcement of assignment awards in the February. Require applicants to obtain clearing permits from QDNR prior to receiving assignment on freehold land or leasehold land.

Action required by: Local Boards (Cane Protection Boards), QDNR and Shire.

Enhancing the Principle of Balanced Decision Making
Recommendation: Provide for the earlier consideration of environmental and social factors in the cane assignment process through existing mechanisms such as "Continuous Crushing Agreements" and corporate policies.

Action required by: Local Boards (Cane Production Boards), CANEGROWERS, and CSR.

Enhancing the Partnership Principle
Recommendation: That the Environmental Advisory Committee and Local Boards members improve the present referral process. Industry wide, basic legislative amendments should support more effective communication between Environmental Advisory Committees and Local Boards. These should be codified in sugar industry legislation.

Action required by: Minister for Primary Industries, CANEGROWERS, Local Boards (Cane Production Boards) and Environmental Advisory Committee.

Recommendation: Better incorporate the Shire and other relevant participants into the assignment process. This could be accomplished through an effective referral process, observer status on Local Boards, full voting rights on Local Boards, or other appropriate mechanisms.

Action required by: Minister for Primary Industries, Local Boards (Cane Production Boards), CANEGROWERS, CSR and Shire.

From Flexibility to Adaptability
Recommendation: Immediately undertake discussions among all relevant parties that will develop an effective environmental monitoring network within the next two years. Within the next three years, conduct an environmental impact audit to examine the compliance, enforcement and effectiveness of Conditions of Assignment. Within the next five years, complete an environmental management audit. Effective and regular environmental monitoring should be required under the sugar industry legislation.

Action required by: CANEGROWERS, Mills, Local Boards (Cane Production Boards), QDNR, QDPI, QEPA, Shire, BSES, CSIRO and other research organisations.

Enhancing the Precautionary Principle
Recommendation: Develop mechanisms that place more responsibility on applicants and the industry for determining the nature and extent of acid sulphate soils before the review of an individual application.

Action required by: CANEGROWERS, mills, and BSES to determine: (i) need for industry sponsored surveys which further the existing information base; and (ii) the need for and basis of cost-sharing arrangements which support appropriate soil tests during the application process.

Relevant government agencies (*e.g.* QDPI, QEPA, QDNR) and research organisations (*e.g.* CSIRO) should participate in these discussions. This could be an important research frontier.

Recommendation: Develop and apply an environmental impact screening mechanisms that identify applicants who must more carefully consider environmental and farm management issues with the submission of their assignment application.

Action required by: Local Boards (Cane Production Boards), relevant government agencies, CANEGROWERS.

Recognising Legacies of the Past and Dealing with the Future

This report outlines some of the issues related to the cane assignment process and environmental management. Effective responses to the changes, uncertainties, complexities and conflicts that will continue to be part of the sugar industry's future lie in innovative administrative mechanisms, planning initiatives, and scientific research. Thus, there are conceptual and practical shortcomings in present responses that suggest the need for changes to the sugar assignment process. While the industry is currently in a phase of reduced expansions, it needs to be adequately prepared for future expansions when economic conditions become more favourable. We argue that ESD in the sugar industry requires a better integration of economic, social and environmental considerations. Hence, this report outlines a number of responses that the sugar industry may wish to consider in future planning.

The industry must take a leadership role if the importance placed on the environment and sustainability is to be realised. Present Conditions of Assignment suggest that failure to comply with restrictions may see the award revoked. This places increased responsibility for enforcement on the Local Board (Cane Production Board). These are new roles for these organisations. Leadership by the Local Board (Cane Production Board), CANEGROWERS and mills can establish an expectation that compliance is expected and required by all farmers. This type of widely based, voluntary action could engender very strong public support. In its absence, public support will be nurtured through compliance and enforcement. The recommended audit should provide insight into both voluntary compliance and enforcement measures. Those findings will reflect on the leadership qualities of the sugar industry, and identify the need for evolutionary and revolutionary change in its management of natural resources.

The policy environment for ESD in the context of the sugar industry will continue to respond to changing political, economic, social and environmental considerations. While the manner in which resources are managed will vary, public expectations for, and support of, effective environmental management policies will remain. In this regard, the principles for ESD will form the basis for the development of new and improved initiatives. The efficient and equitable allocation of new land for cane production must be central in these. The challenge for the sugar industry is to embrace, rather than resist, the inevitable trend toward greater public intervention in its affairs. In response, government must provide a stable environment in which locally relevant decision-making can occur and in which appropriate and viable monitoring, cost-sharing and regulatory arrangements can be supported. The Australian sugar industry must continue to develop its own capacity to plan for expansion (and contraction). Such planning must be a continuous activity rather than a single exercise. Further, the industry must develop its own strategic view on where and how sugarcane will be grown – both at regional and whole of industry levels. This view will need to be based on the best available scientific information and full utilisation of the products of its substantial investment in environmental R&D.

Many recommendations made in this report encourage and require strong leadership. Without a visible commitment to ESD, the most sophisticated institutional innovations that promote positive change will fail. Without leadership, ESD will be relegated to a thin coat of green paint masking the resource development practices of the past.

Acronyms

ABARE	Australian Bureau of Agricultural and Resource Economics
ABS	Australian Bureau of Statistics
AHD	Australian Height Datum
ANZECC	Australian and New Zealand Environment and Conservation Council
ASL	Above Sea Level
BSES	Bureau of Sugar Experiment Stations
COAG	Council of Australian Governments
CSR	CSR Limited
DCDB	Digital Cadastral Data Base
EAC	Environmental Advisory Committee
EC	European Community
EMS	Environmental Management Strategy
ESD	Ecologically Sustainable Development
EU	European Union
GATT	General Agreement on Tariffs and Trade
GHD	Gutterdige, Haskins and Davey Limited
GIS	Geographical Information Systems
HAT	Highest Astronomical Tide
HFCS	High Fructose Corn Syrup
HRCCC	Herbert River Catchment Coordinating Committee
HRIC	Herbert Resource Information Centre
HSC	Hinchinbrook Shire Council
ICM	Integrated Catchment Management
IDAS	Integrated Development Assessment System
IPA	Integrated Planning Act
ISA	International Sugar Agreements
ISO	International Sugar Organisation
NAFTA	North American Free Trade Agreement
NRM	Natural Resource Management
PMP	Property Management Plan
QDEH	Queensland Department of Environment and Heritage
QDNR	Queensland Department of Natural Resources
QDoE	Queensland Department of Environment
QDOL	Queensland Department of Lands
QDPI	Queensland Department of Primary Industries
QDPLG	Queensland Department of Housing, Local Government and Planning
QEPA	Queensland Environmental Protection Agency
QSC	Queensland Sugar Corporation
RL	Reduced Level
SCERP	Sugar Coast Environmental Rescue Package
SIIP	Sugar Industry Infrastructure Package
UWO	University of Western Ontario
WCED	World Commission on Environment and Development

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1 ECOLOGICALLY SUSTAINABLE DEVELOPMENT AND THE AUSTRALIAN SUGARCANE GROWING INDUSTRY

1.1 Environment and Economy - Integrative or Conflicting Forces?

Many people believe that the 'environment' is and will increasingly be an important issue in the 21st century. In this regard, the idea of sustainable development has attracted considerable interest since the Brundtland Commission (also known as the World Commission on Environment and Development (WCED)) identified it in 1987 as the driving force behind its 'global agenda for change' entitled *Our Common Future.* The concept was defined as development that "meets the needs of the present without compromising the ability of future generations to meet their own needs" (WCED, 1987: 43). A fundamental aspect of sustainable development is the belief that economic and ecological concerns must be seen as interdependent systems rather than opposing forces. In the words of the Brundtland Commission, "economy is not just about the production of wealth, and ecology is not just about the protection of nature; they are both equally relevant for improving the lot of humankind" (WCED, 1987: 38). Although the concept of integrating economic and environmental considerations into decision making appears attractive, the WCED believed that it would be difficult to achieve because it required government leaders, the private sector and people to adopt a very different mindset. Part of the needed adjustment focused on the institutional arrangements for resource management.

The following statements from *Our Common Future* illustrate some of the challenges to and requirements of future 'sustainable' institutional arrangements:

- Effectively implementing sustainable development would require immediate and decisive political action ... to begin managing environmental resources to ensure both sustainable human progress and human survival.
- The objective of sustainable development and the integrated nature of global environment/development challenges pose problems for institutions, national and international, that were established on the basis of narrow preoccupations and compartmentalized concerns. The challenges are both interdependent and integrated, requiring comprehensive approaches and popular participation.
- Most of the institutions facing those challenges tend to be independent, fragmented, working to relatively narrow mandates with closed decision processes. Those responsible for managing natural resources and protecting the environment are institutionally separated from those responsible for managing the economy. The real world of interlocked economic and ecological systems will not change; the policies and institutions must.
- The other great institutional flaw in coping with environment/development challenges is governments' failure to make the bodies whose policy actions degrade the environment responsible for ensuring that their policies prevent that degradation.
- The ability to anticipate and prevent environmental damage requires that ecological dimensions of policy be considered at the same time as the economic, trade, energy, agricultural and other dimensions. They should be considered on the same agendas and in the same national and international institutions.
- Making the difficult choices involved in sustainable development will depend on the widespread support and involvement of an informed public and of non-governmental organisations, the scientific community and industry.

These statements identify some of the changes required to traditional management approaches, and particularly the importance of designing effective institutional arrangements to achieve sustainable outcomes. The reality is that in some instances, achieving sustainable development will require a fundamental rethinking and readjustment of the way in which government and industry organize themselves. At other times, changes at the margins of existing institutional arrangements (*e.g.* legal, financial, economic, administrative, organisational) will suffice. However,

the demand for change comes at a time when many public resource management agencies are dealing with budget cuts and there is often a sense of retreat or retrenchment.

It could also be argued that recent and current international economic forces could further undermine governments' ability to effectively manage growth and development. For instance, globalisation has challenged all levels of governments, but particularly national governments, to meet the challenges posed from the emergence of global corporations, and the increasing influence of supranational institutions such as the General Agreement on Tariffs and Trade (GATT) and the North American Free Trade Agreement (NAFTA). Global economic forces in the 1980s have "brought the formerly distinct worlds of trade and environment into contact and, all too frequently, conflict" (Esty, 1994: 2). This "either environment or economy" view is in stark contrast to integrative perspective advocated by the concept of sustainable development. Furthermore, expanded trade, under initiatives such as the NAFTA, could result in negative environmental outcomes. These problems include pollution spillovers into developed countries from increased industrial activity in developing countries; lower environmental standards and a loss of sovereignty in developed countries as laws and regulations are "harmonised" at compromise or baseline levels; limitations on the ability of developed countries to use trade measures to support international environmental agreements; and marketplace disadvantages for facilities in developed countries that compete against plants located in "pollution havens" - resulting in job losses or downward pressure on developed countries' environmental standards (Esty, 1994: 2). Global trade could cause environmental harm by promoting economic growth that results in an unsustainable use of resources and wasteful production.

Since the 1980s, globalisation and ecologically sustainable development (ESD) are two paradigms that have changed the manner in which humans interact with each other and with their environment. In the context of agriculture in developed countries, the WCED (1987) maintained that:

- Production in industrialised countries has been highly subsidised...[and] has encouraged the overuse of soil and chemicals, the pollution of both water resources and foods with these chemicals, and the degradation of the countryside.
- The financial and economic burden of subsidies must be reduced.
- In general, patterns of government intervention [in agriculture] suffer three basic defects. First, the criteria that underlie the planning of these interventions lack an ecological orientation and are often dominated by short-term considerations. The second defect is that agricultural policy tends to operate within a national framework with uniform process and subsidies, standardised criteria for the provision of support services, indiscriminate financing of infrastructure investments, and so forth. The third defect...lies in incentive structures. In industrialised countries, overprotection of farmers and overproduction represent the accumulated result of tax relief, direct subsidies, and price controls.

According to McMicheal (1994), the recent globalisation of agriculture is characterised by the creation of national regulatory bodies that exercise less regulatory control, agricultural liberalisation, increasing specialisation in food production, the development of niche markets for both fresh and produce foods, and an increase in contract farming.

The dilemma confronting the reform of existing institutional arrangements comes from changes at both conceptual and practical levels. On the one hand, sustainable development suggests institutional arrangements must consider environment, economy and society as interdependent systems. However, the conditions that have guided resource management have changed and are still changing due to domestic and global forces, and their financial support has been often eroded. In short, within this changing social and economic system, the role and capacity of public agencies to effectively guide development are often perceived to be uncertain at best and ineffective at worst.

People expect the environment to sustain life, support community and economic activities, and look beautiful. Balancing these expectations and meeting people's needs are a challenge at the best of times. The natural environment is critical to agriculture's economic and social success. Multinational corporations as well as farm families are dependent on the environment to support their well being. Although the economic benefits of agricultural development are clear, the stresses that are placed on the environment are often subtle and not immediately evident. However, they can be profound. These impacts include land degradation (*e.g.* clearing overstocking, cropping on marginal land, irrigation and exotic species) and water issues (*e.g.* scarcity, quality and nutrient loads, waste water disposal, rising groundwater and associated salinisation, and pollution of coastal waters) (Commonwealth, 1996).

These comments suggest the complexity of dealing with many environmental issues. According to Dovers (1997), it is important to distinguish between systemic and non-systemic sustainability problems. Systemic problems are characterised by causes that are deep within modern society. Effective responses to these problems have serious implications for modern society, such as energy use, settlement and transport structure, agricultural practices, resource consumption and lifestyle. Global examples include climate change, biodiversity loss and poverty. In contrast, non-systemic sustainability problems are discrete and smaller. They may be solved by adjustments at the margins of individual or social behaviour. These problems are illustrated by the more routine tasks of management such as the issuing of a permit, integrated catchment management, or fisheries management (Dovers, 1997). The focus of this document embraces both of these problems. Sugar is an internationally traded commodity that is dominated by large corporations. Expansion of the area of sugarcane land in Queensland has been traditionally viewed as a 'routine' activity that required a permit. However, changing circumstances, that will be described later, have transformed what was once generally perceived as a 'routine' process with 'predictable' and 'negligible' outcomes and impacts, to one fraught with conflict, uncertainty and complexity. An issue arising from this situation is to identify the changes required in the present institutional arrangements that would provide for more sustainable outcomes.

1.1.1 The Australian Sugar Industry

The international sugar trade illustrates the tension among economic, social and environmental concerns. Sugar is a global commodity. National governments and multinational corporations have participated in sugar growing and trade for centuries. In Australia, the sugar industry is one of its largest rural industries, producing in 1996/1997 approximately 5.3 million tons of raw sugar, worth in excess of $2 billion to the Australian economy. The institutional arrangements for the Australian sugar industry have changed significantly, in part, due to global forces. In 1991, the *Sugar Industry Act* repealed and replaced what had been previously a fragmented array of statutes that pertained to the sugar industry. One significant feature of the *Act* was its requirement for an annual expansion of 2.5% (approx. 10,000ha statewide between 1991 and 1996). It also included provisions that, for the first time, required 'the environment' to be considered in these decisions. Since the 1990s, approximately 20,000 hectares per year have been converted, and in 1998 over 507,000 hectares of land were used for cane growing.

The ability of all participants involved in expansion of cane growing area to effectively deal with 'environmental issues' is unclear. The rhetoric from both the government and the sugar industry seems positive, as illustrated in the advancement of ESD principles. For instance, all levels of Australian government have endorsed the principles of sustainable development in signing an *Intergovernmental Agreement on the Environment* (1992). Sugar producers have produced similar documents and support the use of *Codes of Practice*. There appears to be recognition of the problem and the need for solutions by all participants. However, making statements is one thing, translating them into effective action is often quite another. If the rhetoric is not realised by effective actions, the environmental, economic and social consequences could be substantial at national, regional and local scales.

Sugarcane is grown along 2,100 km of coastline from Grafton in northern New South Wales to Mossman in north Queensland (Figure 1.1). Small industries have recently commenced on the Atherton Tablelands in north Queensland and the Ord River district in Western Australia. In these areas, soil and climate are favourable for sugarcane growing. However, significant portions of the eastern coast of Australia retain very high ecological, social and cultural values. Despite the economic benefits of sugar production, there is a growing unease about sugarcane development because it is perceived by some people to be a major cause of ecological impact. These impacts include erosion and sedimentation, loss of riparian vegetation, damage to coastal wetlands, and impacts of diffuse sources of nutrient pollution and heavy metals (Brodie *et al.*, 1984; Industry Commission, 1992; Bramley and Johnson, 1995; Johnson *et al.*, 1996; 1999a). The development of the legislatively stipulated growth of new cane lands has fragmented the landscape and encouraged the use of marginal lands (Johnson *et al.*, 1997; 1999b). The Sugar Industry Working Party (1990) estimated that 16,080 hectares of land, or about 5% of the land used for sugarcane crops, is farmed in marginal or unsuitable areas. In the face of increased global competition, this situation could become worse. Despite the pronouncements that both the sugar industry and Australian governments embrace ESD, their ability to effectively guide the recent, and potentially future high levels of sugarcane farm expansion and avoid/minimise negative impacts is unclear.

The institutional arrangements that are often perceived to be part of the problem, as well as a vital part of the solution, are generally poorly understood. This is particularly true for the sugar industry in Queensland. For instance, one member of a 1992 Industry Commission inquiry into the sugar industry described the industry as follows:

> For all my working life I have been engaged in the examination of agricultural policy in Australia. I have found it harder to fathom what goes on in the sugar industry than to come to grips with any other rural industry. This is partly because there has been less information available on the sugar industry than on other rural industries. Traditionally the Queensland sugar industry and Queensland Governments have not been attracted to openness in providing information...But the difficulty in coming to terms with the sugar industry is largely the policy arrangements are so complex, and that there are interactions between elements of the arrangement [not easily understood] (Edwards, 1993: 1).

Knowledge about the nature and processes that operate within the sugar industry are central in understanding both problems and solutions. This requires a focus upon institutional arrangements. These are interpreted to be the interaction among:

- legislation and regulations;
- policies and guidelines;
- administrative structures;
- economic and financial arrangements;
- political structures and processes;
- historical and traditional customs and practices; and
- key participants or actors (Mitchell, 1990).

It is important to understand changes at all these levels in order to grasp the impacts of these activities on the environment and on people. This focus on institutional arrangements is consistent with the views of the WCED (1987: 62), which maintained that implementing sustainable development would require a change in attitudes and objectives and in the institutional arrangements at every level. Without this reorientation of institutional attitudes, little progress could be achieved. The WCED (1987: 63) also believed that implementing sustainable development required:

> Community knowledge and support, which entails greater public participation in the decisions that affect the environment. This is best secured by decentralising the management of resources upon which local communities depend and giving these communities an effective say over the use of these resources.

Figure 1.1 Sugarcane producing areas in Queensland.

At first glance, the institutional arrangements that have guided the recent expansion of sugarcane in Queensland exhibit a number of these qualities. Despite the consolidation and liberalisation of the sugarcane industry on 1991, there remains significant regulatory and local control over the growing and harvest of cane. Local Boards comprised of industry (sugarcane millers) and growers are, to a significant degree, responsible for controlling the level and location of sugarcane

production, and promoting the growing and commercial harvest of sugarcane (Industry Commission, 1992). This process is known as "assignment". Although these bodies have existed since the 1920s, the *Sugar Industry Act 1991* (and the new *Sugar Industry Bill 1999*) requires them to consider both economic and environmental factors in allocating land. Thus, Local Boards and the assignment process are characterised by local participation through a mix of industry and grower representatives, and consideration of both environment and economy.

These characteristics of sustainable development operate within the context of a global sugar trade. However, there appears to be a fundamental contradiction between the growing concern about the importance of the environment, and the need for effective institutional arrangements to implement ESD in a global economy. The precise role and responsibility of the private sector in managing this growth during this period of less regulation are indeterminate.

ESD of agricultural resources raises many complex issues. There is uncertainty in economic, social and environmental conditions. These contexts can change quickly and result in the removal or appearance of obstacles to effective implementation. Some impacts are site specific, while others are more general in nature. Thus, there appears to be no simple answers or single correct solutions. An integrated set of responses to address the uncertainty, complexity, change and conflict that are associated with agricultural resources in general, and sugarcane growing specifically, is required. This report seeks to answer these questions within the context of the cane land allocation in the Queensland sugar industry in order to determine the extent to which ESD is operating at a local level, and what marginal changes are feasible to improve present performance

1. 2 Report Organisation

The second chapter in this document examines the history of the sugar trade from both global and Australian perspectives. The concept of ESD from global and Australian viewpoints is developed in the third chapter. Five principles that provide the evaluative framework are identified and described. The research methodology and the case study region are also described in Chapter 3. The fourth chapter explains the current relevant institutional arrangements for natural resource management in the State of Queensland, and for sugarcane assignment. The last chapter uses the principles of ESD to assess current performance. It also highlights the conclusions and discusses the implications of the findings for future practice and research.

2 THE SUGAR INDUSTRY – PAST AND PRESENT: GLOBAL AND AUSTRALIAN INITIATIVES AND POTENTIAL ENVIRONMENTAL IMPACTS

2.1 Introduction

This chapter outlines some important historical aspects of sugar trade and Australia's sugar industry. The second part of the chapter reviews the environmental impacts of developing cane lands and growing sugarcane. In this manner, a context to appreciate the need for and direction of current initiatives is provided.

2.2 The World Sugar Trade

For centuries, sugar has evoked "strong social, political, geographical and emotional" attachments, and has been the cause and prizes of wars (Hannah and Spence, 1996: 20). It is a sweetener and source of energy, and has been widely traded since at least the 14th century. Although it was viewed as a spice and luxury in 17th century Britain, it is now a basic part of many diets. Between 1900 and the present, world demand has grown from 8 million tons to 155 million tons. Initially obtained exclusively from sugarcane grown in the Polynesian Islands of the South

Pacific, sugar is now produced from a variety of sources (*e.g.* sugar beet and synthetic sweeteners) in over 120 countries or territories.

Table 2.1 contains some statistics for the world trade of sugar for the period 1955 to 1998. Two distinct periods can be noted from these data. The first is characterised by rapid growth in net imports between 1955 and 1980. During this period, the pattern of imports changed with developing countries increasing their share of world imports from 26% to 44% between 1975 and 1980. The second period (1980-present) has seen world trade reach a near steady state of about 23 million tons annually. However, the distribution of demand has changed. Developed countries have imported less sugar. This decline has almost been matched by an increase in imports by developing countries. These data suggest that world markets have undergone significant structural changes. Australia, as the world's largest net exporter, has a heightened interest in these trends. The significant structural factors that all sugar producers have faced include: (a) volatile changes in world trade patterns and price, (b) the introduction of substitute products, and (c) domestic trade developments.

Many countries, including Australia, are highly dependent on sugar for export revenue. In response to the high level of volatility of world sugar prices (Table 2.1), a number of multilateral and intergovernmental agreements were negotiated between 1950 and 1998 (Figure 2.1). The general intent was to "keep the world free market sugar price within stated ranges" (Hannah and Spence, 1996: 136). For instance, International Sugar Agreements (ISAs) were negotiated in 1953, 1958, 1968 and 1977. Their general objective was to provide "a reasonable price, not exceeding the cost of production, including a reasonable profit of efficient producers" (Hannah and Spence, 1996: 23). For a variety of reasons, including the impacts associated with the Cuban Revolution (1959), the dissolution of the USSR (1991) and the implementation of national policies, they generally failed to meet their price objectives.

Table 2.1 World net imports of sugar 1955-1998.

Year	Total (M t)	Developed Countries	Developing Countries	Net Imports as % of World Consumption	Price US cents/lb (1985=1.00)
1955	11.70	8.90 (76%)	2.80 (24%)	31.2	N/A
1960	16.75	12.96 (77%)	3.79 (23%)	34.7	9.18
1965	17.15	12.88 (75%)	4.27 (25%)	30.8	5.58
1970	18.40	12.94 (73%)	4.71 (27%)	25.1	9.44
1975	23.06	13.53 (74%)	4.87 (26%)	24.7	28.00
1980	23.06	12.79 (56%)	10.27 (44%)	26.1	25.00
1985	23.01	11.29 (49%)	11.64 (51%)	23.5	4.06
1990	23.14	10.33 (47%)	12.22 (53%)	21.3	8.73
1995	22.87	7.18 (31%)	15.69 (69%)	20.1	8.47
1998	22.93	4.50 (19%)	18.43 (81%)	18.6	4.81

(Sources - Hannah and Spence, 1996: Licht, 1998)

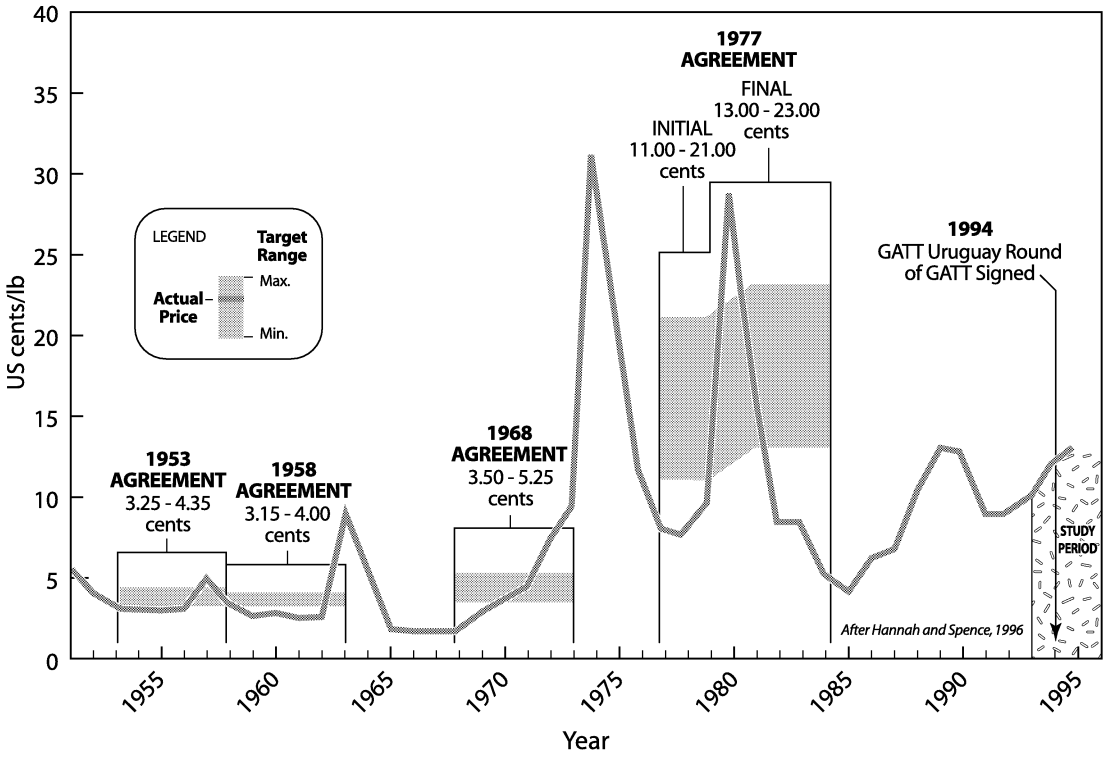

Figure 2.1 The price of sugar: target and actual from International Sugar Agreements to GATT.

Some insight concerning the complexity, volatility and difficulty in managing sugar prices through these international agreements is provided by activities between 1974 and 1989 (Figure 2.1). In 1974, the ISA price was targeted in a range between $0.035/lb and 0.0525/lb while the actual price peaked at $0.64/lb (US). The 1984 price was supposed to be between $0.13/lb and 0.23/lb, while the actual price plunged to $0.03/lb (US). The major reasons for this volatility relate to changing national policies in the United States and European Community (EC), and declining consumer demand. In response to the extremely high price of 1974, the EC established policies that: (i) increased the price support for domestically produced sugar; and (ii) increased domestic production quotas. These initiatives transformed the EC from a net importer to a major sugar exporter by 1980. In addition, the high sugar price in 1974 also led the United States and Japan to encourage the production of alternative sweeteners such as high fructose corn syrup (HFCS). Other importing countries unable to afford the world price embarked on expansion programs (Hannah and Spence, 1996). Collectively, these initiatives resulted in a major increase in sugar production. However, the demand for sugar did not keep pace, and declined in developed countries. Although demand for imports increased in developing countries, the substantial imbalance between supply and demand resulted in the precipitous decline in prices. Sugar stocks from the early 1980s were not cleared and world prices remained depressed until 1989. In the early and mid-1990s, prices rose in response to decreasing demand from Asia and decreasing volumes of world sugar stocks due to production declines in Europe and South America. However by late 1998, world sugar prices had again declined substantively as the effects of the Asian Economic Crisis, devaluation of Eastern European currencies and increased production in South America and Western Europe substantially raised sugar stocks.

Since the mid-1970s, sugar has lost a significant portion of its market share to sweeteners such as corn syrup and high fructose corn syrup (HFCS). In the 1980s, HFCS consumption grew rapidly, in part because of import barriers to sugar, and domestic programs in the United States, Europe and elsewhere for beet and sugarcane. Between 1980 and 1997, HFCS consumption in the United States grew from 14% to 40%. Part of this increase was the result of decisions made by Coca-Cola and Pepsi to use HFCS rather than sugar (CANEGROWERS, 1999). Indeed, the

focus of the competition has shifted from one tuned to sugar derived from cane versus beet, to the production of 'sweeteners' from a wide variety of natural and artificial sources. Future sugar consumption is likely to be influenced by a combination of factors including: the price of sugar and alternative sweeteners, per capita incomes, population growth, sugar availability, government policies, consumer preferences and technological advances.

Fluctuations in the demand and price of sugar also impact multinational corporations and individual farmers. CSR is Australia's largest manufacturer of raw and refined sugars and operates two refining mills in the Herbert River district, the location of the case study for this research paper. The Colonial Sugar Refining Company (CSR) was formed in 1855 to refine sugar and soon after diversified into raw sugar milling. It has been exposed to the impacts of price fluctuations. For instance, after diversifying into natural gas and oil exploration in 1977, CSR's survival was based largely on profits from its sugar and building material divisions. However, this support was undercut with the previously mentioned severe drop in sugar prices in the early 1980s. It struggled until corporate and management restructuring turned its fortunes around in 1985. While CSR was addressing its corporate problems during the late 1970s and early 1980s, many cane farmers were living below the poverty line and accused the company of mismanaging the industry in which it played a dominant role (Bright, 1998).

Since January 1985, there have been no further ISAs with economic clauses. Instead, the International Sugar Organisation (ISO) provides information, statistics and analysis and a forum for intergovernmental policy discussion. This reflects two important shifts from historical approaches. First, current economic and political beliefs suggest that the free market is best able to govern the market. Interventionist policies, such as the ISAs, are viewed as "bad". Second, there has been more price stability in the market since 1988 (Figure 2.1). During the study period, a increase in sugar prices would prompt many existing cane growers to consider expanding their holdings, and new farmers to enter the industry. This recent period of relative price stability has been assisted by the ISO which makes markets more transparent through its information providing and facilitation roles. Hence, the perceived need for ISA-type arrangements is diminished. However, the historical pattern of sugar price volatility suggests that the recent period of stability will not be an enduring one.

It is also important to appreciate the role and linkage between international and national sugar policies. At present, national policies are significant and are responsible for subsidizing about 25% of the world's sugar production. There are several forms of national policy instruments and include the following (Hannah and Spence, 1996):

1. *Border measures* that control import levels, and differentiates domestic prices from international prices.
2. *Domestic production measures* that range from guaranteed prices, production quotas, and subsidies on domestic production, inputs or credit, deficiency payments, and export subsidies.
3. *Domestic consumption measures* primarily in the form of price controls or rationing systems.

The need for domestic policies relates to the significantly higher cost of producing sugar from beet than from cane. They are also believed to be necessary to protect farmers and consumers from price volatility. Both developed and developing countries have established domestic policies to serve both international as well as national interests. During the era of International Sugar Agreements, domestic policies were also established in order that a nation's exports could meet its export target. At a national level, public policy goals such as redistributing income, reducing the economic burden on resource-based industries, preventing the de-population of rural areas and achieving self-sufficiency in food production could be pursued through sugar policies (Hannah and Spence, 1996; Johnson *et al.,* 1998).

The traditional protection afforded sugar and other industries through domestic policies has recently been viewed as unfair and inappropriate. The primary objectives of the 1994 GATT Uruguay Round on agriculture related to increasing the market access commitment of individual countries, decreasing the use of tariffs and domestic support for agriculture, and reducing the subsidies provided to exported agricultural products. Signatory countries are required to import a minimum share of 3% of their domestic market in 1995, rising to 5% by the end of 2000. Non-tariff barriers and variable import levies are to be replaced by a base rate tariff. Tariffs are to be reduced. These changes should have minimal effects on existing sugar policies. In Queensland, the tariff on raw and white sugar was removed in July 1997. The tariff had been reduced from \$115 t^{-1} in 1989 to \$55 t^{-1} immediately prior to its removal. However, the reduction of internal price support, border protection and export subsidies for sugar commodities by other nations was expected to produce a \$10 million to \$40 million annual benefit to Australia (CANEGROWERS, 1999). This promise of growth combined with the increasing price for sugar provide significant incentives for both farmers and the sugar refining industry to expand its production capabilities.

2.3 Australian Sugar Policy

Commercial sugar production in Australia commenced in the 1870s, and is now one of Australia's largest export industries (Sugar Industry Working Party, 1996) (Table 2.2). The State of Queensland accounts for around 95% of production and all of Australia's raw sugar exports (Industry Commission, 1992). The industry is very competitive in the global market. Although world demand has remained relatively constant at 23 Mt since 1975, Australia's share has grown from 2.7 t to 4.7 t (Table 2.2). This growth has been achieved in "one of the most restrictive regulatory regimes of any Australian industry"(Industry Commission, 1992: 1). The nature and rationale for this arrangement are the focus of the following section.

Table 2.2 Selected statistics for the Queensland sugar industry 1955-1998.

Year	Area Assigned (ha)	Area Harvested (ha)	Cane Crushed (t)	Sugar Produced (t)
1955	241,220	147,927	8,754,124	1,158,389
1960	240,673	132,535	8,824,393	1,346,026
1965	302,977	197,387	13,762,451	1,921,031
1970	301,544	211,518	16,438,360	2,371,097
1975	299,017	245,795	21,068,863	2,715,398
1980	333,209	274,259	22,540,369	3,148,999
1985	359,472	288,359	23,003,606	3,208,610
1990	372,119	323,441	23,929,650	3,353,969
1995	477,257	364,079	35,292,688	4,620,532
1998*	516,132	382,839	37,117,798	4,745,378

(* - Forecast; Source – Australian Sugar Milling Council)

All sugar industry activities - cane growing, milling and marketing - in Australia have been regulated through a series of Commonwealth and State legislative statutes and regulations. Most existing controls were granted between 1901 and 1939, largely by the Commonwealth Government to protect the new industry from international forces. Initial import protection was established in 1901 through the *Customs Act 1901* as a condition for Queensland joining the Commonwealth of Australia. This protection was increased under the *Regulation of Sugarcane Prices Act* and *Sugar Acquisition Act of 1915* as a wartime measure, with an embargo placed on the import of sugar, the introduction of fixed domestic pricing, and a monopoly acquisition and marketing structure of Queensland sugar. By 1922, Australia was a net exporter of sugar.

In 1923, the Sugar Board was established under the *Sugar Acquisition Act.* This legislation required the Sugar Board to acquire and market all raw sugar produced in Queensland (Industry Commission, 1991). At the same time, a system known as 'land assignment' was introduced to

control the location and amount of sugarcane produced. Conditions of Assignment established that cane was only grown on assigned land, and that the growers were required to deliver all cane from that land area to a specified mill. It is this process that is of central concern to this report. Mills were obligated to accept all cane produced on assigned land. Pricing and delivery arrangements were outlined in accompanying regulations. According to the Industry Commission (1992: 2),

> In retrospect, it is easy to understand why many in the [sugar] industry supported regulation. Growers feared the regional economic power of millers and, as the industry expanded, both growers and millers feared that overseas buyers could exploit the industry. Regulations were also seen as a means of reducing risk and stabilising producer incomes, and as a way of maintaining established growers the higher prices attainable from domestic sales.

The Commonwealth/Queensland sugar agreements were renewed at five-year intervals. The Queensland Sugar Board carried out the marketing of sugar in both Queensland and New South Wales, and the Commonwealth price support continued in the form of an embargo on imports of sugar and its close substitutes. These pricing arrangements were reviewed in 1970 and a new formula to establish annual adjustments to domestic sugar price was introduced.

Early expansion of the industry led to continued growth in exports. These exports to mainly unprotected markets (*i.e.* countries that did not sign ISAs or other international agreements) led to lower grower returns and a consequent push for further controls to safeguard established growing and milling interests. The two pool pricing system incorporating mill peaks was designed to discourage cane growing on unassigned land and to ensure higher returns to established growers. Further controls on industry expansion were introduced in 1937 after Australia acceded to the first International Sugar Agreement. It specified restrictions on export volumes, and as a result 'penalty' prices for sugar produced on unassigned land was announced ($1 per ton). Although the regulatory aspects of the ISA lapsed in 1984, Australian policy continued to evolve, reflecting the balance between bargaining strength of the sugar industry, and changing national and international market conditions. By 1984, the nature of the industry had changed dramatically. Producers now had better access to market information on which to base production and marketing information. There was also a closer integration between the global and domestic sugar economies (Hannah and Spence, 1996).

In 1990, there were 37 laws related to the sugar industry as well as numerous regulations that controlled the Australian sugar industry. As noted earlier, practically every aspect of the industry, including areas of the land on which cane could be grown was regulated. Criticisms of this approach generally related to the constraints it placed on the industry's capacity to maintain its viability and international competitiveness by (ABARE, 1991; Industry Commission, 1992; Hungerford, 1996):

- restricting inputs of the land they raised the costs of growing cane;
- inducing more intensive production methods that increased the demand placed on the land;
- excluding some people to enter sugarcane farming, and preventing some existing growers from growing as much as they wished;
- acting as a disincentive to the development of an export-oriented refinery industry; and
- preventing growers, millers and other participants firms from seeking out and exercising market opportunities.

On this basis, there was a strong view that Australia's sugar industry was in need of reform by the late 1980s.

2.4 1991 Sugar Industry Reforms

The *Sugar Industry Act 1991* repealed and replaced nearly all of the 37 existing laws pertaining to the sugar industry. Three of the most significant changes related to the administrative

arrangements for assignment, the minimum level of expansion to be achieved, and the consideration of environmental issues in the assignment process. Previously, sugarcane had to be grown on a specified area and location of land, and delivered to a specific miller. Under the new *Act,* cane could be grown anywhere on the cane grower's property. In addition, the *Act* provided for more flexibility in the transfer of assignment within a grower's own land holding, between growers and between mills. This easing of assignment regulations enables cane growers to have a greater measure of freedom to determine their own farm management practices.

Another important aspect concerned the requirement for annual expansion of 2.5% annually (about 10,000 ha) state wide between 1991 and 1995, and greater flexibility in the administration of the *Act.* Some of this flexibility was achieved by delegating increased responsibility to Local Boards. These bodies, comprised of millers and growers with a neutral Chair, were created in 1926 to administer, in part, the cane assignment process. Until 1991, cane land expansions were 'planned for' by the Sugar Board and reflected Australia's ability, under international agreements (*e.g.* International Sugar Agreements) to export sugar. Between 1991 and 1995, the area under assignment had to grow at an unprecedented rate of 2.5% per year. It is this level of expansion, combined with the ability of Local Boards and relevant public agencies to control the environmental impacts of this development that are sources of significant concern. It would also place significant demands upon the mills to increase their capacity to crush cane. Under the *Sugar Act 1991* (amended in 1994), sugarcane grown on assigned land must continue to be accepted for refining by the designated mill.

Provisions within the *Sugar Industry Act 1991* and assignment regulations, which are administered by the Queensland Sugar Corporation (QSC), mention that environmental, social and economic aspects must be considered in determining the desirability and feasibility of applications for cane land expansion (QSC, 1991). This report examines the implementation of these requirements and regulations in the Herbert River district. The specific requirements will be described in Chapter 4.

Despite the 1991 changes in Australia's sugar industry, the economic, political and technological uncertainties that have confronted it in the past will remain. For instance, both domestic and export markets are not stable. A decline in the consumption of products, such as beer, can decrease the demand for sugar (Hungerford, 1996). The increased use of alternative sweeteners can also erode domestic and foreign markets. Other countries, particularly the US and EU continue to provide their agricultural industries with quotas, tariffs and price support. The potential re-emergence of Cuban sugar onto the US market and increased competition from new sugar industries (*e.g.* Thailand) would impact exporting nations. This point highlights the complexity and uncertainty of integrating environmental and economic considerations of a global commodity.

2.5 Sugar and the Environment

During the late 1980s and early 1990s, there was a growing realisation that expansion in the area of cane growing and cane growing itself had the potential to cause significant environmental damage. This was because of the industry's increasing size, its coastal location, and its intensive use of fertiliser, chemicals and irrigation water. Severe soil erosion has long been recognised as a potential threat to long-term productivity of sloping land growing sugarcane, with soil losses in excess of 200 t ha^{-1} reported in the Mackay region (Sallaway, 1979) and in excess of 500 t ha^{-1} on the wet tropical coast (Prove and Hicks, 1991). The adoption of green cane harvesting-minimum tillage practices has been an important step in decreasing sediment supply to the coastal zone from sugarcane lands. However, the practice has received only partial acceptance by the industry. Despite the fact that in many areas soil erosion remains a problem, the precise rate and impact of sediment delivery from catchments in which sugarcane is grown to estuarine and marine

environments remains poorly understood (Pailles *et al.*, 1993; Pailles and Moody, 1995; Wasson, 1996).

QDNR (1998) identified the following impacts of agricultural development in cane growing regions:

- changes to natural drainage systems, flood flows and flood peaks;
- the clearing of natural vegetation and consequent loss of native fauna habitats;
- changes on groundwater levels;
- decline in water quality;
- siltation of watercourses and the Great Barrier Reef lagoon;
- the introduction of weeds and exotic plants and animals; and
- reduction in habitat and thus reduction in populations of fish and crustaceans.

The major sources of diffuse source pollution (*e.g.* fertiliser and pesticides) have generally increased in magnitude in recent years and have been predominantly associated with expansion in the area of land supporting sugarcane. Recent research (Bramley and Johnson, 1995; Mitchell *et al.*, 1995) has shown that nutrient concentrations in streams in selected sugar catchments are generally below national guidelines (ANZECC, 1992) for freshwater. Exceptions were generally associated with peak flow events. Although nutrient levels are currently low, understanding of ecosystem behaviour is not sufficiently developed to allow the assimilative capacity of these waters to be predicted with certainty. Furthermore, while an increasing amount is known about the fate and behaviour of nutrients, information on accession, persistence and behaviour of pesticides is sparse. Current knowledge suggests that the periodicity, volume and intensity of rainfall influence the downstream effects of agricultural production. Hence, minimisation of diffuse source pollution is likely to depend on carefully matching actual land use to land use suitability.

Development of land and water resources for new cane assignment has had a large negative impact on riparian vegetation, freshwater wetlands, swamps, billabongs and waterholes in most cane growing areas. Results from the CANEGROWERS environmental audit indicated that 70% of the farms surveyed had a riparian zone classed as moderate (<15m) or worse (GHD, 1996). Mangrove areas have largely remained intact, although some clearing did occur in the 1960s and 1970s. Large areas of riverine rainforest with patches of Eucalypts and the riverine rainforest have also been cleared in most cane growing regions. For example, in the Johnstone Rivers system, there has been a 60% reduction in the area of coastal wetlands between 1951 and 1992 (Russell *et al.*, 1995). On the Herbert River floodplain, Johnson *et al.* (1997; 1999a, b) have shown a 60% decrease in the area of Melaleuca dominated vegetation patterns (including a 40% decrease since 1943), and a 50% decrease in riparian rainforest patterns since European settlement.

The development of new sugarcane land may require additional irrigation works (*e.g.* Burdekin, Mackay, Isis, Maryborough), or drainage infrastructure (*e.g.* Herbert) that have two potential impacts. First, environmental impacts associated with irrigation may include salinity, rising water tables, salt intrusion and water resource depletion. Drainage works can result in acid sulphate soil problems and discharge of tail water into coastal ecosystems. These negative impacts can be transferred to existing and/or adjacent landowners. Second, the financing of these works must also be considered. According to the Queensland Department of Primary Industry (1993: 2),

> In the current climate of economic rationalism and application of the 'user pays' principal, governments are becoming increasingly reluctant to finance the entire costs of such projects. Even when the infrastructure is paid for by the state, many farms are too small, or the farmers too indebted, to support further investment in irrigation.

As will be detailed later in this report, the Queensland Government subsidises drainage works. Issues of fairness related to who pays and who benefits from these projects are significant. For instance, drainage works may be required to support upstream sugarcane farming. However, the

financing of a drainage project could see existing downstream farmers supporting a portion of these costs while seeing negligible, if any, benefit. This example reinforces the need to effectively link environmental, economic and social considerations in decision making.

3 ECOLOGICALLY SUSTAINABLE DEVELOPMENT: EVALUATIVE FRAMEWORK, METHODS AND CASE STUDY AREA

3.1 Ecologically Sustainable Development

The ideas of the Brundtland Commission were furthered in 1992 at the Earth Summit in Rio de Janeiro. Two outcomes from meeting were *Agenda 21* and the Rio Declaration. The former is "perhaps best seen as a collection of agreed negotiated wisdom as to the nature of problems, relevant principles, and a sketch of desirable and feasible paths towards solutions, taking into account, national and other interests" (Grubb *et al*., 1993: 17). In general, it supports the Commission's initial thoughts – economic, social and environmental systems were linked; intragenerational and intergenerational issues must be stressed; and policy and institutional reform were critical. These should provide the basis for ongoing discussions on international environment-development issues that could have implications for national, state and local levels of government.

Australian governments articulated their sustainable development principles under the term 'ecologically sustainable development' (ESD). In 1992, the Commonwealth Government adopted a *National Strategy for Ecologically Sustainable Development* in order to pursue the following objectives:

- to enhance individual and community welfare by following a path of economic development that safeguards the welfare of future generations;
- to provide equity within and between generations; and
- to protect biological diversity and maintain essential ecological processes and life support systems.

It is difficult to argue against the intent of these policy objectives. However, no strong consensus exists on how to best achieve them. Key questions concern who should take action (*e.g.* level of government, private sector, individuals), what action should be taken (*e.g* market mechanisms, regulations, voluntary, privatisation, nationalisation), and how urgent action is needed. These are difficult questions to answer definitively.

However, the vision of ESD in Australia is very clear. It aims to "meet the needs of Australians today, while conserving our ecosystems for the benefit of future generations" (COAG, 1992: 1). It is important to distinguish between the process and outcome of ESD. In the context of pursuing resiliency, Dovers (1997: 304) suggested the following distinction.

> *Sustainability* is the ability of a natural, human or mixed system to withstand or adapt to, over an indefinite time scale, endogenous or exogenous changes perceived as threatening. *Sustainable development* is a pathway of deliberate endogenous change (improvement) that maintains or enhances this attribute to some degree, while answering the needs of the present population.

Thus, sustainable development is the process that delivers sustainability. It is the process of decision making that is the focus of this report and forms the basis of the evaluation framework.

3.2 Evaluation Framework

The purpose of the research was to evaluate the sugarcane assignment process in the Herbert River district in terms of its compliance with the principles of ESD. This required an explicit set of criteria against which judgments about performance could be made. While the definition of sustainable development has been popularised, it's meaning and measurement have been elusive. However, a review of *Our Common Future*, and the Earth Summit Agreements identifies at least

five principles that should characterise sustainable development. These principles, which are modified from Mitchell (1995), are balance, ecosystems, partnerships, flexibility, and the precautionary principle (Table 3.1). Combined, these principles support the integration of environment and economy that the Brundtland Commission sought. These are discussed further below.

Table 3.1 Sustainable development principles as reflected in the Rio Declaration and *Agenda 21*.

Principle	Statement from Rio Declaration and Agenda 21
Balance	– integrate environment and development into decision making
Ecosystem	– environmental protection shall constitute an integral part of the development process – reduce and eliminate unsustainable patterns of production and consumption – conserve biodiversity
Partnerships	– meet the development needs of present and future generations – access of information held by public authorities, opportunities to participate in decision-making processes – enhance development, adaptation, diffusion and transfer of technologies – special attention to developing countries, indigenous people, women, youth
Precautionary Principle	– where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation
Flexibility	– enact effective legislation – supportive and open economic system – market incentives, environmental accounting – integrated land planning – combat deforestation – biotechnology – promote sustainable agriculture and rural development

3.2.1 Balance

Integration between environment and economy was a central component of the Brundtland Report. A balanced perspective recognises the economic, social, and environmental aspects of resource development and management. However, a key concern pertains to the relative weight given to each element. Past management efforts have usually favoured short-term economic gains over long-term factors.

For this study, an important qualitative aspect of balance pertains to the level of decision making where environmental and economic issues are considered clearly and directly. Smith (1993) identified three levels of decision-making based on the type of question/problem being asked/solved.

- Normative planning asks questions related to "What should be done?"
- Strategic planning considers "What could be done?"
- Operational planning asks "What will be done?"

Ideally, environment-economy issues should be considered at all levels. In the context of the sugar industry, initiatives such as the GATT, the *Sugar Act 1991*, and Local Government Strategic Plans could be considered normative and strategic level documents. The cane assignment process is an operational level of decision making.

3.2.2 Ecosystem Approach

An ecosystem approach appreciates the complexity of relationships among and within environmental, social, and economic systems. Rather than focusing attention on one element of the environment, attention is often turned to considering how human health or other broad measures of quality affect the natural and social environment. To implement this approach, attention is often given to watersheds or bioregions. Environment and natural resource management is often ill suited to administratively based boundaries. While it is not feasible to form agencies exclusively based on 'natural' boundaries, it is appropriate to plan on the basis of ecosystems and incorporate this information into appropriate implementing documents (*e.g* policies, strategic plans, legislation, and regulation). In the context of the sugar industry in the Herbert River district, the ecosystem approach considers at least three key perspectives.

The first perspective considers the interaction of biophysical processes. In the Herbert River district, long-standing resource issues have concerned inadequate land drainage which has limited crop productivity, and flooding which has inflicted damages to the town of Ingham and crop losses (Cameron McNamara, 1984). Emerging resource issues concern the impacts associated with acid sulfate soils, the maintenance of riparian corridors for wildlife, and decreasing biodiversity through the loss of some remnant ecosystem types on the coastal lowlands (QDEH, 1995; Johnson *et al.,* 1998). Solutions to the problems require, in part, an adequate understanding of biophysical systems. Inadequate information could see decisions made which might lead to poor outcomes including not only environmental problems, but the transfer of problems from one property owner to another, or the inefficient expenditure of public and private funds. From this perspective, the comprehensiveness and appropriateness of the Conditions of Assignment should be considered.

The second perspective of the ecosystem approach suggests that institutional arrangements work in a coordinated manner. For instance, it is not uncommon to have fragmented responsibilities for water management. One agency may be responsible for drainage, another with fisheries, another with soil erosion, and yet another with water quality. The Brundtland Commission noted this tendency. The solution to the problems associated with a fragmented approach does not necessarily imply a 'consolidation of responsibilities' that simply transfers an inter-agency problem to an intra-agency one. Since the interconnected nature between economic and environmental systems is unlikely to change, policies and institutional behaviour must. Such an adjustment is "one of the chief institutional challenges of the 1990s and beyond" (WCED, 1987).

These comments are relevant to resource management agencies in Queensland where there is a complex web of laws, policies and agencies (Johnson *et al.*, 1998). In addition, there is separation between resource development and resource management activities as illustrated by the division of responsibilities that occurred in 1996 between the former Queensland Department of Primary Industries for agricultural production and the then new Department of Natural Resources for resource management. Providing for an integrated resource management approach that allows for adequate information of biophysical processes, and provide for the effective administration is a long-standing challenge for governments worldwide. The issue of administrative fragmentation will be addressed under the partnership principle. The third ecosystem approach perspective focuses attention on environment-economy-society linkages. A noted earlier, this aspect is addressed under the balance principle.

3.2.3 Partnerships

As discussed, responsibility for environmental and resource management is often shared between private and public managers at international, national, state, regional, local and individual property scales. Partnerships respond to this reality and should ensure the equitable treatment of

all these participants. People and groups who have a legitimate concern should have an opportunity to influence the formulation and implementation of resource management and development decisions. Information among participants should also be exchanged.

The Brundtland Report and the Earth Summit suggest that a participatory planning approach is an essential component of a democratic society. In the context of this report, participation not only includes the involvement of citizens, but of other relevant public and private resource management agencies. In providing for effective participation, mechanisms should be in place to provide for conflict resolution.

Kernaghan (1994) provides insight on the meaning and types of partnerships used in Canada. "So-called true partnerships promote empowerment in that they involve a sharing of decision-making power between or among partners" (Kernaghan, 1994: 61). However, this definition excludes many other interactions between resource managers where there is little power sharing. This shortcoming prompted Kernaghan (1994: 61) to provide a second definition of partnership that embraced a "relationship involving the sharing of power, work, support and/or information with others for the achievement of joint goals and/or mutual benefits." Thus, understanding the nature of the relationships and power sharing among participants is crucial in understanding partnerships.

The character of participation is one important component in understanding relationships and power sharing. Three types of decision-making styles typify resource management agencies in historical and contemporary contexts (Figure 3.1). A well-established type is "Decide-Announce-Defend" (Figure 3.1a). When a public agency becomes aware of a problem, it considers solutions through the use of "rational planning methods". This form of decision making provides almost no opportunities for partnership to form since there is very little sharing of information or work. Instead, the key public agency would announce a solution "which solved the problem" and fulfilled its legislative requirements. Unfortunately, historical inertia, financial arrangements and legal requirements often skewed the range of adjustments that were considered. If the proposal were controversial and groups attacked it, a public dispute was 'created' and forced the public agency to defend its interests. Information meetings, lobbying and media campaigns illustrate some of the efforts which proponents might undertake in order to gain public and political support. Regardless of the outcome, these are adversarial strategies and provide little opportunity to form future partnerships.

The "Solomon Trap" is a second common type of decision-making (Carpenter and Kennedy, 1988) (Figure 3.1b). This approach seeks to identify relevant stakeholders and to obtain their views. Through forums such as public meetings, focus groups, polls and surveys, a resource management agency consider how the public views the economic, social and environmental implications of alternative solutions. What is less clear is the basis upon which such input is incorporated into the proposal.

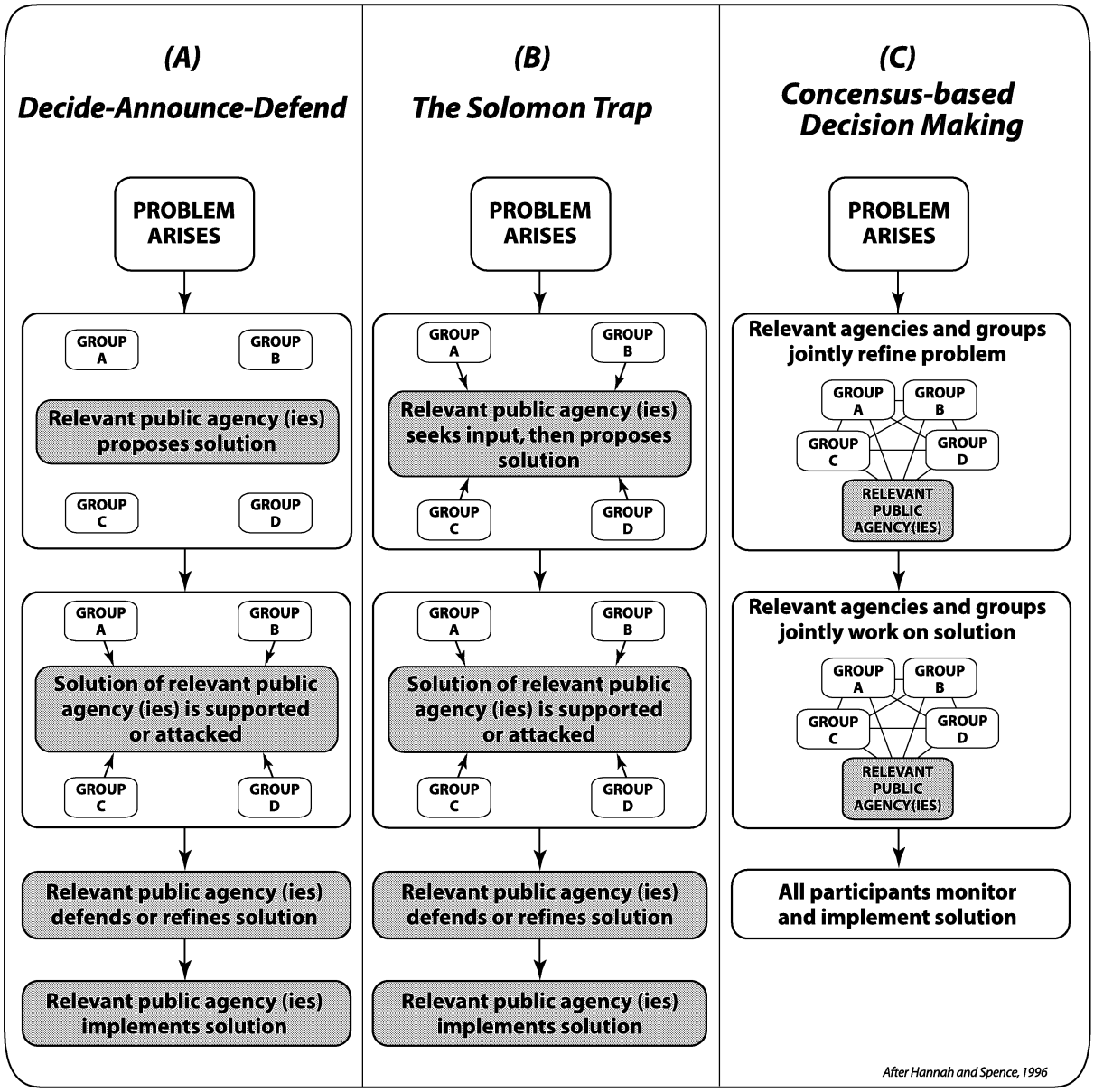

Figure 3.1 Three common participatory approaches to resource management.

Unfortunately many public agencies do not enjoy the same level of esteem afforded the Bible's King Solomon who threatened to cut a baby in two and give the halves to two women each of whom claimed to be the mother. In this way, he believed it would be possible to determine the identity of the real mother, because she would not agree to the baby being cut in half. While King Solomon was seen as possessing divine wisdom because he did not kill the child and was able to distinguish the true mother, a resource agency may be surprised that its efforts to obtain public input are unappreciated and that its judgment is questioned. After the public agency announces the solution that in its view best serves the public interest, some stakeholders may be dismayed that their key concerns were inadequately addressed. According to Carpenter and Kennedy (1988), this disappointment can turn into feelings of betrayal. Some participants may disagree with the solution offered. As with the "Decide-Announce-Defend" approach, a public agency may expend significant efforts in justifying its proposals to the public and politicians, but ends up in a "Solomon Trap" because many interests may be dissatisfied with the decision.

The "Solomon Trap" represents a limited form of partnership because the relationship is essentially focused on the one-way exchange of information. Relatively little effort and opportunity to establish ongoing partnerships exist, and there is little sharing of decision-making

power. In this approach, partnerships often develop from *ad hoc* and reactive responses to particular problems.

Consensus-based decision making represents a third and more complete form of partnership (Figure 3.1c). At present, a key participant who could represent a range of people (*e.g.* a public agency, private user or non-governmental organisation) perceives a problem. That participant will work with key public and private agencies/groups in order to define the problem, identify appropriate solutions and implement relevant programs.

In a collaborative partnership such as this, the role of the key public agency is significantly different from the previously noted decision-making styles in that:

- It is a facilitator rather than the focal point for making a decision. All participants share information among themselves, define the nature of the problem, identify possible solutions, and suggest appropriate means of implementation.
- Efforts are focused on problem solving. In both the 'Decide-Announce-Defend" and "Solomon Trap", public agencies could end up devoting significant energies to defending their position. These efforts can be stressful on organisations and people.
- Differences among participants are resolved through direct meetings. Public agencies no longer serve to explain, justify, interpret or judge the full range of views of other participants. These responsibilities are shared with each stakeholder.
- Participants shape the problem-solving process. Since the collective experience in developing effective, efficient and equitable procedures is limited, some trial-and-error is taking place. In addition, a well-formulated process can change due to evolving external and internal pressures (*e.g.* new government, fiscal circumstances, environmental crisis, changing problem definition, and change in participants or membership).

These traits are one measure of partnership. Other aspects are also relevant. First, a general consensus exists that partnerships are best served when involvement occurs early in the decision-making process throughout the entire process, and after the decision is made. Partners should not be asked to simply ratify a decision that has already been determined (Mitchell, 1990). Second, there should be sufficient time for partners to consider information provided to them. Third, when there are disagreement, partners should, at a minimum, explain the rationale supporting their decisions. Ideally, effective conflict resolution processes are established to settle these disputes.

3.2.4 Flexibility

Our understanding of the environment and human interactions with it is continually evolving. Social and personal attitudes and behaviours are also dynamic. Political and economic circumstances can change almost overnight on the basis of the future's market in New York, an announcement from the central bank, or the results of an election. Since these types of changes must be accommodated in individual, community and government management strategies, there is a need for flexibility. This principle is illustrated in the reliance on the mix of policy instruments advocated in the Rio Declaration (Table 3.1). It also suggests that monitoring be established in order that learning and adapting are achieved.

3.2.5 The Precautionary Principle

The precautionary principle has been used by decision-makers to consider the impacts of policies, programs, and projects. Although it has been applied since the 1950s in Germany, its inclusion as Principle 15 in the Rio Declaration has raised its international profile and popularity. That document rationalised and defined the principle as follows:

> In order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of

> full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation.

The precautionary principle recognises the importance and the different types of uncertainty in resource management (Table 3.2). The challenge is to apply appropriate management processes and decisions in the face of uncertainty.

Table 3.2 Defining different kinds of uncertainty in resource management.

Type	Definition
Risk	System parameters are well known. Range of outcomes and the odds are known and can be predicted.
Uncertainty	Major system parameters are known. Range of outcomes is known but the odds are not.
Ignorance	Scientists will be surprised by the outcomes because they do not know. Do not know what questions should be asked.
Indeterminacy	Scientific knowledge is inadequate. Causal chains are open. Understanding is not possible.

(Source: Wynne, 1992; Mitchell, 1995; Young, 1995)

Rather than stopping all resource development, applying the precautionary principle has more to do with changing the balance of decision-making power. It emphasises the responsibility of resource developers must take in either: (i) demonstrating that their initiatives will not cause harm; or (ii) providing the means to compensate potentially impacted communities or people (O'Riordan, 1995). These comments suggest that responsible decision making is an important element of the precautionary principle. Some mechanisms which can achieve this goal include: monitoring changes in resource capital, placing the onus of responsibility on proponents, developing safe minimum standards, enhancing community consultation and education, and providing anticipatory approaches to resource management. Thus, applying the precautionary approach is particularly relevant for those who view integrated resource management an effective institutional arrangement. Research and education can aid this process.

3.3 Data collection and synthesis

In applying the framework previously outlined to an evaluation of the cane assignment process in the Herbert River district, data were obtained from five sources:

1. Written records of applications for assignment;
2. Spatial data indicating biophysical and land use characteristics of the lower Herbert River district;
3. A statistical analysis of the relationship between the granting or rejection of assignment applications and key biophysical, economic and social parameters;
4. A geo-statistical analysis of the relationship between the granting or rejection of assignment applications and key locational parameters; and
5. Interviews with key sugar industry and government respondents at local and state levels.

3.3.1 Applications for Assignment

Cane assignment application files located at the CANEGROWERS Ingham office for the period 1993-1996 were examined. A total of 525 applications were submitted to that office during the study period (Table 3.3).

Table 3.3 Number of applications for assignment for each mill area in the Herbert River district.

Year	Victoria Mill Area	Macknade Mill Area	Herbert District Total
1993	189	27	216
1994	61	22	83
1995	79	19	98
1996	107	21	128
Total	436	89	525

A copy of an application form is contained in Appendix 1. These forms provided information about:

- the location of the property;
- the type of application;
- the mill area (Macknade or Victoria);
- the total area applied for; and
- the proposed planting schedule to make the assignment effective.

Final decisions, area granted for assignment and any conditions the Local Board placed on the assignment were recorded. Correspondence among relevant participants concerning environmental aspects associated with an application was noted.

The 525 applications covered an approximate area of 16,000 ha. It was feasible to link information from complete application forms with the spatial database (that is described below) for 472 applications (89.9%) of the total application pool. The complete applications encompassed an area of about 15,000ha or about 94% of the total area applied for. In addition to incomplete information, difficulties were also encountered in linking some applications to the Digital Cadastral Database (DCDB) layer (particularly in the vicinity of Helen's Hill). Despite these problems, the available record is believed adequate to reasonably assess the cane assignment process in the **Herbert River district** between 1993 and 1996.

3.3.2 Spatial data

A range of data were collected and collated to underpin the evaluation. Table 3.4 lists the key spatial data sets utilised, their source and accuracy. It is important to note that although some of the errors presented may seem insignificant in terms of catchment scale analysis, they can become a larger problem when they are compounded with other small errors over a large area. Hence the following need to be acknowledged when considering the general utility of the data collected.

1. *All spatial data is of limited accuracy*. This is due to the fact that instruments recording distances and angles have inherent accuracy limitations. It is also because databases are primarily an abstract or generalisation of the actual geographic feature they are representing. Digitising errors are often relatively minor when compared to the process of cartographic abstraction itself. Classic examples of this include soil and vegetation mapping.
2. *The precision of GIS processing tends to exceed the accuracy of the data*. In principle, data should be expressed in a precision that reflects the accuracy of the data collected.
3. We have methods for describing the positional accuracy of point features, but little has been developed for abstract features. More comprehensive modeling will be required if we are to develop methods for describing *accuracy within spatial databases and track its propagation through complex GIS processes*.
4. *Ideally there would be a set of confidence limits on all GIS products*, resulting from descriptions of error in the database and its propagation through the GIS process. In some situations this would be difficult to determine as multiple-source data sets may be manipulated and overlayed, in this case warnings may replace confidence limits to steer unwary users away from meaningless results.

Table 3.4 Spatial data collected to underpin the evaluation of the cane assignment process in the Herbert River district.

Dataset	Description	Source	Accuracy
Digital Cadastral Database (DCDB)	Digital database of cadastral features in Queensland. Collected on a local government area boundary basis. Contains both linework (*e.g.* property boundaries) attribute data (*e.g.* tenure).	Queensland Department of Natural Resources	Attribute accuracy approximately 98%. Linework, average horizontal accuracy is estimated to be +/- 50m, with 60% of the linework within +/- 25m and approximately 10% of linework outside the accuracy of +/- 50m.
Land Cover	Land cover of the lower Herbert River catchment was visually interpreted from scanned and rectified 1:25000 aerial photography acquired for 1943, 1961, 1970, 1977, 1988 and 1992 and 1:10000 digital orthophotography acquired in 1993, 1994 and 1995. An unsupervised classification of SPOT Panchromatic and MSS imagery was used to map land cover in 1996. Land cover boundaries were mapped onto a geo-referenced digital base in ARCINFO GIS.	Classification drew on previous vegetation (Tracey, 1982; Blackman *et al.* (1992); Perry, 1995) and soil surveys (Wilson and Baker, 1990; Heiner and Grundy, 1994)	Spatial accuracy ±7m for 1:25000 aerial photography, ±1m for 1: 10000 ortho-photography and ±10m for SPOT imagery. Classification of units and boundaries not inspected in 1996 was undertaken by extrapolation from equivalent photographic units. Final accuracy of ±10m in the horizontal for map.
Land Suitability for Sugarcane	Based on a combination of geology, soil, vegetation and climate data, this dataset is the output of applying a simple rule base to determine biophysical suitability for sugarcane growth.	Queensland Department of Natural Resources (Wilson and Baker 1991)	Scale of publication is 1:100000 with a horizontal accuracy of +/- 50m.
Mahogany Glider Habitat	Habitat mapping for mahogany gliders based on detailed vegetation mapping and field trips.	Queensland Department of Environment	Maximum scale of use 1:50000, with horizontal accuracy of +/- 25m.
Mangrove Vegetation	Mangrove vegetation boundaries were interpreted from air photos as per details for land cover	Johnson *et al.* (1997) and Perry (1995)	As per land cover mapping.
Height 3m Above Sea Level	Represents the 3m ASL contour. Generated using elevation data and the ArcInfo Grid module's function: CONTOUR. The elevation data was gridded prior to having contours extracted.	Base data derived from Herbert Mapping Project	Contours within 95% accuracy of known spot heights with accuracy of +/-1m. The grid cell size used was 250m.
Height 9m ASL - Cattle Creek	As per above but geographic extent located only on the Cattle Creek sub-catchment.	Base data derived from Herbert Mapping Project	Contours within 95% accuracy of known spot heights with accuracy of +/-1m.

Table 3.4 cont.

Dataset	Description	Source	Accuracy
Slope Greater Than 3%	Dataset was generated using the gridded elevation data and the ArcInfo Grid module using the SLOPE function.	Base data derived from Herbert Mapping Project	It was not possible to verify the accuracy of this dataset.
Acid Sulfate Prone Soils	A qualitative assessment derived from a rule base incorporating soil type, elevation, distance from coast and geomorphology.	Based on data from Wilson and Baker (1991)	Scale of mapping was 1:100000 with a horizontal accuracy of +/- 50m.
Lakes, Lagoons & Wetlands	This dataset delineates lakes, wetlands, swamps, lagoons and billabongs defined in the land cover mapping.	QDoE, Herbert Mapping Project	As per land cover data.
Stream Buffers – 10, 20 and 40m	Dataset was generated using Herbert Mapping Project stream data and the BUFFER command in ArcInfo. Only selected major and minor streams were included, reflecting the true stream protection laws which only include named streams.	Base data derived from Herbert Mapping Project	Relative linework accuracy of +/-5m.
Flood Mapping	Linework for the coverage of the 1967 and 1977 floods was intended as a guide to the full extent of the inundation area.	Cameron McNamara (1980)	It was not possible to verify the accuracy of this dataset.
Drainage Board Boundaries	The data provides the areal extent of gazetted drainage boards.	Queensland Department of Natural Resources	Maximum scale of use 1:50000, with horizontal accuracy of +/- 25m.
Location of Cane Assignment	Location of farms was determined using the Sugarcane Assignment Register (SCAR) database in conjunction with the DCDB, linked using the lot, plan and parish attributes. Cane blocks from the Herbert Mapping Project were used to determine the location of cane block. Data describing sugarcane assignment applications over the 1993 to 1996 period were then linked to the Victoria Mill and Macknade Mill datasets. Links were established according to the year cane was planted and the area applied for. Corrections were made according to the advice of local cane inspectors.	Queensland Sugar Corporation	Linework accuracy as per the DCDB. Positional accuracy is estimated to be approximately 90%.

These considerations suggest that GIS processes and results need to be kept in context with the system from which they were derived, the methods and instruments that were used to record the feature and the system in which the results will be applied. Many of the features represented in this study are more continuous than exactly bounded into distinct classes, and so have inherent limitations.

3.3.3 Spatial analysis of land cover data

A spatial analysis of land cover in the lower Herbert River catchment was also undertaken. A number of key indices were calculated in ARCINFO to quantify changes in shape, size and spatial pattern of vegetation units. These indices have been successfully used in a number of similar studies:

- *Edge:area ratio*, which quantifies the amount of irregularity in the shape of remnant stands of vegetation (Sharpe *et al.*, 1981);
- *Forest island dissection index* (DI), which compares the amount by which any one "island" (or in GIS terms, polygon) of vegetation is more dissected than another and, therefore, would have a greater edge to interior. Any index greater than 1 is a measure of such irregularity in comparison to an index of 1, which is circular in shape (Sharpe *et al.*, 1981). DI can be represented by the following equation:

$$\mathrm{DI} = \frac{p}{\left(2\sqrt{p\,a}\right)}$$

  where p = island perimeter (metres) and a = island area (ha)
- *Landscape dissection index* (DL), which measures the cumulative edge:area ratio for the entire landscape (Sharpe *et al.*, 1981). DL can be represented by the following equation:

$$\mathrm{DL} = \sum_{i=1}^{n} \frac{p}{\left(2\sqrt{p}\sum_{i=1}^{n} a\right)}$$

  where p = total perimeter (metres) and a = total area of the forest island (ha);
- *Island distribution index* (IDI), which measures landscape aggregation and is similar in logic to the nearest neighbour statistic. IDI emphasises the pattern of islands in the landscape. IDI = 1 in a randomly distributed population, < 1 in an aggregated population and approaches uniformity if the value is close to 2.1491, where islands would have maximum spacing, in which case they are regularly distributed in a hexagonal pattern (Bowen and Burgess, 1981). IDI can be represented by the following equation:

$$\mathrm{IDI} = 2\overline{r_c}\,(l\,p)$$

  where $\overline{r_c}$ = mean centroid-to-centroid distance from a forest island to its nearest neighbour and λ = density of forest islands (number per ha)
- *Diversity* ($H^{/}$) and *Evenness* (E) indices which compare changes in richness and landscape apportionment (Medley *et al.*, 1995). $H^{/}$ and E can be represented by the following equations:

$$H^{/} = -\Sigma P_i \ln P_I$$

  where P_i represents the proportion of total area (or entropy measure) in category *i* of each land cover/use type

$$E = H^{/} / \ln s$$

  where s = total number of land cover/use categories
- Number and density of islands (*i.e.* number per unit area) and cover class as a % of total area measure landscape pattern.

3.4 Statistical Analysis

A survey of approved sugarcane assignments was carried for the years 1993-1996. The results of this survey were used to determine the relative importance of a number of factors on the final assignment decision. For each year two mills, Macknade and Victoria, were recorded on a farm basis as follows:

- Approval rate (0, <100%, 100%);
- Amount applied for; and
- Current assignment.

Farms were also categorised according to the tenure description and an assignment application type. In the first two years, there were farms with an Approval Rate of 0 or <100%; in the third year (1995). All farms (excepting one) were recorded with the value of 100% for Approval Rate; and in the fourth year (1996), Approval Rate took all three values (o, <100%, 100%). Also available in the fourth year were the proportions of Applied For to be planted in Years 1 and 2 and a Recommendation from the Environment Advisory Committee. Further geographical details were available for some farms for that year and they consisted of:

- Nearest rail distance;
- Distance to Victoria Mill; and
- Distance to 1996 centroid of whole cane district.

For each of the years 1993, 1994 and 1996, a multinomial logistic regression was performed, relating the Approval Rate to the various factors available for each year. A separate analysis was performed for the two mills. Table 3.5 summarises the scheme used to simplify the fitting of the logistic equation. The Approval Rate was coded (0,1,2) corresponding to the approval ratings (0, <100%, 100%). The continuous and discrete predictor variables were coded as 0,1 variables according to whether the variable was less than or equal to a critical value (given the value 0) or greater than the critical value (given the value 1), as follows:

Table 3.5 Description of predictors.

Factor	Variable Description	Critical Value
A	Applied For – 93,94	10
	Applied For – 96	50
T	Type	2
D	Land Tenure	1
R	Recommendation	2
C	Current Assignment	2
Y1	Year 1 % Applied For	0.5
Y2	Year 2 % Applied For	0.5
NR	Nearest Rail	3000
DV	Distance to Victoria Mill	20000
D96	Distance to 1996 Centroid	400

A further factor PY was constructed taking the value 0 if there was only one year intended for planting the amount Applied For, or 1 if there were two or three years planned for planting.

3.5 Geo-Statistical Location Analysis

When dealing with spatially distributed phenomena, it is often useful to provide a visual representation of the distribution. This can be done with the use of the standard deviational ellipse or the ellipse of dispersion. The standard deviational ellipse gives a graphical

representation of an area with a radius of one standard deviation along each axis around the centroid. In this case, the land cultivated with sugarcane. The methodology for the calculation of the standard deviational ellipse with the cross of dispersion involves a number of steps. The following description is derived from Kellerman (1981).

The ellipse is centred on the unweighted centroid, which is sometimes also called the spatial mean. In the case of this research there are no weights associated with the pixel coordinates, so the centroid is simply the mean of the X and Y coordinates.

The two dimensional extension of the standard deviation defined in univariate statistics is the standard distance (d). Equation 3.1 shows that the standard distance is the square root of the sum of the variances of the X and Y coordinates. With s_Y^2 being the variance of the Y coordinate and s_X^2 being the variance of the X coordinate.

Equation 3.1

$$d = \sqrt{s_X^2 + s_Y^2}$$

The standard deviation ellipse has the property that the larger arm is the line that minimises the squared deviations between the point coordinates and the axis (just like a linear regression line). The minor axis (the smaller arm) has the maximum sum of squared deviations from the point coordinates to the axis. This is necessary to ensure the major and minor axes are at right angles to each other. In statistical terms the two axes are uncorrelated.

To draw the standard deviation ellipse it is necessary to determine the degree of rotation " from the original X axis. This can be derived from the formula:

Equation 3.2

$$\tan(2\alpha) = \frac{2\,\mathrm{cov}(X;Y)}{s_X^2 - s_Y^2}$$

where cov(X;Y) is the covariance of X with Y (Equation 3.2). Once α is calculated the length of the axes of the ellipse can be calculated.

The length of the arms of the ellipse centred on the centroid (Equations 3.3 and 3.4) are:

As required the sum of the squared distances from the data points to the longer axis will be minimised and will be maximised to the shorter axis.

Equation 3.3

$$sX' = \sqrt{sX^2\cos^2\alpha + sY^2\sin^2\alpha + 2\,\mathrm{cov}(X;Y)\sin\alpha\cos\alpha}$$

Equation 3.4

$$sY' = \sqrt{sX^2\sin^2\alpha + sY^2\cos^2\alpha + 2\,\mathrm{cov}(X;Y)\sin\alpha\cos\alpha}$$

There are a number of formulas for the area of the ellipse but the general one (equation 3.5) is:

Equation 3.5

$$A = \tfrac{1}{2}\pi d^2$$

3.6 Interviews

The fifth source of data was interviews directed to officials involved in assignment and/or land and water planning at local and state levels. The purpose was to gain a better understanding of the sugarcane industry and natural resource management. The interviews provided an opportunity to gain insight into the experience and knowledge of managers involved directly in the implementation of relevant programs. Respondents were asked to describe their role in sugarcane management, their views on the strengths and weaknesses or current practices, and alternatives to address weaknesses. Throughout the research, ongoing communication with many of these respondents also provided clarification and understanding about the programs.

3.7 The Case Study Area: Herbert River District

The evaluation of the cane assignment process utilised a case study approach. Its major advantages relate to its ability to show historical and causal processes. This enables researchers to answer 'how' and 'why' questions (Stoecker, 1991). It also provides for a policy relevant setting to consider practice rather than a theoretical one. In this manner, this report hopes to provide useful feedback to line managers. The weakness of the case study approach is its potential lack of objectivity and difficulty in providing generalisation (Stoecker, 1991). Since no accurate measure of independent variables or control groups is often possible, this approach usually relies on retrospective or post-program evaluations. These shortcomings may compromise the reliability of the research when used as the primary means of analysis. However, since there has been a dearth of studies that have assessed the environmental aspects of the cane assignment process, it is appropriate to utilise the case study approach.

The Herbert River catchment drains an area of approximately 10,000 km^2 to the Coral Sea and is the largest of the river systems located in Australia's sub-humid to humid tropical north east (latitude 15-19^0 S, longitude 145-146^0 E) (Figure 3.2). The Herbert River rises at an elevation of approximately 1,070m and has a total length of 340 km. The catchment has three distinct geomorphic sections: the upper catchment (6,000 km^2), the intermediate catchment (1,000 km^2) and the lower catchment (3,000 km^2). In the upper catchment, the topography ranges from level alluvial plains to rugged, deep incised ranges. In the western parts, the land is generally gently undulating while in the eastern portion of the upper catchment, the topography rises irregularly and reaches altitudes over 1,000 m. The middle catchment consists of a deep gorge before entering the lower catchment. The lower catchment consists of a coastal plain flanked by mountains in excess of 1,000m high, but commonly at 600m to 900m with steep slopes. It is the 3,000 km^2 lower catchment bounded to the north by the Cardwell Range and by the Seaview Range to the south that is relevant to this study. The catchment normally experiences warm humid to sub-humid summers and mild dry winters. Large rainfall and temperature gradients exist across the catchment and variability of rainfall is also very high. Mean annual rainfall is 1,370 mm and ranges from in excess of 4,000 mm in the coastal ranges to 750 mm in the extreme west. Approximately 74% of the mean annual rainfall occurs from December to March, decreasing to a minimum in the June to October period.

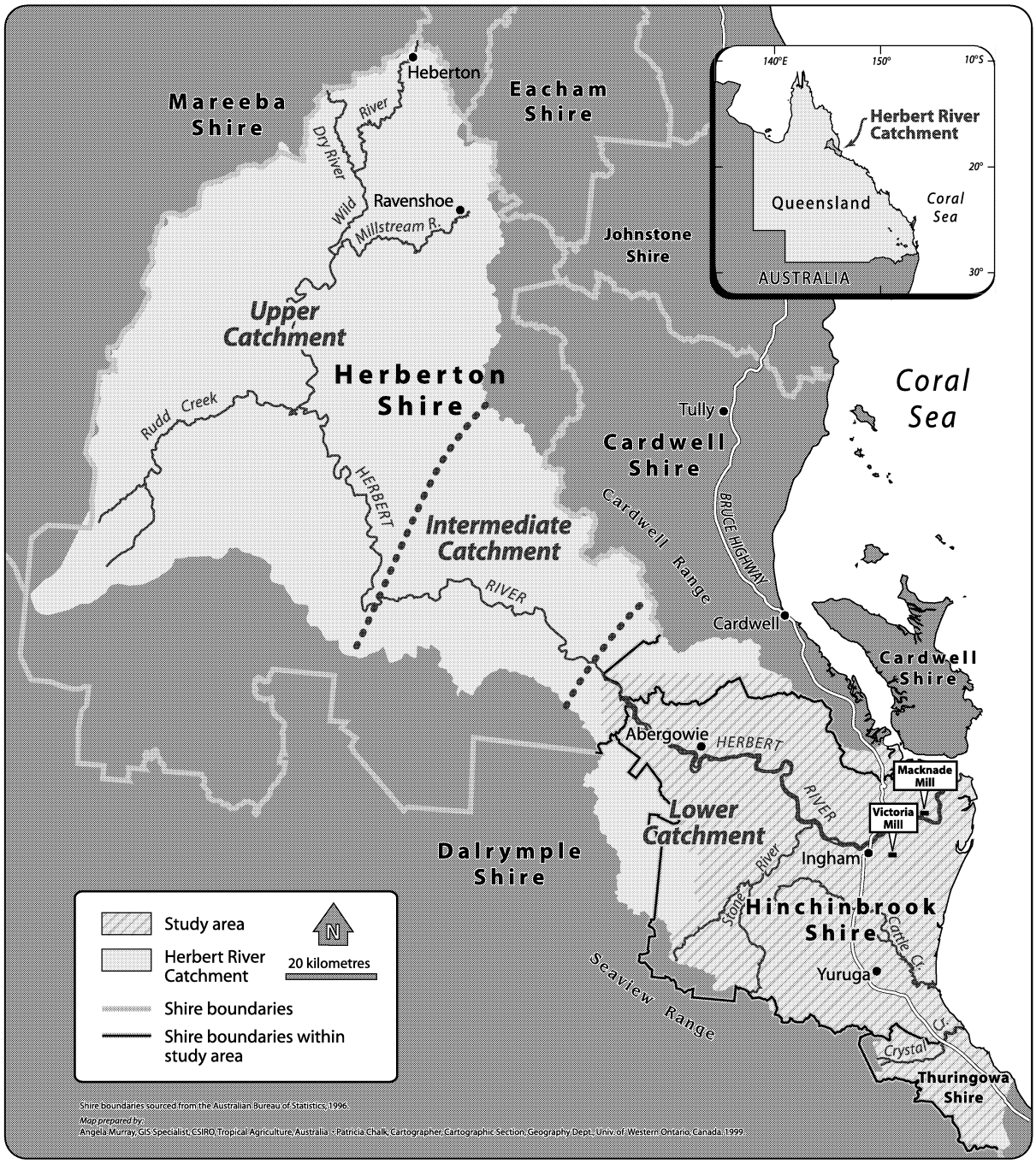

Figure 3.2 The Herbert River Catchment.

Large areas of the upper catchment remain under natural vegetation and are used for extensive beef cattle grazing, while much of the lower catchment has been cleared for crop production or exotic pastures. Agricultural and pastoral production are the largest users of land in the catchment. Natural vegetation in the lower catchment consists predominantly of open Eucalyptus and Melaleuca woodlands, with areas of open grassy plains and dense Melaleuca wetlands (Figure 3.3). Rainforest patterns occur on the creek and river levees. In terms of arable agricultural production, the sugar industry located in the lower catchment is dominant, with approximately 70,000ha of sugarcane under cultivation. Other important industries are plantation forestry, beef cattle and small crops such as pineapple, melon and pumpkin. Small areas are utilised for mining (in the upper catchment only) and industrial activities, or are alienated for urban development.

Two main shires are located in the catchment – Herberton and Hinchinbrook. The catchment has two major population centres (Ingham and Ravenshoe) and a total population of

approximately 20,758 people (1996 Census), of whom 66% are located in the lower catchment. The administrative boundary of the Hinchinbrook Shire is coincident with the lower Herbert River catchment, and it is this region that is of primary relevance to this study. Communities, such as Abergowrie, Halifax and Macknade, have their roots in the sugar industry. Ingham is the major centre with a population of 15,600 people. Thuringowa is a municipality located south of Crystal Creek. It is dominated by population centres on the western and northern limits of Townsville City (Figure 1.1). Sugarcane is grown in both Thuringowa and Hinchinbrook Shires.

The sugar industry in the Herbert River district has approximately 65,000ha of land supplying cane to two sugar mills (Victoria and Macknade) and is the largest intensive agricultural industry in the catchment. Cane is grown mainly in the area surrounding the mills and extending along the Herbert River to Abergowrie and along the Stone River to Upper Stone. Cane has also extended south from Yuruga to Crystal Creek (Johnson and Murray, 1997). The area of cane grown and the amount of sugar produced in Queensland have increased substantially since World War II and most particularly since 1991 (Figure 3.4). The Herbert River district has been one of the most rapidly expanding areas within the state. In 1998, the Herbert River district accounted for approximately 17% of the total assigned area in Queensland and produced about 18% of total sugar. The 30-year average yield per harvested area is 79.3 t/ha for the Victoria mill area, and 77.4 t/ha for the Macknade mill area. The 30-year average commercial cane sugar content (ccs) for Victoria mill area is 13.48 and 13.31 for Macknade Mill. The 30-year average sugar yield for Victoria Mill is 11.23 t/ha and 10.43 for Macknade Mill. Sugarcane with its many varieties will grow well on a wide range of soils. No simple soil/crop yield relationship is evident. However, in general, higher yields and/or lower production costs are associated with well drained and relatively fertile soils, while poorer yields are associated with very wet or the very dry soils. The variation in yield for any given soil reflects both seasonal variation as well as individual farmer expertise (Johnson and Murray, 1998).

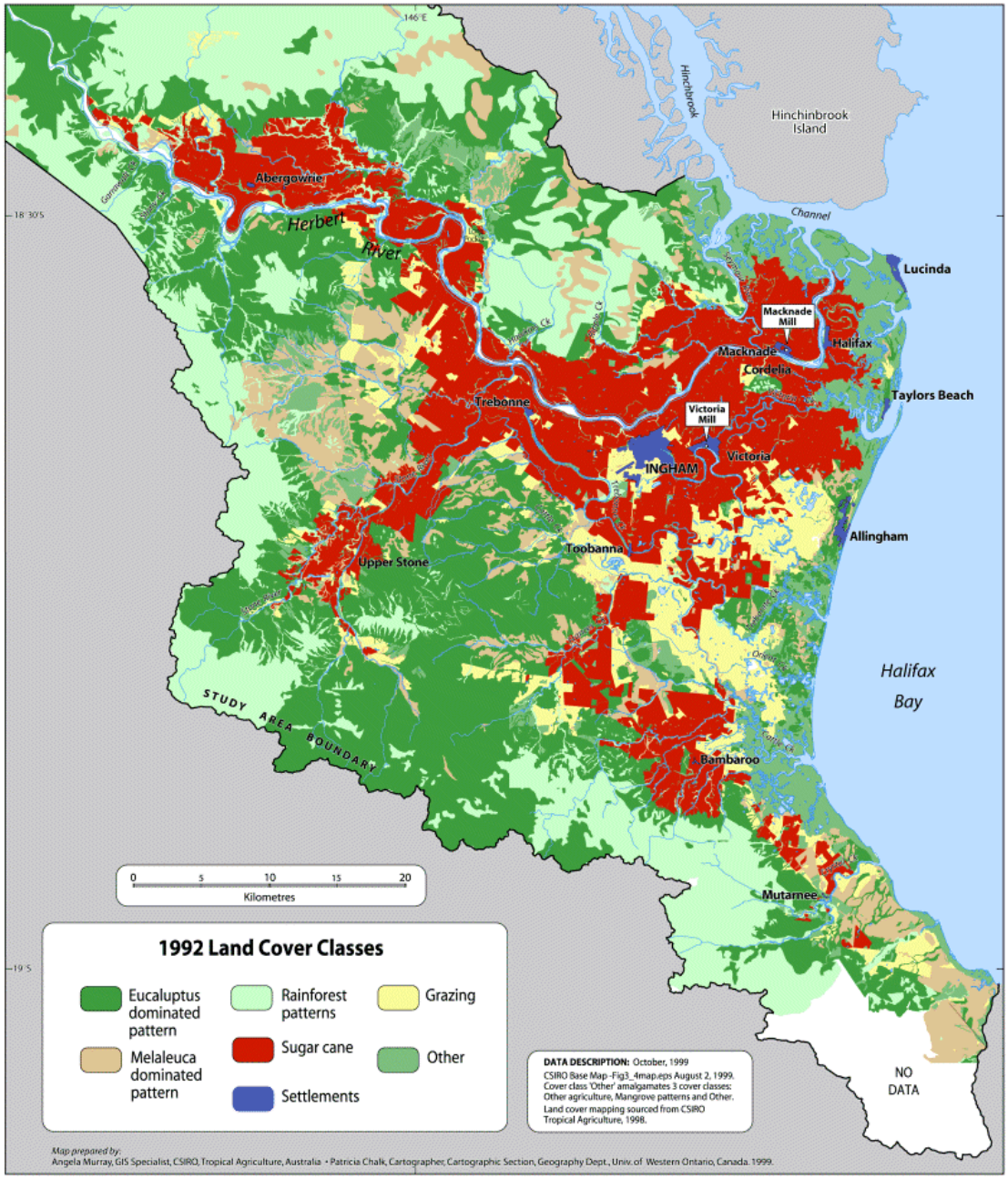

Figure 3.3 Land cover in the Herbert River catchment (1992).

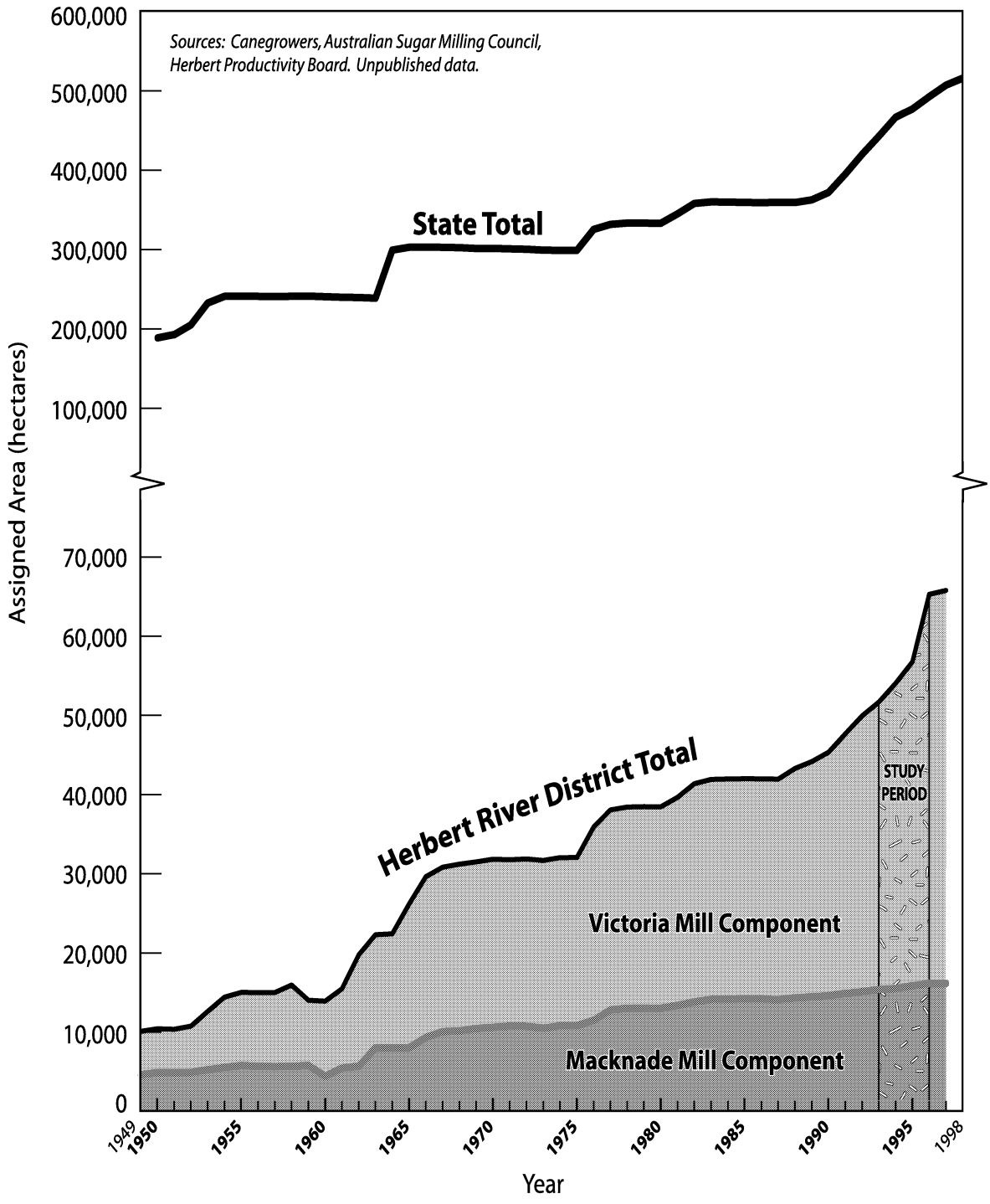

Figure 3.4 Growth in the assigned land in Queensland and the Herbert River district.

3.9 Sugar in the Regional Economy

The sugar industry has been the dominant economic force in the Herbert River district since the mid-1870s. The industry has had a similar impact on most populated coastal regions of eastern Australia north of 30^0 S. Table 3.6 describes the distribution of employment by industry sector in the Hinchinbrook Shire. Approximately 95% of the Herbert sugar industry in contained within the boundaries of the Hinchinbrook Shire. Table 3.7 shows that the contribution of the Herbert sugar industry to output and employment in the regional economy of North Queensland, while relatively small, is comparable to a number of manufacturing sectors in the regional economy, including Wood and Paper manufacturing, Machinery and Appliances and Non-metal manufacturing.

Table 3.6 Industry employment in the lower Herbert 1990/91 and 1995/96.

Industry Sector	**Hinchinbrook Shire**	
	1990/1991	1995/1996
Agriculture, Forestry, Fishing, Hunting	1,291	1,357
Mining	36	33
Manufacturing	703	872
Electricity, Water, Gas	40	79
Building Construction	202	273
Wholesale and Retail Trade	863	884
Transport and Communication	217	201
Finance, Property and Business Services	226	294
Public Administration and Defence	226	491
Community Services	685	1,049
Recreation and Personal Services	245	392
TOTAL	5,198	6,185

(Source: ABS, Cat. No. 2015.3, 1991); ABS, Cat. No.2015.3, 1996; Robinson *et al.,* 1999).

Table 3.7 Sectoral contributions to regional output and employment.

	Output		**Employment**	
Sector	Amount ($000's)	%	Persons (#)	%
Herbert Sugar Industry	206,288	3.1	1,367	1.9
Animal Industries	100,541	1.5	452	0.6
Herbert Beef Cattle	13,283	0.2	121	0.2
Other Agriculture	355,570	5.3	2,988	4.2
Forestry/Fishing	37,050	0.6	286	0.4
Coal/Petroleum Mining	140,056	2.1	522	0.7
Other Mining	417,437	6.2	1,226	1.7
Food Manufacture	521,287	7.8	2,826	4.0
Wood/Paper Manufacture	92,571	1.4	917	1.3
Machinery/Appliances	67,947	1.0	635	0.9
Metals Manufacture	1,042,024	15.5	1,559	2.2
Non Metals Manufacture	51,293	0.8	415	0.6
Other Manufacture	46,068	0.7	418	0.6
Electricity/Water/Gas	179,132	2.7	722	1.0
Building Construction	377,768	5.6	5,058	7.1
Trade	587,865	8.7	14,290	20.0
Transport/Communication	440,417	6.5	5,478	7.7
Finance	580,320	8.6	5,389	7.5
Public Administration	494,731	7.4	8,303	11.6
Commonwealth Services	689,081	10.2	13,133	18.4
Recreation/Personal Services	283,223	4.2	5,393	7.5
TOTAL	6,723,951	100.0	71,498	100.0

(Source: Robinson *et al.*, 1999)

The effect of the Herbert district sugar industry on regional employment in north Queensland region can be disaggregated into the number of jobs generated directly by the industry, and those resulting from flow-on effects. Direct employment includes those persons employed in the growing and milling of sugarcane. The flow-on employment results from the industry support effects generated by sugar industry purchasing of goods and services from each of the sectors defined in the input-output table. Tables 3.8 and 3.9 show the industrial significance of Herbert sugar industry in terms of output and employment effects respectively

Table 3.8 Estimated output effects of the Herbert sugar industry on the north Queensland regional economy ($000s).

Sector	Initial Effect	Flow-on Effect	%	Total Effect	Rank	%
Animal Industries	0	267	0.2	267.72	19	0.1
Other Agriculture	0	21,930	14.8	21,930.82	4	6.2
Forestry/Fishing	0	114.72	0.1	114.72	20	0.0
Coal/Petroleum Mining	0	276	0.2	276.76	18	0.1
Other Mining	0	430	0.3	430.50	17	0.1
Food Manufacture	0	1,965	1.3	1,965.39	13	0.6
Herbert Sugar Industry	206,288	0.00	0.0	206,288.00	1	58.2
Wood/Paper Manufacture	0	837	0.6	837.29	15	0.2
Machinery/Appliances	0	7,822	5.3	7,822.07	8	2.2
Metals Manufacture	0	1,418	1.0	1,418.47	14	0.4
Non Metals Manufacture	0	499	0.3	499.52	16	0.1
Other Manufacture	0	4,237	2.9	4,237.40	10	1.2
Electricity/Water/Gas	0	7,262	4.9	7,262.28	9	2.0
Building Construction	0	9,137	6.2	9,137.32	7	2.6
Trade	0	24,936	16.8	24,936.70	3	7.0
Transport/Communication	0	21,689	14.6	21,689.35	5	6.1
Finance	0	28,244	19.0	28,244.09	2	8.0
Public Administration	0	3,549	2.4	3,549.25	11	1.0
Community Services	0	10,339	7.0	10,339.66	6	2.9
Recreation/Personal Services	0	3,4119	2.3	3,411.59	12	1.0
TOTAL	206,288	148,370	100	354,658		100
Multiplier	1.00	0.719		1.719		

(Source: Robinson *et al.*, 1999)

Table 3.9 shows the industrial significance, in terms of employment, of the Herbert sugar industry on the regional economy of North Queensland. Robinson *et al.* (1999) estimates that 1,367 people are employed directly in the sugar industry and approximately 1,936 additional people are employed in the regional economy in industries supporting the sugar industry in the Herbert district. It is estimated that approximately 3,304 people are employed directly or in industries supporting the sugar industry. The employment multiplier (2.417) estimates that for every additional person employed in the industry, a further 1.417 people are employed in other industries in the regional economy.

Table 3.9 Estimated employment effects of the Herbert District sugar industry on the regional economy (number of persons employed).

Sector	Initial Effect	Flow-on Effect	%	Total Effect	Rank	%
Animal Industries	0.00	1.40	0.1	1.40	17	0.0
Other Agriculture	0.00	184.29	9.5	184.29	6	5.6
Forestry/Fishing	0.00	.89	0.0	.89	20	0.0
Coal/Petroleum Mining	0.00	1.03	0.1	1.03	19	0.0
Other Mining	0.00	1.26	0.1	1.26	18	0.0
Food Manufacture	0.00	10.65	0.6	10.65	13	0.3
Herbert Sugar Industry	1,367	0.00	0.0	1,367.00	1	41.4
Wood/Paper Manufacture	0.00	8.29	0.4	8.29	14	0.3
Machinery/Appliances	0.00	73.10	3.8	73.10	8	2.3
Metals Manufacture	0.00	2.12	0.1	2.12	16	0.1
Non Metals Manufacture	0.00	4.04	0.2	4.04	15	0.1
Other Manufacture	0.00	38.45	2.0	38.45	11	1.2
Electricity/Water/Gas	0.00	29.27	1.5	29.27	12	0.9
Building Construction	0.00	122.34	6.3	122.34	7	3.7
Trade	0.00	606.17	31.3	606.17	2	18.3
Transport/Communication	0.00	269.78	13.9	269.78	3	8.2
Finance	0.00	262.28	13.5	262.28	4	7.9
Public Administration	0.00	59.57	3.1	59.57	10	1.8
Community Services	0.00	197.06	10.2	197.06	5	6.0
Recreation/Personal Services	0.00	64.96	3.4	64.96	9	2.0
TOTAL	1,367	1,936.96	100.0	3,303.96		100
Multiplier	1.00	1.417		2.417		

(Source: Robinson *et al.*, 1999)

3.10 Key Natural Resource Management Issues

This regional summary is supplemented below by a selection of facts and widely held perceptions of issues affecting the sugar industry in the Herbert River district obtained from relevant sugar industry documents and survey responses from the Herbert River Integrated Catchment Management Coordinating Committee. The intent is to provide a 'snapshot' of key elements that have influenced sugarcane assignment. These include:

- Since 1991, the area has been one of the most rapidly expanding cane-growing areas in the country (QDPI, 1995). Soil surveys (Wilson and Baker, 1990) identify another 40,000ha of land well suited and available for sugarcane growing. This potential for expansion will have to be considered in the context of environmental and economic considerations.
- The relationship between growers and millers throughout Queensland is often associated with conflict. Season length, division of proceeds from the sugar product, and transport are issues of long-standing dispute.
- Technological innovation has played an important role in increasing productivity and decreasing harvest costs. Herbert River growers have increasingly used laser levelling rather than bedding of paddocks. Green cane harvesting is used by over 98% of farmers in the district (CANEGROWERS, 1998). It reduces production costs, provides the return of some nutrients to the soil through trash blanketing and reduces erosion. BSES and CSR continue to develop varieties of cane to increase productivity.
- The area has a long history of drainage problems. Compared with the past, drainage problems in the 1990s have not been as significant for most growers due to below average rainfalls. During the study period, precipitation during the spring and the summer harvest season provided ideal conditions for sugarcane growing (Figure 3.5). Farmers could easily access fields and the sugar content of the cane could be expected to be relatively higher than usual. However, wet years in 1998 and 1999 have again raised the profile of drainage issues. An attempt is being made to address these issues in the lower catchment through the development of a Master Land and Water Management Plan as part of Stage II of the Sugar

Industry Infrastructure Package (SIIP).

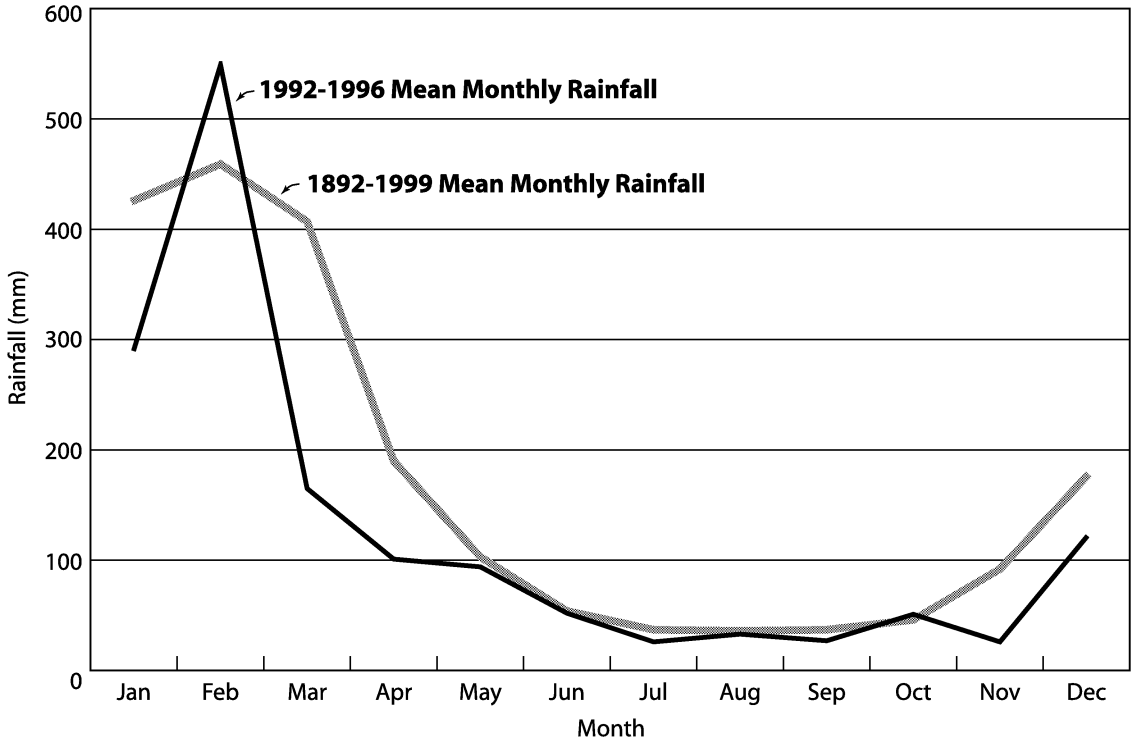

Figure 3.5 Precipitation in the Ingham area: historical and recent patterns.

- In the Herbert River district, environmental issues related to sugarcane expansion became very prominent in 1995. In that year, assignment was granted in an area known as Pomona land holding, which was identified as an important habitat for an endangered species, the Mahogany Glider (QDEH, 1995). A conservation order was placed on the site, and later a draft conservation plan was prepared. There was a significant level of uncertainty and conflict among industry, government and non-government participants concerning this development. The proponents applied for a drainage permit under the *Water Resources Act* 1989. Following a series of reviews by the HSC, QDEH and QDNR, assignment was granted on the area and immediate surrounds. The land was planted to cane, however as expected, the crop there has performed very poorly in the wet years of 1997 and 1998 (QDNR).
- Acquisition of digital ortho-photography at a scale of 1:10,000 was completed in 1997 by the Herbert Mapping Project. A range of private and public agencies sponsored the project. Before that time, only topographic and cadastral maps at 1:50,000 scale were easily available to most resource managers. A Herbert Resource Information Resource Centre was established in Ingham in 1997 as a shared GIS facility for public and private resource managers. The HRIC has exceeded all expectations in terms of its impact on the District and has played a major role in enhancing access of stakeholders to available information (Johnson and Walker, 1997).
- Elections in 1996 saw new governments formed at both federal and state levels. Their commitment to ESD differed markedly, with the Federal government implementing the Natural Heritage Trust in support of the environment, while Queensland reduced support to catchment management and increased spending on water infrastructure. The state government re-organised the administrative arrangements for resource management by forming the Department of Natural Resources (QDNR). It reflects the amalgamation of the Natural Resources Section of the former QDPI and Department of Lands. The remaining QDPI focuses on production issues. The former Department of Environment and Heritage (QDEH) had its name changed to Environment (QDoE), as was the case with the former Department of Housing, Local Government and Planning (QDHLGP) which was called

Planning and Local Government (QDPLG).

- Elections in 1998 saw a new Government in Queensland and the incumbents returned federally. The new Queensland government retained QDNR, but split QDEH in to the Queensland Department of Environment and a newly formed Environmental Protection Agency. QDLGP was renamed, Department of Communication, Information Local Government and Planning and the new *Integrated Planning Act* was formally gazetted by State Parliament. State policy on the environment has benefited from the change, with the new regime actively exploring options for operationalising their ESD commitments.

A 1992 workshop associated with the Herbert River Catchment Coordinating Committee (HRCCC) identified a number of natural resource management issues including flooding, sedimentation, bank erosion, major river course changes, rural drainage, tourism and recreation, biological issues (including wildlife habitats), and water quality and quantity issues. These issues were perceived to result in the loss of valued land, loss of agricultural production, damage to roads, rail lines and other infrastructure, access difficulties and loss of tourism and recreational opportunities.

Sugarcane expansion can have a direct and indirect effect on some of these issues and impacts. For instance, inappropriate rail line development could increase flood levels and increase flood losses and infrastructure damage. On the other hand, tours of sugarcane fields and operations could be part of a "Herbert River Tourist Experience". Thus, sugarcane can be a positive or negative contributor to these issues and impacts.

3.11 Summary

A number of factors should be considered in the research. First, the Herbert River area represents about 10% of the total sugarcane growing area in Australia. Second, during the study period, precipitation patterns were lower than usual and promoted high sugar content in sugarcane. This factor combined with relatively high prices, a well-developed rail network, the availability of suitable land, and the need to expand the land base by 2.5% per year made additional sugarcane development in the Herbert River district both desirable and feasible, from grower and miller perspectives. During the study period, 525 applications covering an area of 16,000ha were made. Spatial representation of the data was possible for 472 of the applications, which reflects about 15,000 ha. The economic importance of the sugar industry to the regional economy cannot be overstated. However, there are concerns that future sugarcane expansion should not detract from the ecological integrity of the area. The next chapter describes the institutional arrangements that were responsible for managing this sugarcane expansion.

4 THE INSTITUTIONAL ARRANGEMENTS FOR ENVIRONMENTAL MANAGEMENT IN THE SUGARCANE ASSIGNMENT PROCESS

4.1 Introduction

This chapter is organised into three sections. The first describes how public resource management agencies have influenced water and land management during the study period as well as major initiatives that have occurred between 1996 and 1999. The second section examines the cane assignment process. The final section reviews two significant government and industry statements in order to assess the appropriateness of the evaluative framework.

4.2 Legacies of the Past: Resource Management by Public Agencies in Queensland

The water management record of the Queensland government before 1989 emphasised a structurally focused, development approach (Fenwick, 1985; Smith, 1998). While many of these

projects contributed to increased economic growth, many interview respondents questioned the efficiency and effectiveness of this approach. In this pre-1989 period, some landowners in the lower Herbert River built levees and other flood and drainage works which failed to comply with the requirements of the *Water Resources Act 1989*. These landowners were not sanctioned for these violations. According to several government officials, senior managers and relevant ministers did not support assertive legal enforcement. An unfortunate legacy of this period is the perception held by some landowners that they can, in the future, alter surface water flows without government approvals and penalties. The scale of these individual works is often inadequate to solve problems and/or the solutions contribute to significant conflicts between neighbours. Any efforts to achieve effective partnerships must address this problem. People must know the 'rules of the game' and be assured that these will be followed and enforced.

The belief that Australian exports could grow between $10 million and $40 million annually as a result of the Uruguay GATT Agreement encouraged a climate for sugarcane expansion. Rapid expansion was also stimulated by the *Sugar Industry Act 1991* (amended in 1994) provisions that required a minimum expansion of 2.5% (about 10,000 ha) per year between 1991 and 1995. It was exceeded in 1995 (QSC, 1995) (Figure 3.4). After 1995, the Queensland Sugar Corporation (QSC) would determine the extent of any expansion. However, it realised at the outset that this growth had to be managed. To that end, the Minister for Primary Industries, who is responsible for the activities of the QSC, committed:

> Officers of his department [to be] readily available to provide assistance and advice as required (Briody, 1992: 5).

There were no additional resources provided to QDPI or other agencies in the Herbert River district to specifically address this need. Thus, any government involvement in sugarcane expansion was done with existing or fewer human and financial government resources. In addition, neither Victoria nor Macknade Mills hired additional field staff to supervise the expansion activities during the study period.

The need to incorporate public resource agencies into the assignment process was emphasised by the QSC (1993: 7):

> Where the need arises, Local Boards should liaise with the Queensland Department of Primary Industries, Land Use and Water Resource Groups, Drainage Boards and the Bureau of Sugar Experiment Stations in respect of proposed new land and where necessary, are to attach as conditions of the grant assignment, any land use restrictions imposed by such authorities. The Corporation has informed relevant organisations of the expansion and requested them to make officers available for consultation with Local Boards as necessary.

Interviews with regional public agency officials suggested that they were not well informed about this request through normal administrative channels. In the Herbert River district, they perceive their lobbying of the Local Boards as the key factor that prompted the 1996 formation of the Environmental Advisory Committee. Details about this group will be provided later in this chapter.

A more recent aspect of the management legacy pertains to the 1988 state election. At that time, a new State Government was elected and committed itself to providing more effective natural resource management. It focused attention on formulating new resource management policies, and adjusting administrative arrangements. That tradition appears to have been followed by subsequent governments (at least in print). Commonwealth governments have also advocated the need for ESD. The following sections discuss the basis and nature of government involvement that significantly influences the sugarcane expansion process.

4.3 Queensland Departments of Primary Industries (QDPI) and Natural Resources (QDNR)

In 1989, the new state government responded, in part, to the need to implement sustainable development by enhancing the institutional capacity to implement resource programs. The Department of Forests and the Water Resources Commission were amalgamated into the Department of Primary Industries (QDPI). During the study period, QDPI influenced sugarcane growing through legislation, programs, and policy statements. It administered the *Water Resources Act 1989* which provides for the:

> Construction, control and management of works with respect to water conservation and protection, irrigation, water supply and drainage;..and protection and improvement of the physical integrity of water resources.

This statute guides drainage boards, which have been formed in some portions of the lower Herbert River (Figure 4.1). QDPI provided a rural extension service program, which focused on the production, financial and resource management aspects of farm activities. Participation in this service was voluntary. Policy statements, such as "Land Use Practices for Wet Tropical Floodplains" represent the third mechanism available to QDPI and other agencies (QDNR, 1996). This document was being prepared during the study period and was endorsed in January 1998 (QDNR, 1998). The intent is to guide agricultural land development, and more specifically drainage at the farm level, on Queensland's wet tropical coast. However, it is not legally binding. Management principles, land assessment, farm planning, drainage requirements and design, and implementation and management arrangements are discussed. Local Sugarcane Assignment Boards (Local Boards) are encouraged to utilise the document in order to guide their decision-making.

The *Herbert River Flood Management Study* was undertaken between 1978 and 1980 by Cameron McNamara on behalf of the Herbert River Improvement Trust. The goal of the study was to recommend a program of short and long-term proposals that conform to an overall flood management strategy. The area inundated from Herbert River flooding was defined as the study area. The recommended flood mitigation options consisted of additions to the natural levees over a 10 km length of the lower Herbert River with associated floodgates and overflow structures to contain the river in this reach up to the 1 in 3 year flood. Land drainage problems to the north and south of the river are compounded by backup flows from the Herbert River during flood events and the inability of these areas to drain into the river during high water levels. Floodgating of creeks draining these areas was recommended to prevent backflows (Rudd *et al.*, 1985).

The study recommended that the following set of structural and non-structural measures be implemented:

- Partial containment of the Herbert River to prevent up to 1 in 3 year flood events spilling into the adjacent floodplain over a 20 km length of river.
- Protection of the town of Ingham by an upstream training levee system and a flood by-pass channel.
- Upgrading of the flood forecasting and warning system.
- Floodplain zoning.
- Floodproofing of construction in the floodplain.
- Flood education measures.

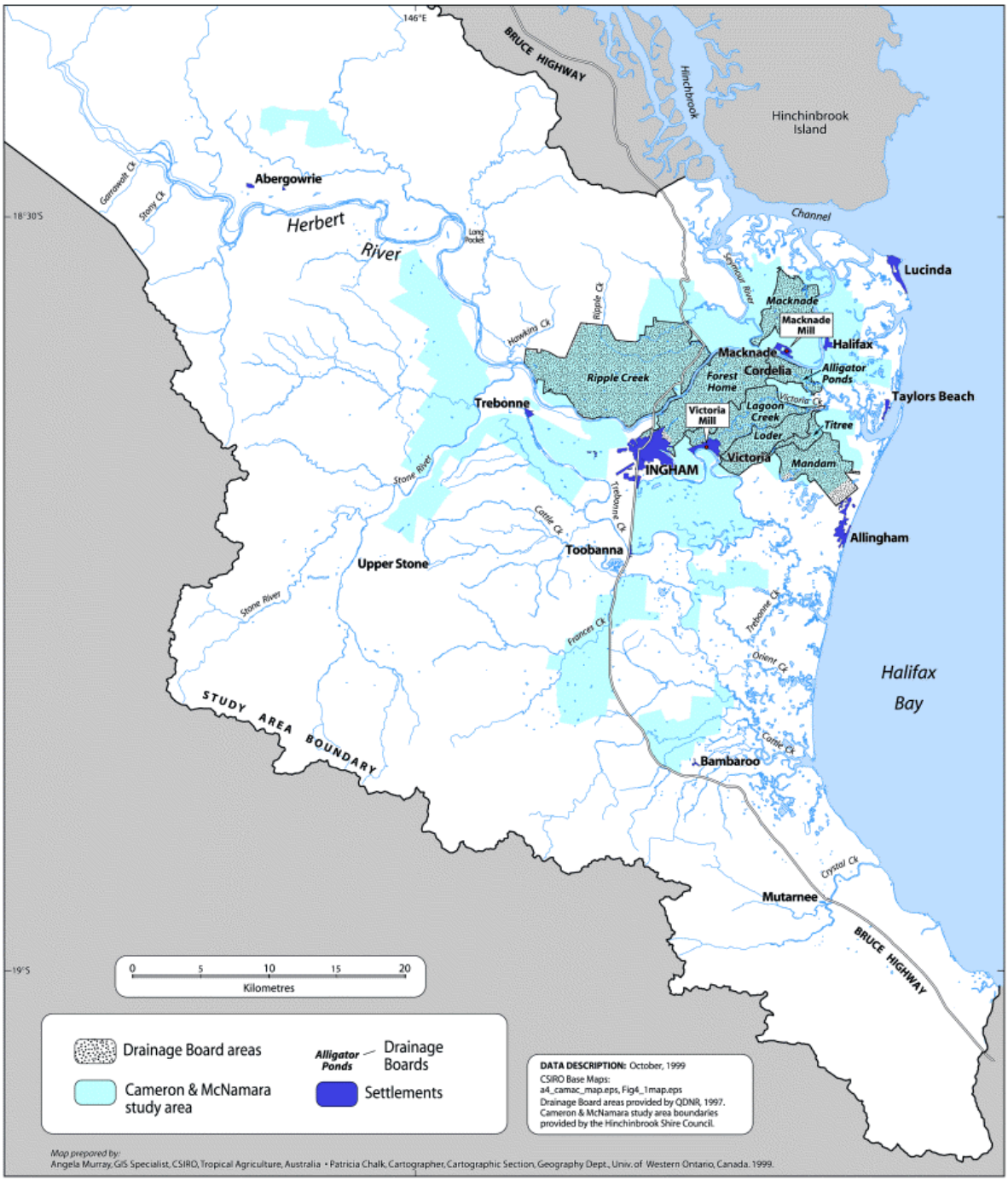

Figure 4.1 Drainage Boards and the Cameron-McNamara study boundaries.

The recommendations of most interest to this present review of cane assignment process pertain to the partial containment of flood flows. Some construction associated with this recommendation was completed and includes the floodgates on Catherina Creek (which drains the Forestholme sump) and Ripple Creek. These projects drain these two sump areas and prevent back up water from entering the sumps, and the levee system along the Herbert River (Rudd *et al.*, 1985). Drummond (1993) suggests that existing levees may have resulted in increased water levels downstream of the Anabranch.

The *Hinchinbrook Rural Drainage Plan* was prepared between 1981 and 1984 on behalf of the Hinchinbrook Shire Council. The Plan covered many of the drainage areas both existing and proposed. The plan recommended works in association with the four existing drainage boards totaling $1.2 million. Much of that work has not been implemented (Drummond, 1993).

The main issues for each drainage area were:

- Ripple Creek Drainage Area: the drainage plan recommended the construction of a controlled overflow from Ripple Creek to the Seymour River. It is proposed to incorporate the adjacent drainage area serviced by the informal Seymour Drainage Committee upon amalgamation of the Boards.
- Forestholme Drainage Area: Attention has been focussed on the controlled outlet capacity to Alligator Ponds and the urban contribution to runoff as being the main limitations to improved performance of this scheme.
- Mandam Drainage Area: Runoff from significant areas outside the gazetted boundary and the overflows from Palm Creek cause major difficulty in this scheme. The board has to date undertaken significant work to enhance the capacity of its existing outlet to Mandam Creek. The Rural Drainage Plan recommends the construction of an additional outlet to Victoria Creek.
- Loder Creek Drainage Area: The key limitation to the drainage performance of this scheme is the capacity of Lagoon Creek downstream of its confluence with Loder Creek (Drummond, 1993).

The *Hinchinbrook Rural Drainage Plan* (Cameron McNamara, 1984) has been consistently referred to in Conditions of Assignment granted between 1993 and 1996 (Table 4.1). That study's objectives were "to achieve a consistent standard of drainage which would increase rural production and to define required works, their location, cost and benefits to be achieved from the works, and subsequent management and operation leaving only detailed design and documentation necessary to implementation" (Cameron McNamara, 1984: 1-1). These ends were achieved by classifying the lower catchment according to the perceived need, scale and feasibility of structural drainage works. This categorisation, based on site inspections, interviews with relevant private and public resource managers, questionnaire responses from growers, public meetings and 1981 cane productivity data, was used to screen potential areas. Of the three categories established, only two were the subject of detailed drainage design and subsequent benefit-cost and environmental impact analysis, and review of institutional alternatives. The report provided economic analysis on nine structural alternatives and recommended that a drainage board be formed under the *Water Resources Act*. Since these areas contain parts of catchments, it is unclear how adequately this delineation promotes effective drainage or catchment management (Figure 4.1). The use of the catchment has been a longstanding principle in water management.

At present, these recommendations form the basis of the more detailed drainage design and institutional analysis being conducted through the Sugar Infrastructure Improvement Package (SIIP). Initiated in 1992, this Commonwealth-State agreement is to enhance the sugar industry's performance. If sufficient landowner support is achieved within the lower Herbert River catchment, the desirability and feasibility of these proposed works can be considered. The formation of a single Water Management Board is a requirement of SIIP. A key outcome of the process will also be the development of a Master Land and Water Management Plan for the lower Herbert

These legislative, farm extension and floodplain policy guideline functions were transferred to the newly created Department of Natural Resources (QDNR) following the 1996 agency reorganisation. The remaining QDPI maintained responsibilities for regulating marine habitat (*e.g.* mangrove) clearing under the *Fisheries Act 1994*. Draft Guidelines for a "Fish Habitat Code of Practice" were prepared in 1999 by QDPI (Fisheries Group) in cooperation with CANEGROWERS (Tapsall *et al.*, 1999). The intent is to provide 'strategic permits' to farmers for regular maintenance works (*e.g.* slashing and mowing of existing roads; spot spraying and blanket spraying; trimming trees along existing farm roads; and medium impact de-silting of drains in areas of marine habitat). After QDPI (Fisheries Group) review, individual permits may be issued for major excavations of existing drains, the construction of new drains; and new land

clearing or re-assignment in designated areas. One-day workshops will be held for landholders and contractors who undertake work. Completion of the workshop will be a requirement for permit approval.

Table 4.1 Evolution of the Conditions of Assignment: 1993-1996.

General Concern	Specific Condition	Applicable Year 1993	1994	1995	1996
Administrative	– failure to comply with any condition may result in assignment being rescinded	*	*	*	*
	– all requirements with all or any relevant State legislation applying to a particular location, development, proposal or project must be met				*
Drainage	– works must comply with the *Rural Drainage Plan* (1984) or other approved standards	*	*	*	*
	– growers may be required to cooperate in formation of community-based drainage or soil conservation schemes	*	*		
	– plans for works must be in accordance with the plan submitted at the time of application		*		*
	– any works within or connecting to a watercourse, lake, or spring must be authorised by a relevant license or permit under the *Water Resources Act 1989* prior to the works being undertaken		*	*	*
	– areas known to be preferential flood overflow paths are excluded				*
Land and Water	– areas of acid sulphate soil may not be used for cane growing			*	*
	– development must comply with Interim Guidelines for Development on Floodplains			*	
	– following areas excluded:				
	– mangrove swamps naturally subject to tidal inundation				
	– areas below 3m contour (generally unsuitable)				*
	– riparian zones of 10m along courses and drainage lines, or lesser widths as adopted by HRCCC				*
	– adherence to QDPI Guidelines for Sustainable Development on Floodplains is recommended				*
					*
Soil	– land holders are encouraged to seek and adopt advice from DPI on soil conservation measures for slopes >3% slope			*	
	– land holders must seek and adopt advice from DPI on soil conservation measures for slopes >3%				*
	– areas of class 4 and 5 DPI land suitability excluded				*
Wildlife	– 100m riparian zone of native vegetation must be maintained on each side of existing watercourses as a habitat corridor for the Mahogany Glider				*

The Queensland Department of Lands (QDOL) was also merged into the new QDNR. Since 1991, the QDOL was required through an amendment to the *Lands Act* to consider the environmental implications of leasing and selling Crown Lands (Duncan, 1993). Cane land expansion in the Herbert River district has involved the purchase or lease of Crown Land. In selling and leasing Crown Lands, the Federal *Native Title Act* requires adequate consultation with an 'accredited' body. In the Herbert River district, this body is the Central Queensland Indigenous Land Council. To date, no native title claims have been lodged over agricultural land in the Herbert.

One impending change is the introduction of a *Natural Resource Management* Bill (Maher & Associates and MacDonald, 1998). A discussion paper released in 1994 identified the following

objectives:

- to provide for the equitable and efficient allocation of State owned or controlled water, forest and fisheries resources;
- to maintain the availability of natural resources for the economic development of rural industries;
- to maintain and enhance the quality of natural resources and to protect them from degradation;
- to minimise or prevent the environmental impact of natural resource use; and
- to enhance the economically efficient and effective use of natural resources.

One significant suggestion in the Discussion Paper was the introduction of statutory-based Natural Resource Management Plans in order to:

- determine the allocations of State owned or controlled water, forest and fisheries resources in a local area such as a catchment or district;
- define use/management practices for water resources, State Forests and fisheries; and
- define use/management practices for Special Management Areas in both freehold and leasehold land (Maher & Associates and MacDonald, 1998). Other management mechanisms under consideration include Codes of Practice and the use of voluntary NRM Agreements where individuals wish to protect privately owned or managed natural resources.

At the time of writing, no definitive action had been taken on the NRM Discussion Paper.

4.4 Queensland Environmental Protection Agency (QEPA)

The Queensland Environmental Protection Agency (formerly the Department of Environment between 1996 and 1998) and formerly the Department of Environment and Heritage (QDEH) (before a 1996 agency reorganisation) is charged with promoting the conservation, management and wise use of the environment for the long-term public benefit. That agency conserves vegetation and wildlife species through a range of mechanism provided by the *Nature Conservation Act 1992*. For instance, it may enter into agreements with private landowners to protect designated wildlife areas. Acquisition may be negotiated between the agency and a landowner. These areas are designated on the basis of supporting rare and threatened wildlife, critical wildlife habitat, a protected area (*e.g.* National Park), or areas of significant nature conservation interest.

This legislation is relevant to the Herbert River district. In 1995, an interim conservation order under the *Nature Conservation Act 1992* was placed on the Pomona land holding because the clearing of the forest area for cane growing would "have a significant detrimental effect" on the Mahogany Glider. A *Draft Mahogany Glider Conservation Plan* was prepared (QDEH, 1995). It outlined over 28,000ha of critical habitat requiring protection. Much of this area is suitable for sugarcane growing, and some of it has already been assigned. Funding for this $16 million conservation plan was provided from the Sugar Coast Environmental Rescue Package Agreement (SCERP). A Commonwealth-State program supported by CANEGROWERS, SCERP aimed to provide a total of $16 million over a 3-year period for the acquisition of land, and the development of intergovernmental management initiatives, public education programs and landowner assistance measures. With the expected cuts to Commonwealth budgets and the potential impacts on state initiatives, it is unclear whether the announced total of $16 million will be secured. The adequacy of the $16 million is also questionable given that 75% of the entire amount was dedicated to the Mahogany Glider program alone.

Some interview respondents maintained that QDoE could use the *Environmental Protection Act 1994* to influence land clearing and farming by placing a "duty of care" on farmers to protect the environment. Under the *Act*, an Environment Protection Policy on air, noise, water and waste management is to be developed, and a specific reference is made to a Code of Practice for

Agriculture. The latter is being drafted currently with the participation of the agricultural sector (that includes the sugar industry) and will be discussed later in this chapter. The efficacy of this approach is unknown. On the one hand, the *Act* uses the term "environmental harm" to embrace a wide range of impacts, it refers to "contaminant" and excludes land clearing for agricultural development as a regulated activity. These provisions suggest that the development of land for agricultural production is not regulated by the *Act*. On the other hand, the court could view the storage of acid sulphate soils in farm ponds as a "contaminant" exclusive from land clearing activities. The final outcome of litigation will reflect several issues including: (i) if the activity causing environmental degradation was defined as a "land clearing activity"; (ii) if acid sulphate water is defined as a "contaminant"; (iii) if the relevant water quality criteria (yet to be defined under the legislation) has been violated; (iv) a demonstrable lack of due diligence by a landowner (yet to be defined in an Agricultural Code of Practice); and (v) the significance of environmental harm resulting from this activity.

There is no question that the *Environmental Protection Act 1994* will be more relevant in managing specified farming practices. Farming practices which create air emissions (*e.g.* cane burning), discharge water which contravene stormwater quality standards, contaminate land or ground water through the use of pesticides, or exceed specified noise levels could be prosecuted. In 1997, an Environmental Protection Policy for water was introduced. It could support the development and implementation of catchment-wide plans.

The *Coastal Protection and Management Act 1995* manages the coastal zone and development on it from an ecological perspective. It supports the preparation of regional coastal management plans from about 6km offshore to above the high water mark. Provisions are to be incorporated into the Strategic Plans of local government. Under the *Act*, control districts may include (Maher & Associates and McDonald, 1998):

- tidal rivers and lands up to 100m from the highest astronomical tide mark (HAT);
- land up to 1km inland from HAT at a river estuary/delta;
- islands; and
- foreshores up to 400m above HAT.

A coastal management plan for the Cardwell/Hinchinbrook Region has been developed.

4.5 Queensland Department of Communication, Information, Local Government and Planning and the Hinchinbrook Shire

This department was formerly the Queensland Department of Planning and Local Government (QDPLG). It and its predecessors ensured that the requirements of the *Local Government (Environment and Development) Act* are met. Local governments are responsible for implementing the *Local Government (Environment and Development) Act* in a manner consistent with goals and objectives stated in its strategic plan. In 1998, the state passed the *Integrated Planning Act 1997* that provides for the development of State Planning Policies. These will be implemented through local government plans and the Integrated Development Assessment System (IDAS). Ecological sustainability as well as traditional planning goals will be pursued through coordinated planning, managing the development process, and the effect of development of the environment (Maher & Associates and MacDonald, 1998).

The IDAS is part of *IPA*. IDAS purports to provide a procedure through which up to 60 different types of approval may eventually be delivered in a "one-stop shop" for developers. In order to achieve this outcome, the IDAS provides an avenue through which State agencies act as referral agencies for applications made to local government that raise issues falling within their jurisdiction. According to Maher & Associates and MacDonald (1998), it will provide a "whole of government" approach to the review of development proposals, requests for information,

public notification, decision making and dispute resolution. Key to the success of the process is the performance of "assessment managers" and "referral agencies". The assessment manager administers and processes an application, and has a major role in final decision making. While the assessment manager will vary from case-to-case, local government will assume this as a default option.

Two types of referral agencies are identified in IDAS. A "concurrence agency" can request relevant information, identify conditions of approval that must be incorporated into the final application which the assessment manager must include if approving, and refuse the application under specified circumstances. As of December 1998, the Environmental Protection Agency (formerly the Department of Environment and Heritage), the Department of Employment, Training and Industrial Relations, and the Queensland Fire and Rescue Authority have become concurrence referral agencies with respect to some development applications that fall within their jurisdiction. "Advice agencies" must be consulted, but the assessment manager is not bound by any comments provided to them (Maher & Associates and MacDonald, 1998). Responses from all referral agencies will be required within specified time frames to support more timely decision making. Implementation of *IPA* will be phased in over a five-year period.

The Hinchinbrook Shire adopted its first plan in 1984. Unfortunately, it cannot be considered 'strategic'. It identified a "rural zone" which dominated all other land uses and promoted a climate for poorly planned cane land expansion. Under law, permitted development (*i.e.* consistent with the zoning) is considered "as a right" which precludes the shire reviewing proposals and initiating environmental assessments. Cane land expansion within the rural zone is not referred to the Shire. Rather than providing a strategic vision, it controlled the "subdivision of land, as distinct from the subsequent use of land" (Sinclair Knight Merz, 1998: 7). In short, the Shire received very little information and had very little influence regarding the cane expansion process and its final decisions. The development of sugar-related rail and road systems impacts on shire drainage works. In addition, the Shire eventually maintains roads developed for sugarcane transport. Since these developments were treated "as a right", they were not reviewed through the impact assessment provisions of the *Local Government (Planning and Development) Act.* Other legislation related to transport development provides for Shire participation in these areas. It is the 1984 plan that was in force during the entire study period. During the late 1990s, there were significant developments at both state and local levels that have provided for more strategic planning. These are discussed below.

Thuringowa Shire adopted its plan in 1988 and was revised in 1996. Like the Hinchinbrook Plan, the old plan failed to effectively guide rural development, and specifically sugarcane expansion south of Crystal Creek (Figure 3.2). In particular, it had a very strong focus on urban development issues. No attempt was made at integrating rural water and land management issues into the assessment of planning proposals and development applications. At present, Thuringowa Shire is preparing a planning scheme that will comply with the new *IPA* legislation and will replace its 1996 Shire Plan. The statement of proposals is to be advertised in November 1999.

A revised local planning scheme for Hinchinbrook Shire was gazetted in December 1997. It embraces many of the themes contained in *IPA.* Considerable emphasis was placed on integrating water and land management issues into the assessment of planning proposals and development applications. According to Vella (1999), the new strategic plan enables Hinchinbrook Shire to better influence development throughout the entire area, not just Ingham. The goal of the plan is to:

> provide a framework to facilitate the continuing use and development of the Shire's resources according to sound environmental and catchment management practices, and, to promote the diversification of the Shire's economic base, for the long-term benefit of the Community (Hinchinbrook Shire Council, 1997 as cited by Vella, 1999: 18).

Three environmentally related objectives support this goal statement:

1. Catchments and subcatchments within the Herbert River catchment will be identified.
2. No adverse environmental impacts are to be associated with the development and use of land within any catchment identified in (1) above. This will achieved by having regard for and implementation of the goals of ICM.
3. Sensitive and sustainable land use practices will be promoted through the development process.

Vella (1999: 19) maintains that:

> this will be implemented by requiring and encouraging "all development and land uses…to adopt sound management practices so as to minimise, mitigate and contain the impacts on the land, water and biological resources of the catchment system." Additionally, "the Council may refuse to support any proposal which would prejudice the long-term values of the resources within the catchment system affected."

Five land use classes were established: Public purposes, Rural, Town, Village and Special Activities. Although no direct zoning mechanism was established to conserve natural resources, agricultural land uses and wetland conservation are to be regulated.

Protection of the environment from agricultural activities is to be achieved by changing the definition of a rural zone. This provision requires landholders to apply for Shire approval for intensive rural activities under the following circumstances:

- The land is classified as Class 4 or 5 agricultural land; or
- The land is classified as Class 1,2 or 3 and contains one or more of the following features:
  - (a) a known wetland as identified in the Plan;
  - (b) a parcel of land the subject of a Conservation Order or Interim Conservation Order under the *Nature Conservation Act 1992*; or
  - (c) a fish habitat reserve as defined in the *Fisheries Act 1994*; or
  - (d) an Active Coastal Area as described in the Strategic Plan
  - (e) Wet Tropics World Heritage Area; or
  - (f) an area of known Mahogany Glider habitat as identified in the Plan, and not included in a Conservation Order or Interim Conservation Order; or
  - (g) land below the RL 3.0 metres AHD contour; or
- The land in abutting a fish habitat reserve as defined in the *Fisheries Act 1994*.

Intensive agriculture is defined as:

> The use of land for intensive production of crops, such as but not limited to sugarcane and horticulture, at rates of production beyond the natural capacity of the land where the land relies upon the regular and systematic application of fertilizers and other chemicals, and includes the establishment of any infrastructure necessary for the conduct of the use. The definition does not apply to small-scale agriculture conducted on premises or a site less than two hectares in area.

Thus, an impact assessment approach is to be utilised in enhancing environmental management in the Hinchinbrook Shire.

The new planning scheme also requires landholders, overseen by council, to maintain conservation values on good quality agricultural land, so as to promote ecologically sustainable primary production. It also introduces other provisions that encourage the sustainable use of natural resources and the protection of environmental systems or features of local conservation value.

The Herbert River Improvement Trust is essentially another arm of local government. Having a jurisdictional area embracing the Hinchinbrook Shire, this agency consists of two local councilors and a QDNR representative. While it is primarily concerned with in-stream erosion and flood protection, it could play a modest role in water and related land management. In the

Hinchinbrook Shire, a river improvement notice of 10m adjacent to specified watercourses has been applied to subdivision proposals on land. For a $110.00 fee, this notice is attached on the land title that prevents alteration of the channel and the clearing of the adjacent corridor. This mechanism provides for secure land tenure under the Herbert River Improvement Trust and precludes clearing or development within the designated area. The primary objective is to ensure major watercourses are maintained for rural and urban drainage purposes. The 1994 NRM Discussion Paper suggests that River Improvement Trusts could become NRM statutory bodies and assume a range of water-related responsibilities.

4.6 Integrated Catchment Management

The Queensland Government released *Integrated Catchment Management* (ICM) in 1991 as a means of considering:

> the management of land, water and related biological resources in order to achieve the sustainable and balanced use of these resources. It provides a framework for fostering cooperation and coordination between many land holders and other resource users, community groups and government agencies involved in the use and management of land and water resources (Queensland, 1991: 1).

While it was recognised by the government that other initiatives, such as the proposed State Conservation Strategy, state-wide environmental programs (*e.g.* Landcare), and broad regional strategies such as the Far North Queensland 2010 Growth Management Strategy and Coastal Protection Strategy would be important activities, ICM was to involve all sectors of the community and thereby achieve integrated and coordinated action. ICM was also to focus on several important issues, rather than a single one, in achieving an integrated perspective.

The final product of the ICM process is a Catchment Strategy that ranks catchment issues, and identifies appropriate implementation mechanisms. This document was in the process of being written during the study period. It was released in November 1998. The Herbert River Catchment Coordinating Committee's objectives were to:

- Coordinate government agencies and the community to pursue common goals.
- Seek community involvement in catchment management.
- Identify and rectify natural resource degradation.
- Promote the wise use of all natural resources within the catchment.
- Identify key indicators of biodiversity and monitor as a measure of catchment health.
- Encourage the retention of significant natural habitats within the catchment (HRCCC, 1998: 2).

The eight-chapter plan covers issues related to land, water, stream and habitat management as well as implementation. Concerning land management, key issues included:

- inappropriate land use allocation and its impacts on resources and natural systems;
- impacts of land management on productivity; and
- impacts on other values of land and adjacent land and water resources.

The fragmentation of habitat, poor water quality and quantity monitoring, and the loss of wetlands were other issues identified in the strategy. Many of the principles and recommendations noted in the strategy formed the basis for the previously described Hinchinbrook Strategic Plan. Thus, implementation of the strategy is underway. An opportunity exists for the catchment strategy to develop Codes of Practice or other mechanisms that could influence cane land expansion or related activities such as drainage or irrigation practices.

4.7 Other Legislative Requirements

The outcomes of the previously noted Hinchinbrook Shire Strategic Plan review and HRCCC planning are unclear. This uncertainty also extends to some other recent legislative initiatives in Queensland, such as the *Wet Tropics Management Plan* that proposes the protection of other sensitive areas (Wet Tropics Management Authority, 1995). When a local land use scheme is adopted, information from these and other relevant Commonwealth and State initiatives should be incorporated into relevant municipal planning documents. State agencies will also have to have regard for these statements.

The Commonwealth Government is involved through funding programs such as the previously mentioned SCERP. In 1992, it funded in cooperation with the State Government and the sugar industry a Sugar Industry Infrastructure Package (SIIP). The Herbert River district was successful in its application, and a preliminary engineering study has identified eight drainage projects worthy of more detailed engineering design. That study also advocates the formation of a single drainage board to provide for an adequate level of maintenance. That single board would replace the existing fragmented arrangement, but would not extend to the entire cane growing area of the lower Herbert River. At the time of writing, agreement had not been reached on a single drainage board. Similarly, a number of proposed works were in doubt due to concerns voiced by the QEPA, QDPI Fisheries and Environment Australia.

4.8 The Queensland Sugar Industry

4.8.1 The Sugar Industry Act 1991

Before 1991, growth in the sugar industry was controlled through a series of international agreements and tariffs. In Australia, the Sugar Board provided a highly centralised decision-making structure. This arrangement changed in 1991 with the passage of the *Sugar Industry Act 1991*. That statute provided for annual minimum increases in assignment of 2.5% (about 10,000 ha) between 1991 and 1995, and greater flexibility in the administration of the *Act*. Some of this flexibility was achieved by delegating increased decision-making responsibility to Local Boards. However, the centralised administration of the Central Sugarcane Prices Board meant that they were not that active. Under the recent tenure of the Queensland Sugar Corporation (QSC), this situation has changed.

A detailed review of the cane assignment system can be found in ABARE (1991) and Industry Commission (1992). In brief, sugarcane or land assignment was introduced in 1926 to control the level and location of sugarcane production, and to preclude the growing and commercial harvesting of cane (Industry Commission, 1992). Until 1991, cane land expansions were 'planned for' by the Sugar Board. Assignments were originally specified in terms of particular plots of land on a designated farm, and growers could not easily get permission to change assignments even within existing farm boundaries. This requirement was changed in 1991. Cane can now be grown on any part of an assigned area. While growing on unassigned land is not prohibited, mills are not obliged to accept it and the grower receives a penalty price of $1 per ton. Mill and farm assignments continue to control the size and rate of growth at state and local levels. At a local level, these regulations match cane production with a mill's crushing capacity and transport infrastructure, so that expansion does not penalise existing growers (Industry Commission, 1992). Improvements and expansion of the transport network and mill infrastructure occur regularly in response to market conditions, and provide opportunities for cane land expansion. At a state level, regulations should ensure markets for the sugar products.

4.8.2 Considerations in Granting Assignment

Section 12 of the *Sugar Industry Act 1991* identifies the principal objectives of the QSC as:

- Ensuring that the policies for the Queensland sugar industry are successfully implemented.

- Enhancing the efficiency, competitiveness and access to markets of the Queensland raw sugar industry.
- Enhancing the long-term economy of the Queensland sugar industry.
- Enhancing the benefits flowing from the Queensland sugar industry to cane growers and mill owners and to the economy of Queensland.
- Encouraging initiative and innovation among cane growers and mill owners and others involved in the Queensland sugar industry (QSC, 1995: 4).

While the QSC is responsible for implementing the *Sugar Industry Act 1991*, it has delegated much of the responsibility for mill-area decision making to the 25 Local Boards in Queensland. These bodies are constituted under the *Act* with the objective of ensuring the efficient participation of mill owners and cane growers in the production and milling of cane. As noted earlier, each Local Board comprises an independent chair, two mill representatives, and two mill supplier representatives. It is the Local Board which acts as an 'agent' for the QSC, and receives and determines applications for new and increased assignment (Briody, 1995). Powers to rescind assignment are reserved by QSC on the advice of the Local Board. The *Primary Producers' Organisation and Marketing Act 1926* established CANEGROWERS as the formal grower body for sugarcane (excluding marketing functions) (CANEGROWERS, 1995).

QSC's statutory objectives are oriented toward economic considerations, although the "long-term economy" of the industry can be achieved, in part, through effective natural resource management. Direct reference to the environment in the *Sugar Industry Act 1994* is found in Sections 144(2)(c) and 147(4)(a)(iii) that require environmental issues to be part of the decision-making process. Reference to the environment is also found under the *Sugar Industry (Assignment Grant) Guidelines* which are established under Section 29(b) of the *Sugar Industry Act 1994*. The guidelines should be viewed as QSC policy that must be complied with by all Local Boards. All respondents from the Macknade and Victoria Local Boards were keenly aware of their obligations under the *Act* and *Guidelines*. Section 6 of the *Guidelines* outlines general considerations in granting assignment, and includes the following implicit and explicit references to the environment:

> - the principal objectives of the Corporation mentioned in section 12 of the *Act*; and
> - any view expressed by the relevant Local Board on a relevant local matter; and
> - the capacity of the proposed assignment's land for producing commercial crops of sugarcane when subjected to correct agricultural practices; and
> - the prospects of preparing and using the proposed assignment's land without undue damage to the environment...

In addition, Section 8(1)(e) of the *Sugar Industry (Assignment Grant) (No.2) Guideline 1995* indicates that an application will be granted if the QSC and Local Board are satisfied that the proposed assignment land is:

> able to be prepared and used for the growing of sugarcane without undue damage to the environment.

The Local Board is also to consider the efficient and cost-effective delivery of sugarcane to the receiving mill. For applicants who do not hold an existing assignment, their willingness and capacity to develop the land in a timely manner (usually a 2-year period) and their place of residence is appraised. Thus, a mix of environmental, economic and social factors is the basis of the final assignment decisions.

4.9 The Cane Assignment Process in the Herbert River District 1992-1996

As noted earlier, there are two CSR mills operating in the Herbert River district – Victoria and Macknade (Figure 3.2). Each has its own Local Board and shared the same chairman during the study period. As the previous discussion indicated, between 1992 and 1996 the sugarcane assignment process was changed in two specific aspects. First, more responsibility for awarding

assignment was delegated by the QSC to Local Boards. Second, the formal consideration of environmental considerations had become a legal requirement.

Before the Local Board considers an application, decisions made by governments and corporations at international, national and local levels establish a context for local awards (Figure 4.2). Millers and growers also make decisions that influence the assignment process. Together, these considerations define the desirability and feasibility of any expansion activity. Applicants who are awarded assignment must make it effective within a three-year period. Each level of the decision-making context is considered below.

4.9.1 International Agreements

The context for expansion reflects, in large part, perceived market opportunities and the corporate (miller's) perception regarding the desirability and feasibility of mill expansion (Figure 4.2). Traditionally, these opportunities were influenced through a series of International Sugar Agreements (ISAs) with the objective of controlling price volatility and overall supplies. The GATT is now the mechanism that will guide trade in the future.

A significant economic signal for the Australian sugar industry is the annual "World Market Prospects" report that is prepared by the QSC's marketing agent CSR. It considers the world demand for and supply of sugar, and significant world and national legislative initiatives (*e.g.* GATT, U.S. Farm Bills, European Union Agricultural Policies) to identify market opportunities for Australian products. This report is circulated to local boards, millers, CANEGROWERS and other relevant organisations. The feasibility of increasing mill capacity will reflect corporate goals and capabilities, the opportunities for cane land expansion, and infrastructure needs (*e.g.* rail lines, roads, and bridges). Decisions to increase mill capacity are most often made a few years prior to implementation. These are all economically oriented messages.

4.9.2 Continuous Crushing Agreement

In the Herbert River district, a "Continuous Crushing Agreement" between the CANEGROWERS and CSR significantly influences the regional industry's development (Figure 4.2). It establishes the harvesting period, production and crushing capacities, future growth, and transport planning for the regional sugar industry. This agreement has implications for expansion planning and natural resource management. However, factors external to the industry which pertain to the availability of sugarcane land (*e.g.* zoning in shire plan, wetlands) can influence plans to expand cane farming.

The 1995 Agreement specifies the harvest season as starting on the Monday between June 19 and June 25 (unless extraordinary circumstances arise), with a target season length of 20 weeks and 3 days (*i.e.* ending by November 15). This period is coincident with a high level of sugar content in the stalks (as measured by commercial cane sugar (ccs)), and before the summer rains prevent easy access onto paddocks. The average sugar content ranges from around 10 ccs at the beginning and end of the season to 13.5 ccs in the middle (Figure 4.3). After harvesting, ccs within the sugarcane decreases quickly. Since ccs is one basis for payment to growers, it is important to minimise this loss through the effective scheduling of harvesting and processing. This factor is particularly important in the Herbert River district since the mills are not centrally located in the cane growing areas. Like most cane growing areas, most cane transport is done on mill-owned and maintained narrow gauge railways. The "Continuous Crushing Agreement" guides railway development by tying it to cane assignment. Since the transport of the cane from delivery points to the mills via the rail system is the miller's responsibility, both CANEGROWERS and the mills must be confident that the transport network can deliver the cane in a timely manner. The implicit objective is to match sugarcane production with transport and crushing capabilities.

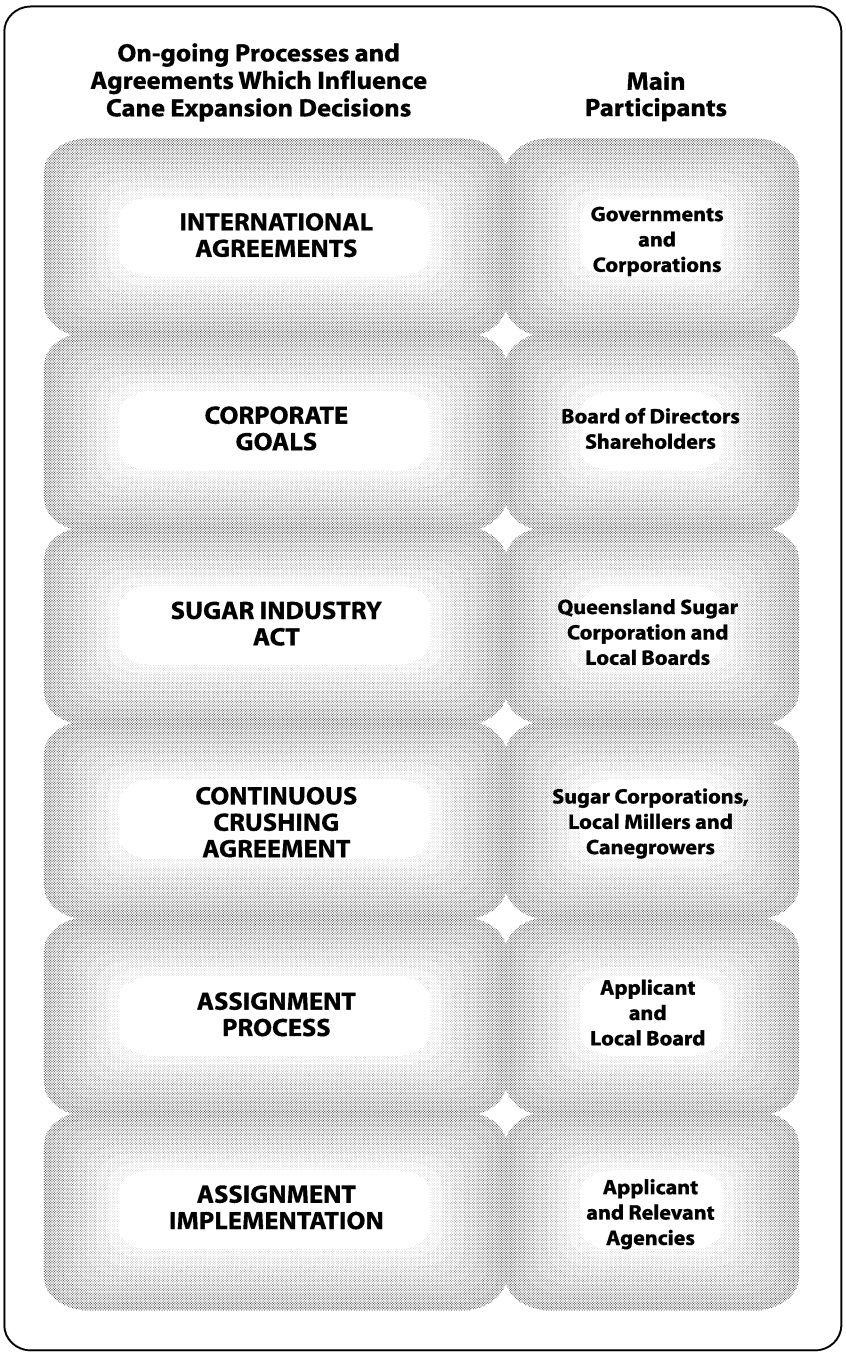

Figure 4.2 Decision-making context and the assignment process.

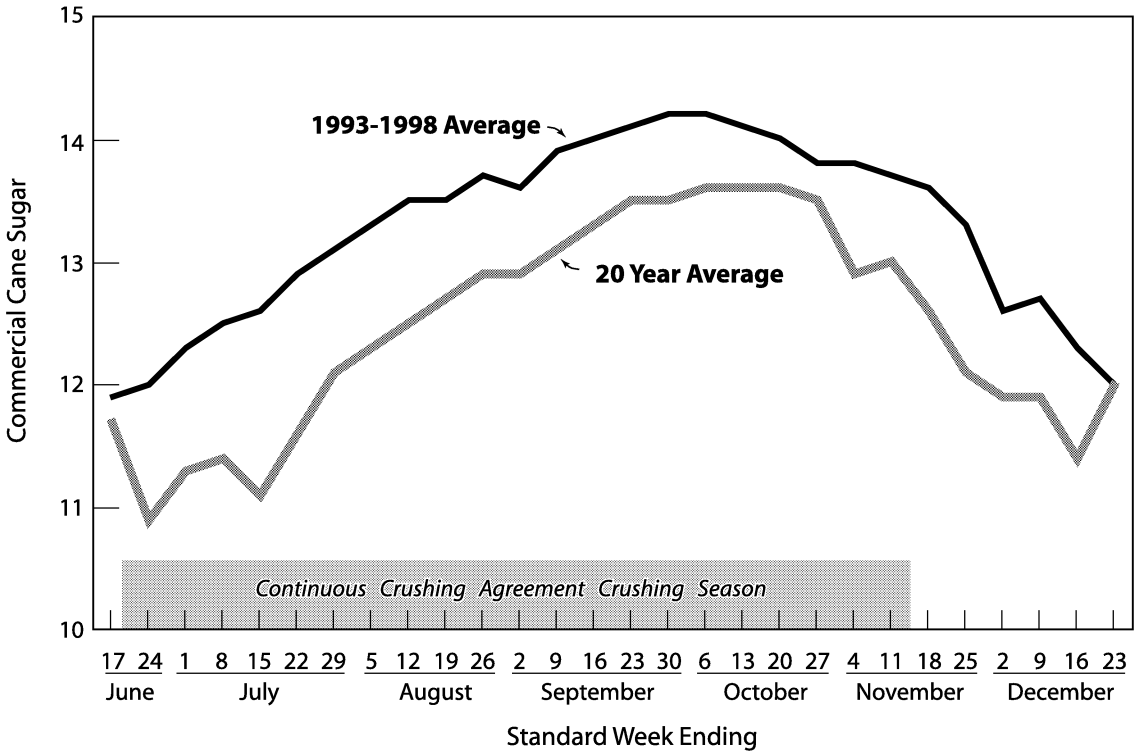

Figure 4.3 Average Commercial Content of Sugar (CCS) in the Herbert River district.

Growing sugarcane presents a number of other management challenges. When a sugar crop is planted, it may be 12 to 18 months before it is harvested. Over that time, loan payments must be made. In the Herbert River district, real estate agents and QDNR staff suggested that existing cleared cane land could sell for $10,000 to $12,000 per hectare, while uncleared suitable land demanded $2,500 to $6,000 per hectare. These costs can impose a heavy burden for new and rapidly expanding operations, and provide opportunities for financial institutions to influence the nature and extent of expansion. Given the wide array of viewpoints that prevail upon the formal assignment process, there is a need for effective institutional design.

Other biophysical aspects of the sugarcane crop present management challenges. Maximum sugar output can be achieved in the middle of the growing season when ccs is highest (Figure 4.3). However, the realisation of this objective requires enormous increases in existing mill crushing capacities to handle the crop before it deteriorates. For the rest of the year, the mill remains idle. Under present economic conditions, milling representatives suggested that this situation is not viable. To increase the productive use of mill facilities, CSR has, since 1993, operated on a continuous basis - 7-days-per-week, 24-hours-per-day during the harvest season. The present June to November harvest period represents a compromise between benefits of spreading the cost of milling capital over a longer season and the reduction in sugar yield at the beginning and end of the season. This means that if cane production exceeds crushing capacity, the length of the harvest season must be extended when ccs is dropping. While the "Continuous Crushing Agreement" provides compensation to farmers in these circumstances, extending a harvest season can cause conflict. For instance, after an extended harvest season, the following year sees a shortened growing season that leads to smaller cane sizes that attract lower returns. Short cane is also more susceptible to flood damage that is most likely to occur during the summer period (December - February). Thus, compensation must be seen in light of the potential economic losses to farmers and the ability of the mill to pay.

Expansion in the Herbert River district is based on CSR's ability to transport and crush sugarcane grown at an estimated yield of 83 tons per hectare. Existing growers must feel secure in the mill's ability to crush the crop, and CSR must be assured that farmers can deliver the agreed amount of

cane. These themes are the essence of the "Continuous Crushing Agreement".

4.9.3 Formal Assignment Process

Figure 4.4 illustrates the assignment process that generally applies to the Herbert River district during the study period. International markets and "Continuous Crushing Agreements" set the context for the formal assignment process. As will be noted shortly, the process shown in Figure 4.4 complies with the environmental requirements of the *Sugar Industry Act 1991*.

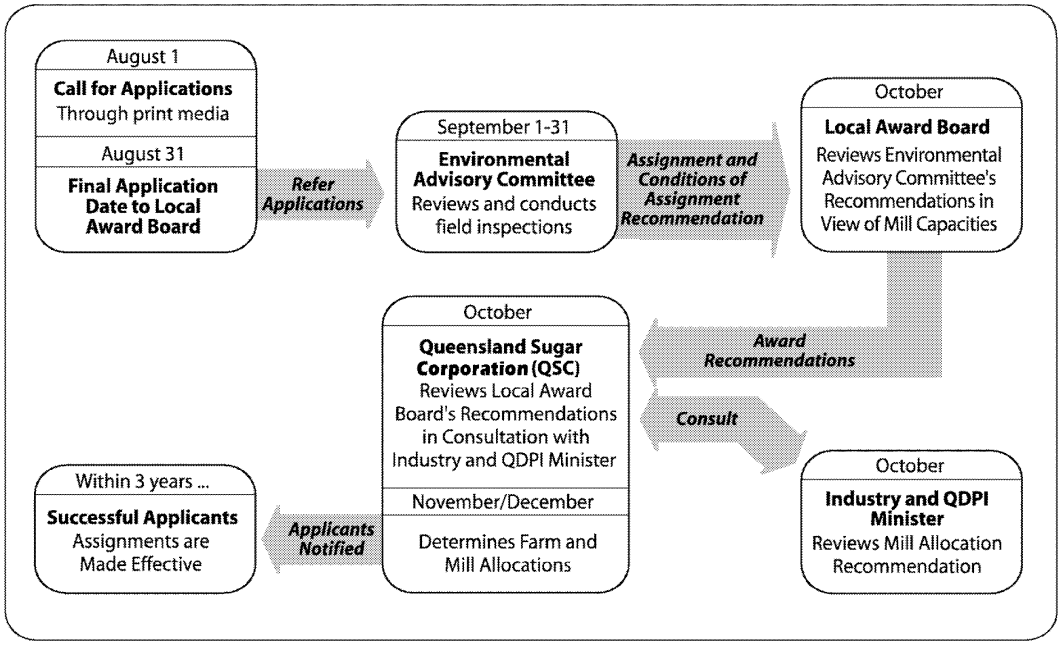

Figure 4.4 Formal sugarcane assignment process

The QSC places an advertisement in regional newspapers across the state and the CANEGROWERS magazine. Interested readers apply to the relevant Local Board that receives and reviews the applications following the previously mentioned QSC guidelines. During the study period, the application form required information concerning the:

- type of application (*e.g.* new or increased);
- applicant's address;
- new grower or current assignment information (*e.g.* mill, existing assignment, increase sought, spare land available);
- location of increased assignment (*e.g.* previously assigned or new land);
- land tenure (*e.g.* lease or freehold);
- evidence of title and any land use restrictions;
- land cover (*e.g* cleared, uncleared, partly cleared, under cane); and
- development program (*i.e.* when planting of cane will occur).

The state agencies and relevant statutes, programs, and policies described in the previous chapter influence individual applicants, and the decision-making process. However, the Local Board essentially makes the final decision. Before 1994, participation from government agencies and drainage boards was almost non-existent. In 1994, QDPI with some informal input from QDEH provided some comments. A more visible and multi-agency mechanism was used in the review of 1996 applications.

By 1996, an Environmental Advisory Committee (EAC) comprising representatives from QDPI, QDEH, BSES, and CSR considered the environmental impacts of the application based on: (i) available 1995 ortho-photo mapping, (ii) soil surveys and other available mapping, (iii) local

knowledge, (iv) information provided on the application, and (v) a Property Management Plan which was required from all applicants for the first time in 1996. In preparing these Property Management Plans, some applicants received detailed assistance from QDPI, others more informal assistance from BSES or CSR field staff, while others submitted rough sketches of their properties. All plans focused on land management issues.

Representatives from the Local Boards and Environmental Advisory Committee conducted site inspections for properties of significant concern. Final recommendations were made by the Environmental Advisory Committee and were forwarded to the Local Boards. After considering which applications met the guidelines, the advice of the Environmental Advisory Committee and having reached agreement on mill capacity, the Local Boards advised the QSC regarding: (i) the total number of applications; and (ii) the amount of expansion it was prepared to approve. This information was presented by the QSC to industry groups and the Minister for QDPI (as required by statute), and a final decision was made by the QSC. Applicants were notified in writing by the QSC.

The evolution of the referral process is one visible mechanism to address the need to consider environmental considerations. A second innovation was realised in the incremental development of environment-related Conditions of Assignment (Table 4.1). In the 1993 assignment, the Conditions of Assignment related to the environment did not exist. By 1996, the list of conditions embraced traditional drainage issues, as well as land and water, soil and wildlife values. A key issue concerns how these conditions are monitored and enforced.

Unsuccessful assignment applicants could appeal to the Sugar Industry Tribunal, or apply in subsequent years. Successful applicants had two years to make assignments effective (*i.e.* delivering sugarcane to the mill). Twelve-month extensions could have been given. Farmers were required to abide by regulations and codes of practice established under the *Environmental Protection Act 1994*. If drainage works (as defined by statute) or irrigation waters were required, applications under the *Water Resources Act 1989* must be submitted to QDNR for review. QDPI and QDNR provided extension services to farmers.

For the 1996 award, the call for applications was made on 1 August and a decision announced by 31 December at the latest. For the 1997 award, the QSC announced that applications must be submitted to Local Boards by 31 June 1996. Local Boards are to notify the QSC by 31 July of the total applicant demand and the desired mill application. Applicants were to be notified in late September of final decisions. It is the process shown in Figure 4.4 and some of its outcomes that is the subject of the evaluation.

4.10 The Evaluative Framework Revisited

Prior to employing the evaluation framework, it is appropriate to identify its suitability to assess the major participants – both private and government - in the sugarcane assignment process. This section describes government and CANEGROWERS' views of ESD according to the five principles of balance, partnerships, ecosystem, flexibility, and precaution.

4.10.1 Government View of ESD

Historically, there has been inadequate regard for environmental considerations by public and private resource managers at Commonwealth, state and regional levels. With the publication of *Our Common Future (Brundtland Report)* in 1987, this situation changed. For instance, all levels of Australian Government signed an *Intergovernmental Agreement on the Environment* (1992) to pursue the following principles (Australia, 1992: 8):

(1) Decision-making processes should effectively integrate both long and short-term economic, environmental and equity considerations.

(2) Where there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.
(3) The global dimension of environmental impacts of actions and policies should be recognised and considered.
(4) The need to develop a strong, growing diversified economy that can enhance the capacity for environmental protection should be recognised.
(5) The need to maintain and enhance international competitiveness in an environmentally sound manner should be recognised.
(6) Cost effective and flexible policy instruments should be adopted, such as improved valuation, pricing and incentive mechanisms.
(7) Decisions and actions should provide for broad community involvement on issues which affect them.

The Agreement commits all levels of government to ecological sustainable development (ESD) principles. These and other principles were endorsed at the 1992 Earth Summit (Grubb *et al*., 1993).

4.10.2 CANEGROWERS' View of ESD

The key participants in the sugar industry have responded to the need for ESD (Industry Commission, 1992; Senate Standing Committee on Industry, Science and Technology, 1989). Provisions within the *Sugar Industry Act 1994* and assignment regulations, which are administered by the Queensland Sugar Corporation (QSC), mention that environmental, social and economic aspects must be considered in determining the desirability and feasibility of applications for cane land expansion (QSC, 1991). CANEGROWERS and the Australian Sugar Milling Council are the two main industry associations. CANEGROWERS is a statutory organisation representing nearly all cane growers in Queensland and is financed by a grower levy based on cane supplied. Although CANEGROWERS has been interested in 'environmental' issues for some time, it has been particularly active since the completion of a 1996 audit of the canegrowing industry in Queensland (GHD, 1996). The audit contained over 150 recommendations, many of which have been acted on. Some of these initiatives are described below.

In 1997, CANEGROWERS endorsed a Code of Practice that met government guidelines. This initiative supports the sustainable and efficient use of resources and minimises off-farm impacts (including movement of sediment, nutrients and chemicals) (CANEGROWERS, 1999). These guidelines were endorsed by the QDoE (now QEPA) as a Code of Practice under the *Environmental Protection Act 1994*. The *Code of Practice for Sustainable Cane Growing in Queensland* has been distributed to all cane growers in Queensland. Through its extension program, the Bureau of Sugar Experiment Stations (BSES) is supporting its implementation. Major sugar-related research and development is also the responsibility of the BSES. Financed by growers and millers, BSES approves cane varieties to be grown in mill areas, provides extension services to farmers, and conducts research into the growing of cane. It has encouraged farmers to adopt environmentally friendly practices and identifies sustainable resource use as an important principle (Briody, 1994). Sugarcane research has tended to focus on biophysical aspects of the plant. CSR has had an ongoing sugarcane variety program. More recently, QDPI, QDNR and CSIRO have intensified their sugar-related research, and a CRC for Sustainable Sugar Production established. The latter will devote some research effort into socioeconomic aspects of the industry.

The environmental audit also prompted the development of an Environmental Management Strategy (EMS). The four objectives of the EMS are to:
(1) Adopt agricultural practices that minimise off-farm impact and ensure the sustainable and efficient use of soil and water resources.

(2) Achieve a balance between cane growing and the protection of natural systems and fostering biodiversity.
(3) Achieve appropriate use, storage and disposal of agricultural chemicals and farm waste.
(4) Raise the level of communication on environmental maters so as to ensure that:
    - cane growers have reliable information on which to base decisions which result in adoption of best management methods which meet legislative requirements and that they have a clear understanding of the impact which cane growing practices have on the environment; and
    - industry bodies, government agencies, community groups and conservation organisations are adequately informed on CANEGROWERS' environmental policy and initiatives directed at maintaining a profitable, sustainable cane growing industry.

CANEGROWERS adopted an environmental policy in 1990. In 1995, this policy was revised in the document *Caring for the Environment* that embraced the following principles:
(1) Industry and farm management practices should enhance the efficient and sustainable use of soil and water, safeguard public health, help preserve natural resources and desirable flora and fauna, and combat feral animals such as wild pigs;
(2) Concerns about the environment should not be treated in isolation from economic and social considerations;
(3) Preservation of the environment is everyone's concern and the cost should be borne equally within the community;
(4) Individual landholders are best placed to address issues as part of voluntary publicly-funded programs as well as R&D projects;
(5) Where sensible precautions are taken and best technology used, farmers should be free of bureaucratic interference in the everyday running of their properties;
(6) Farmers should be active participants in an open consultation process between government, industry and the community;
(7) Primary producers have rights and obligations;
(8) Government has a role in providing information, education and incentives to encourage active and self-regulatory environmental management of farms; and
(9) Unacceptable behaviour by individuals should be discouraged.

While the principles of environmental management have evolved since that time, they provide a benchmark against which the activities in the Herbert River district may be assessed.

The milling sector has also developed environmental initiatives. For instance, CSR (1998) has developed an environment policy that commits it to;
- always seeking to comply with all laws and business decision making;
- fully integrating environmental considerations into business decision making;
- ensuring that its people work in an environmentally responsible manner;
- contributing to the development of industry and regulatory standards;
- measuring its impacts and setting goals for improvement; and
- maintaining good relations with its neighbours, the community and regulators.

Even though these statements are not binding on any of these participants, they represent a shift towards more sustainable management.

In considering the suitability of the evaluative framework, the statements from government and CANEGROWERS are of particular relevance to this report. Although it is a promotional document, *Caring for the Environment* clearly indicates that the Queensland cane growing industry recognises its responsibilities towards the environment. It is also reasonable to obtain statements that are applicable to the study period 1993-1996. Industry and government statements serve as a benchmark against which intent and process can be assessed.

Table 4.2 links specific statements from the *Intergovernmental Agreement on Ecologically Sustainable Development* and *Caring for the Environment* with the five principles – ecosystem, balance, partnerships, flexibility and precaution - that support the concept of sustainable development. There are at least three significant differences between the *Intergovernmental Agreement* and *Caring for the Environment* principles. The first concerns agreeing on the breadth and depth of the balanced, ecosystem, partnership, and flexibility principles. For instance, the *Intergovernmental Agreement* highlights the need for a global perspective in ecosystem management, while CANEGROWERS are more concerned for providing efficient farm operations by controlling feral animals as well as a healthy environment. While these types of differences are important, it is more appropriate to consider differences and similarities in a broader context. In general terms, the other two important differences pertain to the precautionary principle, and how management strategies should be bounded. During the interviews with government and industry officials, a wide range of views was expressed concerning the nature of these concepts. Despite these differences, there are many areas of similarity and the CANEGROWERS appear to be committed to more effective resource management as reflected in the completion of an environmental audit of the canegrowing industry in 1996.

Table 4.2 Comparing and contrasting resource management principles in the *Intergovernmental Agreement* and *Caring for the Environment.*

Principle	Specific Statement
Precautionary	*Intergovernmental Agreement:* • Where there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. *CANEGROWERS:* • Where sensible precautions are taken and best technology used, farmers should be free of bureaucratic interference in the everyday running of their properties.
Balance	*Intergovernmental Agreement:* • Development of a strong, growing diversified economy which can enhance the capacity for environmental protection should be recognised. • Decision-making processes should effectively integrate both long and short-term economic, environmental and equity considerations. *CANEGROWERS:* • Concerns about the environment should not be treated in isolation from economic and social considerations.
Partnerships	*Intergovernmental Agreement:* • Decisions and actions should provide for broad community involvement on issues that affect them. • The need to maintain and enhance international competitiveness in an environmentally sound manner should be recognised. *CANEGROWERS:* • Preservation of the environment is everyone's concern and the cost should be borne equally within the community. • Farmers should be active participants in an open consultation process between government, industry and the community. • Primary producers have rights and obligations. • Unacceptable behaviour by individuals should be discouraged.
Ecosystem	*Intergovernmental Agreement:* • The global dimension of environmental impacts of actions and policies should be recognised and considered. *CANEGROWERS:* • Industry and farm management practices should enhance the efficient and sustainable use of soil and water, safeguard public health, help preserve natural resources and desirable flora and fauna, and combat feral animals such as wild pigs.
Flexibility	*Intergovernmental Agreement* • Cost effective and flexible policy instruments should be adopted, such as improved valuation, pricing and incentive mechanisms. *CANEGROWERS:* • Government has a role in providing information, education and incentives to encourage active and self-regulatory environmental management of farms. • Individual landholders are best placed to address issues as part of voluntary publicly funded programs as well as R&D projects.

In 1999, CANEGROWERS (1999) committed Local Boards to develop and publish environmental and land use guidelines in order that the suitability of proposed new cane production areas can be assessed. QDNR and QDoE are to be consulted in the development of the guidelines. The guidelines will also comply with other relevant statutes.

The initiatives noted above focus on a variety of activities that have occurred since 1996. In order to provide for a fair assessment, it is appropriate to consider developments prior to 1996 in order that comments may be framed in an appropriate context.

4.10.3 CANEGROWERS' Environmental Audit of the Queensland Canegrowing Industry

CANEGROWERS and the rest of the sugar industry are aware of the need for effective action in terms of their ESD obligations. Part of their response was the completion of an environmental audit of the canegrowing industry (GHD, 1996). In order to establish an industry perspective on the potential for environmental impacts of cane assignment, the following section reviews the findings of an environmental audit that was commissioned by the CANEGROWERS Council and released in 1996 (GHD, 1996). This completion of the audit is consistent with the temporal perspective provided in this research effort. The audit's findings were based on 180 interviews and 130 farm audits completed along the entire sugarcane-growing coast from Rocky Point to Mossman (Figure 1.1). Interview respondents included a wide range of interested parties – industry organisations, local, State and Commonwealth Government, research organisations, Landcare and Integrated Catchment Management groups, conservation groups, recreation and commercial fishermen, and a range of other community and aboriginal groups. A significant majority of respondents (63%) and the majority from each sector interviewed perceived that "current environmental management practices within the sugarcane growing industry needed improvement" (GHD, 1996: 4).

Farm expansion was perceived as having potentially high impact by a majority of respondents. Specific issues concerned:

> the clearing of land for expansion affecting habitat values and critical ecosystems; 49% of all respondents believed this was a high priority issue. The growing of sugarcane on riverbanks was seen to be adversely affecting the riparian or vegetation corridors which are critical for river health, bank stability and fauna habitats; 56% of all stakeholders believed riparian zones are a high priority management issue… (GHD, 1996: 5).

Respondents from community groups in the Herbert River district commented that the river was "seen as merely a culmination of a [series] of open drains with swamp grasses, battered creeks and straightened creeks" (GHD, 1996: 5). The farm audit generally concurred with this portrayal of river systems and further stated that the

> riparian zone issue and the value of retaining these areas needs to be better understood by the industry in terms of water quality… Riparian zones should be revegetated with native species, as they provide good pollution, nutrient and sedimentation sinks as well as ameliorating water salinity problems (GHD, 1996: 15).

The report noted that the destruction of riparian vegetation is regulated under Section 70 of the *Water Resources Act 1989* and can be an offence under the *Land Amendment Act 1992*.

The impact of cane growing on endangered species and fauna/flora is an issue that is closely related to riparian corridors. There was a perception among non-farming interview respondents that "the government, rather than encouraging sustainable farming, [was] promoting expansion beyond sustainable limits through infrastructure development packages. These packages are often for weirs or drainage schemes which conservationists consider to be environmentally suspect, or for expansion onto marginal areas" (GHD, 1996: 6). These structures interfere with natural flows, downstream flushing, groundwater levels, and fish migration. Expansion onto

marginal land was defined as land that needed some form of amelioration before it was suitable for farming (*e.g.* drainage, excessive fertiliser application). It was also perceived that the exposure of acid sulphate soils and exacerbation of existing sodic soils were problems associated with the development of marginal lands. Drainage problems were also believed to be associated with land leveling practices that prevented natural run off and recharge of creeks and watercourses (GHD, 1996).

Concerning wetlands, the report noted that these should not be drained since this further exacerbates local hydrologic problems. Creeks and waterways should not be blocked off or straightened without appropriate permits such as those provided under the *Water Resources Act 1989*. Concern was also expressed over acid sulphate soils and erosion. The report recommended that

> the management and identification of acid sulphate soils needs to be better understood by growers in all regions. It was recommended that CANEGROWERS develop a code of practice for growers relating to management of acidic and element-deficient soils (GHD, 1996: 16).

The authors also advocated the development of management practices for soil erosion in drains and for the protection of riparian zones.

Interviews with farmers suggested that government policies are also unwittingly contributing to habitat loss, and consequent soil and water degradation.

> These policies include the opening up of marginal land…to crop production. Some growers indicated that perceived pressure from industry organisations to increasing production was influencing many growers to utilise marginal land (drain wetlands, open up saline areas, cut down Melaleuca swamps, etc) and in combination with government export policies and price of crops, results in over-intensive use of the land (GHD, 1996: 20).

Non-farmer respondents questioned the integrity of the assignment process and perceived that Local Boards acted "too quickly" (GHD, 1996: 6). "In the past, QDoE and QDPI have had little input into the outcomes of the system. No mechanisms were reported in place to halt and address potential undue environmental damage. It was believed that the potential of vertical expansion was not adequately assessed on current land prior to the granting of additional assignment on new land" (GHD, 1996: 6).

The report commented on the unfortunate lack of data and the inadequate implementation of on-farm management practices to mitigate against water quality impacts. It was believed that these shortcomings posed "a risk to the industry" (GHD, 1996: 12). The report recommended that:

> Increased monitoring of water quality in local creeks and waterways should be facilitated or encouraged by local CANEGROWERS' offices in order to counter negative perceptions of the effects of nitrification, sedimentation, turbidity and salinity of water resources.

Awareness and compliance with existing government regulations, industry codes of practice and Australian Standards were considered low. In terms of who should undertake further action to protect the environment, farmers preferred the Department of the Environment (48%), individual growers (22%), voluntary conservation agreements (16%), and rate relief (14%). Unfortunately, more precise information concerning the feasibility of these alternatives was not provided.

To a large extent, the audit maintained that growers throughout the state were suffering the legacy of poor past management practices that reflected a time when environmental regulation, community awareness and scientific information on the beneficial aspects of riparian zones were not well known. In summary, the CANEGROWERS' audit suggests that all participants – government, the industry, growers and the public – must change practices that have contributed to a lamentable "legacy of the past" that provides a poor foundation for popular public support.

In reflecting on the findings of the audit, CANEGROWERS (1999: 38), suggested that it was disappointed by the audit and commented:

> As the industry's understanding and appreciation of environmental issues has matured it has become evident that some of the audits [156] recommendations reflect an imperfect understanding of sugarcane growing, some recommendations are repetitive and some important issues are not covered in any of the recommendations.

CANEGROWERS committed itself to responding to the audit, in part, to identify outstanding issues that may need to be addressed and their level of priority. It is hoped that this current research effort can assist in furthering some of the ideas contained in the audit, provide the CANEGROWERS some food for thought as they consider their response to the audit, and in these ways contribute to improving the practice of ESD throughout the sugar industry.

5 ASSESSING THE SUGARCANE ASSIGNMENT PROCESS IN THE HERBERT RIVER DISTRICT

5.1 Introduction

This chapter is divided into nine sections. Prior to examining the assignment process itself, we provide a brief review of those government initiatives initiated since 1996 (Section 5.2). This discussion will focus on the *Integrated Planning Act 1997* and the *Sugar Bill 1999*, and will establish the need for additional improvements to the assignment and land use planning processes. The nature of the data is also described (Section 5.3). The remainder of the chapter considers two issues: (i) an evaluation of the cane assignment process and selected outputs during the study period 1992-1996 (Sections 5.4 - 5.8); and (ii) an assessment of the adequacy of the current (*i.e.* 1999) institutional arrangements for environmental management in the sugarcane assignment process (Section 5.9). Where these are deficient, alternative measures that could ensure a more sustainable process are identified. The evaluation and the determination of adequacy are guided by selected measures of ecosystem (Section 5.4), balance (Section 5.5), partnerships (Section 5.6), flexibility and adaptability (Section 5.7) and the precautionary principle (Section 5.8). These five principles reflect the underlying principles of ESD. Summary comments and implications are noted (Section 5.9).

5.2 Is there a need for change in the cane assignment process?

Since 1996, land use and cane assignment planning processes affecting sugar industry development have undergone significant changes. Prior to 1993, both planning systems operated in a relatively separate manner with only the Hinchinbrook Shire Plan having an indeterminate influence on assignment activities (Figure 5.1). In addition, the *Water Resources Act* played a role in guiding drainage activities after assignments had been granted. However, as noted in Chapter 4, the shortcomings of the statute combined with the lack of enforcement reduced its ability to influence activities.

By 1999, a large number of initiatives had been undertaken that impacted on both land use planning and cane assignment (Figure 5.2). At a local level, amendments to the *Planning and Development Act* (*IPA*) and the re-writing of the Hinchinbrook Shire Plan were two of the most significant changes. These adjustments combined with new and revised regulations, particularly those established under the *Environmental Protection Act* and *Fisheries Act*, will influence both cane planning and the implementation of assignments. Thus, there is a greater degree of direct interaction between land use planning and cane assignment. The cane growing industry has also become more responsive to environmental concerns. It has worked with government agencies and others to establish an Environmental Strategy and Codes of Practice (Figure 5.2). Given the nature and degree of these changes, it is appropriate to question the need for further reform of the assignment process.

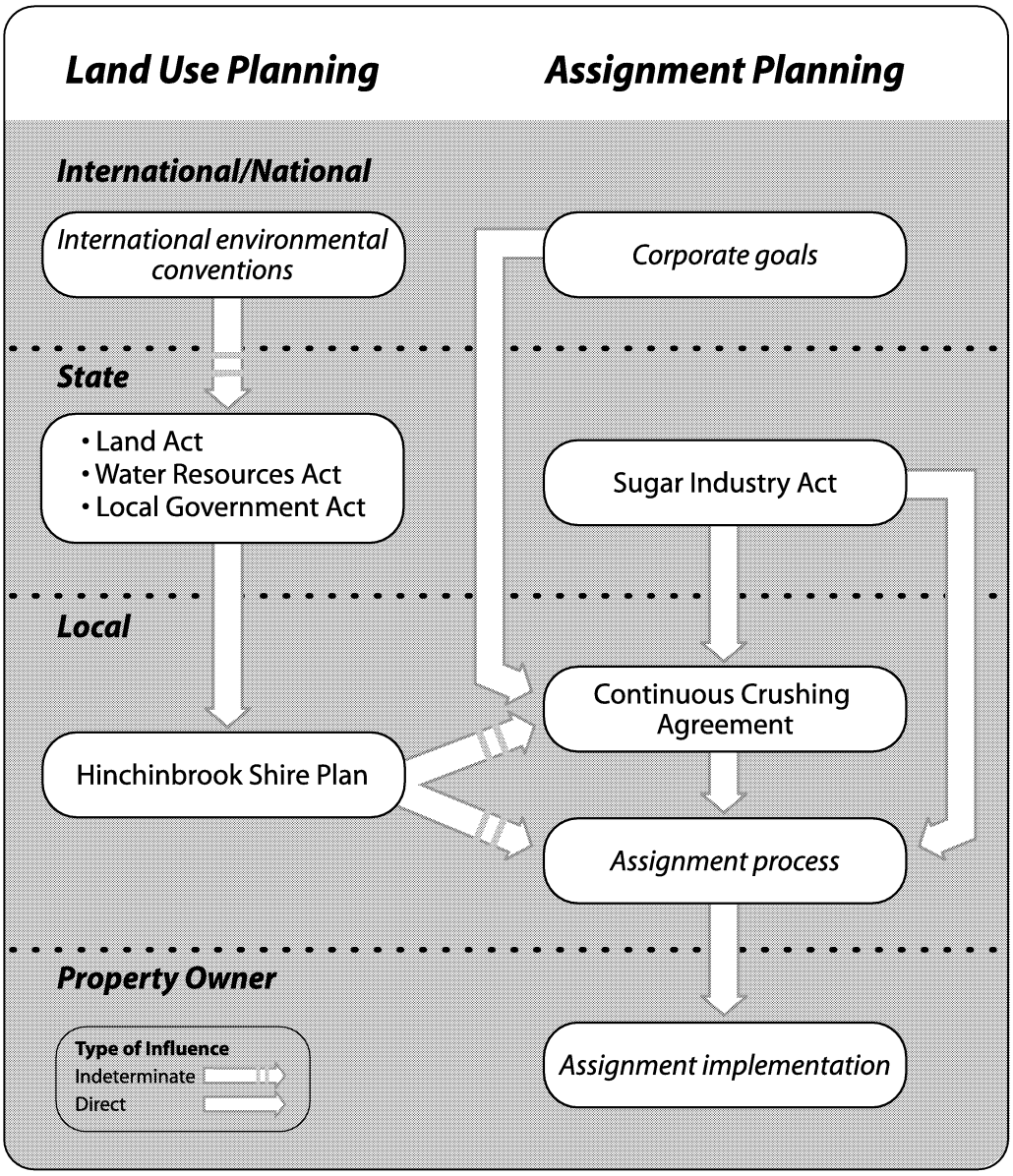

Figure 5.1 Land use planning and assignment planning (1991).

Very briefly, the four points noted below support this need:

1. Many recent changes, such as regulations under the *Fisheries Protection Act 1994* and the development of Codes of Practice and Environmental Protection policies, are focused at the operational level of planning. However, they are often perceived as reactive rather than proactive. Their frequent use, particularly on newly assigned marginal lands, prompts the question; "Why was this land assigned in the first place?". Environmental Protection Policies and recommendations contained in documents such as, *Land Use Practices in Wet Tropical Floodplains* and *Codes of Practice* are an important part of the solution that ensures that an appropriate "duty of care" is achieved. However, they are part of a package that must incorporate strategic and normative level responses too.

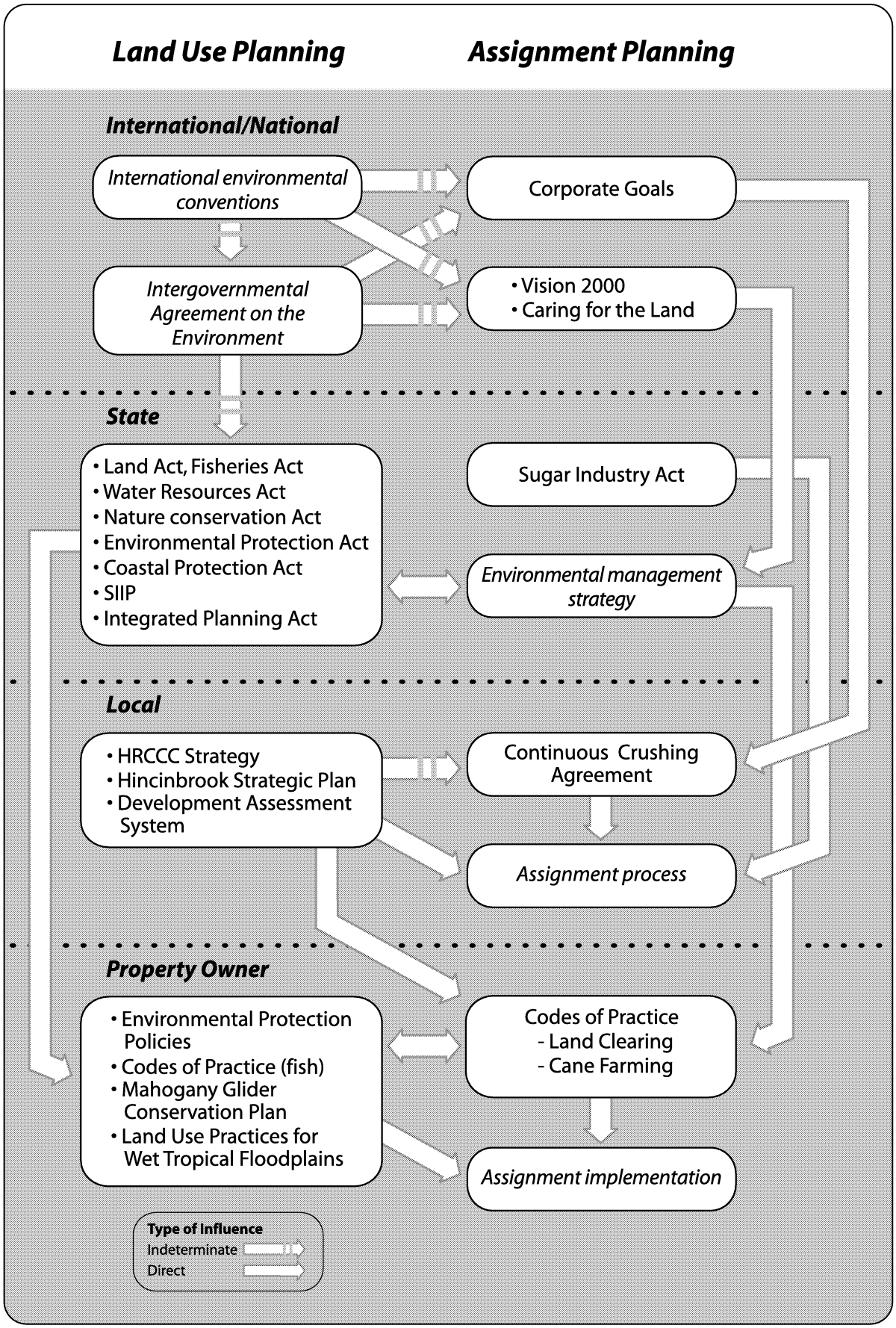

Figure 5.2 Land use planning and assignment planning (1999).

2. There have been a number of advances at normative and strategic levels. All levels of government – national, state and local – have supported their statements about the need for ESD with legislation and/or strategic planning initiatives. The draft Cardwell/Hinchinbrook Coastal Management Plan, as well as the revised *Hinchinbrook Shire Strategic Plan* provide legislative support for initiatives. The *Mahogany Glider Conservation Plan*, and the Herbert River Catchment Coordinating Committee's Strategy will influence land use planning and development in the Hinchinbrook Shire (Figure 5.2). The intent is to implement many of the provisions contained in these documents in local government Planning Schemes. Future sugarcane assignments should be excluded from areas identified as 'valued' or 'sensitive' in these documents. The extent to which recent changes influence corporate goals and the "Continuous Crushing Agreements" is unclear. It appears that decisions made at these levels will continue to drive the need for increased assignments. Indeed, the link between Corporate Goals and the Continuous Crushing Agreement remains indeterminate (Figure 5.2). Thus, integrating economic and environmental decision-making remains a challenge.
3. The introduction of the *Integrated Planning Act 1997* and the reformulation of the *Hinchinbrook Shire Strategic Plan* are fundamental guides for future resource management activities. The *IPA* has allowed the Shire to require landholders wishing to conduct intensive agricultural activities, such as cane farming, to obtain the its prior approval. While this mechanism could provide benefits, it appears to be focused on development control rather than strategic planning. Indeed, the intent of *IPA* appears to be primarily focused on streamlining decision-making processes, rather than enhancing its effectiveness. Initial reviews of *IPA* suggest the following items require further attention (Barker, 1997; England, 1999; Moon, 1998):
   - The technical aspects of development studies must be rigorous. Existing descriptions fail to clarify if an impact assessment versus an environmental reporting approach will be adopted. If the former intent were desired, proponents must ensure that the need for development is clearly demonstrated; that the magnitude and significance of impacts are predicted and measured; and that alternative measures are assessed rigorously. If this is not the intent, the requirements of the environmental report must be defined.
   - The legislative requirements and administrative practice of impact assessment support:
     - an integrated approach: environmental, social and cultural;
     - an accountable and environmentally responsible decision-making process;
     - an assessment process that pursues and achieves the best solutions rather than acceptable ones;
     - the consideration of cumulative impacts;
     - specific recommendations that are enforceable with penalties;
     - a decision-making process that is perceived and is open, participatory and fair;
     - an efficient process; and
     - the linkage between property-specific decisions with decisions made at larger geographic scales.

   This comprehensive approach is quite onerous, particularly for individual farmers.
4. While there is no question that the government initiatives described in Chapter 4 will support better management of the 'natural' environment, it is unclear how well they support ESD in the context of linking environmental, economic and social considerations. This was the clear challenge that the Brundtland Commission identified when it suggested that:

   > Those responsible for managing natural resources and protecting the environment are institutionally separated from those responsible for managing the economy. The real world of interlocked economic and ecological systems will not change, the policies and institutions must (WCED, 1987: 9).

Since the 1990s, 'environmental policies' have changed dramatically but there have been relatively marginal adjustments in the administrative arrangements for sugarcane assignment. For instance, the requirement for environmental plans and Codes of Practice are being 'added on' to the existing cane assignment system. An outcome of this situation is that

locally based forums to support the ongoing and constructive dialogue between the 'sugar industry' and 'others' are not readily apparent. The system appears to be centrally controlled as reflected in the binding 2.5% annual increase in assigned area. This requirement appears to have been generated from 'the top', with little participation from 'the bottom'. However, locally based forums are required not only to support the principles of ESD, but also to work out 'routine' issues. It is unclear how the present arrangements effectively integrate economic and environmental considerations. They certainly did not provide the additional resources to government agencies that were promised by the minister.

With the proclamation of the *Sugar Industry Bill 1999*, several changes have been made to the process of assessing and assigning new cane lands. These changes provide additional requirements for environmental and sustainability issues to be considered in the horizontal expansion process and thereby provide the capacity to consider such issues prior to the allocation of land for cane production. Cane Production Boards have an important role in achieving the sustainable production of cane by making guidelines that relate to land use, the environment, and transport. These guidelines are to be considered when assessing applications for cane production areas. Production Boards are further required to consider the suitability of the land for cane production when assessing applications through consideration of land capability, appropriate agricultural practices and any relevant environmental guidelines. Additional changes include the requirement that negotiation teams assess the demand for cane expansion before Production Boards assess individual applications and the ability of cane production boards to require additional information from applicants before deciding an application. These developments address environmental issues but appear to fall short of effectively integrating environmental, economic and social considerations.

Effective responses to the changes, uncertainties, complexities and conflicts that will continue to be part of the sugar industry's future lies in administrative mechanisms, planning initiatives, and scientific research. On the one hand, government policies could be seen as a 'command-and-control' approach that seeks to regulate every aspect of the industry. This can stifle progress, be costly to monitor, and be frustrating for and confusing to individual farmers who now have a plethora of regulations before them (Figure 5.2). Not only are they concerned with the environment, but they must also make a living at the end of the day. On the other hand, government policies could be seen as identifying new standards of industry performance. How that will be done is often perceived to be primarily the industry's problem. While these views are somewhat simplified, the current policy environment does not adequately embrace the five principles of ESD. Thus, there are conceptual and practical shortcomings in present responses that suggest the need for changes to the sugar assignment process.

5.3 Application Profile in the Herbert River District: 1993-1996

As noted earlier, 525 applications for assignment, covering an approximate area of 16,000ha, were submitted to the Victoria and Macknade Local Boards for approval during the study period. It was feasible to link information from complete application forms (Appendix 1) with the spatial database for 472 applications (89.9%) of the total application pool. These applications encompassed an area of 15,013ha or about 94% of the total 15,994ha area applied for. The data that are presented in the maps and tables below will refer to those applications with spatial representation.

Table 5.1 provides a profile of the outcomes from the cane assignment process during the study period. During the study period, 472 applications were spatially represented and comprised an area of 15,013ha. From this total, 355 (75%) applicants were awarded their entire request, 92 (20%) were awarded less than their request, and 22 (5%) were denied. Of the 15,013ha applied for, 12,165ha were awarded, representing an 81% approval rate. 1,962ha were not awarded on

the basis of an applicant being granted less than 100% of their request. In addition, 887ha were denied an award. All applications that were denied occurred in 1996 and represented an area of 2,736ha. Since the 1996-application pool contains applications that were denied, the following analysis pays particular attention to it. This point is re-enforced in Figure 5.3 that identifies the location of applications during the study period. While some of the awards represent consolidation within traditional cane-growing areas, much of the development pushed new frontiers into the Upper Stone, Toobanna, and Mutarnee regions. These data and pattern of development raise concerns about how effectively the sugarcane assignment process (Figure 5.1) supported the principles of ESD. Each principle is considered in the following sections.

Table 5.1 Profile of assignment applications awards and denials, Herbert River district: 1993 - 1996.

			Spatially Represented Data							
	Total Applications Submitted		Applications Recorded		Granted 100% of Request		Granted < 100% of Request		Application Denied	
Year	Number	Area	Number	Area	Number	Area	Number	Area	Number	Area
1993	216	4080	199	3979	166	3374	33	331	0	0
1994	83	2876	77	2849	59	2663	18	41	0	0
1995	98	2477	87	2185	86	2149	1	6	0	0
1996	128	6561	109	6001	47	865	40	2736	22	887
Total	525	15994	472	15013	358	9051	92	3114	22	887

Note: Area figures are in hectares.

5.4 Enhancing Ecosystem Management

The ecosystem approach is one principle of sustainable development. There are many challenges to developing and implementing an ecosystem approach. According to Mitchell (1997), one challenge of the ecosystem approach is to consider how it can be applied to solve real-world problems in a timely manner. A second issue pertains to ensuring managers are not unduly human-centred and consider the needs of non-human species with which we share this planet.

These introductory comments serve to structure the following three-part discussion of the ecosystem approach. The first focus directs attention on the perceptions of the residents in the Herbert River catchment. The second perspective considers human use and management of the environment by examining drainage issues and planning. The last focuses on non-human species, specifically land cover and landscape pattern changes, and endangered species and habitat management.

5.4.1 Community attitudes towards the environment

The views of Herbert River catchment residents towards their quality of life and their perception of regional resource management issues were surveyed in 1996 and 1998 (Butterworth *et al.*, 1997; Macreddin and Syme, 1999). In general, respondents had a fairly high level of satisfaction with living in the Herbert. The survey reported that residents found resource management issues to be generally important and that some issues required urgent action. High ratings of personal importance for the Herbert community included water quality problems, land degradation, water quantity problems, and nature conservation. Moderate importance was placed on flooding, wetlands management, vegetation on riverbanks, and the loss of biodiversity. This relatively high level of awareness of problems implies general support for some of reform of current institutional arrangements (Figure 5.1). Indeed, the community believed that they, rather than the state, Commonwealth or other outside agents had a reasonable level of control over activities in the Herbert River catchment. However, since land and water management issues were not uppermost in people's minds, any reforms should, from most local residents' perspective, not interfere with their first priority – life issues. These life issues included high unemployment, a

lack of opportunities for young people, and a lack of diversity of industry.

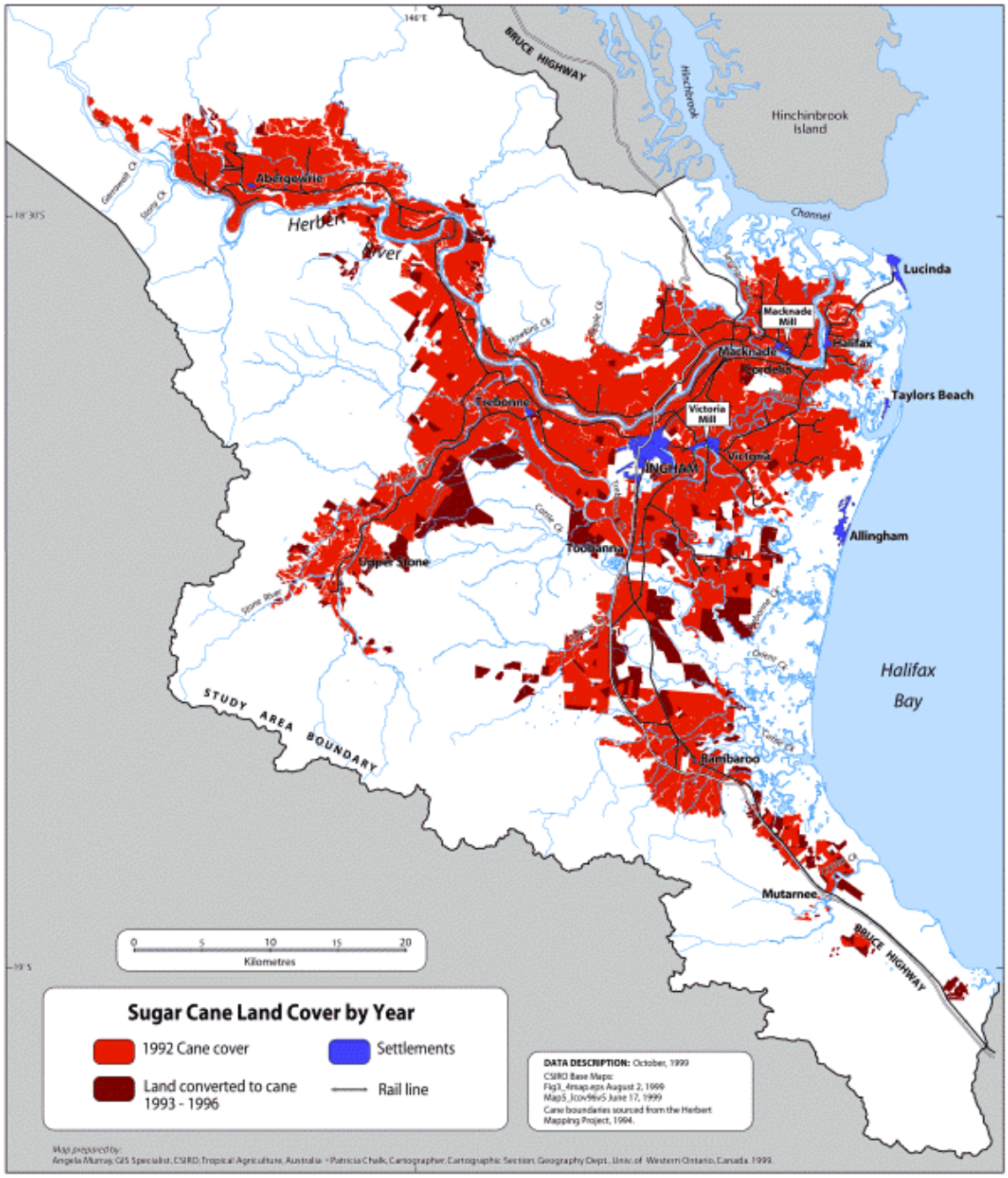

Figure 5.3 Location of assignment grants (1993-1996).

These perceptions reflect the Herbert River community's complete living experience – that mix of environment, economy and society. The next two subsections focus attention on two other aspects of ecosystem management – drainage and biodiversity.

5.4.2 Responding to drainage problems

The *Hinchinbrook Rural Drainage Study* has been consistently referred to in the Conditions of Assignment granted between 1993 and 1996 (Table 4.1). As noted earlier, that study's objectives were "to achieve a consistent standard of drainage which would increase rural production and to define required works, their location, cost and benefits to be achieved from the works, and subsequent management and operation leaving only detailed design and documentation necessary to implementation" (Cameron McNamara, 1984: 1-1).

Much of the land awarded assignment between 1993 and 1996 was not considered for detailed study in the 1984 *Hinchinbrook Rural Drainage Study* (Table 5.2 and Figure 5.4). Of the 450 spatially represented awards approved during the study period, 141 (31%) were located entirely within the Cameron-McNamara study area. However, these awards represented only about 10% of the total land area awarded (1,280ha of a total of 12,164.9ha). These data suggest that the individual drainage works for the successful applicants situated on the 10,884.9ha located outside the Cameron-McNamara study area were not guided by a strategic water management plan. In partial response to this situation, the Local Board requested that "plans for works must be in accordance with the plan submitted at the time of application" (Table 4.1). However, in the absence of an overall drainage plan, it is unclear how these proposals would be written or reviewed effectively. Individual applications, which included one proposal for development of over 1,500ha, failed to contract a professional engineer to write a drainage report.

Table 5.2 Location of applications relative to the Cameron-McNamara study area. Figures shown for applications with spatial representation.

					Cameron-McNamara Study Area Applications					
	Total Applications		Total Approved		Total Overlapping		1996 Approved		1996 Denied	
Year	Number	Area	Number	Area	Number	Area	Number	Area	Number	Area
1993	199	3979	199	3705	57	502	0	0	0	0
1994	77	2849	77	2704	33	428	0	0	0	0
1995	87	2185	87	2155	18	130	0	0	0	0
1996	109	6001	87	3602	33	221	25	221	8	138
Total	472	15013	450	12165	141	1280	25	221	8	138

Note: Area figures are in hectares.

While Property Management Plans prepared by farmers can use 'rule-of-thumb' guidelines to consider individual farm drainage problems, there is no effective plan that considers the cumulative impact of these individual land use changes. Many applicants for new cane assignment only provide sketch maps of their planting intentions, and do not seek professional assistance. This is sometimes not a problem, as some areas will require drainage works which do not connect to watercourses (and do not require a permit). Some successful applicants, such as those in the Pomona and Wharps land holding areas, required drainage permits under the *Water Resources Act 1989*. Indeed, some of the areas of Cattle Creek are perceived by the Environmental Advisory Committee as unsuitable for cane farming because of the high probability of inadequate drainage. Farmers who received assignments in this area may request major drainage projects in order that a reasonable level of productivity is achieved. This demand could be associated with a return to more 'normal' precipitation patterns and levels (Figure 3.5). Since these projects would be beyond the ability of individual landowners to finance, government cost sharing would be required.

Downstream landowners may be concerned that new farms and proposed works could significantly increase inundation of their properties. Hence, increased drainage conflicts among landowners could occur without effective management processes. If drainage works and/or permits were denied, farmers would be unable or have some difficulty in recouping financial returns from their full assignment. This situation could promote the farmers to use inappropriate agricultural practices in order to increase productivity. This potential problem could be heightened if prices for sugar retreat from recent high levels (Figure 2.1).

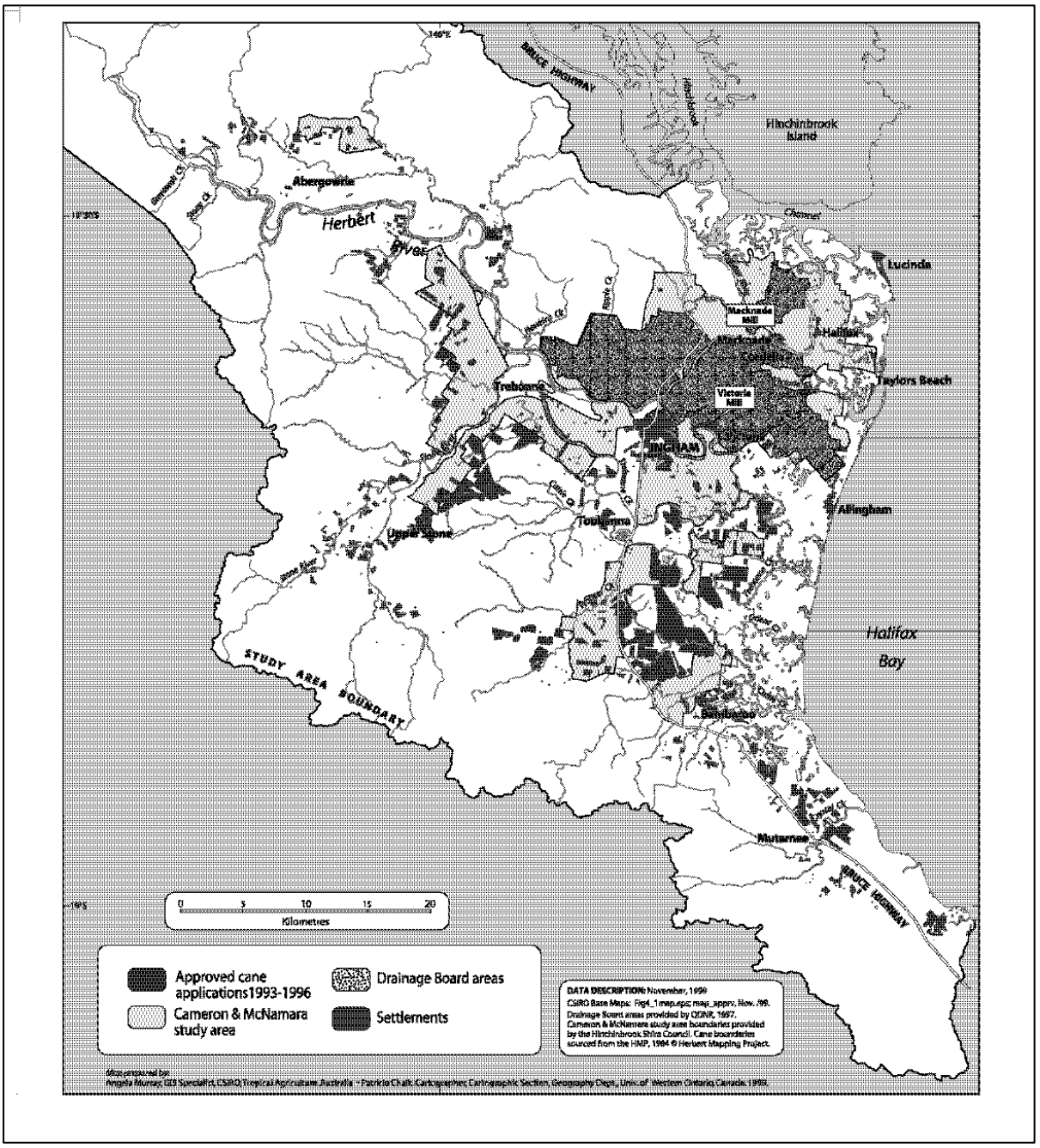

Figure 5.4 Location of assignments awarded relative to Drainage Board and Cameron-McNamara study area.

At present, a cost-sharing approach to major drainage works is being contemplated under the Sugar Industry Infrastructure Package (SIIP). Initiated in 1992, this $117 million Commonwealth-State program aims to enhance the sugar industry's economic performance by developing required infrastructure, such as major drainage works. In the Herbert River district, there are two SIIP initiatives. The first is focused on the Cameron-McNamara study area (Figure 5.4). It generally supports the structural adjustments recommended in that 1984 study. The second study is focused on the remainder of the Herbert River district. If sufficient landowner support is achieved within the lower Herbert, the desirability and feasibility of these proposed works can be considered. Although past attempts to form a single drainage board have failed to produce tangible results and there are statements in the Conditions of Assignment that refer to drainage boards (Table 4.1), the formation of a Water Management Board is a requirement of SIIP. On the one hand, the creation of a single drainage authority will be resisted by individual farmers and may be impossible to implement. On the other hand, these studies should provide for a

comprehensive drainage plan that guides individual farm-level projects.

While environmental assessments are part of the SIIP process, the following shortcomings can be identified:

- The need for the projects is unclear. They are motivated by the perceived economic needs of industry and government. The normative judgements about the need for infrastructure appear to have been made without rigorous consideration of social and environmental factors, particularly at the local level. This approach does not effectively reflect the principle of balanced management.
- Environmental assessments appear to be 'tagged on' to the end of the process, rather than the beginning. According to the Brundtland Commission, ecological factors should be considered at the same time as economic and other dimensions.
- The significance of environmental impacts has often not been well demonstrated. Part of this shortcoming is the absence of clearly defined values attached to significant ecological features.

These deficiencies suggest that the SIIP process fails to adequately consider the linkages within the natural ecosystem as well as those with the economy and society.

5.4.3 Land Cover and Landscape Pattern Changes in the lower Herbert River Catchment

According to the Commonwealth Government (1996, ES-14), land clearing and related activities are the "single largest threat to biodiversity" in Australia. The situation is deteriorating as threatening activities continue." Johnson *et al.* (1999a) described land cover change in the lower Herbert River region since European settlement. Figure 5.5 shows changes in land cover since the 1970s. The period between 1970 and 1996 saw a rapid expansion in the area of sugarcane. The consequences of this expansion have resulted in a decrease of approximately 40% in the area of Melaleuca dominated patterns (half of this area was converted between 1992 and 1996), a 13% decrease in the area of Eucalypt woodland. In contrast, there has been a 70% increase in the area of sugarcane during the same period.

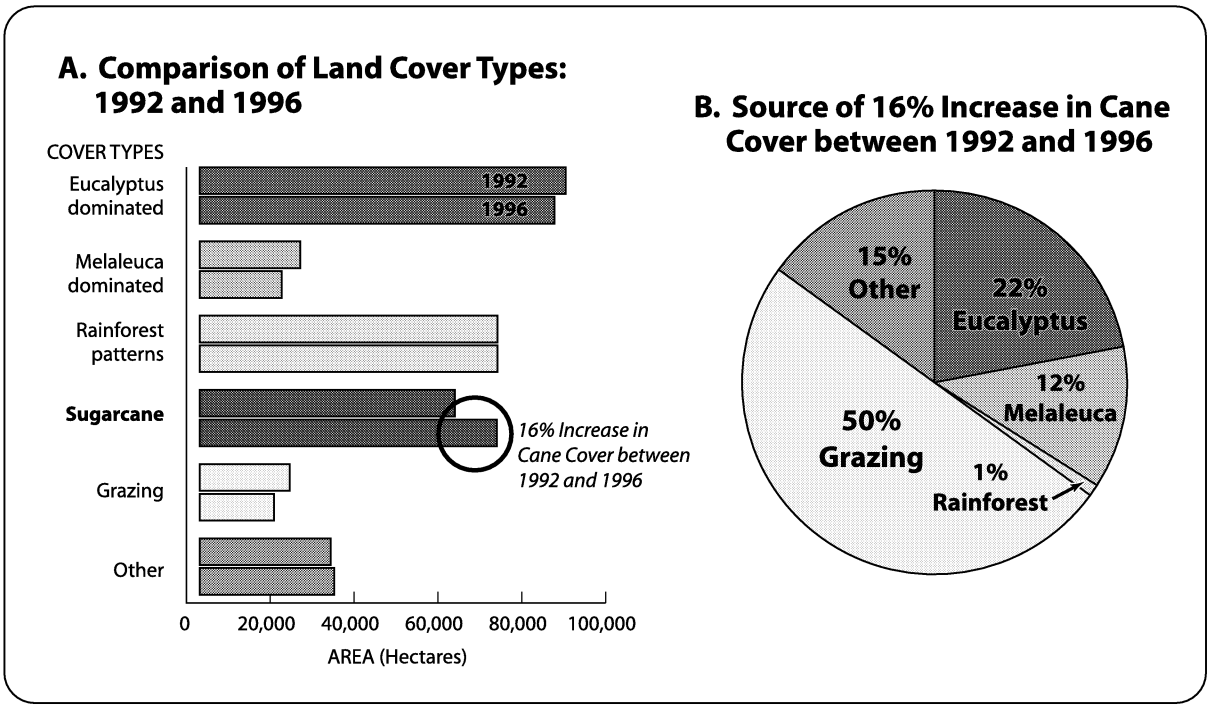

Figure 5.5 Land cover changes 1992-1996.

Johnson *et al.* (1999a) undertook an analysis of landscape pattern in the lower Herbert River region since European settlement. Figure 5.6 shows the number of Melaleuca, Eucalypt and rainforest islands has increased since European settlement. The number of sugarcane islands has remained relatively stable over the last 50 years, however island number peaked during major periods of sugar industry expansion in the 1970s and 1995-1996. Although the number of islands increased for Melaleuca, Eucalypt and rainforest land cover, mean island size for Melaleuca decreased substantially between 1992 and 1996. Mean island size for Eucalyptus patterns and for sugarcane increased during the same period.

Island distribution indices (IDI) for rainforest and Melaleuca patterns between 1977 and 1996 show contrasting island aggregation characteristics. Rainforest patterns show an increasing IDI, indicating that remnant cover is disaggregated, while IDI for Melaleuca patterns declines over time, indicating a pattern of island aggregation. It could be concluded that this contradicts results presented in Figure 5.6, although it is not unexpected given that in an ever increasing "sea" of agricultural land, remnant areas of Melaleuca tend to occur as clusters on the floodplain. However, as previously discussed, the mean size of each cluster is also decreasing.

Landscape distribution indices (DL) for rainforest patterns, Eucalyptus and sugarcane increased between 1992 and 1996, indicating that islands of these land cover classes have become longer and narrower over time. In contrast, values for Melaleuca patterns have declined slightly. These results support those obtained for IDI distributions. Measures of diversity and evenness show an increasing landscape richness and evenness in the lower catchment between 1977 and 1994, as the landscape became more evenly divided among component cover types. However both measures begin to decline post 1994, in response to the large increase in the area of sugarcane. Hence a more uniform/less diverse landscape now exists on the Herbert coastal floodplain when compared with historical patterns.

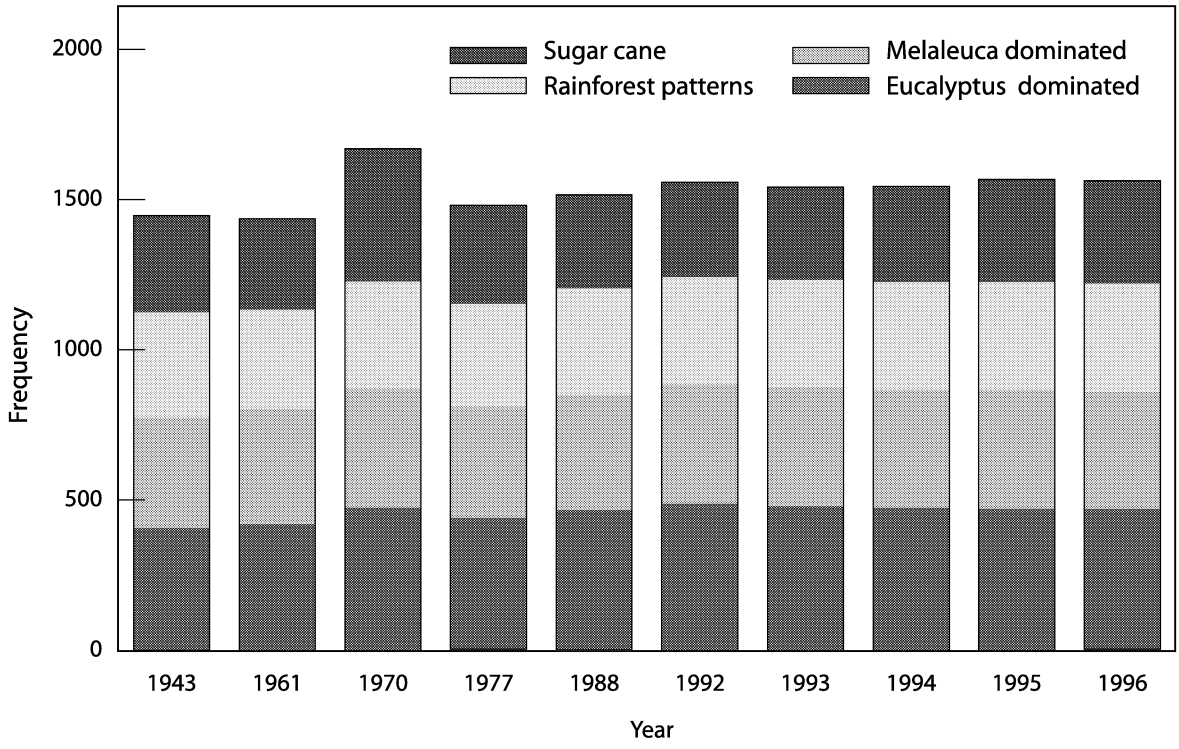

Figure 5.6 Land cover island analysis 1992-1996.

These results support those obtained in a companion study focussing on land cover changes in seasonally inundated areas of the lower Herbert River floodplain (*i.e.* areas below 13m AHD) (Johnson *et al*., 1999b). This study concluded that mean island size for rainforest islands decreased from 128ha in 1860, to 28ha in 1942 and to 24ha in 1996. Similarly, mean island size for Melaleuca forests decreased from 135ha in 1860, to 82ha in 1943, to 46ha in 1977 and to 22ha in 1996. The trends observed in the lower Herbert River catchment are not unique. Similar trends are apparent in the Tully, Murray (Tait, 1994), Johnstone (Russell and Hales, 1996), Mulgrave-Russell, Mossman, Daintree and, to a lesser extent, Burdekin and Haughton River catchments (Johnson *et al.*, 1997).

Given these results, it is clear that the ecosystem in the lower Herbert River has been altered substantially. Hence, unless a change in current land use policy, planning and management occurs, then the area of Melaleuca, Eucalypt and rainforest cover in the catchment will be reduced to a very low level. It is likely that the area of these classes on the floodplain proper are already less than is required to perform as effective and functional biological units (Johnson *et al.,* 1997). While no attempt was made to evaluate the ecological status of remaining riparian and wetland areas, a recent ecological audit of river catchments in Queensland (Moller, 1996) demonstrated that the ecological condition of remaining stands of native vegetation outside of reserves and National Parks in the Herbert River district is poor to very poor. This finding implies that improving the ecological status of native vegetation requires increased efforts to acquire public lands, and/or more effective programs that are targeted at freehold land. These results have also served to identify those land cover types requiring priority management attention.

One of the most intense issues of conflict during the study period, and one that lingers today, concerns the clearing of valued species habitat. This conflict is illustrated in the awards granted in Mahogany Glider habitat, particularly in the Wharps and Pomona areas (Figure 3.2). In 1995, an interim conservation order was issued under the *Nature Conservation Act 1992* to land clearing activities in the Pomona area. A draft Conservation Plan, issued in 1995, raised public and industry concerns about the mapping methodology and the criteria for defining critical habitat. Under the *Nature Conservation Act 1992*, critical habitat is defined as:

> Habitat that is essential for the conservation of a viable population of protected wildlife or community of wildlife, whether or not special management considerations and protection are required.

Unfortunately, two fundamental cornerstones of this definition are not readily apparent and make implementation difficult. First, the phrase "essential for the conservation of a viable population" cannot be clearly defined by "biophysical science" alone. Instead, this judgement involves both a scientific and social/political view about what is "essential". There is guidance in neither the statute nor regulation on this matter. This shortcoming requires attention in the future. The second issue concerns areas that can be mapped and relevant land use practices performed on both freehold and leasehold land. Where critical habitat is located on freehold land, the need to compensate landowners could have significant financial implications. Thus, there is a need to balance ecological ideals with financial realities in order that some effective action is taken. On leasehold land, land clearing is subject to a permit under the *Lands Act 1994*. Since permits should be refused in areas of critical habitat and there is no 'loss' to the leaseholder, no compensation is needed. The critical habitat maps should form the basis for identifying relevant areas in local Planning Schemes. At present, these maps are produced at a scale (1:50,000) that precludes their use at a property-specific level. This limitation, combined with the need for an ongoing dialogue with farmers, highlights the need for well-qualified and well-rounded field staff.

During the period of study, 143 applications were submitted to the Local Board that covered 691.9ha of Mahogany Glider habitat (Figure 5.7 and Table 5.3). Forty-one of these applications were made in 1996, after the Pomona controversy. However, a significant amount of uncertainty

remains. It is unclear that the Mahogany Glider is endangered. Since habitat maps that have been produced after 1996 have identified different habitat boundaries, the credibility of the 'science' has been questioned. The adequacy of the Condition of Assignment (Table 4.1) that indicates a 10m riparian zone of native vegetation maintained along watercourses is also questionable. Not only is it difficult to enforce, but some farmers clear land prior to their application for assignment (called pre-emptive clearing). In these cases, there were no effective laws in place during the study period to prevent this activity.

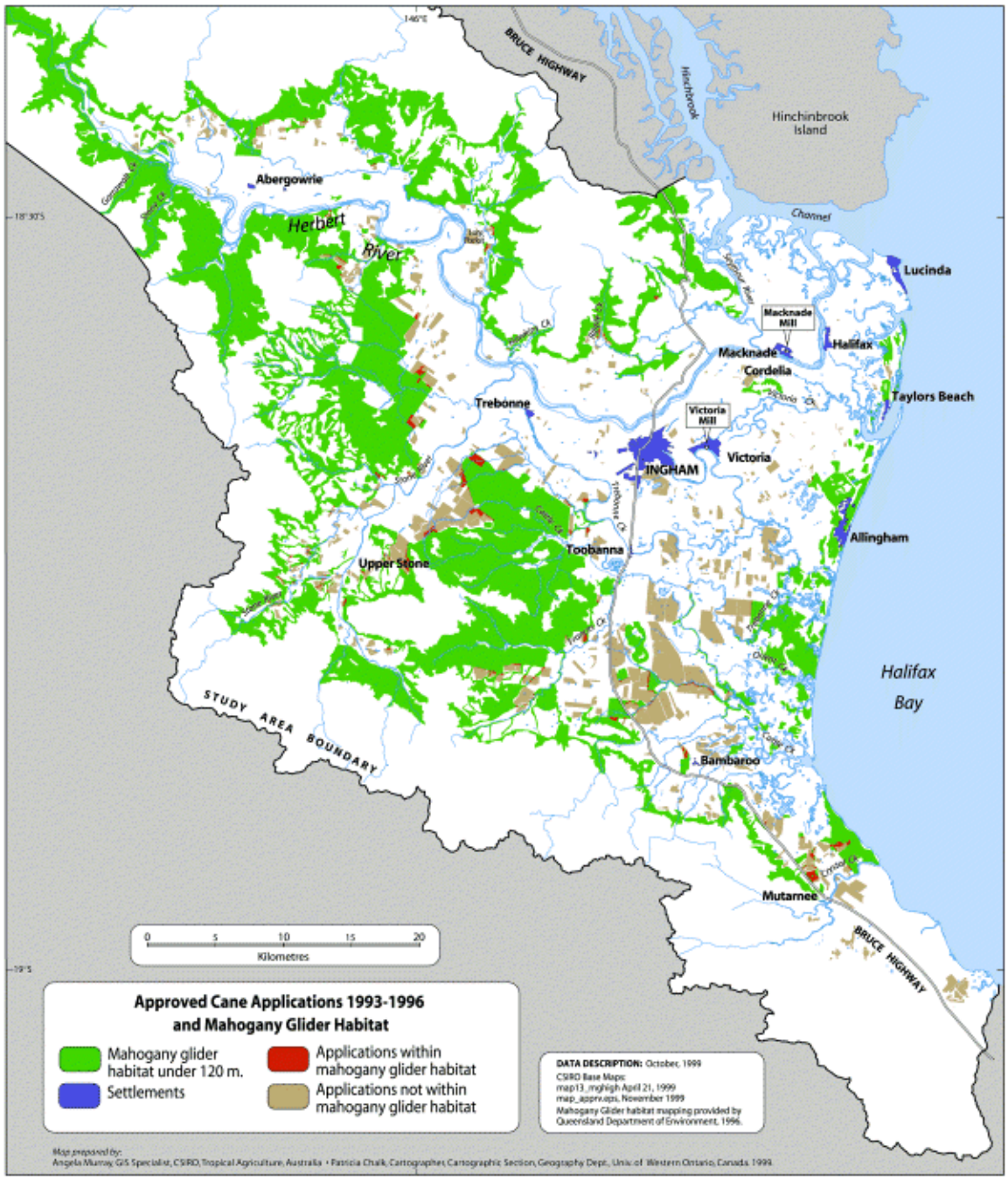

Figure 5.7 Location of assignments awarded relative to mahogany glider habitat.

Altering the timing of the call for assignment applications could reduce the perceived need for applicants to clear their land in a pre-emptive manner. At present, the timing of the decision-making process may support this activity and its negative ecological outcomes. Announcing final assignment decisions in the summer months as was done in 1995 can have such an effect. For many growers in the Herbert River district, land clearing is perceived to be most convenient, easiest and cheapest in February - March while the harvest is three months away and the ground

is moist. This period also provides sufficient time to plant a crop and harvest it in the next season. Between 1993-1996, specific announcement dates have varied. They have primarily reflected administrative requirements rather than an applicant's needs and environmental conditions. This timing, when combined with a farmer's potential need to make payments on any necessary loans and a perception that Local Boards favour applicants who can provide cane to the mill quickly, often promotes land clearing and planting before the announcement of assignment grants (*i.e.*, pre-emptive clearing). This perception is created, in part, by the application form which asks the area of land that is cleared, uncleared, partially cleared and under cane (Appendix 1).

Table 5.3 Location of applications relative to Mahogany Glider habitat as defined by QDoE (1996). Figures shown for applications with spatial representation.

					Mahogany Glider Habitat Area					
	Total Applications		Total Approved		Total Overlapping		1996 Approved		1996 Denied	
Year	Number	Area	Number	Area	Number	Area	Number	Area	Number	Area
1993	199	3980	199	3705	53	132	0	0	0	0
1994	77	2849	77	2704	16	188	0	0	0	0
1995	87	2185	87	2155	33	151	0	0	0	0
1996	109	6001	87	3602	41	222	30	167	11	56
Total	472	15013	450	12165	143	692	30	167	11	56

Note: Area figures are in hectares.

The review of applications for the 1993-1996 period suggests that many applicants have substantial areas of partially cleared or cleared land (50%+), and some applicants (10%-15%) have some cane planted at the time of application. Pre-emptive clearing can negate or reduce the applicability of subsequent conditions placed on an approved assignment. If the application were refused, it could place a farmer in some financial difficulty. One adjustment would be to impose penalties for the pre-emptive clearing of land through the assignment system. However, this approach alone would not respond to the needs of applicants. In addition, the high level of enforcement required is beyond the capacities of existing public agencies to staff and would be contrary to the partnership principle. The sugar industry seems to be unwilling to adopt this enforcement role. A more consistent approach to reduce pre-emptive clearing is by announcing assignment decisions when farmers are most likely to undertake these activities. Another option could require the granting of clearing permits from QDNR prior to receiving assignment.

It was noted earlier that 1997 applications were due 30 June 1996, and assignment awards announced in September 1996. While this adjustment could assist in reducing pre-emptive clearing, it is unclear how effective it will be in the Herbert River district. The majority of local interview respondents specified that announcements should be made in the February period. Since soil moisture, precipitation patterns and farmer practices vary throughout the state, the most effective approach may require application and announcement dates to be based on a regional or mill basis. This represents a shift from the present practice that applies the same administrative timing across the state. Its feasibility should be considered in the context of essential administrative requirements.

Recommendation: Legislative and voluntary initiatives be undertaken to reduce the clearing of valued habitats. Reduce the perceived need for pre-emptive clearing by adjusting the timing of the assignment process. In the Herbert River district, this would see the announcement of assignment awards in the February. Require applicants to obtain clearing permits from QDNR prior to receiving assignment on freehold land or leasehold land.

Action required by: Local Boards (Cane Protection Boards), Shire and QDNR.

In addition, raising the current level of grower's environmental awareness would be beneficial. The CANEGROWERS' audit found that about 23% of farmers were unaware of any industry Codes of Practice (Figure 5.8). About 37% cited Work Place Health and Safety, and 26% cited chemical codes as the most significant reasons that prompted the need farm operations to be concerned about the environment. There seems to be an extremely low level of awareness about environmentally sound procedures for, and impacts of, land clearing. While the audit indicated that a farmer would not knowingly implement farm practices that would undermine their ability to produce sugarcane, there was a general lack of understanding about long-term, broad-scale effects. This shortcoming lead some farmers to clear trees to the edge of gullies; maintain bare earth drains rather than grassed ones; and continue the use of down slope rows rather than contour ones. GHD (1996, 22) believed that a concerted education program was required "to bring to the attention of farmers the benefits of investing a small amount of effort in changing practices to maintain an environmentally sustainable farm operation."

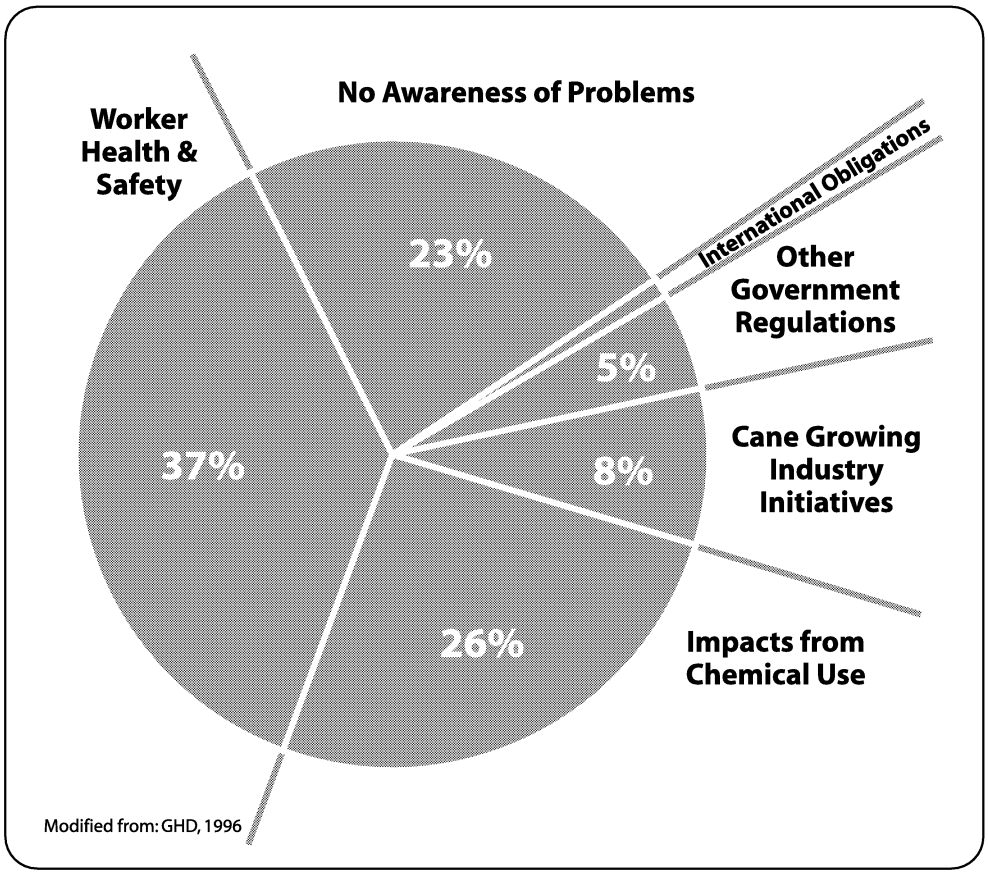

Figure 5.8 Growers level of environmental awareness.

While the audit team found that grower attitudes in the Herbert River district were more progressive than many areas of the State, in general, industry attitudes were characterised as:

> rather insular "assignment-limited" attitudes towards the environment demonstrates a lack of awareness of the wider State and national concepts such as Landcare, ICM, farm plans, revegetation and remnant protection programs, Property Management Plans (PMPs), national strategies on weeds and the management of vertebrate pests, more efficient pricing, water conservation measures, improvements in technical advice and training and ESD programs (GHD, 1996: 23).

The fact that the Herbert River district was viewed as an "isolated pocket" of a progressive attitude in a sea of ignorance and indifference has particular significance. Any shortcomings in

the Herbert River district will be even more significant in the rest of Queensland. The CANEGROWERS' leadership was challenged by the audit "to develop a performance measurement and reporting system for district offices regarding effectiveness of performance and local contact programs" (GHD, 1996: 18). Part of that performance indicator could reflect the assignment process. A preliminary approach is provided below. As noted earlier, by 1996 the Conditions of Assignment and the referral mechanism were well developed in the Herbert River district (Table 4.1). Both the Local Board and Environmental Advisory Committee agreed that no development would occur:

- below 3m ASL or slopes greater than 3%
- in soil suitability classes 4 and 5 for cane growing
- in areas prone to acid-sulphate soils, without an appropriate management plan prepared.

An initial assessment based on these measures can be conducted for the 1996 year (Table 5.4). The data suggest that only two applications were made from properties that entirely or partially contained unsuitable soil. Approval was given on condition that the areas of unsuitable soils not be farmed. Forty applications were from areas that were below 3m ASL or had slopes greater than 3%. Seventeen applications were granted approval on condition that the QDPI be consulted and/or land below 3m ASL be excluded from production; 17 were approved without these relevant conditions being applied; and six were denied. In areas identified as potentially acid sulphate prone, six applications were approved with the relevant condition (Table 4.1), one was approved without the condition applied and one was denied. Given the scale of the mapping and relatively low level of activity, these levels of approval, conditional approval and denial should not cause too much concern. The maps are unable to provide site-specific information. Since the computer-based mapping used in this present report was not available to the Local Board and EAC, these results are encouraging. Local knowledge combined with field checks seems to have served the region well although there are some isolated problems with acid sulphate soils.

Table 5.4 Profile of Conditions, Comments and Decisions for 1996 Applications according to selected locational characteristics.

	Overlapping		**Not Overlapping**		**Overlapping Area Details**							
Locational ~	**Total Applications Submitted**				**Applications Approved**		**Condition Applied**		**Condition Not Applied**		**Application Denied**	
Characteristics	**No.**	**Area**	**No.**	**Area**	**No.**	**Area**	**No.**	**Area**	**No.**	**Area**	**No.**	**Area**
3m ASL or slope > 3%	40	2047	69	1783	34	1819	17	1324	17	495	6	228
unsuitable soils	2	28	107	3581	1	21	1	21	0	0	1	7
potential acid sulphate soils	8	434	101	3310	7	292	6	285	1	7	1	142
Mahogany Glider habitat	41	2484	68	1735	30	1867	4	985	26	882	11	617

Note: Area figures are in hectares.

What is somewhat disturbing, however, is the relatively high incidence of awards located in areas of Mahogany Glider habitat that failed to have the relevant condition attached to it (Table 5.4). While 11 applications were denied in these locations, 30 were approved and only 4 required the 10m buffer of native vegetation be maintained along watercourses (Table 4.1). This reinforces the comments made in the CANEGROWERS' audit that noted the importance of education programs targeted at farmers. Indeed, this program should be extended to members of the Local Board. The data contained in Table 5.4 implies that 'functional resource issues' such as soil suitability, slope, and the potential risk of acid sulphate soil hazards are afforded more credibility than 'natural environmental issues' such as Mahogany Glider habitat. This attitude seems inconsistent with ESD and the intent of the Conditions of Assignment.

The inconsistent and relatively poor application of identifying the Mahogany Glider habitat as a Condition of Assignment on individual awards reflects, in large part, a difference in values between the Local Board and the EAC. Many of the criteria identified in the Conditions of Assignment (Table 4.1) reflect functional values; that is where is a significant risk to water quality or land degradation. These risks can affect the long-term viability of a grower's operation. The Mahogany Glider issue reflects an environmental value that is perceived to pose no significant risk to human health or farm operations. Part of the problem may also be associated with the lack of accessible information when decisions were made. Given the publicity that was associated with the land clearing in the Pomona area, there is no doubt that all participants were aware of the Mahogany Glider issue.

A more assertive stand on this type of environmental issue could demonstrate the type of leadership that GHD (1996) believed was necessary if the sugar industry was to distance itself from the "legacy of the past." In this context, the adequacy of the Conditions of Assignment must be questioned. The EAC and Local Boards could benefit from an open and public discussion about the adequacy of current Conditions of Assignment. Similarly, these issues could be better dealt with under *IPA*. However, as mentioned in Section 5.2, *IPA* has a number of deficiencies. In particular, its apparent inability to deal with cumulative impacts and variable environmental provisions in Shire Planning Schemes remains problematic.

At a broader level, a number of complementary options are available to the sugar industry to support specific provisions embedded within the assignment process:

- Legislative and voluntary initiatives could be developed and implemented to reduce the clearing of valued habitats. Motivational and voluntary incentives have already been used in some cane growing regions, and include activities such as ICM. Hence motivational incentives must be a core mechanism for improved natural resource management. Two examples of a potential application would include:
  - The identification of agreed wetland and riparian areas in cane growing catchments to underpin negotiated agreements among land holders, government and the broader community on buffer setback widths. This activity would preferably be embedded and implemented within a broader catchment planning exercise undertaken as a partnership among government, the sugar industry and the community; and
  - The establishment of voluntary conservation agreements between cane growers and government under the *Nature Conservation Act (1992).*
- Conservation covenants are particularly effective in protecting remnant vegetation or wetlands, and can be use to underpin approaches such as management agreements. The use of conservation covenants can also be linked to other incentives, for example, the local government rating systems (for rate relief purposes), to recognise the value of uncleared land.
- Although some protection for natural resources is currently afforded by planning controls embedded within a number of state laws, problems exist in areas subject to the provisions of the *Water Resources Act 1989*, or on land with freehold tenure. An increasing regulatory role for Local Government (*e.g.* through the invocation of planning controls if consent is required for subdivision, zone change and drainage development) provides some opportunity for improved natural resource management. Some of these issues are presently being addressed in the revised planning schemes of Noosa, Hinchinbrook, Cardwell and Johnstone Shires. However, for improved management to occur, greater integration among local and state government, industry and the community must be a priority.
- Opportunities also exist for the implementation of financial incentives for retention and management of high value habitat areas in cane growing regions to be dedicated as Nature Refuges or Coordinated Conservation Areas. Finally, government acquisition of riparian areas and wetlands of regional, national and international importance remains an option.

5.5 Enhancing the Principle of Balanced Decision Making

The essence of balanced decision making is to integrate economic, social and environmental considerations. Three views of balance are provided: (1) shape analysis, (2) analysis of assignment decisions, and (3) assessment of the decision-making structures.

5.5.1 Shape analysis

How concentrated or dispersed development occurs is an important issue. In order to examine this aspect, analysis as described in Section 3.5 was undertaken in order to determine the shape of the sugarcane growing area over time (Figure 5.9). The ellipses shown in Figure 5.9 contain 60% of the cane growing area. The summary analysis statistics that support the figure are provided in Appendix 2.

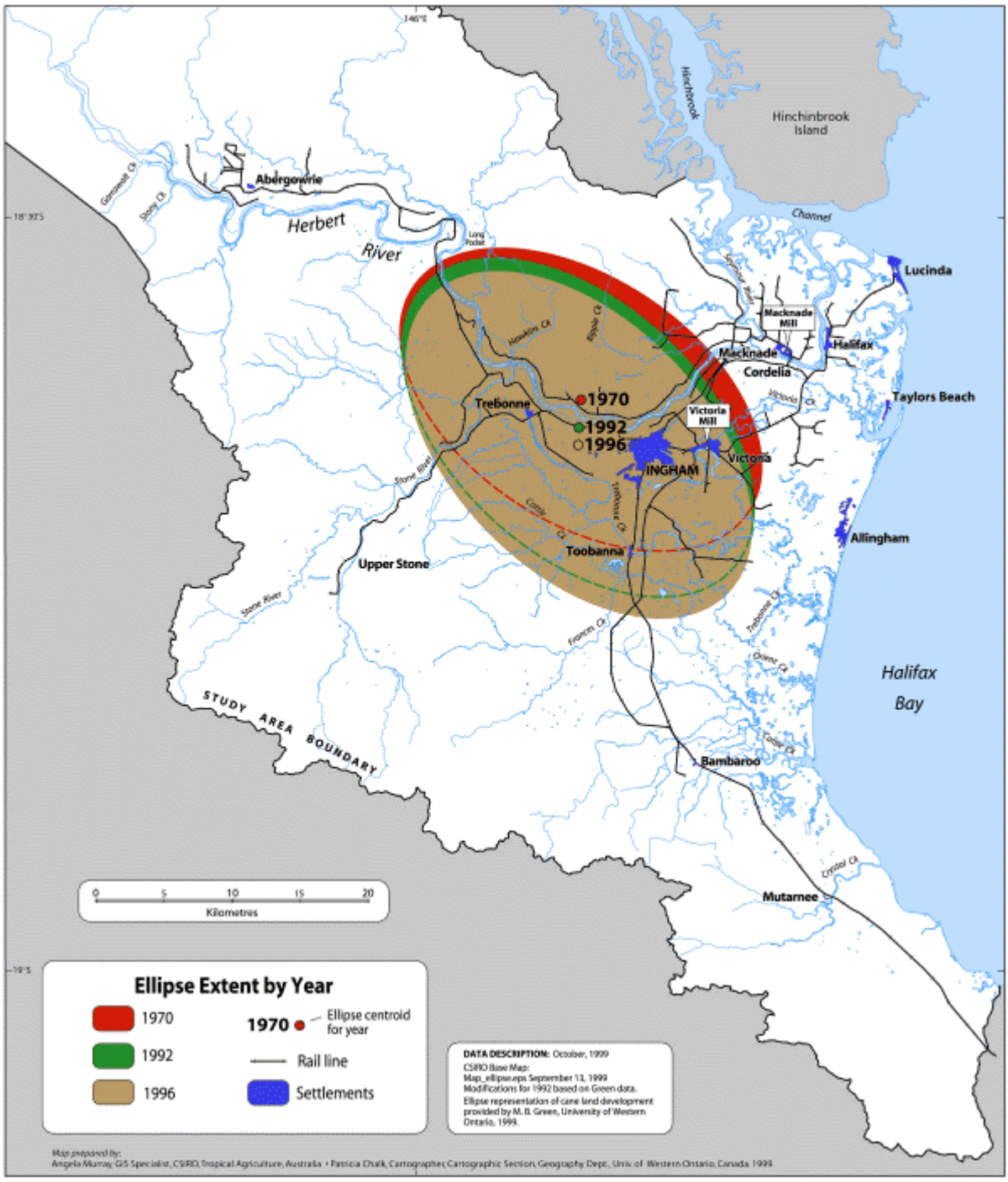

Figure 5.9 Land cover changes in the lower Herbert River district: 1970, 1992 and 1996.

The analysis suggests that development has and remains to be relatively concentrated as illustrated by the more circular rather than linear shape. Figure 5.9 suggests that the direction of development has changed over time. The first period of development was between 1970 and 1992, the period prior to the introduction of the *Sugar Industry Act 1992*, when significant changes occurred with respect to the general movement of the district. This change occurred when the rate of annual increase was relatively modest compared with more recent expansions (Figure 3.4). Between 1992 and 1996, the ellipse shape has moved further southwest. Its general shape is about the same as that which existed in 1970. This suggests that for 1970 and 1992, the cane growing area has remained at the same level of concentration. The smaller size of the area of the ellipse also implies that some infilling near the centroids has occurred. However, since the centroids have moved to a limited degree, it is difficult to comment conclusively on this issue. However, there is no doubt that concentrated development allows for efficient use of the cane tram and road network. The analysis clearly indicates that over time there have not been radical changes in the either the orientation or compactness of sugarcane cultivation. This is consistent with incremental change, which certainly seems to characteristic of the assignment process. On this basis, the pattern of expansion between 1992 and 1996 did not reflect a significant change from past practice.

It is noted that the mill locations are not near the centre of the ellipses for any of the years noted in Figure 5.9. This has implications for the transport network and may be worthy of further investigation.

5.5.2 Statistical analysis

As described in section 3.4, a statistical analysis was conducted in order to determine what variables were associated with final assignment decisions: those applicants that received 100% of their application request, those that received less than 100% of their application request, and those who were denied their request. For the years 1993 and 1994, the following five variables were studied: (i) the area of land applied for, (ii) the type of farmer (new, existing), (iii) land tenure, (iv) current assignment. None of these were positively correlated with the Approval Rate. Since the approval rate for 1995 was nearly constant at 100%, it was not analyzed. There were no significant factors in the logistic regression of the above 11 factors for Macknade Mill in 1996. The data for Victoria Mill in 1996, with all of the above 11 factors, were subjected to stepwise logistic regression (both forward and backward) and a subset of five significant factors was identified, as indicated in Table 5.5 below:

Table 5.5 Logistic parameter estimates.

Factor	Estimate	Standard Error	Chi-Square (df=1)	Pr > Chi-Square
A	-1.3292	0.5153	6.65	0.0099
Y1	2.0543	0.4977	17.041	0.0001
PY	-1.1708	0.4838	5.86	0.0155
NR	-1.3225	0.4537	8.50	0.0036
DV	1.4281	0.4787	8.90	0.0029

A table of the frequencies associated with the 2 levels of the above five factors and the 3 levels of the Approval Rate (i.e. 100%, <100%, 0) variable are given in the Table 5.6 below for Victoria Mill in 1996:

A positive sign for the estimates of the factors in Table 5.6 indicates that they contribute to increasing the Approval Rate. Consequently, we see that high percentage amount planted in year 1, and high distance to Victoria Mill are both associated with an increase the Approval Rate. Similarly, higher levels of amount Applied For, the number of years intended for planting and the Nearest Rail Distance are associated with lowering the Approval Rate.

Table 5.6 Frequencies for Victoria Mill in 1996.

	Approval	Denied	Received < 100% of request		Received 100% of request	
Level	0	1	0	1	0	1
A	14	10	16	17	48	2
Y1	21	3	26	7	18	32
PY	6	18	9	24	37	13
NR	9	15	20	13	37	13
DV	22	2	20	13	28	22

These last comments are only applicable to one year and one mill. However, they may be indicative of some of the mechanisms used in determining final sugarcane assignments. The logistic regressions have been performed on simplified codings of the predicting factors, and no interaction terms have been included in the regression equation. These interactions and other non-significant effects may be confounded with the resulting subset of important factors for Victoria Mill in 1996. A more detailed data set may provide more conclusive evidence of any strong predictors of the how approval rate is determined. However, this analysis suggests that environmental factors were not significant in determining awards for 1996. This conclusion raises questions concerning the achievement of balanced management.

5.5.3 The Environmental Advisory Committee and the Assignment Process

The formation of the Environmental Advisory Committee (EAC) and the development of the Conditions of Assignment (Table 4.1) reflect the Local Boards' primary responses to the requirement. Through these mechanisms, the Local Boards and the QSC are satisfied that assigned land is "prepared and used for the growing of sugarcane without undue damage to the environment" (*Sugar Industry (Assignment Grant) No.2) Guideline 1995*, Section 8(1)(e)). Prior to the formation of the EAC, there were few opportunities for views outside of the sugar industry to be expressed. While the Local Board and the members of the EAC should be given credit for its implementation, it provides only modest opportunities to significantly influence decision making. This shortcoming was also identified in the CANEGROWERS' environmental audit (GDH, 1996).

One way of considering balanced decision making is to return to the idea of the different levels of decision making - normative, strategic and operational (Section 4.1.1). The EAC is focused on operational level decisions and has no influence at normative and strategic levels. This situation can lead to a conclusion that suggests that this form of participation is little more than tokenism, because many important decisions are already made before the operational phase is reached. In the sugar industry, normative and strategic decisions are made through international agreements (*e.g.* GATT), corporate strategies (*e.g.* shareholder meeting, investor decisions), and regional plans (*e.g.* Continuous Crushing Agreement) (Figures 4.2 and 4.4). To enhance balance, efforts are required by both public and private managers at normative, strategic and operational levels of planning to better consider environmental, social and economic issues at all geographic scales.

The "Continuous Crushing Agreement" represents an important strategic level of decision making in the sugar industry because it reflects both producer and grower perspectives. At present, production and crushing capacities, future growth and transport planning are addressed through the "Continuous Crushing Agreement". It provides a basis for medium-term planning at the regional level. In the Herbert River district, the agreement notes that over an unspecified time period, the amount of assigned land could reach 100,000ha (Agreement, 1995). In planning for forthcoming expansions, it was agreed to work together to determine a forecast area of new land to be harvested in the following year by early July in each year. Based on this area and the cultivated area recorded for the current season, and using the five-year average rotation for

harvest (which included the estimated area for harvest for the current season), the district forecast area for harvest in the next year can be determined; and that

> ... CSR undertakes that crushing capacity will be available for the processing of the whole district crop yielding up to 83 tons per hectare over the forecast area for the harvest determined ... at CCS levels of up to 14.0 units, within the target season length.

The "Continuous Crushing Agreement" is the key strategic planning document which guides cane expansion in the Herbert River district. At present, it essentially matches projected increases in crushing and transport capacity to production capacity. It is corporate goals and the ability of the mill to crush cane that primarily influences the nature of the "Continuous Crushing Agreement". Despite the many changes that have occurred in Cane Assignment and Land Use Planning processes since 1996, none appear to have a direct influence on neither corporate goals nor the "Continuous Crushing Agreement" (Figure 5.2). This situation has implications for the nature of conflict resolution.

Presently, international agreements and the "Continuous Crushing Agreement" favour economic and corporate goals. These goals establish the context that drives the cane assignment process (Figures 4.2 and 4.4). In short, the task of the assignment process is to ensure that cane production, that does not degrade the environment, meets mill capacity. The outcome of this decision-making structure relegates the environment, as well as the concerns of local government, to an accommodative or reactive position relative to these primarily economic considerations. Environmental factors are incorporated explicitly through the referral of assignment applications to the EAC. In addition, some applicants may contact relevant government officials about the preparation of Property Management Plans or similar advice. However, at this level of decision making, the ability of environmental interests to influence the cane assignment process is limited.

When a conflict concerning assignment has occurred, "environmentalists" have sometimes questioned why the assignment was granted in the first place (*i.e.* strategic question). In contrast, the "sugar industry" has asked the EAC to identify what mitigative measures or Conditions of Assignment (Table 4.1) would adequately support sugarcane development (*i.e.* operational question). This difference illustrates the difficulties in trying to achieve balanced decision making late in planning processes. Once economic goals (*e.g.* mill capacities, corporate profit targets) are established, it becomes difficult for a person to raise other legitimate issues and be perceived as a "constructive" participant. In addition, these discussions are periodic, rather than ongoing. If decisions are to be more balanced, there is a need for the cane allocation process to effectively consider the "environment" earlier in the decision-making process, and on an ongoing basis.

In considering the principle of balance, it is also appropriate to incorporate the concerns of local government. As noted in Chapter 4, the Hinchinbrook Shire Plan (1984) was predominated by the "rural use" designation that precluded the Shire from reviewing proposals and initiating environmental assessments. It also failed to provide for a contemporary view of environment-development linkages. During the study period, the Local Boards in the Herbert River district did not refer cane land expansion within the rural zone to the Shire. Therefore, the Shire received very little information and its Strategic Plan (1984) had very little influence regarding the cane expansion process and its final decisions (Figure 5.1).

Given the Shire's responsibilities, this situation is unfortunate and perplexing. The development of sugar-related rail and road systems impact on the Shire's drainage works. The Shire is obligated to maintain these roads once they are developed. All these associated developments are treated "as a right" which precludes their formal review through the impact assessment provisions of the *Local Government (Planning and Development) Act.* This is in contrast to other statutes, such as those related to transportation that provide for the Shire's full participation. Thus, the effects that cane land expansion have on land valuation, drainage flows and road maintenance costs - all responsibilities of the Shire – are addressed through the transport planning process. However,

local government is poorly informed during the assignment process and does not participate in the discussions concerning the development of the "Continuous Crushing Agreement". Social impacts are also overlooked in the existing process. There is no representation from the Social Impact Assessment Unit (Queensland Department of Family and Community Services) or Shire on the EAC that could assist in enhancing the balance of decision making. While opportunity for these issues to be addressed under *IPA* exists, it is unclear whether this will occur in practice.

This situation could be addressed to some extent by broadening the participant base of the "Continuous Crushing Agreement". For instance, medium-term expansions could better incorporate environmental and social issues that identify both constraints and opportunities for growth. The recent establishment of the Herbert Resource Information Centre should facilitate this type of planning. In addition, through the CANEGROWERS, Shire and the Queensland Department of Families, Youth and Community Care, social issues related to the role of the family farm, as well as economic and environmental considerations could guide medium-term expansions. This mix of issues could be incorporated into mill expansion and transport planning activities and alternative assignment options assessed using tools developed by researchers in the Sugar CRC (*e.g.* Walker and Johnson, 1998). In this manner, Local Boards could better consider and communicate to potential applicants the relative weight that both the industry as a whole and existing cane growers give to specific decision criteria. It could also make an explicit statement that ensuring the viability of family farms would be given preference, or that future expansion would favour specific locations. At a corporate level, CSR could ensure that its corporate strategy effectively embraces the "green" values that it stated in Chapter 4. The common element in these initiatives is to introduce environmental and social issues earlier in the cane assignment process.

The sugar industry's rhetoric about ESD principles (Table 4.2) suggests that the ecological dimensions of policy are on a par with economic and social concerns. The evidence presented above suggests that this balance is inadequately achieved within the cane assignment process. The fact that a former 'routine process' has come under significant public scrutiny suggests that current practices are inadequate. The CANEGROWERS' audit supports this conclusion when it suggests that many non-farm respondents questioned the integrity of the assignment process and perceived that Local Boards acted "too quickly" (GHD, 1996: 6). They also noted that QDoE (now QEPA) and QDPI have had little input into the process. They believed that no mechanisms were in place to avoid and address the potential undue environmental damage. From this perspective, these are what Dovers (1997) termed non-systemic sustainability problems that can be solved, in part, be improving the information base and improving existing institutional arrangements at the margins.

However, the problems currently experienced by the sugar growing industry also reflect more deeply rooted or systemic sustainability problems. Part of the problem is related to the intractable policy problems that implementing ESD poses for resource policy makers and managers. Some of the characteristics that make the environment a difficult policy issue relative to economic and social policies, include temporal scales that exceed those determining policy and management attention, broadened spatial scales, irreversibility, complexity, ignorance and uncertainty, cumulative impacts, shifting social values and economic circumstances, and changing urgency, both perceived and real (Dovers and Lindenmayer, 1997). These difficulties are particularly evident in systemic problems such as climate change and biodiversity, rather than discrete projects or routine activities. Having corporations adopt more transparent decision-making in order that the weight applied to environmental, social and economic factors is clear and direct requires a fundamental change in current practice. It is also incumbent on the non-corporate sector to better understand the need for an adequate profit margin.

These statements as well as the evidence provided in this report suggest the need for a more

balanced decision-making process. It is beyond the scope of this study to consider the corporate adjustments required from sugar producers such as CSR. However, one step towards that principle is to recognize the different levels of planning, and to ensure that opportunities for participation at all levels are provided. At a minimum, those state and local government agencies, whose programs may be impacted by sugarcane awards, should have adequate opportunity to influence decision making. This objective can be achieved by broadening participation in the "Continuous Crushing Agreement" to the views of relevant government agencies, local government and the public. The desirability and effective management of cane expansion could be more broadly considered from economic, environmental and social perspectives. In this manner, the sugar industry would enhance the development of a balanced perspective earlier in the planning process, and ideally reduce current levels of frustration, time, and resources required to resolve conflicts.

Recommendation: Provide for the earlier consideration of environmental and social factors in the cane assignment process through existing mechanisms such as "Continuous Crushing Agreements" and corporate policies.

Action required by: Local Boards (Cane Production Boards), CANEGROWERS, and CSR.

5.6 Enhancing the Partnership Principle

Partnership was a third important principle of sustainable development. It is believed that by consulting with people living in a region who will be affected by a decision, it is possible to:

- define the problem more effectively;
- access information and understanding that fall outside an agency's technical expertise,
- identify solutions that are socially acceptable; and
- create a sense of ownership for the decision which facilitates effective implementation (Mitchell, 1997).

The extra time and energy needed to provide for effective participation can be a source of frustration and criticism for decision-makers. However, a lower level of conflict and more effective implementation should reward this effort.

The establishment of the EAC was the mechanism to provide for more formal communication between the Local Boards and those government and industry representatives who had an interest in "environmental" issues. However, the manner in which this referral has been implemented (Figure 4.4) has many of the previously described shortcomings associated with the 'Solomon Trap' (Figure 3.1). Members of the EAC can feel betrayed and frustrated when their recommendations are not acted upon because there is ineffective two-way communication. In cases where there are differences of opinion between the EAC and Local Board, the latter was under no obligation to inform the former of why it rejected an EAC recommendation. In addition, the Local Board was not required to inform the QSC that a difference of opinion existed at all. These differences of opinion can occur at two levels and pertain to: (i) areas that are suitable for cane expansion; and (ii) individual applications.

By 1995-1996, the Local Board had developed a list of Conditions of Assignment that could be placed on an award (Table 5.7). These would be supported by the provisions of the *Sugar Industry Act*. However, by that time, the EAC had also developed a list of biophysical criteria that identified unsuitable land for sugarcane expansion that differed from those established under law (Table 5.7).

Major differences of opinion between the two groups relate to two issues. The EAC viewed expansion below the 9.5m level in Cattle Creek and in Mahogany Glider habitat areas as undesirable. The Local Board did not share this view.

Based on the criteria noted in Table 5.7, Figure 5.10 identifies areas that both groups believe as desirable and undesirable for cane expansion, as well as areas of disagreement – where only the EAC believe that land is unsuitable. The location of lands that were awarded assignment in the area of disagreement is also shown. In order to provide a fair assessment of this analysis, the sequence of development should be placed in context. The Conditions of Assignment evolved over the study period (Table 4.1). In addition, the EAC commenced an initial review in 1995, and its membership was expanded in 1996. Therefore, Figure 5.10 largely provides a hindsight evaluation of expansion during the study period.

Table 5.7 Criteria for defining unsuitable land for sugarcane farming from Local Board and Environmental Advisory Committee (EAC) perspectives (1996).

Unsuitable land for sugarcane farming, according to the Environmental Advisory Committee
1. Stream buffers (40m/20m major/minor streams)
2. Water bodies, swamps and wetlands
3. Mangroves
4. Acid sulphate prone soils
5. Areas below 3m ASL
6. Soils unsuitable for sugarcane
7. Slopes of 3% or steeper
8. Mahogany Glider habitat
9. Areas below 9.5m ASL in the Cattle Creek subcatchment
Unsuitable land for sugarcane farming, according to the Local Board
1. Stream buffering (10m)
2. Water bodies, swamps and wetlands
3. Mangroves
4. Acid sulphate prone soils
5. Areas below 3m ASL
6. Soils unsuitable for sugarcane
7. Mountains or Hills (No soil suitability rating & no other constraint)

Note that tenures unavailable for sugarcane farming have also been excluded, including residential, industrial, national parks, reserves and Wet Tropics areas.

Development that occurred in the area of disagreement should not be considered as necessarily bad. However, it does highlight the need for effective site visits, strategic planning, Property Management Planning, and conflict resolution mechanisms between the EAC and Local Boards. It is the latter that is considered here.

Over 70% (8,655ha) of the awards granted during the study period occurred on land that both the Local Board and Environmental Advisory Committee were deemed suitable by both bodies (Table 5.8). About 7% (741ha) of the land was granted on land that both groups perceived as unsuitable. This last statistic is not viewed as a significant concern because scale of mapping used in the GIS is not appropriate to make site-specific comments. Field checks could better determine the appropriateness of these cane developments. Of greater concern to this report is the 2,768ha of development that occurred in the area of disagreement. This represented about 20% of development during the entire study period. More importantly, in 1996, over 1,400ha of the total assignment of 3,601.5ha (38.8%) were located in this region. In the absence of an open and transparent decision-making process and effective conflict resolution mechanisms, cane expansion in these areas may alarm government officials (and interested members of the public) who are concerned with drainage and habitat issues. It is these considerations that the Local Boards and EAC disagree on.

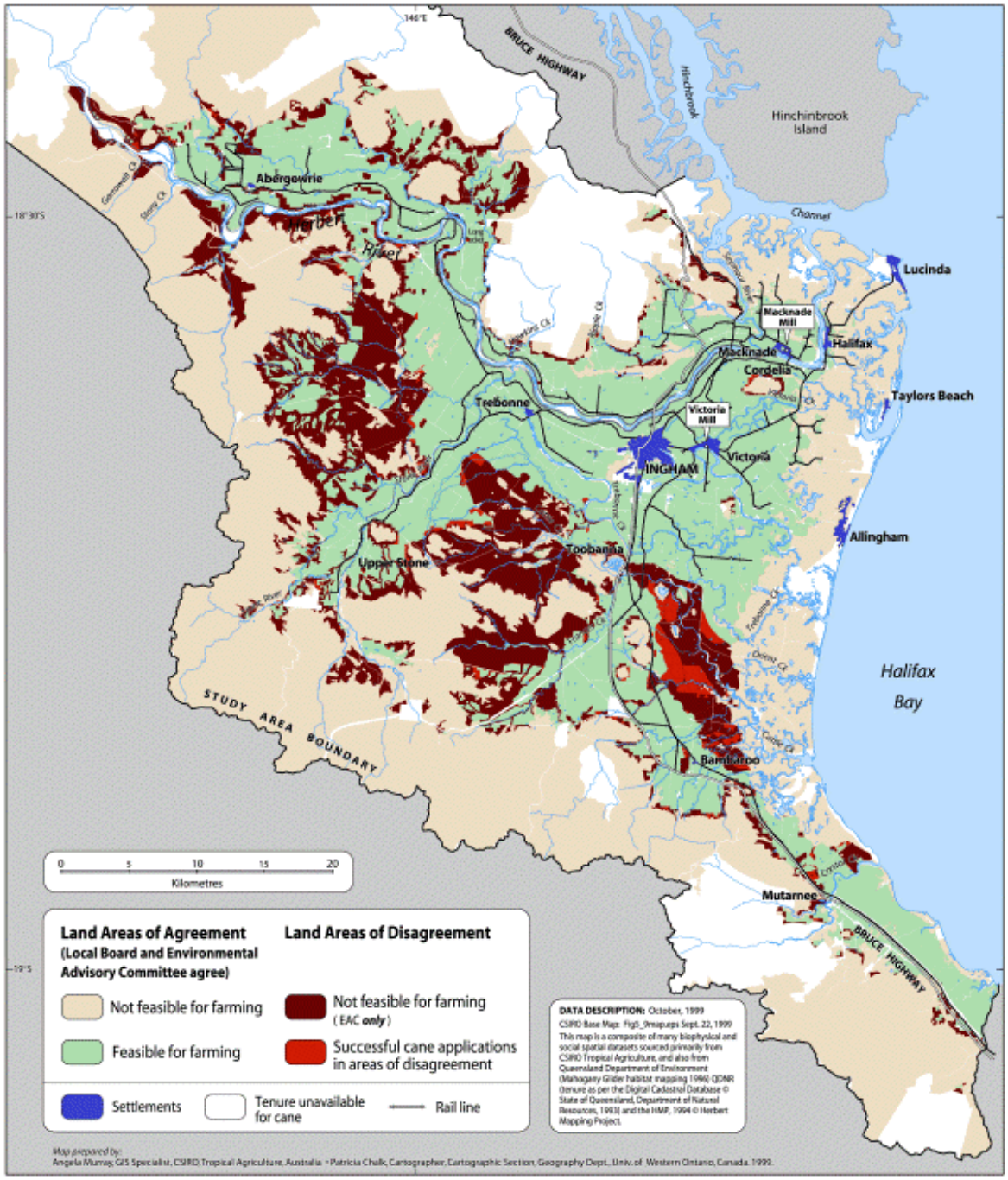

Figure 5.10 Land capability for sugarcane: Local Board and Environmental Advisory Committee perspectives (1996).

It is appropriate to note that the Hinchinbrook Shire Plan (1984) supported all the cane development that is shown in Figure 5.10 and Table 5.9. It was treated "as a right". However, the differences of opinion illustrated on Figure 5.10 reflect, in part, the evolution of values that have occurred since the writing of that document in 1984.

In the context of sugarcane assignment, this evolution re-enforces the need for continuous dialogue at strategic and normative levels of planning. Unresolved conflicts at these levels, combined with any unresolved issues concerning individual awards could result in increased levels of frustration and conflict. Since members of the EAC will likely have contact with those applicants who require a permit or seek their advice, this is potentially a very significant issue. Some members of the EAC were generally satisfied with the process, while others expressed some level of frustration. Members of the Local Board were generally pleased with the input from the EAC however, there is an absence of an unreserved and strong endorsement of the

current process. Any effort to remove some of the difficulties associated with the "Solomon Trap" would enhance the implementation process.

Table 5.8 Assignment decisions relative to Local Board and Environmental Advisory Committee (EAC) views of land suitability and tenure.

	Agreement				**Disagreement**	
	Local Board and EAC believe land is:				**EAC believes land is unsuitable:**	
	Suitable		**Unsuitable**		**Unsuitable**	
Year	**Number**	**Area**	**Number**	**Area**	**Number**	**Area**
1993	157	3255	199	171	16	279
1994	53	1787	77	70	9	847
1995	69	1734	87	180	9	240
1996 (approved)	58	1879	109	320	15	1402
Total	337	8655	472	741	49	2768
1996 (denied)	16	534	5	217	1	135

Note: Area figures are in hectares.

Differences of opinion concerning individual applications reflect operational level conflicts concerning at least three themes. First, it reflects the EAC's single focus on environmental criteria relative to the Local Board's legally required foci on economic, environmental and social factors. Second, it can indicate the greater importance given to other factors that was noted in the previous section. Third, it may imply a lack of credibility and indicate the high level of uncertainty, indeterminacy and ignorance in the technical aspects of resource management (Table 3.2). These will be discussed in greater detail in Section 5.7. In any event, the basis of final decisions is generally unclear to members of the EAC and others outside the process. A one-way exchange of information is supported through the present referral process. Even though assignments are awarded, conflicts concerning the desirability and feasibility of individual awards generally go unresolved.

In addition, the present length of time given to the EAC to review applications may be inadequate. Given that EAC members already have full-time demands from their employers and no accommodations were made to facilitate their participation, it would be appropriate to reconsider the length of time required to effectively review applications. On a positive note, the need for additional time may be reduced as a result of the establishment of the Herbert Resource Information Centre.

Current conflict resolution mechanisms are not clearly visible and effective. The two available approaches took the form of: (i) an informal "administrative pressure" that could be applied by the QSC in response to a comment/complaint by an individual applicant or EAC member; or (ii) a formal appeal to the Sugar Industry Tribunal. The QSC was likely to be unaware of differences of opinion between the Environmental Advisory Committee and Local Board on individual applications as well as feasible areas for future development (Figure 5.10). More effective dispute resolution mechanisms should be incorporated into the sugar industry legislation. While changes have been made in the *Sugar Industry Bill 1999*, resolution of disagreements relating to individual assignments remains problematic. This approach would raise awareness that a conflict exists. Based on this knowledge, appropriate responses could be determined. It would also serve as an incentive for Local Boards and the EACs to hold meaningful discussions that might resolve the conflict at the local level. At the time of writing, effective negotiations of this type are lacking. If these locally based mechanisms fail, decisions can be made through the existing mechanism – the Sugar Industry Tribunal – or through other forums that are not locally based. If the current situation is not addressed, these conflicts could prompt the need for more radical changes to the membership, responsibilities and powers of Local Boards, and their relationship with advisory

bodies. Some of these have been addressed in the *Sugar Industry Bill 1999*.

Recommendation: That the Environmental Advisory Committee and Local Boards members improve the present referral process. Industry wide, basic legislative amendments should support more effective communication between Environmental Advisory Committees and Local Boards. These should be codified in sugar industry legislation.

Action required by: Minister for Primary Industries, CANEGROWERS, Local Board (Cane Production Boards) and Environmental Advisory Committee.

Since there are many natural resource managers who are impacted by sugarcane assignment decisions, it is appropriate that their legitimate interests are raised, information shared and appropriate decisions made. Presently, environmental issues are addressed through the referral to the EAC. Miller and grower interests are very effectively considered through existing decision-making procedures. However, local government is directly impacted by decisions and is essentially excluded from the process. Expansion into new areas will often require road construction, which will eventually be maintained by local ratepayers. Roads and rail lines will affect drainage. All these items are of significance to the Hinchinbrook Shire. At present, no formal mechanism is available to provide it with information concerning the location of applications or final decisions. Unfortunately, its Strategic Plan (1984) provided little opportunity to effectively guide cane expansion (Figure 5.1).

As noted earlier, River Improvement Trusts can have notices placed on a land title when subdivision plans are approved. In the case of the Herbert River Improvement Trust, the shire is the only participating municipality. Given the concern over the maintenance of riparian corridors and the past legacy of individual and unapproved drainage works in the Herbert River catchment (Section 4.1), it is appropriate to consider similar mechanisms for the assignment process. The impact on local rates would be negligible. Possible cross-sanctions with the *Water Resources Act 1989* and the *Transport Planning and Coordination Act 1994* could also be provided. The consideration of social and economic aspects could be broadened and deepened through the Shire's participation. More timely notices concerning rate changes can be provided.

Recommendation: Better incorporate the Shire and other relevant participants into the assignment process. This could be accomplished through an effective referral process, observer status on Local Boards, full voting rights on Local Boards, or other appropriate mechanisms.

Action required by: Minister for Primary Industries, Local Board (Cane Production Boards), CANEGROWERS, CSR and Shire.

5.7 From Flexibility to Adaptability

One promising approach in environmental management is adaptive management. Pioneered by C.S. Holling and others, it emphasizes direct experimentation with policy initiatives, learning from experience and systematically adapting strategies in response to what is learned. Lee (1993) believed adaptive management begins with the premise that the complexity of ecosystems precludes sufficient understanding to base accurate predictions of cause and effect by policy makers and managers. In this instance, it is appropriate to design experiments, monitor results, and modify measures on the basis of feedback. The emphasis is on learning from the experience, rather than imposing solutions based on certain assumptions (Mitchell, 1997). Typically, when our traditional solutions fail, another one that is again based on uncertain assumptions replaces them. These are flexible solutions that are largely based on 'rules of thumb'. Adaptive management treats both natural and human systems as complex, uncertain, constantly changing, and non-linear. Learning from past experiences is a key feature.

Iles (1996) identified the five important features for adaptive management to operate effectively. First, monitoring systems must be established to track and evaluate environmental and social changes. Second, a framework needs to be established in which policy measures can be designed

and employed as hypotheses about whether specific actions are effective. Third, mechanisms need to be established that enable the constant revision of policies based on the feedback from monitoring. Fourth, mechanisms to sustain systematic and comprehensive learning need to be developed. Fifth, adaptive management needs the creation of supple and dynamically changing management structures and processes.

Institutional factors, uncertainty, lack of commitment, and reliability are obstacles confronting the widespread application of adaptive management. However, there are opportunities for both government and private participants to learn from past efforts. For instance, research questions concerning the productivity and management practices of land inside versus outside drainage board areas, or in marginal areas can be explored. The impact of varying widths of wildlife corridors can also be explored, as can be the reconstruction of native habitats. These suggestions are applicable across all sugar-producing areas of Queensland.

While the list of assignment conditions (Table 4.1) is a visible response, the effectiveness of its implementation will be unclear without effective monitoring. At present, enforcement is to be achieved primarily through the voluntary reporting of potential violations by individuals. This approach will be most effective for drainage and the maintenance of wildlife corridors that can affect adjacent landowners and are evident. However, failure to comply with elevation-based or soil-type based conditions is more difficult to detect. The recent introduction of the conditions makes it untimely in this report to consider their effective implementation. However, this question must be addressed in the future.

It is important to clarify the definitions of monitoring and auditing. While several have been offered (Tomlinson and Atkinson, 1987; Buckley, 1991) at least three are relevant to the sugar industry. *Environmental monitoring* involves the measuring and recording of biophysical, social and economic parameters associated with development impacts. This information should include traditional measures and causal factors. *Environmental impact auditing* considers how good were initial impact predictions (*e.g.* established in drainage plans or enhanced crushing agreements) or how effective were mitigative measures (*e.g* Conditions of Assignment). In contrast, *environmental management auditing* focuses attention on decision-making procedures for resource management and the associated legal obligations, risks and liabilities. Since all three forms of assessment are required and their breadth and depth of coverage is substantial, any efforts in this area must involve both the industry, public agencies, and other relevant participants. However, the Queensland Sugar Corporation must take the lead in this area and ensure that a credible process is established. Sugar mill technical staff, Cane Inspectors and the local Cane Supply Committee can also play an active monitoring role.

> **Recommendation: Immediately undertake discussions among all relevant parties that will develop an effective environmental monitoring network within the next two years. Within the next three years, conduct an environmental impact audit to examine the compliance, enforcement and effectiveness of Conditions of Assignment. Within the next five years, complete an environmental management audit. Effective and regular environmental monitoring should be an industry responsibility required under sugar industry legislation.**
>
> **Action required by: CANEGROWERS, Mills, Local Board (Cane Production Boards), QDNR, QDPI, QEPA, Shire, BSES, CSIRO and other research organisations.**

5.8 Enhancing the Precautionary Principle

It was noted earlier that applying the precautionary principle has more to do with shifting the burden of responsibility onto the proponents rather than stopping all forms of resource development. One element of the precautionary principle would support the previous recommendation to improve monitoring. However, more could be done to support the application of the precautionary principle through transferring more responsibility to proponents. Issues related to the management of Mahogany Glider habitat and acid sulphate soils demonstrate the challenges of moving the management system towards the precautionary

principle.

In the context of acid sulphate soils, government agencies have provided mapping at a scale of 1:100,000 (Figure 5.11). However, more detailed field studies are required to determine the presence and nature of on-farm problems. Little direction is currently provided regarding appropriate actions to be taken by applicants in response to this problem. However, it is reactive rather than proactive, and does not place primary responsibility clearly on the applicant.

Recommendation: Develop mechanisms that place more responsibility on applicants and the industry for determining the nature and extent of acid sulphate soils before the review of an individual application.

Action required by: CANEGROWERS, mills, and BSES to determine: (i) need for industry sponsored surveys which further the existing information base; and (ii) the need for and basis of cost-sharing arrangements which support appropriate soil tests during the application process. Relevant government agencies (e.g., QDPI, QEPA, QDNR) and research organisations (e.g., CSIRO) should participate in these discussions. This could be an important research frontier.

At present, many applications ranging in size from less than 1ha to over 1,700ha are made with little consideration of environmental issues. Without an effective water management plan for the entire lower catchment, a screening mechanism should be developed which requires the submission of a detailed Property Management Plan that addresses drainage and environmental considerations. This screening mechanism would identify those applicants who would be affected by this additional requirement, and could be based on such factors as location (*e.g.* relative to specified habitats, soil types, watercourses), area of existing assignment and/or area of assignment applied for.

As noted earlier, there were only eight applications in areas of potential acid sulphate soil (Table 5.4). However, the mapping of this soil type in the Herbert River district does not extend south of Crystal Creek. This shortcoming highlights the pressing need to fill this information void. It is unclear if appropriate field surveys were completed for new farms located in this unmapped area (Figure 5.11). If these were not, follow-up surveys may be needed to ensure appropriate remedial measures are taken. Given the areas low priority for state government funded surveys two options exist for filling this gap: (i) additional funding under the Commonwealth's NHT Program or; (ii) requiring proponents to fully fund survey costs.

Recommendation: Develop and apply an environmental impact screening mechanisms that identify applicants who must more carefully consider environmental and farm management issues with the submission of their assignment application.

Action required by: Local Board (Cane Production Boards), relevant government agencies, CANEGROWERS.

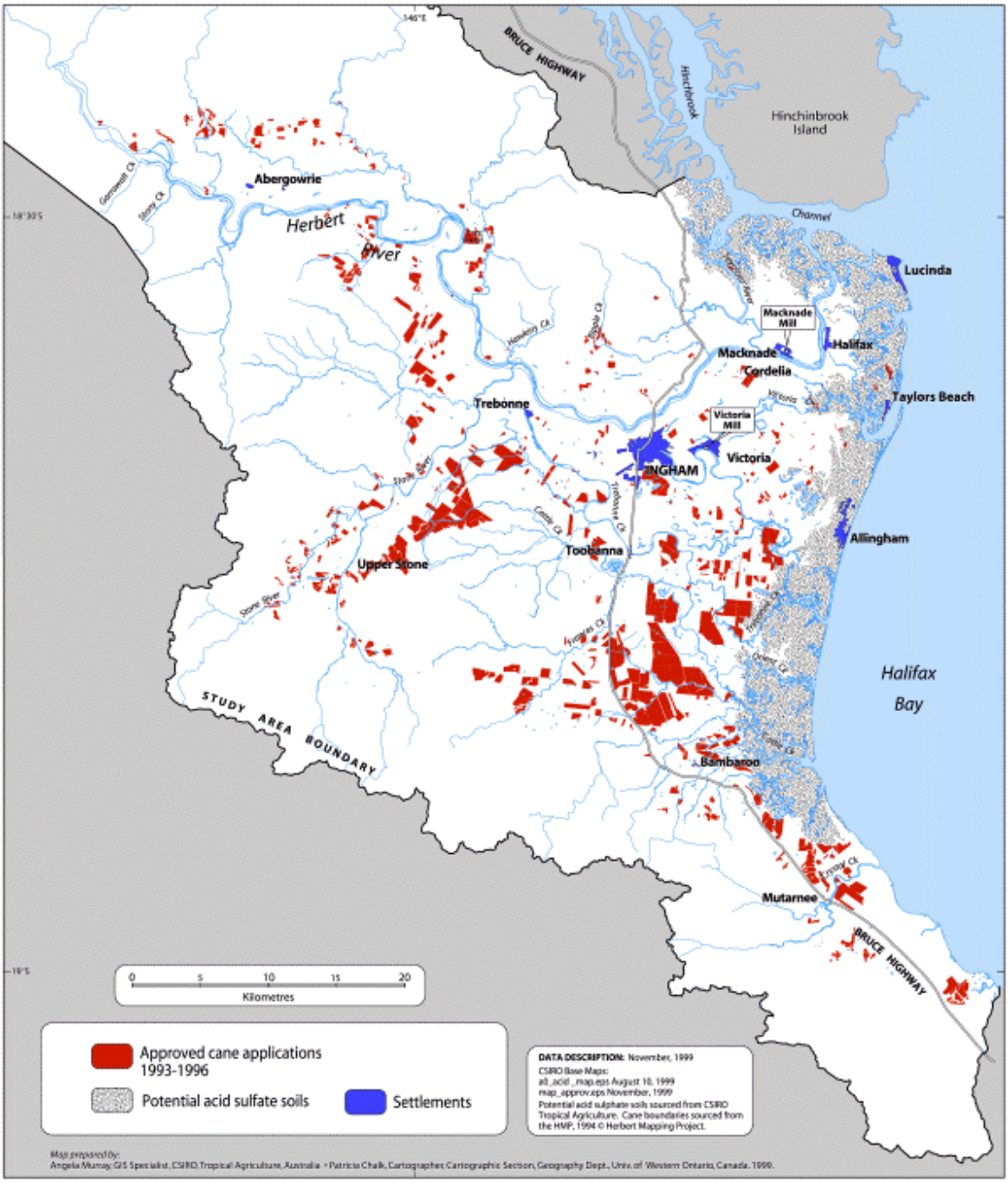

Figure 5.11 Location of awards relative to potential acid sulphate soils.

5.9 Dealing with the Future

Between 1996 and 1999, there have been significant changes to the institutional arrangements for land use planning and sugarcane assignment. A key consideration becomes the extent to which these moved the practice closer to the intent of ESD.

With respect to the ecosystem principle and the practice of drainage issues, little improvement has been made. The new institutional arrangements see the three major participants in these processes – the Hinchinbrook Shire, the Local Board and the Environmental Advisory Committee – agreeing on many criteria that define unsuitable land for sugarcane farming (Table 5.9). However, only the EAC has continued to identify the area below 9.5m ASL in the Cattle Creek subcatchment as unsuitable for sugarcane farming. The enhanced provisions of the revised *Hinchinbrook Shire Planning Scheme* continue to focus on land use issues and neglect drainage issues entirely. Past practice suggests that the difference of opinion that exists between

the Local Board and EAC on this issue will result in future awards in the area below the 9.5m ASL in the Cattle Creek subcatchment. If the SIIP process is successful in obtaining funding from senior levels of government, there are no guarantees that the associated environmental and social impacts will be given an appropriate level of consideration. On a more positive note, the completion of studies will provide a guide for future drainage works that has been lacking.

The practice of ecosystem management will be improved through the Shire and EAC's view that Mahogany Glider habitat and land abutting fish habitat areas (Table 5.9) define unsuitable cane lands. It is appropriate that the Local Board reconsider its view in order to provide unanimous support on this matter. However, the EAC will see itself wishing to maintain 20m or 40m buffers along land that abuts streams that are not designated as Mahogany Glider or fish habitat (Table 5.9). This situation suggests that more nodes might be preserved but the corridors connecting them decline. The adequacy of the size of the nodes to support viable populations in the absence of effective linkages to other nodes is unclear and deserves further scientific study.

Balanced decision making was a second principle of ESD. The previous discussion noted the manner in which "Corporate Goals" and the "Continuous Crushing Agreement" provided the fuel that drove the need for assignments but without much influence from state and local land use planning efforts. This situation had changed. As noted in Section 5.2, Production Boards are required to consider the suitability for cane farming in their planning. Presumably, this provision includes the "Continuous Crushing Agreement". However, differences of opinion among the major participants on what constitutes suitable cane land remain (Table 5.9). Thus, the need to enhance partnerships through improved conflict resolution mechanisms is essential if the assignment process is to become a model of ESD.

Table 5.9 Criteria for defining unsuitable land for sugarcane farming from Local Board, Hinchinbrook Shire Council (HSC) and Environmental Advisory Committee (EAC) perspectives (1998).

Unsuitable land for sugarcane farming, as agreed by all three groups:
1. 10m Stream buffers / wildlife corridors
2. Water bodies, swamps, lagoons and wetlands (*Water Resources Act* 1989)
3. Mangroves
4. Acid sulphate prone soils
5. Areas below 3m ASL
6. Soils unsuitable for sugarcane (DPI class 4 & 5 soils)
7. Slopes of 3% or steeper
8. Mountains or hills (no soil suitability & no other constraint)
Unsuitable land for sugarcane farming, according to the EAC and HSC:
1. 15m Stream buffers
2. Mahogany Glider habitat areas (*Nature Conservation Act* 1992)
3. Land abutting fish habitat areas (*Fisheries Act* 1994)
Unsuitable land for sugarcane farming, according to the EAC:
1. Areas below 9.5m ASL in the Cattle Creek subcatchment
2. 20m Stream buffers on minor streams and 40m stream buffers on major streams

Notes: 1. Tenures unavailable for sugarcane farming have been excluded, including residential, industrial, national parks, reserves and Wet Tropics areas.
2. Depending on the farming works to be undertaken, compliance with additional standards in the Hinchinbrook Rural Drainage Plan (Cameron & McNamara & Ass. 1984) and compliance with any other relevant State Legislation applying to the particular location or development (eg: Lands Act 1994) may become additional constraints.

Collaboration between government and cane industry participants is implied in Table 5.2. Since 1992, they have worked closely on a number of initiatives. While these interactions have a number of positive attributes - being continuous, occurring early in the statute or regulation-making processes, exchanging information and placing responsibility at the local level - there are

other areas that require improvements. Negotiations between the government and industry have not been transparent. At a local level, relevant government departments lacked the capacity to effectively guide the assignment planning and implementation processes. The recommendations of the EAC were perceived to be ignored in final decisions. The capacity of individual farmers to prepare a farm plan and adopt best management practices is varied and usually inadequate. Since the current institutional arrangements do not effectively address these shortcomings, it is possible that development will occur in areas that the only the EAC views as unsuitable (Table 5.9). This may occur because improvements to the *IPA* do not address drainage issues, no improvements to the *Water Resources Act* have been made, and inadequate conflict resolution processes between Local Boards and the EAC remain.

In the Herbert River district, the EAC maintains that 18,292ha of land are unsuitable for development (Table 5.10). If more effective conflict resolution mechanisms are not developed, members of the EAC may feel increasing levels of frustration and betrayal. In this situation, it would be appropriate to consider having the Shire and Local Board review applications, and disband the Environmental Advisory Committee. The Shire would bring increased legitimacy to the process. However, even this membership composition would continue to require the need for effective conflict resolution since differences of opinion between exist between the Local Board and Shire in defining suitable cane land (Table 5.10). While these two bodies, along with the EAC, agree that a 53,714ha of land within Hinchinbrook Shire are suitable for sugarcane farming, they disagree about the status of 23,478ha.

In the context of partnerships, it is important that all applicants in the process are treated fairly. At present, the Shire plans in Thuringowa, Cardwell and Herberton Shires identify farming "as a right". There is over 50,000ha of land in these Shires that are considered part of the Herbert River district (Table 5.10). In the spirit of fairness, the Local Board should apply the land suitability criteria that have been developed in the *Hinchinbrook Shire Planning Scheme 1999* as the minimum standard. In this way, all applicants and award holders will be meeting the same environmental standard. The application of this set of criteria to all Shires would see 3,876ha of land deemed as suitable (Table 5.10).

Another planning alternative to cane land assignment is to consider the role QDNR as the Queensland Government's land manager. Of the 41,912ha of land that either the EAC alone or with the support of the Hinchinbrook Shire's criteria deem to be not feasible for sugarcane, 13,116ha (31%) is leased land tenure (Table 5.11). Much of this land is located west of Toobanna, Upper Frances Creek and west of Trebonne (Figure 5.12). It contains Mahogany Glider habitat and several river corridors. If the Queensland Government wishes to demonstrate some visible support for the actions of its local and state resource management employees who serve on the Environmental Advisory Committee, it would ensure that applicants who are granted future leases maintain 20m and 40m buffers on minor and major streams respectively (Table 5.9). Freehold land dominates the land tenure type that the EAC perceives as not feasible for sugarcane (Table 5.11). Of the 18,292ha it alone believes is not feasible for future cane development, 16,224ha (89%) is freehold. Much of this land is located below the 9.5m ASL in the Cattle Creek subcatchment and highlights the need for effective drainage planning (Figure 5.12). In this manner, improved planning efforts in conjunction with more effective conflict resolution mechanisms can enhance the partnership principle.

Figure 5.12 also suggests that all three major participants perceive that a feasible area for future sugarcane development is located in Thuringowa Shire. However, this area has not yet been mapped for potential acid sulphate soil (Figure 5.11). Until this mapping is completed, the precautionary principle should be applied. Recent institutional innovations have not embraced adaptive management principles. These opportunities should be explored.

Table 5.10 Local Board, Hinchinbrook Shire Council (HSC) and Environmental Advisory Committee (EAC) views of future cane lands and local government jurisdiction areas.

	Overlapping Shire				
Biophysical Limitations, Agreement & Tenure	**Hinchinbrook**	**Thuringowa**	**Cardwell**	**Herberton**	**Total Area (ha)**
Biophysically potential ~ all 3 parties agreed	53714	3876	102	0	57692
Biophysically constrained ~ all 3 parties agreed	95786	5652	1129	27	102594
Biophysically constrained ~ EAC & HSC agree	23478	141	1	0	23621
Biophysically constrained ~ only EAC's view	17634	654	4	0	18292
Tenure* unavailable for sugarcane	65238	19474	16210	4161	105083
Total Study Area Overlap	255850	29797	17446	4189	307282

** Tenure unavailable for sugarcane farming includes residential, industrial, harbours & management, national park, Wet Tropics and reserves (nature, road, rail, waterbody).*

Table 5.11 Local Board, Hinchinbrook Shire Council (HSC) and Environmental Advisory Committee (EAC) views of future cane lands and tenure.

	Tenure								
Biophysical Limitations, Agreement & Tenure	**Freehold**	**Leased Lands**	**Action Pending**	**Mangrove on State Land**	**Mines Tenure**	**State Forest**	**Unallocated State Land**	**Other # Tenures**	**Area (ha)**
Biophysically potential ~ all 3 parties agreed	49346	5152	24	0	10	3099	61	0	57692
Biophysically constrained ~ all 3 parties agreed	35893	44032	61	285	63	18162	4099	0	102594
Biophysically constrained ~ EAC & HSC agree	7653	12059	8	0	1	3760	139	0	23620
Biophysically constrained ~ only EAC's view	16224	1057	21	0	6	924	61	0	18292
Tenure* unavailable for sugarcane	1448	16984	4	2517	3	23311	951	59865	105083
Total Study Area	110563	79284	118	2802	83	49256	5311	59865	307281

** Tenure unavailable for sugarcane farming includes residential, industrial, harbours & management, national park, Wet Tropics and reserves (nature, road, rail, waterbody). Tenures such as freehold would be shown here as unavailable because of overlap with Wet Tropics areas.*
 # Other tenures include mostly National Parks area along with various reserves (including nature, road, railway & waterbody)

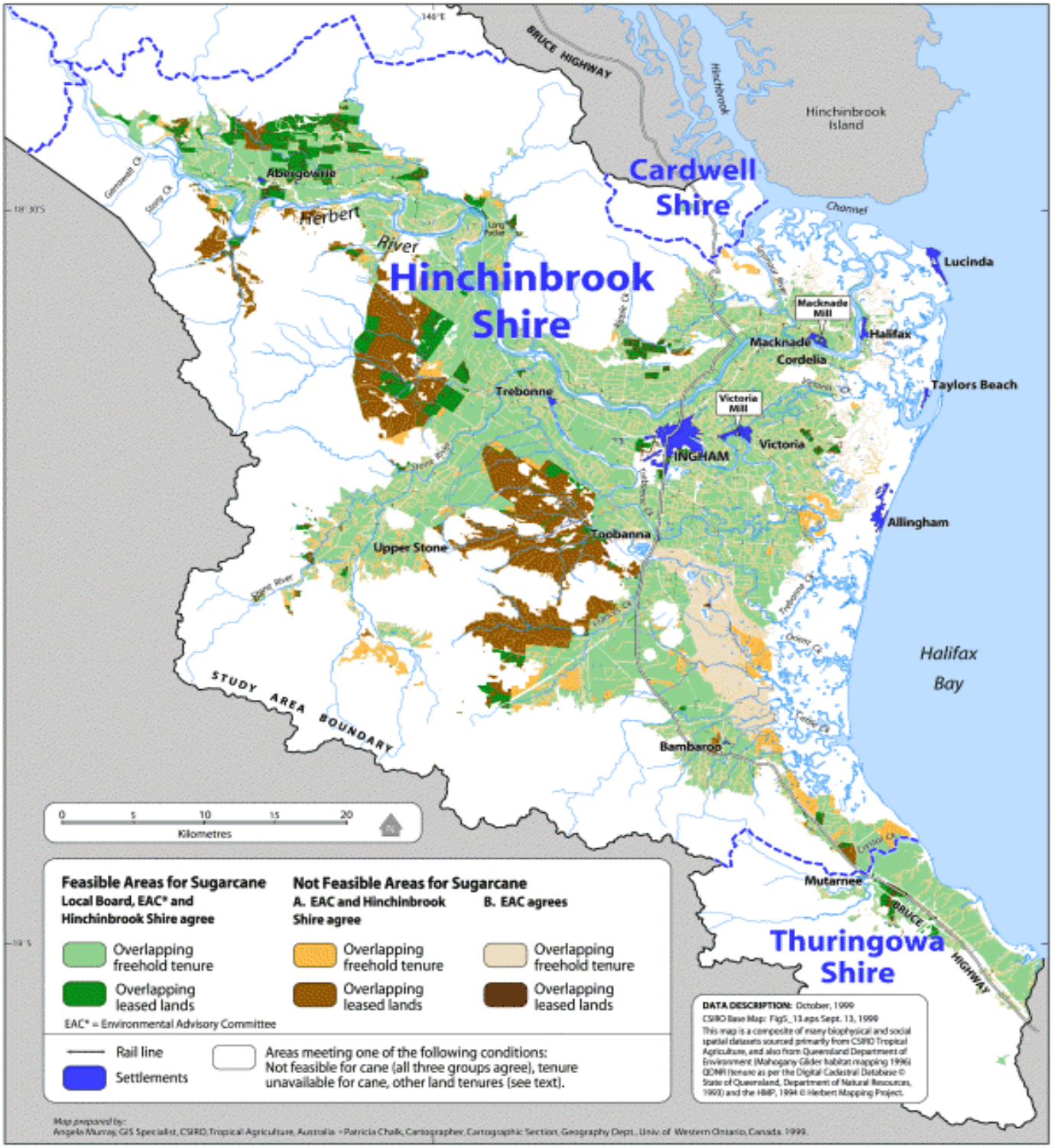

Figure 5.12 Land capability for sugarcane: Hinchinbrook Shire, Local Board and Environmental Advisory Committee perspectives relative to land tenure.

5.10 Concluding Comments: Dealing with the Legacies of the Past

ESD of natural, economic and human resources represents one of the most intractable issues confronting public and private managers. Catchment boundaries and bioregions rarely coincide with the administrative boundaries of government agencies and mill areas. Many political units claim jurisdiction over particular aspects of a resource, and landowners claim rights of use. If these multiple interests are to be accommodated effectively, it is important to legitimise a common set of principles in a clear manner. What appears to have been lacking in the past and to a lesser extent in the present, is demonstrable leadership regarding the management of natural

resources in cane growing catchments. These are elements of the WCED's challenge of reforming our institutional arrangements to achieve sustainable development.

The sugar industry must accept full responsibility to ensure that all aspects of the ESD are met. If the technological and administrative changes in the Herbert River district typify the activities of the other 23 mill areas, this will be a very formidable task. However, while the industry has a specific set of legislative objectives and developed assignment regulations, a clear vision of its commitment to sustainable resource management is lacking. This vision could enhance the credibility and legitimacy of ESD. Since the industry effectively reports to the Minister of Primary Industry (through sugar industry legislation), it is appropriate that it operationally embraces the ESD principles outlined in the 1992 *Intergovernmental Agreement on the Environment.*

The sugar industry has taken some initiatives. It has acknowledged the importance of the environment in *Caring for the Environment* and *Vision 2000.* Research has been supported as demonstrated in the establishment and co-sponsorship of the Co-operative Research Centre for Sustainable Sugar Production. An environmental audit of the cane-growing sector of the industry was completed in 1996. The industry has participated in the development of voluntary guidelines and the Code of Practice (under the *Environment Protection Act 1994*). Considering the strengths and weaknesses of these mechanisms is another area for future research.

This report outlines some of the major issues related to the cane assignment process and environmental management. The industry must take a leadership role if the importance placed on sustainable development and sustainability is to be realised. Present Conditions of Assignment suggest that failure to comply with restrictions may see the award revoked. This implies that responsibility for enforcement rests with the Local Board (Cane Production Board). These are new roles for these organisations. Leadership at the Local Board (Cane Production Board), CANEGROWERS and mills can establish an expectation that compliance is expected and required by all farmers. This also sets an example for existing growers who operate without conditions on their assignment should address relevant considerations as though they were in place. This type of widely based, voluntary action could engender very strong public support. In its absence, public support will be nurtured through compliance and enforcement. The recommended audit should provide insight into both voluntary compliance and enforcement measures. Those findings will reflect on the leadership qualities of the sugar industry, and identify the need for evolutionary and revolutionary change in its management of natural resources.

The policy environment for ESD in the context of the sugar industry will continue to respond to changing political, economic, social and environmental considerations. While the manner in which resources are managed will vary, public expectations for, and support of, effective environmental management policies will remain. In this regard, the principles for ESD will form the basis for the development of new and improved initiatives. The efficient and equitable allocation of new land for cane production must be central in these. The challenge for the sugar industry is to embrace, rather than resist, the inevitable trend toward greater public intervention in its affairs. In response, government must provide a stable environment in which locally relevant decision making can occur and in which appropriate and viable monitoring, cost-sharing and regulatory arrangements can be supported. The Australian sugar industry must continue to develop its own capacity to plan for expansion (and contraction). Such planning must be a continuous activity rather than a single exercise. Further, the industry must develop its own strategic view on where and how sugarcane will be grown – both at regional and whole of industry levels. This view will need to be based on the best available scientific information and full utilisation of the products of its substantial investment in environmental R&D.

Integrating social, economic and environmental considerations into decision making was at the

core of the WCED's view of sustainable development. To that end, consideration should be given to the role of public and corporate agencies. For instance, in considering an application for assignment, Local Boards should ensure that Property Management Plans are completed adequately. The documents should address both the biophysical and financial aspects of the operation. In that manner, farmers will be better prepared for unfavourable changes in precipitation patterns and price. Banks that finance many of the expansion activities may also wish to review an applicant's property and business plan before approving a mortgage. Senior governments can bias decision making through cost-sharing arrangements and support programs. In implementing these types of initiatives, the environmental and social consequences should be considered more systematically. The types of changes noted above reflect the difficult institutional adjustments required to address systemic problems of sustainable development.

In facing the significant challenges of balancing the dual goals of economic efficiency and environmental conservation in relation to cane expansion, the sugar industry can reflect on its own experience and that of other agricultural industries and move to a sustainable future by playing a key role in:

- *Fostering communication* across sectoral, local government and community interests;
- *Developing a structure and related processes and procedures that foster cooperation* between the industry and other industry, community groups and government organisations and paves the way for more equitable decision making and more sustainable natural resource outcomes on the ground;
- *Facilitating coordination* of effort between itself, government and community organisations; and
- *Supporting the integration* of resource management principles (including Codes of Practice for Sustainable Cane Growing) into Local Government planning schemes and broader decision-making processes. For example, the industry may wish (in partnership with lending institutions) to require a business plan to be submitted along with a PMP for an assignment application to be considered.

Many recommendations made in this report encourage and require strong leadership. Without a visible commitment to ESD, the most sophisticated institutional innovations that promote positive change will fail. Without leadership, ESD will be relegated to a thin coat of green paint masking the resource development practices of the past. If the cane assignment system is to provide effective management in the year's ahead adjustments have to be made. It is hoped this report will contribute to that end.

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Appendix 1

QUEENSLAND SUGAR CORPORATION

Form 98(A)
Sugar Industry Act 1991

APPLICATION FORM FOR NEW OR INCREASED EXPANSION ASSIGNMENT

SECTION A FORMAL APPLICATION

Year of expansion: 19____ New ☐ or Increased ☐

Name in which assignment is/will be registered: _____

_____

Postal Address: _____

_____ P/Code: _____

Telephone number: ( ) _____

I/We (the undersigned) certify that the information contained herein has been completed to the best of my/our knowledge and will if necessary provide additional information in support of this application.

Note: This form should be signed by all the applicants named in Section A. Where the applicant is a company, the form should be executed under common seal.

Signature of applicant/s: _____ Date: _____

_____

If you are a new grower please go to Section C ➤

SECTION B APPLICATION DETAILS FOR CURRENT ASSIGNMENT HOLDERS

Home mill area: _____ Farm number: _____

Mill area in which assignment is sought: _____

Existing assignment entitlement: _____ ha

Increase sought in this application: _____ ha

The total area of available spare land
(include new land where applicable) is: _____ ha

QUEENSLAND SUGAR CORPORATION

SECTION B *Continued*

Where is the increase to be located? (Tick appropiate answer)

Present Assigned Description (PAD) ☐ or New Land ☐

If new land, refer to Section D after completing the remaining questions in Section B.

Is any PAD currently leased? YES ☐ NO ☐

If YES, the Lessor's written consent must be supplied.

Attached? YES ☐ NO ☐

Previously supplied? YES ☐ NO ☐

Did you receive assignment as a **new grower** in the past three years? YES ☐ NO ☐

What area, if any, of expansion grants since 1994 have not yet been planted? Please advise year of grant, the hectares amount and reasons.

_____

_____

_____

_____

SECTION C *APPLICATION DETAILS FOR NEW GROWERS*

Mill area in which new assignment is sought: _____

Increase sought in this application: _____ha

Do you presently hold or have you within the last five years held any legal interest in any existing cane assignment in any mill area in Queensland? YES ☐ NO ☐

Have you previously applied for a new assignment? YES ☐ NO ☐

If you answer YES to either of these questions, please provide details:

_____

_____

_____

_____

Please complete Section D

QUEENSLAND SUGAR CORPORATION

SECTION D NEW LAND (not PAD)

Refer to Section 4 of "Important Information for Applicants" before completing this section.

Please list the real property description and areas of the new land proposed for this application:

Description: _____ Area: _____ ha

Description: _____ Area: _____ ha

What is the nature of tenure of this land?

Freehold ☐ Lease ☐ Enforceable option ☐

Please attach **Formal Evidence of Title** in the same name as assignment holder. ☐ Attached

If new land is leased, attach **lessor's written consent** to the application. ☐ Attached

What area of the new land is:

Cleared? _____ ha Partly cleared? _____ ha

Uncleared? _____ ha Under cane? _____ ha

Is the new land subject to any restrictions on its use by any public authority? (e.g. land use, irrigation or drainage) YES ☐ NO ☐

If YES, what restrictions? _____

What distance is the new land from the present or possible delivery point? _____ km

Description of possible delivery point: _____

Please list real property description of all potential new cane lands held in the applicant's name and the areas of each parcel: _____

_____

SECTION E DEVELOPMENT PROGRAM

To be completed by ALL applicants

Please provide a Development Program which illustrates your capacity and willingness to plant the assignment applied for within two calendar years (inclusive) of the grant year. ☐ Attached

From your Development Program list the estimated area available to be planted in:

1st year _____ ha 2nd year _____ ha

Note: This information is sought to assist with the planning and development of industry infrastructure.

Form 96(R)

QUEENSLAND SUGAR CORPORATION

240 Queen Street, Brisbane
GPO Box 891, Brisbane
Queensland 4001, Australia
Telephone: (07) 3231 0199
Facsimile: (07) 3221 2906 Telex: AA41274

_____ Mill

FORMAL EVIDENCE OF TITLE

(To be returned to the Chief Executive at the above address)

I HEREBY CERTIFY that I have sighted the undermentioned document: (State type of document eg Certificate of Title, Deed of Grant, Current Title Search, Registration Confirmation Statement, Instrument of Crown Lease, Lease Document)

*(*Lease documentation will only evidence leasehold)*

_____

which evidences: ☐ Freehold ☐ *Leasehold

current title to land described as: _____

_____

_____

_____ Parish of: _____

having an area of: _____

in the name of (insert name of proprietor): _____

as: Sole proprietor ☐ Tenants in common ☐ Joint tenants ☐

If tenants in common, specify the particular interest: _____

_____

If the land is leased please supply the following:

Start date: _____ End date: _____

Name of lessor/sublessor: _____

Date: _____ Signature: _____

Full Name: _____
(Please print)

Solicitor/Bank Manager/Local Board Chairperson
(Cross out inapplicable)

QUEENSLAND SUGAR CORPORATION

IMPORTANT INFORMATION FOR APPLICANTS FOR NEW OR INCREASED EXPANSION ASSIGNMENT

1. There is only one application form for new/increased assignment. Existing growers, landlocked growers in landlocked mill areas and new growers will complete different sections of Form 98(A).

2. This application should be completed in easily readable BLOCK PRINT to facilitate the determination of your application. Where appropriate, please tick the relevant box to indicate your response.

3. Two **conditions** will apply to all new and increased grants of assignment:

   (a) the assignment being made effective

   (b) the assignment not being transferred, unless the Corporation determines otherwise

   by 30 November, in the calendar year next after the grant year (eg for assignment in grant year 1999 the date would be 30 November 2000).

4. **Formal Evidence of Title** to any new land in the name of the applicant must accompany the application. Applicants may either attach a copy of the relevant title document for example a Certificate of Title, OR attach a completed Formal Evidence of Title form. This form is reproduced on the back of this page and must be signed by either a Bank Manager, solicitor or Local Board Chairperson.

   Options to purchase or lease new land will not be considered unless they are clearly enforceable in a court of law subject only to grant of assignment on that land. These documents must be duly signed by both parties and clearly specify:

   (a) the name of both parties

   (b) the description of the new land

   (c) the term of the tenure. The term of the tenure should be at least the same as the date by which a grant must be made effective

   (d) the commencement date

   (e) the rent payable.

   Similar criteria apply to options to purchase.

5. A **Development Program** should accompany the application and clearly indicate the applicant's capacity and willingness to make the assignment sought effective within two calendar years inclusive of the grant year.

6. Applicants are required to consult with the relevant local council, Department of Transport and/or Department of Main Roads if the cane is proposed to be delivered to the mill, in whole or in part, by road.

7. **Corporation "Guidelines"** issued under Section 149 of the Sugar Industry Act 1991 define the terms of the expansion and state the matters to which a Local Board will have regard in determining an application for the grant of assignment.

8. Applications must be lodged at the office of the **CANEGROWERS Area Committee** in the mill area in which the assignment is applied for by the advertised closing date. No extensions will be granted.

QUEENSLAND SUGAR CORPORATION

For use by the Local Board in consideration of application

SECTION F LOCAL BOARD DECISION

The_____ (home) Local Board or the _____ (receiving) Local Board (if relevant) under authority delegated by the Queensland Sugar Corporation, hereby

(a) ***GRANTS***_____hectares of 19 ____ expansion assignment to the aforementioned applicant/s subject to the following conditions (if any):

_____

_____

_____

OR

(b) ***REFUSES*** the aforementioned application on the following grounds:

_____

_____

_____

Signature of Chairperson: _____ Date: _____

Home Local Board

The home local board has been consulted, and does not consider that the consultation was inadequate.

Signature of Chairperson: _____ Date: _____

Receiving Local Board

The members of the receiving local board, who were present at the meeting to determine the application, unanimously approved it.

Signature of Chairperson: _____ Date: _____

FOR USE BY LOCAL BOARD TO CATEGORISE APPLICATION TYPE

Existing grower ☐	Home mill area ☐	Refused ☐
New grower ☐	Inter-mill ☐	Approved ☐

Appendix 2

Data supporting Figure 5.9

Characteristics of Geometric Analysis of Sugarcane Land for 1970, 1992, 1996

	1970	**1992**	**1996**
Standard distance (km)	19.5	18.0	18.0
Theta in radians	0.87	0.75	.797
theta measured from y axis (degrees)	49.6	43.0	45.7
Standard deviation along x axis (km)	16.1	15.4	15.4
Standard deviation along y axis in (km)	11.0	9.3	9.3
Length of x axis (km)	32.1	30.8	30.9
Length of y axis (km)	22.0	18.6	18.6
Area of ellipse (km^2)	2222.8	1798.3	1802.7

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Chapter 6

Managing For Ecological Sustainability: Moving from Rhetoric to Practice in the Australian Sugar Industry

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ABSTRACT
Management of natural resources on the basis of Ecologically Sustainable Development (ESD) principles is of inherently more complex than management premised solely on maximum productivity or conservation. More facets of the resource base need to be monitored and managed, and a more holistic view the range of potential impacts - particularly cumulative impacts - must be considered. In attempting to operationalise the goals of ESD, a number of Australian states have introduced and fostered community-based approaches to integrated resource management (IRM). Such initiatives have been broadly supported by agricultural industries, however there remains a significant gap between ESD rhetoric and actual practice. Using the Herbert River catchment as a case study, some of the key impediments to the implementation of IRM approaches are examined within the context of sugar industry activities. We argue that integrated community-based approaches to resource planning and management, in concert with a range of policy and economic instruments, can play an important role in assisting the sugar industry to achieve ESD. We also argue that operationalising the concept of ESD through integrated approaches to natural resource management poses enormous challenges and conclude by identifying some essential characteristics of an IRM process that could assist the sugar industry to adapt to, and manage change for, sustainable agriculture.

INTRODUCTION

The sugar industry is one of Australia's largest rural industries, producing in 1996/97 approximately 5.3 million tonnes of raw sugar, worth in excess of 2 billion dollars to the Australian economy. The industry supports over 6,900 cane growers and 29 sugar mills, employing some 19,000 people in total. Sugar cane is grown along 2100 kms of coastline from Grafton in northern New South Wales to Mossman in north Queensland (Figure 1). Small industries have recently commenced on the Atherton Tablelands in north Queensland and the Ord River district in Western Australia. Approximately 507 000 hectares of land are currently under cultivation and as such, the sugar industry is a major user of natural resources on the coastal zone of eastern Australia north of latitude 30^0 S.

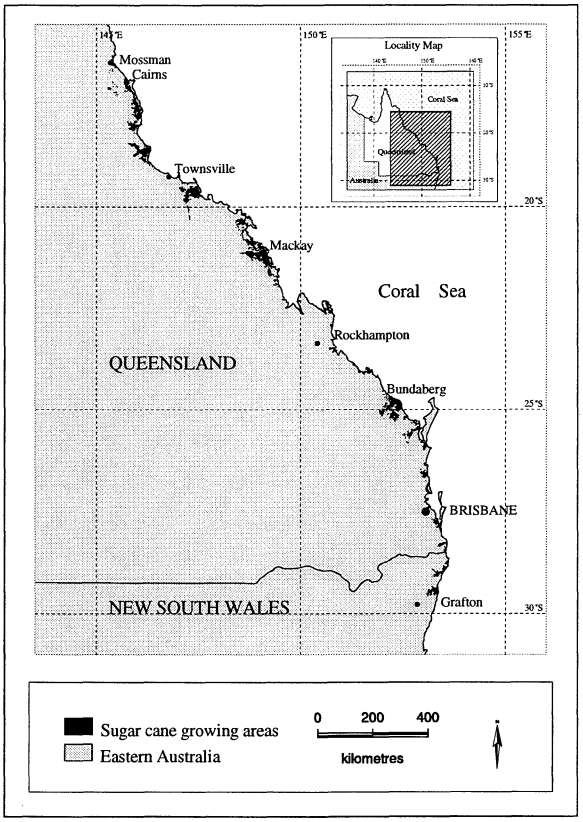

Figure 1. Location of the Australian sugar industry.

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Significant potential exists for the Australian sugar industry to impact on the environment. In response to increasing awareness of its environmental performance, the sugar industry has made positive steps towards overcoming many existing problems. At the farm level, the use of soil conservation structures and minimum tillage techniques in conjunction with green-cane harvesting provide good examples of industry practice aimed at minimising the effects of soil erosion. A greater awareness of off-site effects has also resulted in changed management practices being adopted by many farmers, particularly in the use of inputs such as fertiliser, chemicals and water. At an industry level, the sugar industry has conducted an audit of current farming activities (Gutteridge, Haskins and Davey 1996) and endorsed an Environmental Management Strategy (CANEGROWERS, 1997) to provide a framework for addressing the audit's 156 recommendations. The Strategy contains four broad objectives and 22 desired outcomes to be achieved by 2002. Realisation of these outcomes will require a mix of on-farm initiatives, RD&E and communication activities. In response to the first listed outcome of the Strategy, the industry has developed a Code of Practice for Sustainable Cane Growing in Queensland (CANEGROWERS 1998). The Code has been endorsed by the Queensland Department of Environment and Heritage, under the provisions of the *Environment Protection Act 1994*. The industry has also been able to attract funding from the Natural Heritage Trust.

While acknowledging the improvements that have been made and the fact that the sugar industry has demonstrated a desire to implement ESD (Bonanno 1992), the magnitude of the tasks facing the industry, in terms of the way in which it manages natural resources in the future, remain substantial. As both a major "user" of natural resources and a "supplier" of environmental services, the industry is a key actor in the move toward ESD. However activities at the farm level alone are unlikely to be adequate, and achievement of ESD will require action from government as well as broader participation in sugar industry activities by the wider community.

This paper first reviews the rhetoric surrounding the achievement of ESD and then discusses some of the barriers and opportunities in translating this rhetoric into practice. We argue that planning, in concert with a range of policy and economic instruments, can play an important role attempting to achieve ESD. We conclude by proposing how such approaches may in the future contribute to more sustainable agricultural development and resource use in general in the Australian sugar industry.

THE SUGAR INDUSTRY–ECOLOGICALLY SUSTAINABLE?

The well recognised core principles of ESD are: to maintain ecological integrity, biological diversity and natural capital; to meet basic human needs; to keep options open for future generations; and to reduce injustice; and to increase self-determination (Dorcey 1991). In Australia, the Standing Committee on Agriculture and Resource Management has recommended five basic principles for assessing the level of sustainability achieved by the agricultural sector. These concern (SCARM 1998):

- the long term viability and resilience of farm economies;
- the conservation and enhancement of the natural resource base;
- the minimisation of offsite environmental impacts;
- the quality of farm level managerial skills; and
- the socio-economic viability of rural communities.

Some of the key issues relevant to these principles for the sugar industry, their possible causes and potential impacts are summarised in Table 1. In the sections that follow we briefly examine the extent to which current sugar industry practice is meeting the first three of these principles.

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Table 1. Key ESD issues for the Australian sugar industry.

Issue	Possible causes	Potential Impacts	Sources
Maintaining the economic viability of sugarcane growing	Declining real prices paid and increasing real costs of inputs/production Declining farm equity Yield decline	Exacerbated resource degradation Increasing farm debt Greater reliance on off-farm income	ANAO (1997) Garside *et al.* (1997)
Risk to the sustainability of the natural resource base	Loss of productive capacity of soils under long term monoculture Expansion of cane farming onto marginal lands and environmentally sensitive areas Poor adoption of green cane harvesting practices in some areas High chemical (fertiliser and pesticide) usage in sugar production systems Inappropriate drainage practices Past single focus on increasing sugar productivity and improving efficiency in harvesting/processing Poor fire management and air quality impacts from smoke	Soil structural decline and compaction Declining soil fertility/organic matter Imbalance of soil micro-organisms Increased soil erosion and runoff Loss of biodiversity Increase in greenhouse gas emissions Heavy metal contamination of sugarcane soils Chemical contamination of sugar products and by-products Acid sulfate soils	Chudleigh et al. (1997) Prove and Hicks (1991) Prove *et al.* (1995) Gutteridge, Haskins and Davey (1996) Rayment and Barry (1993)
Environmental impacts of intensive sugar farming systems	Intensive use of sloping lands in areas prone to high intensive tropical rainfall High chemical (fertiliser and pesticide) usage in sugar production systems Clearing of riparian vegetation and laser levelling of coastal wetlands Inappropriate drainage development Mill emission, effluent and waste products Inefficiency of water use/irrigation scheduling Overuse of groundwater	Enhanced nutrient loads and turbidity of surface and ground waters Increased sediment delivery to estuarine and marine environments Salinisation Heavy metal pollution Acidification of drainage ways and fisheries habitats Fish kills in waterways Loss, fragmentation and degradation of habitat Inadequacy of environmental flows	Johnson *et al.* (1998a,b) Arthington *et al.* (1997) Crossland *et al.* (1997) Keating *et al.* (1995) Pailles *et al.* (1993) Pailles and Moody (1995) Gutteridge, Haskins and Davey (1996) Brunskill *et al.* (1998)
Poor integration and coordination of policy and planning across government and industry organisations	Multiple and often conflicting legislation and policy initiatives Fragmentation of responsibilities across and within all three levels of government Ad hoc decision- making on sugar infrastructure development	Gap between policy intent and outcomes Mixed or ambiguous signals to sugar growers Duplication and inefficiency in community service delivery Poor or ill-informed decision making on industry expansion and infrastructure development	Johnson *et al.* (1998a) Bellamy and Johnson (1997, 1998)
Conflict over alternative land uses	Urban expansion onto prime agricultural lands Increasing demand/opportunities for tourism and recreation Short term planning horizons of state and local governments Inadequacy of cane land allocation process	Social tensions between community interests Uncertainty for all stakeholder interests Expansion onto marginal or ecologically sensitive lands Need for industry structural readjustment	Shrubsole (1997) Johnson *et al.* (1998a)
Social problems in cane growing communities	Declining rural population and declining employment opportunities Downsizing of social infrastructure in rural communities Personal Stress Changing community values Declining government capacity to deliver services	Declining productivity Aging population of sugar farmers Threat to viability of social structures	Johnson *et al.* (1998a) Lawrence and Gray (1997) QDLGP (1998)

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Economic Viability of Production

Deterioration in cane growers terms of trade coupled with financial inability to implement sustainable management practices (Prime Ministers Science and Engineering Council, 1995; Australian National Audit Office 1997) represents a significant threat to the capacity of the sugar industry to achieve ecological sustainability (Figure 2). In addition, the Australian sugar industry has been on a productivity (yield of sugar per harvested hectare) plateau since the early 1970s. Garside *et al.* (1997) suggest the plateau is related to both changes in farming system and the phenomenon of yield decline, that is the loss of productive capacity of sugarcane growing soils under long term monoculture.

The management of natural resources in cane growing regions will continue to be undertaken in an environment of increasing long-term demand for sugar, although the effects of the Asian financial crisis, economic uncertainty in Russia and the increase in Brazilian sugar exports are likely to have significant economic impact in the short to medium term. To survive, the sugar industry will need to expand production. However, any intensification or expansion of the industry is very likely to have environmental implications (Williams 1995; Johnson *et al.* 1998a,b), although significant R&D investment is being directed towards practices aimed at improving productivity per unit area. Australia, as an exporter of raw sugar also faces increasingly environmentally conscious international markets. Hence the industry's economic future will be inextricably linked to its environmental performance.

The Natural Resource Base and Environmental Impacts

It is clear that the sugar industry has the potential for significant environmental impacts because of its size, location along the Queensland and northern New South Wales coast and its high use of fertiliser, chemicals and irrigation water. Significant environmental impacts have already occurred in many cane growing regions and these are discussed in more detail by Johnson *et al.* (1998a,b). Four key environmental issues are discussed briefly below. These are not comprehensive and in particular do not include issues relating to soil health and fertility, air emissions, waste management, environmental flows of water or acid sulphate soils.

Soil erosion and sedimentation

Severe soil erosion has long been recognised as a potential threat to long-term productivity of sloping land growing sugar cane. Soil losses in excess of 200 t ha^{-1} have been recorded in the Mackay region (Sallaway 1979) and in excess of 500 t ha^{-1} on the wet tropical coast (Prove and Hicks, 1991). The adoption of green cane harvesting, minimum tillage practices has been shown to reduce soil erosion tenfold; from an average annual soil loss of 148t $ha^{-1}y^{-1}$ to <15t $ha^{-1}y^{-1}$ (Prove *et al,* 1995). These practices have been an important step in sustaining the productivity of cane lands and in decreasing sediment supply to the coastal zone from sugar cane lands. However to-date the practice has received only partial acceptance by the industry. Despite the fact that in many areas soil erosion remains a problem, the precise rate of sediment delivery from catchments in which sugar cane is grown to estuarine and marine environments and the environmental consequences remain poorly understood (Pailles *et al.* 1993; Pailles and Moody 1995; Wasson 1996, Crossland *et al.* 1997).

Diffuse source pollution

Given the size of the sugar industry, considerable potential exists for diffuse source pollution to generate water quality problems in both ground and surface waters. The major sources have generally increased in magnitude in recent years and have been predominantly associated with expansion in the area of land supporting sugar cane. Recent research (Bramley and Johnson 1995; Mitchell *et al.* 1995) has shown that nutrient concentrations in streams in selected sugar catchments are generally below the guidelines detailed by ANZECC (ANZECC 1992) for freshwater. Exceptions were generally associated with peak flow events associated with cyclonic

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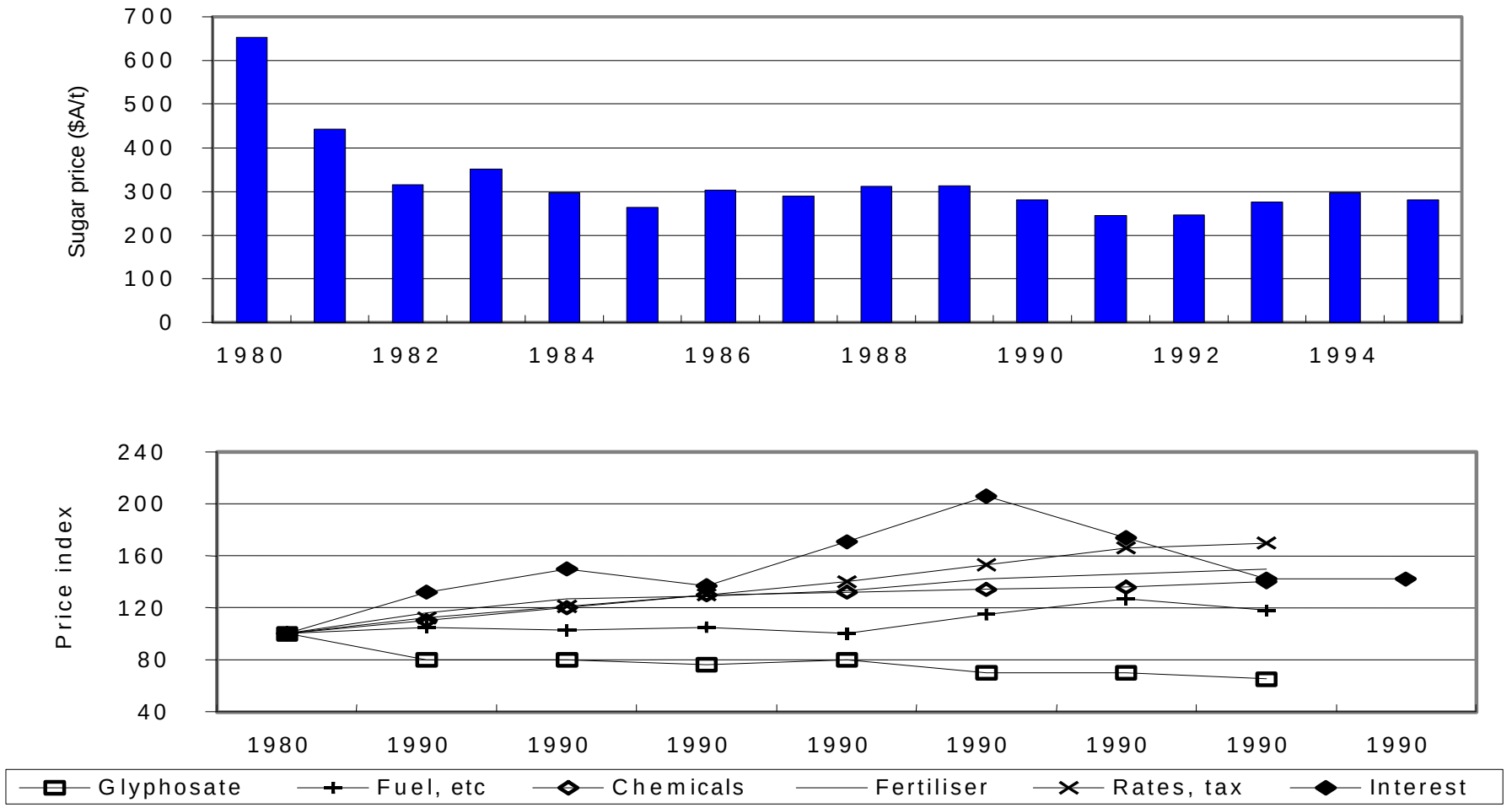

Figure 2. Queensland sugar price, 1980-95, deflated by CPI index (base 1987-88 = 100) and changing relativity in cost of farm inputs (Source: Wegener, 197)

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or similar storm related activity. In north Queensland, nutrient concentrations in streams associated with sugar cane production were generally greater than in those associated with other land uses, but differences between these were only seen during wet season peak flow events.

In the marine environment adjacent to the Wet Tropical Coast, Furnas *et al.* (1995) have shown that direct external inputs of nitrogen (N) and phosphorus (P) through point sources are currently small relative to natural nutrient inputs. Average total riverine inputs of N and P comprise a large proportion of external inputs, but are still small relative to internal recycling fluxes. Although nutrient levels are currently low in marine waters adjacent to sugar producing regions and external inputs are small relative to natural fluxes and stocks, understanding of ecosystem behaviour is not sufficiently developed to allow the assimilative capacity of these waters to be predicted with certainty. The consequence is that pressure exists on the sugar industry to demonstrate that it is not a major contributor when there is circumstantial evidence that it might be.

Information on accession, persistence and behaviour of pesticides in cane growing and adjacent environments is sparse. While the use of organochlorine pesticides such as dieldrin and DDT has been discontinued, little is known of the persistence of organochlorine residues in existing cane growing areas. Many chemicals in this group are known to accumulate in produce suitable for human consumption. Unpublished analyses from the Mackay region (A Garside *pers comm*) have shown dieldrin levels in peanuts harvested from selected cane farms to be 25 times the acceptable level for human consumption. Mercurial compounds have been used as a fungicide continuously since the 1950's, but evidence for their current distribution is scarce. However geochemical analysis in the Hinchinbrook Channel (immediately adjacent to cane fields in the lower Herbert River floodplain) show an approximate 4 fold increase over background levels in mercury concentration since 1950 (Brunskill *et al.* 1998).

Understanding of the accession of nutrients and pesticide into groundwaters also remains limited. Evidence from the Bundaberg area (Keating *et al,* 1995) indicates that extensive nitrate accessions to the area's aquifers have occurred, although no unequivocal data are available to assess whether nitrate concentrations are continuing to rise. Similar findings have been reported in the Burdekin delta (J. Bauld, unpublished data). Likewise, evidence to support pesticide contamination has been scarce, although again, low levels of atrazine and heptachlor have been detected in the Burdekin delta aquifer system (Brodie *et al.* 1984; Keating *et al,* 1995).

In summary, current knowledge suggests that the downstream effects of agricultural production are governed to a large degree by the periodicity, volume and intensity of rainfall. Within individual catchments, climatic, spatial and temporal variability may also be significant. Recent research suggests that nutrient and pesticide loss from land under intensive agriculture is likely to exceed that from other land uses irrespective of the type of intensive agricultural production undertaken (Bramley and Johnson 1995). It is the general nature of intensive agricultural land use and the relatively high inputs that this activity involves, rather than the specific production system in operation, which results in an increased export of pollutants downstream relative to that from lower input land uses such as low intensity grazing or forestry. Minimisation of diffuse source pollution is therefore likely to depend on carefully matching actual land use to land use suitability coupled with appropriate resource management practices.

Heavy metal contamination

Heavy metals are important environmental pollutants when in sufficient quantity and can be mobilised in the environment by human activity (Rayment and Barry 1993). Little is known of the contribution of the sugar industry to heavy metal contamination. While zinc and copper have and continue to be applied in very small quantities, it is likely, given the significant use of phosphatic fertilisers in the sugar industry particularly prior to 1992, that large areas of cane growing land have elevated levels of cadmium. This is a potentially a serious problem given that

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cadmium is extremely toxic to aquatic and marine animals (Hart 1982). In addition, given that cadmium is also known to accumulate in produce suitable for human consumption, much of the current cane growing area may be unsuitable for alternative agricultural land uses. Unpublished analyses (A. Garside *pers comm*) of peanuts from the Mackay and Tully areas have shown cadmium levels 3 times the acceptable level.

Although heavy metals may be transported offsite, environmental pollution by agricultural activities are generally considered to have little influence on heavy metal loadings in streams compared with other sources such as mine and industrial effluent (Arthington *et al.* 1997).

Riparian vegetation and wetland degradation

Considerable areas of riparian vegetation have been removed from the stream banks in sugar cane growing regions. Results from a recent environmental audit indicated that 70% of the farms surveyed had a riparian zone classed as moderate (<15m) or worse (Gutteridge, Haskins and Davey 1996). Mangrove areas have largely remained intact, although some clearing did occur in the 1960s and 1970s. Large areas of riverine rainforest with patches of eucalypts have also been cleared in many cane growing regions (Johnson *et al.* 1998b).

The wetlands, swamps, billabongs and waterholes of coastal areas play an important role in floodplain ecology (eg. providing wildlife habitats) and as an integral part of the surface and ground water hydrological regimes of floodplains (eg. providing important hydrological functions). Clearing for sugarcane has significantly reduced the area of this habitat type in most cane growing regions. For example, in the Johnstone Rivers system, there has been a 60% reduction in the area of coastal wetlands between 1951 and 1992 (Russell *et al.* 1995). On the Herbert River floodplain, Johnson *et al.* (1998b) have shown a 60% decrease in the area of *Melaleuca* dominated vegetation patterns and a 50% decrease in riparian rainforest patterns since European settlement.

What do these trends tell us?

The evidence presented in the preceding sections clearly suggests that the quality of the natural resource base on which the sugar industry depends is declining and that many key components of the surrounding terrestrial, aquatic and marine ecosystems are impacted by sugar industry activities. However, even though a substantial body of evidence exists, it is impossible to answer the question "is the sugar industry ecologically sustainable"? Answering this question in the future will remain problematic given the considerable ambiguity associated with the current understanding of the issues and the lack of a systematic approach to defining and measuring progress toward ecological sustainability.

In moving to point where the aforementioned question can be answered, there is an essential need to develop agreed concepts, definitions, objectives, benchmarks and performance indicators that are understood and "owned" by all stakeholders. Furthermore a comprehensive system of monitoring and evaluation will have to be established if the sugar industry's performance is to be adequately assessed over time. The need for such actions may be further justified if the industry aspires to become compliant with internationally accepted environmental standards (e.g. ISO14000) in the future. Implementing these monitoring and evaluation systems will take time and require a significant commitment of resources. However, they represent an important component of a suite of changes that will be required if the industry is to move towards ecological sustainability. In the sections that follow, we consider a range of other components that attempt to address existing barriers at both a conceptual and operational level.

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ACHIEVING ESD IN THE AUSTRALIAN SUGAR INDUSTRY – NATURAL RESOURCE POLICY, PLANNING AND MANAGEMENT

In attempting to implement the goals of ESD in agricultural regions, a number of Australian states have introduced and fostered community-based approaches to IRM (Bellamy and Johnson 1997). Federal initiatives such as the National Landcare Program (ANAO, 1997) support ESD principles. At the state level Whole Catchment Management (Syme *et al.* 1994) and Property Management Planning (Commonwealth of Australia 1995) have been prominent. However, attempts to put into practice a comprehensive way of promoting ESD at the catchment and regional scale through more community-based approaches both in Canada and Australia (Dorcey 1991; Syme *et al.* 1994) are posing enormous challenges for rural communities, government and industry. Bellamy and Johnson (1998) found part of the difficulty lies in: the complexity of the problems being addressed; the failure to recognise ESD as a continuous process rather than a particular state for which to aim; flawed policy responses and ineffective program and policy implementation;, the weakness of the strategies adopted to resolve conflict;, and the frequent failure to include interests without power in the community. Any attempt to move toward ESD in the sugar industry, however, will require not only significant operational innovations, but also a conceptual shift toward adoption of an IRM paradigm.

Adopting an Integrated Resource Management Paradigm

The IRM paradigm recognises the interdependencies of natural systems, political systems, social systems, and technology in addressing "wicked" problems that are an inherent characteristic of natural resource use (Bellamy *et al.* 1999). Mason and Mitroff (1981) identified wicked problems as being interconnected, complicated, uncertain, ambiguous, conflicting and societal constraints. In recognition of these characteristics, the emerging IRM paradigm has a number of fundamental properties (Bellamy and Johnson 1997) including:

- An integrated systems approach;
- A long term perspective and broad spatial scale focus;
- The concept of 'the whole being more than the sum of the parts';
- Recognition of complexity and uncertainty in system interactions;
- Non-linear processes and connectivity between problems;
- Relevance of human and cultural context and diversity in values;
- People as part of the problem and not external to it;
- Management focus on the scale of landscapes, regions or catchments;
- Coordination of decision-making amongst stakeholders in government, industry and the community;
- Strategies for resolving conflict through negotiation; and,
- Active involvement of the whole community to encourage community ownership of the problem and its solution, and ultimately the adoption of sustainable resource use and management practices.

This new IRM paradigm has evolved from recognition of the failures of current disciplinary or sectorally based approaches based on rational planning principles, and from insights from domains other than agriculture, including the ecological, policy and social sciences (Bellamy and Johnson 1998). In response, a range of policy frameworks, institutional arrangements and implementation processes for IRM have been established around the world. Although contexts and mechanisms vary significantly, the fundamental rhetoric underlying these approaches has a number of common elements (e.g. Lang 1990; RAC 1993; Mitchell and Hollick 1993; Bellamy *et al.* 1999):

- Management of interrelated resources with regard to ecological processes and the maintenance of environmental quality;

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- Involving multiple objectives and multiple players;
- Coordinating government, non-government and community natural resource management policies and activities; and
- Involving community participation in natural resource management.

The IRM rhetoric also supports the integration process moving beyond a purely coordination function to one that involves roles and responsibilities for both the implementation and the monitoring of integrated planning strategies and decisions on resource management at the catchment or regional level.

Responding to the Rhetoric

The 1992 Intergovernmental Agreement on the Environment commits all Australian state and territory governments, the Commonwealth Government and Local Government to the principles of ESD. Both the federal and state governments have introduced measures (e.g. modified policies, programs and institutional arrangements) to protect the environment and manage natural resources more sustainably. A key policy initiative has been the development and implementation of a number of catchment-based initiatives in all Australian States (eg. Total Catchment Management in New South Wales and Integrated Catchment Management (ICM) in Western Australia and Queensland).

The Queensland State Government released an ICM Strategy in October 1991 (Anonymous 1991). It provides a framework for fostering cooperation and coordination between landholders and other resource users, community groups and government agencies involved in the use and management of natural resources (Johnson *et al.* 1996). The Queensland Department of Natural Resources is the lead government agency for implementing the Strategy. Other state government agencies, such as the Department of Primary Industries, Department of Environment and Heritage and the Department of Communication, Information, Local Government and Planning, also play a role in promoting and supporting relevant aspects of the ICM policy initiative. The Queensland initiative is different from most other Australian experiences in that its has no legislative basis; its success will ultimately reflect the ability of relevant public and private interests to voluntarily effect required action.

To-date implementation of the ICM Strategy in Queensland has occurred in 34 catchments covering over 70% of the state. One of the first catchments in the State to initiate ICM activities was the Herbert River Catchment. The Herbert River catchment has an area of nearly 10,000 km^2 and is located on the southern end of the wet tropical coast of north Queensland. It drains directly into the Hinchinbrook Channel, part of the Great Barrier Reef Marine Park. Agriculture is the dominant land use in the catchment, consisting of mainly beef production on native pastures in the upper catchment and intensive sugarcane production on the lower coastal plain. Other significant land uses are forestry, conservation areas (ie. significant parts are within the Wet Tropics World Heritage Area), and smaller areas for horticulture and fodder cropping. The sugar industry dominates the lower Herbert both socially and economically. The sugar industry in general has been a dominant player in ICM in the lower Herbert River catchment since its inception in 1993.

The Herbert River Catchment ICM process has formed the focus of a five-year study to monitor and evaluate the implementation of ICM (Bellamy and Johnson 1997, 1998; Bellamy *et al.* 1999). The analysis of the initial stages of this implementation of ICM in the Herbert catchment by Bellamy and Johnson (1997, 1998) suggests that an ICM process may contribute to a move towards sustainable cane growing by:

- *Fostering communication* across sectoral and community interests facilitated through the establishment of an effective community based forum that reveals the diversity of

perspectives and the importance attributed to specific catchment issues;

- *Providing a structure that fosters cooperation* amongst community and sugar industry groups and government organisations that leads to more equitable decision making and more sustainable natural resource outcomes on the ground;
- *Facilitating coordination* of effort across government, sugar industry and community organisations to achieve outcomes that have benefits to a broad range of catchment stakeholders as well as the environment, and which could not be achieved by any one group alone;
- *Integrating* ICM principles into Local Government planning that provides a basis for implementing a strategic direction for the catchment; and
- *Supporting an emergent strategic ICM approach* of adaptive learning involving key and influential community actors and moves the community towards a sustainable process of integrated planning of natural resource use.

There are still very significant challenges for ICM in the Herbert River catchment. In particular it has a long way to go to achieving tangible outcomes in respect of the key natural resource management issues. However, significant progress is being made in a long term process. The Herbert River catchment is not unique, and its experiences in implementing ICM are relevant to other catchments that have a diversity of significant land and water management and biodiversity protection issues relating to sustainable sugarcane growing.

MOVING FROM RHETORIC TO PRACTICE: CHALLENGES AND OPPORTUNITIES

In responding to the rhetoric on sustainability and the new IRM paradigm, and in attempting to achieve real change, the sugar industry faces a number of significant challenges. These challenges relate to key contextual, structural and process issues influencing and controlling the sugar industry's move towards sustainable resource use (Bellamy and Johnson 1997).

Sustainable Cane Growing - A Way Forward

An ESD framework

In detailing the opportunities for moving toward ESD in the sugar industry it is instructive in the first instance to provide a broader framework for future development. We believe that it is incumbent on the industry, government and the broader community to work together towards ensuring that the following objectives are fulfilled:

1. Natural resource management in cane growing regions is undertaken as a fundamental part of, and necessary precondition for, ESD and the implementation of the precautionary and 'duty of care' principles.

2. Responsibility for natural resource management is shared between government, community and the industry in a transparent and mutually supportive manner.

3. Appropriate incentives are put in place to encourage the use of natural resources only in ways that are ecologically sustainable.

4. Appropriate mixes of incentives are developed and appropriate weighting given to motivational, voluntary, property-right, price-based, and regulatory instruments in ways which are context sensitive and responsive to local, regional and social characteristics.

5. The Australian community as a whole, as well as users and beneficiaries of natural resources contribute towards the provision of incentives to the industry, which has primary responsibility is for the on and off farm protection of the environment.

In the sections that follow we discuss a range of possible incentives, instruments and mechanisms that the sugar industry and its partners in government and the broader community could utilise in moving toward ecological sustainability.

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Institutions

For the framework outlined above to be implemented, it is essential that governments at all levels develop the necessary supporting institutional capacity. Accordingly, governments at all levels must develop structures that empower local communities and the sugar industry to effectively manage and conserve natural resources and provide access to instruments necessary for their operation. Conversely, governments must address problems where local initiatives fail or are incomplete and, importantly, must give consistent signals to resource users and consumers about the importance of natural resources within the broader context of ESD.

Natural resource management needs to be integrated into decision making at all levels of government, community and the sugar industry. Furthermore, stakeholders must be involved in the establishment (where they do not already exist) and operation of relevant decision making and advisory bodies (eg ICM). Improved participation of local government in the cane land allocation process is also necessary. This should be done through the appointment of a local government representative(s) to Local Cane Production Boards whose role is to regulate cane growing and harvesting. Ensuring cross-compliance of cane land allocation process with Local Government planning schemes would also ensure the formal consideration of ESD principles.

Stakeholders, particularly canegrowers, also have a responsibility to ensure that their own internal processes allow real opportunities for the involvement of individual farmers at a "grassroots level". There is potential for self-interest and local needs to dominate important resource management issues. Conflict within decision-making fora represents a major potential threat to improved practice. Visible monitoring and accountability mechanisms are therefore essential pre-requisites for increased community and industry involvement, as are the development of appropriate and effective conflict resolution and facilitation processes. This is especially the case for the operation of the cane assignment system. We believe that it is more efficient to build on and adapt existing administrative and institutional structures, where possible, to address natural resource management issues rather than to create new structures. For example, suggested improvements in the cane land allocation process could include (Johnson *et al.* 1996; Shrubsole 1997):

- Reviewing the present referral process for cane land allocation by establishing and applying locally based conflict resolution mechanisms before requiring the formal involvement of the Queensland Sugar Corporation or Sugar Tribunal. These mechanisms should be codified in new sugar industry legislation;
- Local Cane Production Boards should provide for the earlier consideration of environmental factors in the cane land allocation process through existing mechanisms such as "Continuous Crushing Agreements" (ie agreements between cane growers and sugar millers on the length of the harvesting period, milling capacities, future growth and transport planning) and corporate policies. In so doing, Local Cane Production Boards could reduce the perceived need for pre-emptive clearing by adjusting the timing of the cane land allocation process.

Motivational and voluntary incentives

Incentives aimed at increasing levels of knowledge and understanding or requiring voluntary action, are premised on the belief that environmentally responsible behaviour is far more likely to result when people have a basic knowledge of the issues at stake, and/or a commitment to the principles of ESD (Young *et al.* 1996). Motivational and voluntary incentives encourage all stakeholders to share information and contribute to improved management. Motivational and voluntary incentives have already been used in some cane growing regions, and include activities such as ICM. Hence motivational incentives must be a core mechanism for improved natural resource management. Two examples of a potential application would include:

- The identification of agreed wetland and riparian areas in cane growing catchments to underpin negotiated agreements between landholders, government and the broader

community on buffer setback widths. This activity would preferably be embedded and implemented within a broader catchment planning exercise undertaken as a partnership between government, the sugar industry and the community; and

- The establishment of voluntary conservation agreements between cane growers and government under the *Nature Conservation Act 1992 (Qld).*

Property-right incentives

Two alternative types of property right incentives - covenants or management agreements have potential for application in the sugar industry. Management agreements can be used to reimburse people for the costs of resource management that can not be recovered through normal market mechanisms. An example would be to encourage canegrowers to undertake specified management activity on private land adjacent to public conservation reserves or wetlands.

Conservation covenants are particularly effective in protecting remnant vegetation or wetlands, and can be use to underpin approaches such as management agreements. The use of conservation covenants can also be linked to other incentives, for example, the local government rating systems (for rate relief purposes), to recognise the value of uncleared land. Licence and permit systems are used where there is a need to link natural resource management with an economic activity; pollution permits and land clearing for example. In the design of licence systems, there is a need to place emphasis on the dependability of the licence to protect natural resources in an efficient and equitable manner. Central to this must be the establishment of effective monitoring strategies that not only assess specific activities (eg., cane land allocation) but also general environmental performance.

Tradeable rights systems are frequently advocated by economists, but generally have a poor track record (Nelson 1977). The benefits of transferable property rights are more apparent in areas where equivalent units (eg water) can be traded than where units traded may not necessarily be equivalent (eg wetland preservation schemes). Tradeable rights have a role in the sugar industry but should not be seen as the sole solution. In virtually all cases, they need to be supported by an appropriate network of regulatory, financial and institutional measures (Young *et al.* 1996).

Regulatory incentives

Despite advocating motivational, social and market based incentives, there remains an important role for regulation, because acting alone, non-regulatory instruments are not always effective (Napier 1994). Regulations provide precautionary standards and an essential safety net to protect against the recalcitrant few not persuaded by other incentives. Each level of government needs to set such standards and no level of government should be able to undermine the standard set by another level of government, by a community or by industry itself. It is crucial that the sugar industry and the community be given the opportunity to contribute to the development of standards. As regulatory incentives provide protection against those who do not respond to other measure, they are particularly important when threats to natural resources are likely to become irreversible, for example, in the case of land clearance on coastal floodplains in which the sugar industry is a dominant land user.

Although some protection for natural resources is currently afforded by planning controls embedded within the *Nature Conservation Act 1992 (Qld)*, *Environmental Protection Act 1994 (Qld)*, *Coastal Protection and Management Act 1995(Qld)*, *Fisheries Act 1994(Qld)* and *Integrated Planning Act 1997 (Qld)*, problems exist in areas subject to the provisions of the *Water Resources Act 1989 (Qld)*, or on land with freehold tenure. An increasing regulatory role for local government (e.g. through the invocation of planning controls if consent is required for subdivision, zone change and drainage development) provides some opportunity for improved natural resource management, particularly for the management of riparian and wetland areas. Some of these issues are presently being addressed in the planning schemes of Noosa, Hinchinbrook, Cardwell and Johnstone Shires. However, for improved management to occur, greater integration between local and state

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government, industry and the community must be a priority.

Pricing Incentives

A fundamental consideration in the development and implementation of any policy or instrument mix is the both the private and public cost implication. The cost of controlling and preventing damaging processes in cane growing regions should be borne primarily by those who cause these problems (ie. the sugar industry). However, the Australian community as a whole should take financial responsibility for protecting the natural environment when the costs of doing so cannot be recovered by the use of market mechanisms. Hence, all those who benefit from non-market dimensions of protecting the natural environment, whether directly and indirectly, should contribute to the cost of its maintenance (Young *et al.*, 1996).

The tax system is an important area for reform, particularly when taxation incentives are recognised to be the most cost effective means of encouraging altruistic investments in resource conservation by the private sector (Davenport 1995). Another method of ensuring that users pay is the imposition of levies and charges. These have the additional benefit of making users of natural resources aware of the cost of their activities (Young *et al.* 1996). This is particularly true in the case of water. Acceptance of such levies is likely to be improved if the funds raised are clearly seen to be working towards resource management and protection, preferably by being placed in resource management funds administered by the local community and the sugar industry itself. Opportunities also exist for the implementation of financial incentives for retention and management of high value habitat areas in cane growing regions to be dedicated as Nature Refuges or Coordinated Conservation Areas. Finally, direct acquisition of riparian areas and wetlands of regional, national and international importance remains an option.

Appropriate Scales

As discussed, the wide range of challenging factors facing the sugar industry means that a variety of mechanisms and arrangements are needed to address them, and that many of these solutions will be location or regionally specific. In order to overcome some of these problems, we suggest that the appropriate boundaries for government decision making on natural resource management in cane growing regions are bioregional. However, local government and the sugar industry (whose boundaries are rarely consistent with bioregional boundaries), will require close and identifiable ties with the community, and will have to provide an appropriate base for implementation. Regionally developed strategies based on and consistent with national and international ESD principles will be necessary to assist the sugar industry in increasing the sustainability of its activities. Hence it is important that common national and international agreements on the principles of ESD exist in parallel with coordinated local, regional and industry interpretations, strategy development and implementation (Geno 1996).

Science and Information

Management of resources on the basis of ESD is more complex than management premised solely on maximum productivity or conservation. Policy and planning cannot be expected to achieve societal goals in the absence of adequate data relating to biophysical, economic and social factors that impinge on resource use (Cocklin *et al.* 1987). Scientists traditionally respond to such challenges by advocating that further research is needed to fill gaps in our understanding. In response, Walker *et al.* (1996) propose that the adage that "further research is needed" provides scientists with little opportunity to have a positive impact on sustainable natural resource management. They argue that only by being prepared to invest in understanding the context of decision-making and by finding novel ways of facilitating the uptake of past and future research by decision-makers, can scientists hope to have a significant and consistent impact on practice. Johnson *et al.* (1998b) argue that the challenge for research is to address the needs of decision-makers in three key areas: problem identification; data collection, collation and analysis; and rational use of the outputs of that analysis.

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Notwithstanding these concerns, continued research may be needed to enable more informed and appropriate management of natural resources in cane growing regions. Clearly, research is required to further understanding of the physical and socio-economic systems in which cane production occurs. However, research is also needed in the organisation of that knowledge to provide an effective basis for decision-making in relation to ESD. The integration of information technologies such as GIS, expert systems, other knowledge-based systems and simulation modelling into decision support systems may help in addressing these issues (Fedra, 1995). The role and management of such innovations also demands attention. It is hard to envisage effective ESD in the sugar industry without the use of information technology tools in some capacity (Johnson *et al.* 1998a).

CONCLUSIONS

The policy environment for ESD in the context of the sugar industry will continue to respond to changing political, economic, social and environmental considerations. While the manner in which resources are managed will vary, public expectations for, and support of, effective environmental management policies will remain. In this regard, the principles for ESD will form the basis for the development of new and improved initiatives. The general trend of shifting management responsibilities to lower levels of government will continue, although the extent will be guided by overriding state and federal government policies. There will be a continued emphasis on regional planning to establish a sound foundation for policy implementation.

The magnitude of the tasks facing the Australian sugar industry in its attempt to move toward ecological sustainability in the future remain substantial. The challenge for the sugar industry is to embrace, rather than resist, the inevitable trend toward greater public intervention in its affairs. In response, government must provide a stable environment in which locally relevant decision-making can occur and in which appropriate and viable monitoring, cost-sharing and regulatory arrangements can be supported. The Australian sugar industry must continue to develop its own policies and activities to guide its future developments within a wider context. In so doing, it must recognise that external pressures will evolve with time; hence planning must be a continuous activity rather than a single exercise. Further, the industry must develop its own strategic view on where and how sugar cane will be grown – both at regional and whole of industry levels. This view will need to be based on the best available scientific information and full utilisation of the products of its substantial investment in environmental R&D. Furthermore, for strategic planning to be successful, the sugar industry needs to be proactive in involving itself in non-sugar industry programs related to natural resource management and planning.

In facing the significant challenges of balancing the dual goals of economic efficiency and environmental conservation, the sugar industry can reflect on its own experience and that of other agricultural industries and move to a sustainable future by playing a key role in:

- *Fostering communication* across sectoral, local government and community interests;
- *Developing a structure and related processes and procedures that foster cooperation* between the industry and other industry, community groups and government organisations and paves the way for more equitable decision making and more sustainable natural resource outcomes on the ground;
- *Facilitating coordination* of effort between itself, government and community organisations; and
- *Supporting the integration* of resource management principles (including Codes of Practice for Sustainable Cane Growing) into Local Government planning schemes and decision-making processes.

Significant opportunities exist for the sugar industry to embrace a broad range of integrated resource management principles in the future. These include:

- Developing a strong culture of mutual support and information exchange with other stakeholders responsible for natural resource management in cane growing regions;

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- Developing and refining locally-based industry regulations such as the cane land allocation system and sugar industry environmental codes of practice for cane growing which could be supported by incentive systems;
- Increasing its participation in emerging programs to operationalise the principles of ICM in Local Government planning schemes;
- Continuing to support extension, other industry networks and new opportunities in information technology to improve the capacity of the industry to address resource management issues; and
- Applying the traditional agricultural business concept of managing an asset to resource management activities, so as to establish strong market linkages for land and water resources management with farm enterprise outcomes.

If the Australian sugar industry can operate within this framework, it will be clearly able to demonstrate that environment-economy linkages can lead to positive economic, social and environmental benefits and in so doing, manage for ESD and move the sugar industry, government and community substantively along the continuum from rhetoric to practice.

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Chapter 7

Natural Resource Use and Management in the Australian Sugar Industry: Current Practice and Opportunities for Improved Policy, Planning and Management

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Natural Resource Use and Management in the Australian Sugar Industry: Current Practice and Opportunities for Improved Policy, Planning and Management

Johnson, A.K.L., McDonald, G.T., Shrubsole, D.A. and Walker, D.H.

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Abstract

The Australian sugar industry is largely confined to the narrow, high rainfall coastal zone in which competition from tourist and recreational uses, urban encroachment, public utilities and hobby farms for natural resources has increased significantly in recent years and is likely to grow in the future. This paper briefly examines the socio-political, economic and environmental context in which natural resources are currently managed in the Australian sugar industry. We argue that planning, in concert with a range of policy and economic instruments, can play an important role in the resolution of such problems. Building on the collective national and international experience of other industries, options for efficient and equitable allocation of resources between the sugar industry and its neighbours at the policy level and on-farm are outlined and discussed.

EVALUATION OF INTEGRATED CATCHMENT MANAGEMENT IN A WET TROPICAL ENVIRONMENT: COLLECTED PAPERS OF LWRRDC R&D PROJECT CTC7

Compiled by Jennifer A. Bellamy

VOLUME 4

IMPLEMENTING ICM IN THE HERBERT RIVER CATCHMENT: HRCCC VIEWS AND PROGRESS

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Chapter 1

ICM in Queensland: Response from Committee Members of Johnstone and Herbert River Catchments, 1995

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Background

Eleven committee members from the Herbert River Catchment responded and six from the Johnstone River responded. These included the two Chairs, whose ratings have already been recorded in the report on Chairs and Coordinators. The Chairs responses are also included in this report.

Table 1 summarises how long each member has lived in the area, when they joined the Committee, whether they live upstream or downstream of Abergowrie (for Herbert River members) or in which shire the Johnstone River Committee members live.

Catchment	Position	Lived in area (in years)	Joined the committee	Upstream or Downstream of Abergowrie	Shire in Johnstone catchment
Herbert	Chair	65	From outset	Downstream	
Herbert	Member	36	1995	Downstream	
Herbert	Member	48	1991	Downstream	
Herbert	Member	40	1992	Downstream	
Herbert	Member	18	1993	Downstream	
Herbert	Member	20	1993	Downstream	
Herbert	Member	58	1994	Downstream	
Herbert	Member	14	1993	Downstream	
Herbert	Member	7	1994	Upstream	
Herbert	Member	46	1993	Downstream	
Herbert	Member	59	1993	Downstream	
Johnstone	Member	33	1994		Eacham Shire
Johnstone	Member	25	1991		Johnstone
Johnstone	Member		Since start		Eacham
Johnstone	Chair	34	1991		Johnstone
Johnstone	Member	40	1992		Johnstone
Johnstone	Member	45	1991		Both Johnstone and Eacham equally

The following table summarises response to question 4 on how satisfied members are with progress in the CCC. The ratings used are: 0=no response, 1=very unsatisfied, 2=unsatisfied, 3=neither satisfied nor unsatisfied, 4=satisfied,
5=very satisfied.

Rating:	1	2	3	4	5
Herbert	1	1	3	5	1
Johnstone			1	3	2

Below are comments by members on major achievements in their catchment:

Johnstone

1. Getting people together to talk rationally. Getting a lot of data. Management plan.
2. Finalisation of a strategy for our ICM and now the beginning of the implementation.
3. Raising public awareness. Bringing together diverse groups. Developing "best practices" for industries. Attracting Govt. funding for permanent staff.
4. Has developed a catchment strategy and implementation procedures which have heavily influenced ICM in other parts of the state.

5. Developing a role for the CCC and its members, provide an independent and informed and coordinated view, recognised as a useful body by some key agencies and funding bodies, it has not only "continued" ut is developing a leadership role in NRM and its implementation.

Herbert

1. Cross Section of communities viewpoints of necessary works. Trying to coordinate natural resources activity in the Herbert Catchment.
2. The level of awareness of ICM to Canegrowers has been slow. Formation of the group went well. The formation of a strategic plan has been slow. The ICM group did become involved with issues as they arose, but had no policy at that stage. This is being addressed now.
3. Too early to tell.
4. People from significant backgrounds starting to talk and share ideas. This has proven to be a slow process.
5. Works on the mining sites in the upper catchment.
6. The only achievement I see is the controlling of the mining operations in the Herberton area. This has caused major siltation in the Herbert River. This siltation has caused very dirty water for the residents of the Hinchinbrook Shire. I feel there are too many meetings. Too much talking - more positive decision making required.
7. Formulation of a management strategy. Formulation of Upper Catchment subcommittee.
8. Coordination of the mapping of Tolle catchment and drawing up of catchment management plan.
9. Bringing together different group problems and trying to solve them.

Local Issues

Below are summary tables of questions 6-8. The ratings are 0=no response, 1=very low, 2=low, 3=moderate, 4=high, 5=very high, 6=NA/don't know.

Question 6. In your opinion, what is the significance of the following issues in your catchment?

HERBERT	0	1	2	2.5	3	4	4.5	5	6
Social issues									
Schools			3		2	4		2	
Crime			1		2	5		2	1
Unemployment					2	7		1	1
Health care			1		4	4		1	1
Economic issues									
Land valuation					1	5		5	
High government spending	1	2	1		2	2		1	2
High taxes			1		3	3		4	
Institutional issues									
Too much govt. regulation					2	2		7	
Natural resource management issues									
Agric. land degrad. problems			1		5	1	1	3	
Water quality problems			3		3	1		4	
Water quantity problems			1		4	2		4	
Nature conservation			1		3	4		3	

JOHNSTONE	0	1	2	2.5	3	3.5	4	5	6
Social issues									
School					4		2		
Crime	1		1		2		1		1
Unemployment			2	1	1		1	1	
Health care	1	1	3						1
Economic issues									
Land valuation			1		2		2	1	
High government spending			2	1	1		1		1
High taxes			1				2	2	1
Institutional issues									
Too much govt. regulation			1	1			3	1	
Natural resource management issues									
Agric. land degrad. problems		1	1		2		1	1	
Water quality problems		1	3		1			1	
Water quantity problems		1	1	1			1	2	
Nature conservation		1	1		2	1	1		

Question 7: In your opinion, how serious are the following natural resource management issues in your catchment?

HERBERT							
Affects you personally	**0**	**1**	**2**	**3**	**4**	**5**	**6**
Agricultural and Degradation Problems							
Crop land degradation	1	3	2	2	1	2	
Grazing land degradation	1	4	1	3		1	1
Soil salinity	1	2	1	2		1	4
Weeds	1		1		7	2	
Insects and disease on crops	1	1	1	2	5	1	
Urban expansion onto farm lands	1	1	3	2	2	1	1
Allocation of caneland	1			2	3	4	1
Land clearing	1	1	2	1	2	3	1
Water quality problems							
Surface water salinity	1	2	4		1	1	2
Wastewater management	1	1	2	2	1	2	2
Surface water nutrient enrichment	1	2	1	1	2	1	
Pesticides in waterways	1	1	2	2	1	2	2
Groundwater quality	1	1	2	3	2	2	
Acid soils	1	3	2		2	2	1
Stream bed and bank erosion	1	1	2	3	1	3	
Water quantity problems							
Surface water availability	1	4		1	1	4	
Groundwater availability	1		2	3	3	2	
Rural flooding and water "for the environment"	1	1	1	1	3	4	
Rural drainage	1		2	1		7	
Urban flooding	1	2	1	1	2	3	1
Nature conservation							
State forests and NPs	1	1	2	3	1	3	
Instream and outstream water use conflicts	1	2		3	1	2	2
Dryland veg. habitat loss	1	1	2	3	2	1	1
Freshwater hab. loss....	1	1	1	4	1	3	
Coastal wetland hab. loss	1	1	1	2	2	3	1

HERBERT							
Affects you personally	**0**	**1**	**2**	**3**	**4**	**5**	**6**
Barriers to fish migration	1	1	2	2	2	3	
Other/s							
Lack of water storage infrastructure						1	

HERBERT							
Affects the catchment	**0**	**1**	**2**	**3**	**4**	**5**	**6**
Agricultural and degradation problems							
Crop land degradation		2	3	3	2	1	
Grazing land degradation		1	1	4	3		2
Soil salinity		3	2	1	2		3
Weeds				4	7		
Insects and disease on crops			3	2	4	2	
Urban expansion onto farm lands		4		2	3	1	1
Allocation of caneland			2		5	4	
Land clearing			1	3	3	3	1
Water quality problems							
Surface water salinity		2	3		3	1	2
Wastewater management		4	1	2	3	1	
Surface water nutrient enrichment		2	3	1	3		2
Pesticides in waterways		3		5	1		2
Groundwater quality		1	1	4	3	1	1
Acid soils		2	3	4	1		1
Stream bed and bank erosion			1	1	7	2	
Water quantity problems							
Surface water availability		2	1	3	2	2	1
Groundwater availability		2		2	5	1	1
Rural flooding and water....		1	1	2	6	1	
Rural drainage				1	7	3	
Urban flooding		1			8	2	
Nature conservation							
State forests and NPs		2		6	1	1	1
Instream and outstream water use conflicts		2	1	4		2	2
Dryland veg. habitat loss		2	3	3	3		
Freshwater hab. loss....		2	2	2	3	1	1
Coastal wetland hab. loss		2	2	1	4	1	1
Barriers to fish migration		2		3	4		2
Other/s							
Lack of water storage infrastructure				1			

JOHNSTONE							
Affects you personally	**0**	**1**	**2**	**3**	**4**	**5**	**6**
Agricultural and degradation problems							
Crop land degradation		1	2		1	2	
Grazing land degradation			2		3		1
Soil salinity		3					3
Weeds			2	2		2	
Insects and disease on crops			1	1	1	2	1
Urban expansion onto farm lands			3		2	1	
Allocation of caneland		3			1		2
Land clearing		3	1			1	1
Water quality problems							
Surface water salinity		2					4
Wastewater management		1	1	2		1	1

JOHNSTONE							
Affects you personally	**0**	**1**	**2**	**3**	**4**	**5**	**6**
Surface water nutrient enrichment		3	1				2
Pesticides in waterways		2	1			1	2
Groundwater quality			1	1	1	1	2
Acid soils		2	1	1			2
Stream bed and bank erosion		1	2	1	2		
Water quantity problems							
Surface water availability		2	1			3	
Groundwater availability		2	2			2	
Rural flooding and water "for the environment"			1	2	1	1	1
Rural drainage		3		1	1		1
Urban flooding		3	1				2
Nature conservation							
State forests and NPs		1		1	2	1	1
Instream and outstream water use conflicts		2			3		1
Dryland veg. habitat loss		1		1	1		3
Freshwater hab. loss....				2	2	1	1
Coastal wetland hab. loss				1		4	1
Barriers to fish migration		1			2	1	2
Other/s							
Landowners rights removed by minority pressure groups						1	

JOHNSTONE									
Affects the catchment	**0**	**1**	**1.5**	**2**	**2.5**	**3**	**4**	**5**	**6**
Agricultural and degradation problems									
Crop land degradation		1		1		2	1		1
Grazing land degradation		2		1		1	1		1
Soil salinity		3							3
Weeds				1		2	1	1	1
Insects and disease on crops				1		2	1	1	1
Urban expansion onto farm lands				2		2	1	1	
Allocation of caneland		1		3		1			1
Land clearing		1		3		1			1
Water quality problems									
Surface water salinity		3							3
Wastewater management				2		2	1	1	
Surface water nutrient enrichment		3		2					1
Pesticides in waterways		1		3				1	
Groundwater quality		1		2		1			2
Acid soils		2	1			2			1
Stream bed and bank erosion						4	1		1
Water quantity problems									
Surface water availability		1				3		1	1
Groundwater availability		1		2	1	1			1
Rural flooding and water....		1		1		2	1		1
Rural drainage				1		4			1
Urban flooding		1		1	1	2	1		
Nature conservation									
State forests and NPs		1			1	2	2		
Instream and outstream water use conflicts				1		2	1		2
Dryland veg. habitat loss		2					1		3
Freshwater hab. loss....		1				1	3		1
Coastal wetland hab. loss		2				1	2	1	

Barriers to fish migration	2	2	2
Other/s			
Landowners rights removed by minority pressure groups			1

Question 8: What are the impacts of these natural resource issues on you personally and on people in the catchment?

HERBERT							
Personally	**0**	**1**	**2**	**3**	**4**	**5**	**6**
Aesthetic and Recreational Impacts							
Access to recreation	1	2	2	1	2	2	1
Environmental amenities	1	1		2	3	4	
Loss of scenic values	1	3	2		3	2	
Life Support Impacts							
Drinking water quality			2	4	2	2	1
Human health	1	1	3	2	2	2	
Fishery decline	1	1	1	2	4	2	
Functional Resource Impacts							
High cost of water		3	1	3		3	1
Loss of farm productivity	1	1	1	2	2	4	
Higher production costs		1	3		3	4	
Shortage of irrigation water	1	2	2	2	1	3	
Higher taxes	1	1	1	3	2	2	1
Psychological Impacts							
Loss of independence to make (farm) decisions	1	1		1	4	2	2
Emotional stress on individuals	1		1	5	2	2	
Conflicts with other resource users	1		1	6	2	1	
Loss of confidence in govt's. ability to manage natural resources	1	2			5	3	

HERBERT							
Catchment	**0**	**1**	**2**	**3**	**4**	**5**	**6**
Aesthetic and Recreational Impacts							
Access to recreation		1	2	1	3	3	1
Environmental amenities		1	1	2	4	3	
Loss of scenic values		1	6	2	1	1	
Life Support Impacts							
Drinking water quality				3	4	4	
Human health		1	2	3	2	2	1
Fishery decline		1	1	3	5	1	
Functional Resource Impacts							
High cost of water		1	1	4	2	2	1
Loss of farm productivity		1	1	3	4	2	
Higher production costs			1	2	5	3	
Shortage of irrigation water		2	3		5	1	
Higher taxes			1	3	5	2	
Psychological Impacts							
Loss of independence to make (farm) decisions		1	3	3	3	1	
Emotional stress on individuals			1	4	2	3	1
Conflicts with other resource users			2	6	2	1	
Loss of confidence in govt's ability to manage natural resources			2	1	3	5	

JOHNSTONE								
Personally	**0**	**1**	**2**	**3**	**3.5**	**4**	**5**	**6**
Aesthetic and Recreational Impacts								
Access to recreation		1	2	1		1	1	
Environmental amenities	1	2	1	1			1	
Loss of scenic values	1	1		1		1		2
Life Support Impacts								
Drinking water quality		1	2					3
Human health	1	3						2
Fishery decline		2	3				1	
Functional Resource Impacts								
High cost of water		1				1		4
Loss of farm productivity		1	1			1	2	1
Higher production costs	1					1	3	1
Shortage of irrigation water		1				1	2	2
Higher taxes	1	1		1			2	1
Psychological Impacts								
Loss of independence to make (farm) decisions							4	2
Emotional stress	1					2	1	2
Conflicts with other resource users		3		2				1
Loss of confidence in govt's ability to manage natural resources	1		1		1		2	1

JOHNSTONE								
Catchment	**0**	**1**	**1.5**	**2**	**3**	**4**	**5**	**6**
Aesthetic and Recreational Impacts								
Access to recreation		1		2		2	1	
Environmental amenities	1		1	2		2		
Loss of scenic values	1			1	1	1		2
Functional Resource Impacts								
High cost of water		1			2			3
Loss of farm productivity					2		2	2
Higher production costs	1			1	1		2	1
Shortage of irrigation water		1			2	1		2
Higher taxes	1	1			1		2	1
Life support Impacts								
Drinking water quality		1			1	1	1	2
Human health	1	2		1				2
Fishery decline				3	1		1	1
Psychological Impacts								
Loss of independence to make (farm) decisions		2		1	1	1	1	
Emotional stress on individuals	1			1		1		3
Conflicts with other resource users			1	1	3			1
Loss of confidence in govt's ability to manage natural resources	1				2	1	2	

Question 9: What is the level of public awareness about these natural resource issues and associated impacts?

Catchment	No response	Very low	Low	Low to Mod.	Moderate	Mod. to High	High	Very High
Herbert River			5	1	4			1
Johnstone	1	1			3	1		

Question 10. What do you consider to be the strength of public support to solve these natural resource issues in your catchment?

Catchment	No response	Very low	Low	Moderate	High	Very High
Herbert River			6	4		
Johnstone	1		1	3	1	

Question 11: The implementation of ICM in your catchment is difficult because:

HERBERT	0	1	2	3	4	5	6
11a Resource management problems are not well understood			1		8	2	
11b Technical solutions are not feasible			7		1	1	2
11c The impacts of mismanagement are long term and incremental			1	1	7	2	
11d There is no single acute resource management issue within the catchment			5		5	1	
11e The high level of behavioural change required			1		6	4	
11f The long time frame between implementing a solution and seeing the benefits			2		5	4	
11g The high cost of known solutions			2		7	2	
11h The high level of change required from existing government agencies			1	1	6	3	
11i The absence of clear and immediate economic benefits					8	3	
JOHNSTONE	**0**	**1**	**2**	**3**	**4**	**5**	**6**
11a Resource management problems are not well understood	1		2		1	2	
11b Technical solutions are not feasible	1	1	3	1			
11c The impacts of mismanagement are long term and incremental	1	1		1	2	1	
11d There is no single acute resource management issue within the catchment	1	1			2	2	
11e The high level of behavioural change required	1		1		3		1
11f The long time frame between implementing a solution and seeing the benefits	1	1		2	1		1
11g The high cost of known solutions	1	1	1	1	2		
11h The high level of change required from existing government agencies	1		1	1	1	2	
11i The absence of clear and immediate economic benefits	1		1		3	1	

Question 12. In the last 12 months, the importance of resource management issues has:

Catchment	Increased	Stayed the Same	Decreased	No response
Herbert	8	2	1	
Johnstone		5		1

Changes that have occurred:

Herbert

- Pomono subdivision - CCC responded with inspections and some publicity. No further action taken and in hindsite a lost opportunity. Erosion control works in Herbert River at Long Pocket region and was successful in funding. Cattle Creek drainage - to be dealt with in 1996. Trebonne Creek drainage - to be dealt with in 1996.
- Mahogany glider conservation plan - response in progress
- Main issue is Mahogany Glider habitat conservation is all out clearing for cane expansion. CCC sat on fence and failed to comment (deliberately) on gross environmental vandalism in clearing creek beds and banks on Pomona Station. Even the council is now complaining about failure to observe 10m buffer on creek but still ICM holds the "must be polite" line.

- The CCC has made very broad comments condemning expansion in Pomona, the group could have been more forceful in their statements but have taken a "political approach."
- It is my opinion that the CCC is speaking too much behind closed doors and not informing the public for support etc. Too many of the members of the CCC, have affiliations to too many other organisations. Some have 6 to 8 organisation involvements. The CCC chairman is a Shire Councillor and deputy chairman of the Hinchinbrook Shire, Chairman of Works, member of the Herbert River Improvement Trust, a member of the Rural Drainage Proposed Board and he is involved in several other committees. He and several others in the CCC should not be on the CCC Board. These people should be replaced because they cannot make a decision that is good for all the organisations they represent. Fingers in too many pies. I enclose a copy of the Herbert River Express dated December 5th which outlines my views on why I oppose the decision making capacity of the Trust member, Cr. Barnes. I and the organisation I represent have been asking for this work to be done for more than 15 years. When it could be done cheaply, now we see a very high cost involved. Too much talking and very little factual work has been performed.
- Extensive land clearing due to caneland expansion. Mahogany Gliders Issue has possibly made some people more environmentally aware. Also created friction between landowners and government agencies.
- An increasing awareness of the need for water storage for agriculture in the upper catchment. ICM will be coordinating and monitoring any moves in this direction.
- Buffer zones on land clearing.

Johnstone - no comments were made in this section for Johnstone

ICM CONTEXT

Question 13. What level of public support do you believe your CCC has?

Catchment	Very low level	Low level	Low to Moderate	Moderate level	High level	Very high level
Herbert	2	2		6	1	
Johnstone		1	1	3		1

Question 14. How significant have the following items been in gaining acceptance from the public?

(0=no response, 1=very low, 2=low, 3=moderate, 4=high, 5=very high, 6=NA/don't know)

HERBERT	0	1	2	3	4	5	6
The State Government's ICM policy statement		2	2	6			1
Local government political support			4	4	3		
Local government agencies support			3	5	3		
State government political support			3	7	1		
State government agencies support			1	4	6		
Good financial resources of CCC			5	2	3		1
Efforts of the CCC Chair		1	2	4	4		
Efforts of the CCC Coordinator				4	6	1	
Positive outcomes associated with CCC activities			3	4	4		
Support from relevant industry and community groups	1		2	5	3		

JOHNSTONE	0	1	2	3	4	5	6
The State Government's ICM policy statement		1	5				
Local government political support			4	2			
Local government agencies support				2	3		1
State government political support				2	2	2	
State government agencies support		1	1		2	2	
Good financial resources of CCC				1	3	2	
Efforts of the CCC Chair				1	3	2	
Efforts of the CCC Coordinator				1	1	4	
Positive outcomes associated with CCC activities				1	3	2	
Support from relevant industry and community groups				2	2	2	

Question 15. How effectively have the efforts of your CCC group been accepted by other government agencies within the Herbert?

Catchment	Very ineffectively	Ineffectively	Neither	Effectively	Effectively to very effectively	Very Effectively
Herbert			2	8		1
Johnstone			1	3	1	1

Question 16. How significant have the following items been in gaining acceptance from other agencies? *(0=no response, 1=very low, 2=low, 3=moderate, 4=high, 5=very high, 6=NA/don't know)*

HERBERT	0	1	2	3	4	5	6
The State Government's ICM policy statement			4	2	4		
Local government political support			4	3	4		
Local government agencies support			3	2	5		1
State government political support			1	9	1		
State government agencies support				5	6		
Good financial resources of CCC			5	4	2		
Efforts of the CCC Chair			4	4	3		
Efforts of the CCC Coordinator				3	8		
Positive outcomes associated with CCC activities			2	4	4		
Support from relevant industry and community groups				7	4		

JOHNSTONE	0	1	2	3	3.5	4	5	6
The State Government's ICM policy statement			1	2	1	1	1	
Local government political support			1	3		2		
Local government agencies support			1	2		1	1	1
State government political support			1			2	3	
State government agencies support				1		3	2	
Good financial resources of CCC						2	4	
Efforts of the CCC Chair						4	2	
Efforts of the CCC Coordinator						2	4	
Positive outcomes associated with CCC activities						4	2	
Support from relevant industry and community groups				2		1	3	

Question 17. How effectively have the efforts of your CCC been accepted by relevant local industry and community organisations?

Catchment	Very ineffectively	Ineffectively	Neither	Effectively	Effectively to very effectively	Very Effectively
Herbert		1	2	8		
Johnstone			1	3	1	1

Question 18. How significant have the following items been in gaining acceptance from relevant industry and community organisations? *(0=no response, 1=very low, 2=low, 3=moderate, 4=high, 5=very high, 6=NA/don't know)*

HERBERT	0	1	2	3	4	5	6
The State Government's ICM policy statement			4	2	4		1
Local government political support			3	5	3		
Local government agencies support			2	5	3	1	
State government political support			4	5	2		
State government agencies support				5	6		
Good financial resources of CCC			3	5	2		1
Efforts of the CCC Chair			2	3	6		
Efforts of the CCC Coordinator				3	5	3	
Positive outcomes associated with CCC activities			2	2	7		
Support from relevant industry and community groups	1		1	3	5	1	

JOHNSTONE	0	1	2	3	4	5	6
The State Government's ICM policy statement			3	1	1		1
Local government political support				5			1
Local government agencies support				2	1	1	2
State government political support			1		3	1	1
State government agencies support			1	1	1	2	1
Good financial resources of CCC				1	1	2	2
Efforts of the CCC Chair				1	2	2	1
Efforts of the CCC Coordinator					1	4	1
Positive outcomes associated with CCC activities				1	2	2	1
Support from relevant industry and community groups			1		2	2	1

Question 19. How effective has the involvement of the following groups been to the CCC? (*Ratings are 0=no response, 1=very ineffective, 2=ineffective, 3=neither, 4=effective, 5=very effective, 6=NA/don't know)*

HERBERT	0	1	2	3	4	4.5	5	6
Rural producers			1	1	7		2	
Local govt politicians			3	1	6	1		
Local govt administrators			3	2	5		1	
State govt politicians			4	5	1		1	
State govt agencies:								
DPI				1	5		5	
DEH			2	2	5		1	
Housing, Local Govt. & Planning			3	4	2			2
Dept of Lands			2	4	5			
Valley Trusts (or similar)	1		2	1	6			1
Drainage Board/s			1	2	7		1	
Sugar Industry Infrastructure Package Program			1	2	4		4	

Rural industry organisations (total)	1			1	5	4	
Canegrowers					1	2	
CSR					1	1	
BSES					1		
CU					1		
Dev. Bureau					1		
Environmental organisations (total)	4		1		3	3	
WPS					1	1	
Conservation Movement						1	
Conservationists						1	
Other community groups (total)	5		3	2	1		
Hinchinbrook Concerned Citizens				1			
Hinchinbrook Citizens Association			1				
The media (total)	2		3	2	3	1	
Local press					1		

JOHNSTONE	**0**	**1**	**2**	**3**	**4**	**5**	**6**
Rural producers				1	3	2	
Local govt politicians			2	1	3		
Local govt administrators				2	3	1	
State govt politicians				1	3	2	
State govt agencies:							
DPI					1	5	
DEH		1	2	3			
Housing, Local Govt. & Planning			2	3			1
Dept of Lands			1	2	2		1
Valley Trusts (or similar)	1	1	1	1	1		1
Drainage Board/s		1	2	2			1
Sugar Industry Infrastructure Package Program				1	2		3
Rural industry organisations (total)	1				2	2	1
Dairying					2		
Canegrowers						1	
QDO						1	
Sugar Mills					1		
QFVG					1		
Environmental organisations (total)	3					1	2
Johnstone Ecol. Society						1	
Other community groups (total)	2				1	1	2
Recreational Fishing						1	
Amateur/Commercial Fishing					1		
The media (total)	2				4		

Question 20. How effectively do you believe the news media presents your CCC's position on an issue?

Catchment	**Very ineffectively**	**Ineffectively**	**Neither**	**Effectively**	**Very Effectively**
Herbert	2	2	2	4	1
Johnstone			1	5	

Question 21. What could or should be done at state/local levels to improve the acceptance and involvement of relevant groups in the Herbert River CCC process?

Herbert River

- More public news items. School promotions. Industry promotions at grower level.

- More available funds, so that the community as a whole can see some useful work being completed instead of hearing of numerous studies being done with no effective follow-up work being obvious.
- Continue to support with financial and technical back up
- I think the CCC has to prove its credibility.
- Greater public consultation and "listening" to public opinion
- Increase public awareness of issues eg. organised articles in paper exploring issues to raise awareness. Can be difficult to manage when local "experts" get wound up.
- Recognise the role of the CCC through legislation (The Chair believes the CCC is simply an advisory group).
- The first thing that should be done is change the structure of the present CCC committee. There are members in it who do not have the confidence of the community at large. Their trust is gone and new faces and new ideas must be implemented. Many of the members have their fixed views which are not acceptable to the community. The next question has some clues.
- Greater involvement of local council - information swapping and cooperation prior to action by council. Use of CCC as database and advisory agency - high level of local knowledge on varied topics in group.
- Much more media publicity on CCC objectives and achievements. More funding for specific projects.
- Increase the public's awareness of CCC.

Johnstone

- An ongoing programme of media releases and a public information programme highlighting the achievements and pointing out the benefits to individual stakeholder groups being involved, eg. be involved in forming the strategies and decisions before some bastard does it for you.
- Appoint effective follow-on coordinators and finance the programme effectively
- Much more usage of media for publicity purposes
- Have better local media resources and have an obvious separation between the state and local view when the local view is contentious. The state view is generally seen as "Big Brother."

Question 22. The implementation of ICM in your catchment is difficult because:

HERBERT	Strongly disagree (1)	Disagree (2)	Neither (3)	Agree (4)	Strongly Agree (5)	NA/don't know (6)
22a Large size of catchment (or poor transportation links between parts of catchment)			1	10		
22b Wide variety of values and beliefs among CCC members		3		5	3	
22c Media don't report resource issues accurately		4	1	4	2	
22d Some important constituency groups are not represented on the ICM committee		9	1		1	
22e Perception that ICM has been forced on the catchment by the state government	1	5	2	1	1	1
22f Lack of an effective level of interest by CCC members	1	4	3	2	1	
22g Public's lack of trust in state/local		2	1	5	3	

govt.-sponsored initiatives					
22h Public's lack of interest in community type activities	2	1	5	3	
22i The lack of financial resources within the community	2	1	5	3	

Other/s:

- Lacks specificity and "teeth" to solve public issues - Rating 4 (Agree)
- Ecology vs. development and expansion; downstream effects ignored by upstream development - Rating 5 (Strongly agree)

JOHNSTONE	**Strongly disagree (1)**	**Disagree (2)**	**Neither (3)**	**Neither to Agree (3.5)**	**Agree (4)**	**Strongly Agree (5)**
22a Large size of catchment (or poor transportation links between parts of catchment)	3	1	2			
22b Wide variety of values and beliefs among CCC members	2	2	2			
22c Media don't report resource issues accurately	2	2	1		1	
22d Some important constituency groups are not represented on the ICM committee	2	2	2			
22e Perception that ICM has been forced on the catchment by the state government	2	2				1
22f Lack of an effective level of interest by CCC members	2	2	2			
22g Public's lack of trust in state/local govt.-sponsored initiatives	1				4	1
22h Public's lack of interest in community type activities	1				5	
22i The lack of financial resources within the community		1	3		2	

Institutional Arrangements

Question 23. Rate your level of agreement with the following statements concerning the operations of the CCC. *(1=strongly disagree, 2=disagree, 3=neither, 4=agree, 5=strongly agree, 6=NA/don't know)*

HERBERT	**1**	**2**	**3**	**4**	**5**	**6**
23a The objectives of the local ICM are very clear to all members	1	5		4	1	
23b There is a strong consensus among CCC members concerning what the CCC should do	1	6		3	1	
23c The CCC should coordinate state and local government resource management programs			2	8	1	
23d The CCC should prioritise resource management problems in the catchment		1		7	3	
23e The CCC should provide a forum for conflict resolution among resource users		1	2	6	2	
23f The local ICM process has or will resolve resource conflicts in an open manner	1	1	4	4	1	
23g The CCC should educate the public about the catchment's resource management problems and solutions			1	6	4	
23h The CCC should provide a forum for information sharing within and between public and private resource managers			1	3	7	

23I The CCC should prepare a strategic resource management plan				5	6	
23j The CCC should facilitate the implementation of resource management initiatives noted in the strategic plan				7	4	
23k The CCC should identify a common set of policies which will be implemented by relevant resource managers within the catchment				7	4	
23l The CCC should make private resource managers/owners more responsible for the impacts arising from their activities		2	1	5	3	
23m The CCC should stimulate community or regional development		3	2	4	2	
23n The CCC should be providing individuals with technical advice on solutions to natural resource issues	1	1	1	4	4	
23o The activities of our CCC have been effectively coordinated with the activities of other state and local government agencies		3	1	6	1	
23p The membership of the CCC effectively represents the interests of the catchment community		1	1	8	1	
23q At CCC meetings, all CCC members participate actively		2	2	7		
23r The local ICM process has or will resolve resource conflicts effectively		3	5	3		
23s The local ICM process has or will resolve resource conflicts efficiently	1	2	5	3		
23t The ICM process is very responsive to local needs		1	2	8		
23u The CCC is solving the priority natural resource management problems in the catchment	1	1	2	6		1

JOHNSTONE	**1**	**2**	**3**	**4**	**5**	**6**
23a The objectives of the local ICM are very clear to all members				4	2	
23b There is a strong consensus among CCC members concerning what the CCC should do		1		3	2	
23c The CCC should coordinate state and local government resource management programs		1		2	3	
23d The CCC should prioritise resource management problems in the catchment				3	3	
23e The CCC should provide a forum for conflict resolution among resource users			2	3	1	
23f The local ICM process has or will resolve resource conflicts in an open manner		1	2	1	1	1
23g The CCC should educate the public about the catchment's resource management problems and solutions			1	2	3	
23h The CCC should provide a forum for information sharing within and between public and private resource managers				2	4	
23I The CCC should prepare a strategic resource management plan			1	1	4	
23j The CCC should facilitate the implementation of resource management initiatives noted in the strategic plan		1		1	4	
23k The CCC should identify a common set of policies which will be implemented by relevant resource managers within the catchment				3	3	
23l The CCC should make private resource managers/owners more responsible for the impacts arising from their activities		2		3	1	
23m The CCC should stimulate community or regional development	1	2	2		1	
23n The CCC should be providing individuals with technical advice on solutions to natural resource issues	1			4	1	
23o The activities of our CCC have been effectively coordinated with the activities of other state and local government agencies		1	1	2	2	
23p The membership of the CCC effectively represents the interests of the catchment community				5	1	
23q At CCC meetings, all CCC members participate actively				2	4	
23r The local ICM process has or will resolve resource conflicts effectively		1	1	3	1	
23s The local ICM process has or will resolve resource conflicts efficiently		1	3			2
23t The ICM process is very responsive to local needs			1	4	1	
23u The CCC is solving the priority natural resource management problems in the catchment		1	1	4		

Question 24. Over the last 12 months, the level of financial and in kind support from QDPI has:

Catchment	No response	Decreased	Decreased - Remained the Same	Remained the Same	Increased
Herbert	2			2	3
Johnstone			1	1	4

Changes that have occurred:

Herbert

- Don't know if there has been any changes
- More DPI personnel available for advice; some increased special purpose funding; support for a student to work in the catchment.

Johnstone

- As far as I know financial support has decreased from QDPI - any increase is via NLP or other external funds. However, there are a lot of projects and we are not concerned with counting beans at our meetings
- Introduction of ICM grants
- More funding came through!

Question 25. Over the last 12 months, the level of financial and in kind support from other state and local agencies, and other external funding organisations (eg. National Landcare Program) has:

Catchment	No response	Decreased	Remained the Same	Increased
Herbert	2		6	3
Johnstone			1	5

Changes that have occurred:

Herbert

- As above - I am not aware of the detailed breakdown of contributions.
- Approval of funding for a landcare project.

Johnstone

- More funding came through.
- Significant input from Landcare for projects. Money from LWRRDC for research etc.
- As far as I know, more/additional projects have been funded

Question 26. How clear to you is the role(s) of the following groups in the local ICM process? (*Ratings are 0=no response, 1=very unclear, 2=unclear, 3=neither, 4=clear, 5=very clear, 6=NA/don't know)*

HERBERT	0	1	2	3	4	5	6
QDPI			1	1	7	2	
QDEH			3		8		
Qld Dept. Lands		1	3	1	6		
Dept Housing, Local Govt. & Planning		1	3	1	5		1
Wet Tropics Management Agency			2	4	4		
Great Barrier Reef Marine Park Auth.			2	1	7	1	

River Improvement Trust				2	2	5	2	
Drainage boards				2	2	5	2	
Cane Assignment Committees			2	1	1	5	2	
Local Government				2	1	6	2	
National Landcare Program					3	5	2	1
Industry Groups (total)		2		1		5	3	
Sugar							2	
CSR						3		
Canegrowers				1				
CU						1		
Other community groups (total)		9		1		1		
Dev. Bureau						1		
Environmental groups (total)		5		1		2	2	1
WPS						1	1	
Other/s (Nil listed)								

JOHNSTONE	**0**	**1**	**2**	**3**	**3.5**	**4**	**5**	**6**
QDPI					1	2	5	
QDEH			1	1		3	1	
Qld Dept. Lands			3	1		1	1	
Dept Housing, Local Govt. & Planning	1		2	1		1		
Wet Tropics Management Agency		1	2			2	1	
Great Barrier Reef Marine Park Auth.			2	2		2		
River Improvement Trust			2	1		1	2	
Drainage boards		1	2	2				
Cane Assignment Committees			2	3		1		
Local Government			1			4	1	
National Landcare Program						6		
Industry Groups (total)						3	2	1
Dairying						1	1	
Sugar/Dairying/Other crops						1		
As per CCC membership						1		
Other community groups (total)	3						2	1
Amateur fishing							1	
Environmental groups (total)	3						2	1
Johnstone Ecol. Society							1	
Other/s (Nil listed)								

Question 27. Average hours per month devoted to ICM:

Catchment	Position	Hours/mth
Herbert	Chair	15
Herbert	Member	15
Herbert	Member	10
Herbert	Member	6
Herbert	Member	6
Herbert	Member	6
Herbert	Member	6
Herbert	Member	5
Herbert	Member	4
Herbert	Member	4
Herbert	Member	3
Johnstone	Chair	30
Johnstone	Member	20
Johnstone	Member	15
Johnstone	Member	12
Johnstone	Member	5
Johnstone	Member	4

Question 28. Identify your level of agreement with the following statements:

HERBERT	Strongly disagree (1)	Disagree (2)	Neither (3)	Agree (4)	Strongly Agree (5)
28a The amount of time I devote to ICM significantly interferes with my own business/job requirements	1	4	2	4	
28b The amount of time I devote to ICM significantly interferes with my family commitments	1	6	1	3	
28c My involvement with the CCC causes significant out-of-pocket expenses	1	4	5	1	
28d I find being a member of the CCC personally rewarding because I can contribute to the community			3	7	1
28e I find being a member of the CCC personally rewarding because I care about natural resource mgnt				8	3
28f I find being a member of the CCC personally rewarding because I can meet other members of the community who can influence resource management decision making				9	2
28g I find being a member of the CCC frustrating	1	3	2	3	2
28h I see my role in the CCC as a short-term commitment	1	6	1	3	
28i A CCC's member's role is to provide their personal views on resource management issues at CCC meetings		3	2	6	
28j A CCC member's role is to represent the resource management views of their constituency group at CCC meetings					8
28k A CCC member's role is to provide a catchment-wide perspective of natural resource management issues at CCC meetings.				3	6

JOHNSTONE	(1)	(2)	(3)	(4)	(4.5)	(5)	(6)
28a The amount of time I devote to ICM significantly interferes with my own business/job requirements	1	1	2	1			1
28b The amount of time I devote to ICM significantly interferes with my family commitments	1	1	3	1			
28c My involvement with the CCC causes significant out-of-pocket expenses		4	1	1			
28d I find being a member of the CCC personally rewarding because I can contribute to the community		1	1	3		1	
28e I find being a member of the CCC personally rewarding because I care about natural resource mgnt				3		3	
28f I find being a member of the CCC personally rewarding because I can meet other members of the community who can influence resource management decision making				2	1	3	
28g I find being a member of the CCC frustrating	2	3		1			
28h I see my role in the CCC as a short-term commitment	1	3	1	1			
28i A CCC's member's role is to provide their personal views on resource management issues at CCC meetings	1	4				1	
28j A CCC member's role is to represent the resource management views of their constituency				2		4	

JOHNSTONE	(1)	(2)	(3)	(4)	(4.5)	(5)	(6)
group at CCC meetings 28k A CCC member's role is to provide a catchment-wide perspective of natural resource management issues at CCC meetings.				3		3	

Question 29. Further comments

Herbert

- A possible problem associated with ICM in the Herbert River District is that it is virtually a single industry catchment - this gives the sugar and allied industries a fair bit of punch. My personal opinion (possibly cynical) is that certain issues - expansion, drainage, wet land reclamation, river improvement???, use of pesticides and herbicides - may not be consistent with the ideal of ecologically sustainable development. To varying degrees, these practices can be detrimental to natural flora and fauna, also downstream users of the catchment and adjacent lands and waters.
- If ICM is to succeed, I repeat that a new concept of information and advice must be found. The present views of "so called elected people" eg. Hinchinbrook Council, Canegrowers representatives, CSR and a few other organisations, must be got rid of. Unbiased people who will adopt common sense and reasoning and have a knowledge of all existing problems must be considered quickly. The above-named organisations do not know the trust of the community and I fear that if the present scenario continues, ICM will fail. People want action not to be asked to go to meetings continually. There have been millions of dollars already wasted. Let's be constructive and not destructive.
- Comments on pages 2 and 3: We are being strangled by Bureaucrats who don't know the "grass roots" of problems. Over budgeting and serious lack of communication with the public.
- The issues of Riperian Vegetation on existing cane land is a major issue with the potential of causing anxiety if not managed carefully. The issue of river management that is sand bars, instream vegetation and levies that can be rationalised has to be resolved. The level of meeting attendance is a problem and does effect continuity of the decision making process. The lack of a street frontage office I think effects our ICM public accessibility. There would be extra costs with it but it should be looked at.

Johnstone

- I am a special member with ICM and ecological and planning expertise and do not represent an interest sector as such. I became involved at the commenced of the Johnstone River CCC and am still involved.
- The role of Catchment Coordinators is vital to developing an effective strategy and bringing the diverse stakeholder groups together. He/she should be a mature person with a wide knowledge and experience of the working of government and who has very good personal communication skills. If the best and most effective representatives are to be attracted to serve on CCCs then need to be supported, resource wise, by a facility such as a Catchment Centre (for a group of catchments if necessary) to provide briefing, interpretations and back up support. An effective and ongoing media and public information programme is essential (using community media outlets with locally generated release) to effectively inform the Catchment Community on natural resource management issues.
- So called "Plot Study" is taking too long.
- Re Question on Personal Demands and Motivation [in Committee Members questionnaires only], a CCC participant's role is also to try and understand complexities and other people's points of view. I find ICM more effective as a conservationist. Before ICM any issues were

fought from the trenches or in the pages of newspapers. Now I can bring issues up at meetings and discuss them across the table - and many can be solved with very little angst. Members of Johnstone ICM are heavily involved in their respective groups - which is good in that they are knowledgable and truly representative, but it has meant a heavy commitment in time. Johnstone ICM has been effective because there was a very strong desire by groups to have their say. World Heritage was seen as being "imposed" on them.

Chapter 2

A Survey of the Views of the Herbert River Catchment Coordinating Committee Members November 1997/February 1998 An Interim Report

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ABBREVIATIONS

BSES	Bureau Sugar Experiment Station
CCC	Catchment Coordinating Committee
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DLGP	Department of Local Government and Planning, Queensland
DNR	Department of Natural Resources, Queensland
DoE	Department of Environment, Queensland
DoT	Department of Transport
DPI	Department of Primary Industries, Queensland
GBRMPA	Great Barrier Reef Marine Park Authority
HRCCC	Herbert River Catchment Coordinating Committee
HRIT	Herbert River Improvement Trust
ICM	Integrated Catchment Management
LWRRDC	Land and Water Resources Research and Development Corporation
NHT	National Heritage Trust
NLP	National Landcare Program

INTRODUCTION

1.1 Survey Background

1.1.1 LWRRDC Project CTC7: Evaluation of Integrated Catchment Management in a Wet Tropical Catchment

In 1994, the Land and Water Resources Research and Development Corporation (LWRRDC) funded research staff of the CSIRO Tropical Agriculture (in Brisbane and Townsville), CSIRO Land and Water (in Perth), and the University of Queensland Department of Geographical Sciences and Planning (in Brisbane) to undertake research on Integrated Catchment Management (ICM) processes[1]. This longitudinal study over five years focuses on the community-driven ICM program in Queensland using the Herbert River Catchment process as a case study. The objectives of the investigation are.

1. Monitor and document the process of implementation of ICM in the Herbert River catchment and identify the social, economic and institutional factors that facilitate or hinder this process.
2. Evaluate key impacts of the implementation of the ICM process in terms of attitude and behaviour changes in the community and changes in the severity or tractability of the resource use conflicts for the catchment.
3. Assess the specific technical and related information needs that are relevant to an effective ICM implementation process in a wet tropical environment.
4. Develop a framework and related methods for evaluating the process of ICM implementation that will facilitate the development of more effective catchment management programs in Australia.

The complexities of catchment management are such that longitudinal studies of processes are essential if the issues of catchment management are to be better understood and appropriate lessons learned. The project acknowledges that, by its nature, ICM requires systematic evaluation (Bellamy *et al.* In Press). For example, ICM as a process needs to take many and often conflicting considerations into account. It also operates in a complex environment where uncertainty is more often the rule than the exception. Moreover, indicators of progress are not easily defined and, to date, this area of investigation has largely been neglected (Bellamy *et al.* In Press). In responding to these challenges, the project has adopted a multidisciplinary approach and draws on areas of expertise in natural resources science, social science, land use planning, resource economics, and media analysis.

1.1.2 Objectives of Survey

The LWRRDC CTC7 project seeks to find ways and means to improve the process of planning and implementing community-led ICM in Australia. Crucial to this evaluation is a better understanding of what are the problems faced by the ICM process and how they affect its implementation and ultimately its impact. By way of a longitudinal study of the ICM process in Queensland, the institutional component of the project focuses on finding out how ICM is practised in Queensland generally, and in the Herbert River catchment, in particular. This study aims to:

- provide a better understanding of the essential context in which ICM is conducted;
- provide the key baseline for the assessment of the institutional factors that hinder or foster an effective ICM process in the Herbert; and
- contribute key information for the assessment of the technical needs for effective ICM.

1 LWRRDC Project Reference: CTC7 - *Evaluation of Integrated Catchment Management in a wet tropical environment*

The first stage of the institutional component of the LWRRDC CTC7 project involved two surveys:

- a state-wide survey of ICM officials in Queensland (i.e. all Catchment Coordinators and Catchment Coordinating Committee Chairpersons) in December 1995
- a survey of the opinions of members of the Herbert River Catchment Coordinating Committee (HRCCC) in November 1995.

As part of a longitudinal study, the results of these initial two surveys provide the baseline for the institutional component of the CTC7 project. The results are reported in McDonald and Shrubsole (1996a; 1996b) and Shrubsole and McDonald (1996).

This current report presents the results of a second survey of the opinions of the HRCCC members undertaken in November 1997. The results of the second survey of ICM officials in Queensland in October 1997 are presented in a separate report (see McDonald and Bellamy 1998).

1.1.3 Background to ICM in the Herbert Catchment

Herbert River Catchment Context

The Herbert River Catchment drains an area of approximately 10000 km^2 to the Coral Sea and is the largest of the river systems located in Australia's sub-humid to humid tropical north east (Figure 1). Large areas of the catchment remain under natural vegetation, although about 40% of the coastal lowlands in the lower catchment have been cleared for crop production or improved pastures. Agricultural and pastoral activities are the largest users of land (in area) in the catchment. In terms of arable agricultural production, the sugar industry located in the lower catchment is dominant, covering nearly 65000 ha. Other important industries are forestry and small crops such as pineapples, melons and pumpkins. The middle and upper catchment have significant areas of rainforest in protected areas and State Forest Reserves. The upper catchment is, however, dominated by natural pastures for beef cattle production. Small areas of the catchment are utilised for mining and industrial activities, or alienated for urban development. The catchment population in 1993 was estimated to be approximately 18000 people (1993 National Census), of which 75% live in the lower catchment.

ICM Policy Framework

The Queensland State Government in October 1991 released an ICM Strategy for Queensland outlining the broad policy and structural arrangements (DPIQ 1991). It provides a framework for fostering cooperation and coordination between landholders and other resource users, community groups and government agencies from all levels (i.e. federal, state and local) involved in the use and management of natural resources. The strategy promotes ICM as a participative and consultative process that takes a strategic and planned approach to tackling important natural resource management issues. The Queensland Department of Natural Resources (DNR) is currently the lead government agency for implementing the Strategy. Other state government agencies, such as the Department of Primary Industries (DPI), Department of Environment (DoE) and the Department of Local Government and Planning (DLGP), also play a role in promoting and supporting relevant aspects of the ICM policy initiative.

At the catchment level, land use and resource management is influenced, managed and controlled by a complex domain of government and industry-based natural resource management programs. Of these, the most important are related to state and federal government land administration, river management, nature conservation (including World Heritage Areas and National Parks), and local government infrastructure and town planning (McDonald and Bellamy 1997) and industry arrangements (such as the sugarland allocation process, see Shrubsole 1996). The ICM policy

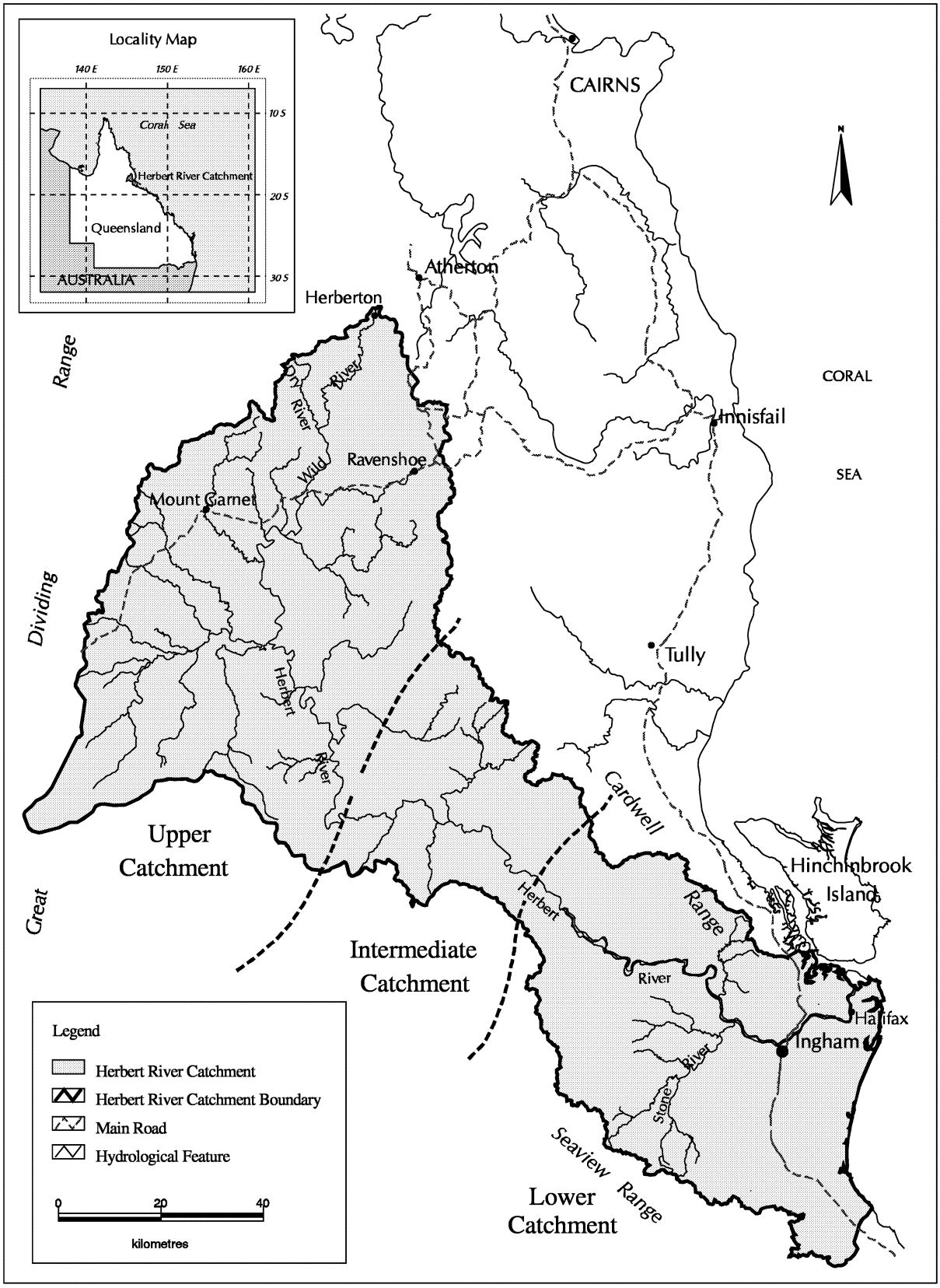

Figure 1. Herbert River Catchment.

initiative is therefore only one of a number of processes and policy initiatives all designed to influence the way natural resources are used and managed.

The implementation of ICM in Queensland is based on the establishment of Catchment Coordinating Committees (CCC). The Queensland Integrated Catchment management Strategy (QDPI 1991) identifies that:

> Catchment Coordinating Committees are established to address complex catchment management issues that involve many community groups and government agencies. Catchment Coordinating Committees comprise representatives of the major sectors of the community and government that are involved in, or influenced by the management of land and water resources in the catchment. Their major roles are to provide a forum for community input and discussion, to prioritise the issues and to develop and promote the adoption of catchment management strategies.

In December 1997, there were 29 Catchment Coordinating Committees (including 2 regional groups) formally recognised under the Queensland State Government's ICM initiative (Rowland and Begbie 1997).

Herbert River Catchment Coordinating Committee

ICM in the Herbert River catchment is a community-led and voluntary process in a formative stage. It commenced in 1992 with the formation of a Catchment Steering Committee of community leaders and government agency representatives, which established the Herbert River Catchment Coordinating Committee (HRCCC) in early 1993. A full time Catchment Coordinator was appointed to the HRCCC in April 1994. This position is funded through the federal government's National Landcare Program and based in the Department of Natural Resources, the lead government agency for ICM in Queensland. In addition, local stakeholder groups including Local Government and sugar industry bodies have provided in-kind support in terms of office accommodation, administrative support and their HRCCC member's time. State and federal government grants that are awarded through a competitive bidding process also financially support most HRCCC activities.

1.2 Methodology

1.2.1 Research Framework

Because of the evolving and holistic nature of the concept of integrated resource management, evaluations of ICM programs or processes require criteria from the environmental, social, economic and policy sciences. Bellamy *et al.* (In press) have developed a conceptual framework for evaluating integrated resource management programs that identifies a range of environmental, policy/institutional, economic, social and technological factors (Figure 2). This evaluation framework adapts the Mazmanian-Sabatier framework (Mazmanian and Sabatier 1981; Sabatier 1986) that identified a variety of legal, political and 'tractability' factors that impact on the different stages of policy implementation. The framework also includes socially significant evaluation indices such as inclusiveness, adequacy, equitableness, effectiveness, efficiency, and democratic involvement (eg. Crane 1988), and recognition of the principles of the PRIME procedural model (Syme *et al.* 1994). This latter model recognises that evaluation needs to cope with multiple parallel tasks occurring at all times. Some of these tasks will be dealing with planning; some with research monitoring and evaluation. The PRIME model also recognises that there should be appropriate areas of influence in the evaluation process by the community as well as agencies.

The framework presented in Figure 2 provides a conceptual model for identifying the causal elements impacting on ICM programs and for establishing the hypotheses to be tested. As such, it also provides a tool to structure multidisciplinary research on the effectiveness of ICM programs. The four key elements of the evaluation framework are:

- Natural resource issue characterisation
- IRM program context
- Institutional structure
- Community processes.

For each of these elements, the framework identifies variables that may potentially influence the ICM program implementation process and its outcomes. This framework has been used to structure the questionnaires for the two surveys of the HRCCC members.

1.2.2 Research Design and Approach

The second survey of HRCCC member's opinions contained selected items repeated from the first survey as well as a range of new questions focussed on HRCCC activities and ICM issues relevant to the context of a process in its fifth year of operation. Items in the survey related to:

- interviewee background information
- attitudes towards HRCCC activities and achievements
- perspectives on key natural resource management issues
- perspectives on roles and responsibilities of CCCs
- use of information sources
- attitudes on the Catchment Management Strategy development process
- perspectives on public attitudes, community support for ICM
- sector involvement in the ICM process
- perspectives on factors influencing ICM implementation
- personal demands and motivation.

The survey was administered to each of the current HRCCC members as individual face-to-face semi-structured interviews based on a pre-set questionnaire. Some questions asked were open-ended, while others required the interviewee to rate their response on a five-point scale. The questionnaire is included in this report as Appendix 1.

Interviews were conducted with 15 of the HRCCC members in November 1997, and a further 3 members not available at that time were interviewed in February 1998. An interviewer supported by a person recording responses conducted the interviews. Due to time constraints in some interviews some questions were omitted and were recorded as 'no response'.

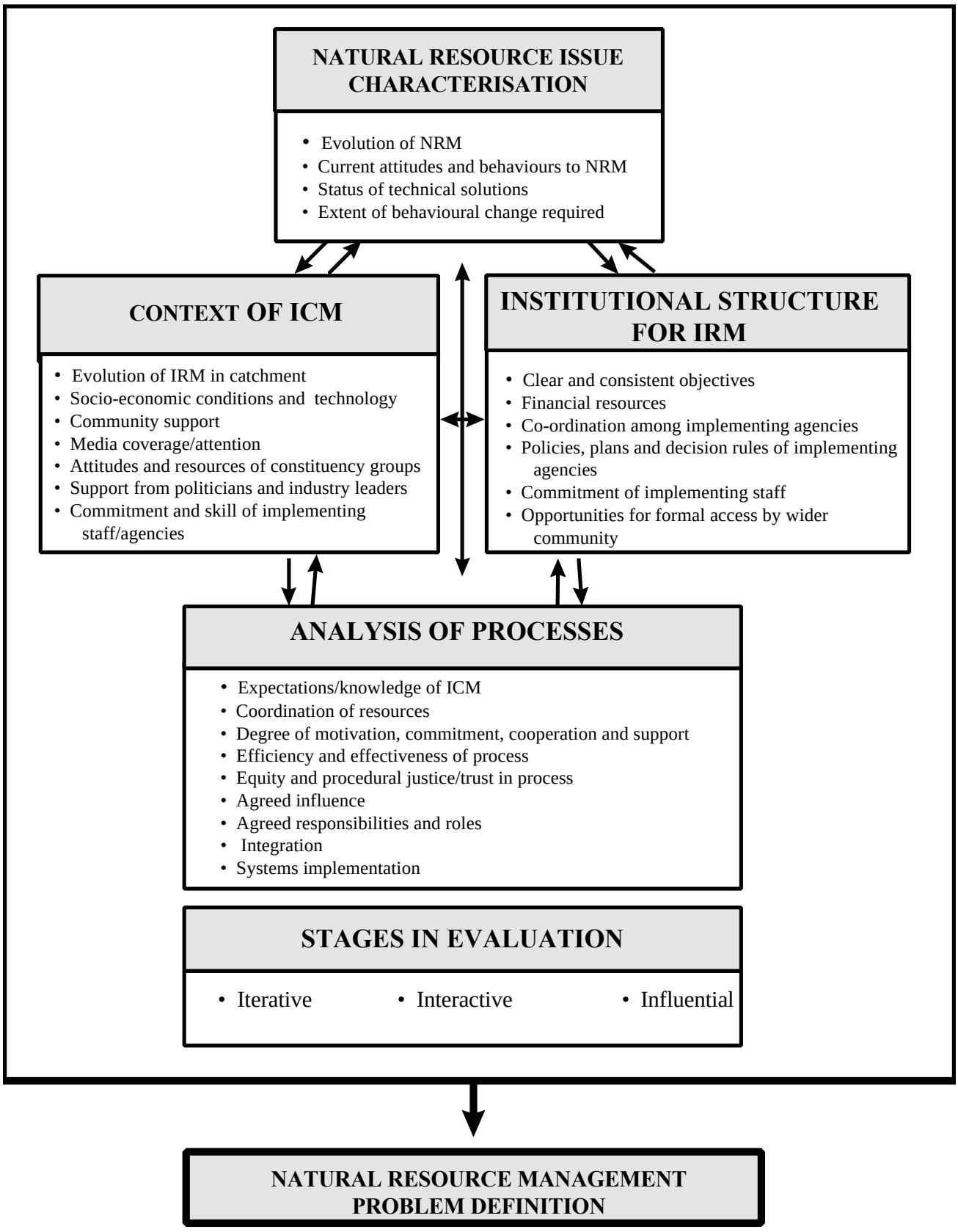

Figure 2. A conceptual framework for the evaluation of IRM programs (Bellamy et al In press)

SURVEY RESULTS

1.3 HRCCC Membership

2.1.1 Representation

In November 1997, there were 17 active voluntary sector members of the HRCCC plus a full-time Catchment Coordinator. These members were nominated to represent a range of rural industry, community and government or other statutory organisations that were considered to have an interest and/or role in natural resource management in the Herbert River catchment, as identified in Table 1.

Table 2.1: HRCCC sector group representation.

Industry	CANEGROWERS (1) CSR Herbert River Mills (1) Cattlemans Union (1) Horticulture/Rare Fruits (1) Queensland Commercial Fishing Organisation (1)
Community Group	Hinchinbrook Citizen's Association (1) Recreational/Sporting Fishing (1) Landcare (1) Wildlife Preservation Society of Queensland (1) Herberton Shire Community/Landcare (1)
Government/Statutory Body	Hinchinbrook Shire Council (3) Herberton Shire Council (1) Herbert River Improvement Trust/Drainage Boards (1) Hinchinbrook Development Bureau (1) Herbert Pest and Productivity Board (1)

The HRCCC has no state government departmental representatives. However, a Catchment Coordinator facilitates the process. This position is funded through the federal government's National Landcare Program and based in the Ingham offices of the Department of Natural Resources, the current lead government agency for ICM in Queensland.

2.1.2 Member Profiles

Table 2 summarises responses to Questions 1, 2, 3 and 4 of the survey. Two members are from the upper catchment (i.e. the Herberton Shire) and the remainder of the Committee members including the Catchment Coordinator live in the lower catchment (Hinchinbrook Shire). Ten members have lived in the catchment for over 40 years and only 3 less than 20 years. Nine of the current members have been involved with the HRCCC since its inception in March 1993 and several were on the original Steering Committee that established the ICM process in the Herbert in 1992. Most of the members are active community members with multiple allegiances and interests. For example, one of the local government representatives on the HRCCC is also a sugarcane farmer and a beef cattle producer. Similarly, the Herbert Pest and Productivity Board representative is also a member of the CANEGROWERS executive and Chairman of the Herbert River Improvement Trust (HRIT). Notably, nine members are cane farmers and two others are employed within the sugar industry. This reflects the economic, social and cultural importance of the sugar industry in the lower Herbert River community.

Table 2. Member profiles

Years lived in catchment?	Upper/Lower catchment	Member of HRCCC since?	Group representing on HRCCC	Occupation
49	Lower	1997	Commercial fishing	Fisherman,
25	Upper	1997	Herberton Shire Council	canefarmer
8	Upper	1994	Community group[1]	Retired miner
21	Lower	1993	Conservation sector	Farmer
48	Lower	1996	Grazing industry[2]	Teacher
10	Lower	1993	CANEGROWERS	Canefarmer, cattleman
22	Lower	1993	Sugar industry (CSR)	Manager
60	Lower	1993	Community group	Technical Field
61	Lower	1993	Landcare[3]	Officer
22	Lower	1993	Development Bureau	Canefarmer
43	Lower	1993	HRIT/Drainage Board[4]	Canefarmer
23	Lower	1995	Hinchinbrook Shire Council[5]	Manager
55	Lower	1997	Recreational/Sports fishing[2]	Canefarmer,
5	Lower	1994	Catchment Coordinator	contractor
49	Lower	1993	Pest &Productivity Board[3,5]	Engineer
45	Lower	1997	Hinchinbrook Shire Council	Canefarmer
43	Lower	1994	Hinchinbrook Shire Council	Extension Officer
45	Lower	1993	Horticulture/Rare fruits	Canefarmer
				Canefarmer
				Mayor/Real Estate
				Canefarmer/Rare fruits

1. Also a member of Mt. Garnet Landcare group in upper catchment
2. Also a member of Landcare group in lower catchment
3. Also member of CANEGROWERS Executive
4. Also Hinchinbrook Shire Council
5. Also member of the HRIT

2.2 HRCCC Activities and Achievements

2.2.1 What has been the major achievements to-date of the HRCCC?

HRCCC members overall considered the HRCCC had made a number of worthwhile achievements including:

(a) *the preparation of the Herbert River Catchment Strategy*:

"creating and sharing a vision (e.g. riparian vegetation to be maintained and restored)"

(b) *HRCCC meetings providing a forum that brings people together in the catchment with very different views*:

".. bring people together who would not normally be together, on ESD, (e.g. Council, CANEGROWERS, conservation, cattlemen) and bringing that relationship out into the open. There is no other forum like it."

"Providing a forum for different views"

"Linked Herbert and Hinchinbrook Shire communities. Decisions made in the Upper Catchment impact on the lower catchment. ICM has bought diverse groups together with a common focus."

(c) *Raising awareness of catchment problems amongst members and within the community*:

" Awareness that the community has a group that is looking at problems and trying to address them. Bringing people together at catchment level, and getting some cooperation over e.g. tin mines. Raising awareness at whole catchment level."

"Bringing awareness of riparian/wetlands on board (e.g. riparian forum)."

"Improved the awareness of landowners and land users"

(d) *Getting funding for a range of projects*:

"Making the community more aware through demonstration projects."

"Projects were needed and would not have been done otherwise."

(e) *Taking on a coordinative and integrative role in the region*:

"ICM is trying to co-ordinate community group projects and facilitate development of project proposals (across local community, shires, regional groups) and are using workshops to do this that involves all 3 levels as well as to identify project leaders. Stopping duplication and competition."

" taking on a coordinative role - integration with HRIT and Pest and Productivity Board work"

"Combined with HRIT to fix the Long Pocket channel."

(f) *Recognition as a source of advice on natural resource issues in the catchment*:

"Council seeking our advice - seen as a consulting body."

"People turn to them for advice"

"Able to get all different groups together and talk, and although no teeth, can give advice. Consultation process allowed this. Getting more recognition as a source of advice to do with the shire. "

Most members were positive about the HRCCC achievements. However, some members expressed some frustration with the perceived mediocrity of the group's achievements. One member could not identify any particular achievements worth noting, and another felt that "not a lot of things have been done". This latter comment however was qualified as reflecting more on the slow rate of progress than the direction the HRCCC was taking. A third member, while noting some "Landcare activities, such as owl boxes", and the HRCCC raising awareness of riparian/wetland issues in the catchment (e.g. through the riparian forum), commented that the HRCCC had "started the ball rolling but had not gone though with it". Several of the newest members were not aware of any specific achievements.

2.2.2 What are some of the most significant projects?

Members were asked to identify a significant of projects or activities undertaken by the HRCCC. The most commonly identified were**:**

- Project with HRIT at Long Pocket wash away.
- Several Owl nesting box program
- Joint restoration and revegetation projects (e.g. Wharps area, riparian area management, artificial wetland development, tree planting).
- Riparian vegetation mapping study
- Riparian "community" forum.
- Acid sulphate soils awareness.

2.2.3 Satisfaction with HRCCC progress?

Members were asked to rate their satisfaction with the progress of the HRCCC on a five-point scale from very satisfied to very unsatisfied. The results are summarised in Table 2.3. 14 members rated their satisfaction with the HRCCC's progress as either 'very satisfied' or 'satisfied', one was 'neither satisfied or dissatisfied', three were 'unsatisfied' with progress and there were no ratings of 'very unsatisfied'.

Table 2.3. Satisfaction rating with HRCCC progress.

	Satisfaction
Very satisfied	1
Satisfied	13
Neither	1
Unsatisfied	3
Very Unsatisfied	0
No Response	0

The reasons identified for a 'satisfied' or 'very satisfied' rating on progress related to the difficulty of the issues, long term nature of process, and community awareness/acceptance issues. Comments included:

"Process is working (not being held up)."
"The issues are difficult - useful forum that's doing well under the circumstance."
"Going as fast as it can proceed - on a learning curve for members including their role. Also in terms of community awareness."
"Better understanding across community and amongst local government, industry and community to coordinate and maintain drainage works. Now opportunities to address soil erosion or water quality at community level."
"Are meeting, getting projects and chasing up on issues and submissions."
"Like it to go a lot faster but not able to do this as it is a slow process getting public acceptance. Also important aspect is the large size and have involvement of lower and upper catchment - which is important to get both (critical difference, from HRIT which is only concerned with lower catchment)."
"Committee doing relatively OK - going 5.5 years - just slow process - because of need for structural change, it takes time."
"Sometimes can be bogged down, but establishing foundations for the future."
"HRCCC has done well but could have gone further."
"Frustrated at speed of implementation of ideas for which there seem to be consensus."

The reasons for either an 'unsatisfied' or a 'neither satisfied or dissatisfied' rating related to the rate of progress, community awareness of ICM, vested interests, and lack of legislative base. Specific comments were:

"Coordination of riparian [issue] is happening but ICM could have made it happen rather than individual farmers. Slightly dissatisfied with the rate of progress rather then the direction."

"Not really working for the real fundamentals of district needs. Lack of public awareness of ICM. Too much interference behind the scenes is hampering it. Taking much too much time."

"Too many vested interests protecting their castles/interests."

"Community does not have power - specifically legislative power."

2.2.4 Improving Performance

Suggestions on improving performance from those members who were 'satisfied' and 'very satisfied' with progress included better publicisation of ICM and the HRCCC in the community, ensuring ICM's legitimacy, better coordination and cooperation amongst state government agencies, support of legislative powers, and adequacy and security of funding. Some specific comments were:

"More exposure in the media to get a name (e.g. Long Pocket process only in the media once it was completed)"

"Catchment group not necessarily seen as representative of the community. Many have an interest but do not bother to get involved. Often not fully aware of the concept and yell when hits them directly. "

"Catchment committee needs to be better known in the community. Needs a bit of strength behind it."

"Issue of who is responsible for resource management needs to be clarified. Catchment Coordinator cannot do it all. Problem of responsibilities across agencies and effective and real coordination of all agencies. Better if agencies were coordinated. Lack of talk between state government agencies is an issue."

"Industry, local government, state government and federal government need to all work together effectively to address drainage issue. ICM is promoting good things to be done in the community and it should avoid ear bashing from extreme views."

"Give it legislative backing - this is essential. (Not because of the powers that are potential - there are so many agencies with powers). Also needs adequate funding, e.g. seed funding for infrastructure."

"Need to improve the legitimacy of ICM. State Government needs to facilitate projects, etc. which would speed up implementation."

"If the HRCCC had more money it could do more. For one thing, the CCC is a big job."

"Coordinator requires additional/financial support and a more secure position."

While suggestions on improving performance from those members who were 'unsatisfied' and 'neither satisfied nor dissatisfied" with progress related to the HRCCC being more proactive (versus opportunistic), communicating better with the community and having support of regulatory powers. Comments included:

"More progress on the ground needed. ICM could be more proactive rather then opportunistic (not touching the big issues such as levee banks)."

"Public communication - e.g. Public meetings, industry branch meeting, etc. Lack of public awareness of ICM needs to be addressed. Need heavy penalties on people not doing the right thing."

"Need to be more proactive and up front, involved with the media, and talking to people (e.g. recent land clearing of riparian areas)"

"ICM needs regulatory power. Consultation process can slow implementation."

2.3 Problem Characterisation and CCC Role

2.3.1 Key Resource Management Issues.

The key resource management issues identified by members fall into a number of categories (not in priority order):

(a) *river water quality* (e.g. impacts of mill waste discharge, fish kills, acid sulphate soils impact, waste water from septics, sedimentation from upper catchment from soil erosion due to either overgrazing or tin mines and tailing dams).
(b) *river management* (e.g. environmental flows, new dams for irrigation, stabilisation of river banks)
(c) *rural drainage* (e.g. rationalisation of river bank levees, infrastructure works).
(d) *riparian zone management* (e.g. revegetation of river banks, buffer zones, exclusion of cattle, weed management)
(e) *wetland degradation* (e.g. preservation and restoration within agricultural lands, fish and wildlife preservation).
(f) *caneland expansion* (e.g. need for land use planning, impacts on remnant vegetation, wildlife corridors, destruction of habitats, drainage works).
(g) *pest and weed management* (e.g. rubber vine, hymenachne, owl boxes/rat control).
(h) *coordinated extension approach* (e.g. avoidance of fragmented approach and often mixed messages, need to push sustainability issues).
(i) *catchment planning* (e.g. land use, coastal management, flood protection/management, catchment rehabilitation).

2.3.2 HRCCC Role in Natural Resource Management

Members rated their agreement/disagreement on four statements relating to the HRCCC's role in natural resource management on a five-point scale from strongly agree to strongly disagree. In general there was reasonable concurrence amongst HRCCC members in respect of these statements. The results are summarised in Table 2.4 and briefly discussed below.

a. The HRCCC helped negotiation among resource stakeholders to accommodate a wide range of resource uses?

Most members agreed with this statement, with 1 member giving a 'strongly agree' rating and 14 others an 'agree' rating in respect of the HRCCC's role. Two members disagreed with the statement but there were no 'strongly disagree' ratings. Specific comments included:

> "Agree - In some small areas"
>
> "Agree - have brought people around the table"

Two members agreed that the HRCCC is helping define the source of resource problems, but disagreed that it was identifying solutions to them.

b. The HRCCC helped stakeholders in defining the source of resource problems and solutions to them?

Most members agreed with this statement, with one member giving a 'strongly agree' rating and 13 others an 'agree' rating in respect of the HRCCC's role. One member disagreed with the statement, two others gave a 'neither agree or disagree' rating, but there were no 'strongly disagree' ratings.

> "Neither agree or disagree - beginning to happen now."
>
> "Agree - For example, riparian vegetation mapping"
>
> "Disagree - not yet helping define the source of problems – doesn't fully

understand the problems."

c. The HRCCC helped stakeholders in ensuring their resource management practices are effective, efficient, equitable, accountable?

Most members agreed with this statement, with 1 member giving a 'strongly agree' rating and 14 others an 'agree' rating in respect of the HRCCC's role. Two members disagreed with the statement but there were no 'strongly disagree' ratings.

"Agree - Just beginning in upper catchment"

"Agree - but only starting"

"Agree - HRCCC starting to get a mediation role with Landcare (e.g. weed management)"

"Agree - Cooperating with BSES to get better advice out to farmers. Also starting to get extension officers."

"Neither - Have not achieved this but Committee likes to think it has"

d. The HRCCC encouraged research and data gathering and analysis in order that solutions to resource problems can be better understood?

Most members agreed or strongly agreed with this statement, with 5 member giving a 'strongly agree' rating and 10 others an 'agree' rating in respect of the HRCCC's role. One member disagreed with the statement, another gave a 'neither agree or disagree' rating, but there were no 'strongly disagree' ratings.

"Agree - what HRCCC is doing is a starting point - and others do the research"

"Agree - e.g. relationship to CSIRO and NLP/NHT"

"Disagree - HRCCC has been a partner but not encouraging it"

Table 2.4. Agreement/disagreement ratings with statements on the HRCCC's role.

	Strongly Agree	Agree	Neither	Disagree	Strongly Disagree	Don't Know	No Response
a. Helped negotiation among resource stakeholders to accommodate a wide range of resource uses	1	14	1	2	0	0	0
b. Helped stakeholders in defining the source of resource problems and solutions to them	1	13	2	1	0	1	0
c. Helped stakeholders in ensuring their resource management practices are effective, efficient, equitable, accountable	1	14	1	2	0	0	0
d. Encouraged research and data gathering and analysis in order that solutions to resource problems can be better understood	5	10	1	1	0	0	1

2.3.3 HRCCC Role in regional resource management

Members identified a number of roles that the HRCCC has played in regional resource management, which can be summarised under four broad themes:

- contributing to the improvement of the overall information base that is available to underpin decision making on natural resource issues in the catchment (e.g. riparian vegetation mapping)
- bringing together catchment stakeholders and developing better understanding as well as raising awareness of natural resource issues.
- facilitating cooperation across stakeholder groups to get things achieved that one alone could not.
- having an advisory and influencing role on planning processes in the catchment, in particular through working in partnership with Local Government and the HRIT.

However there was a divergence of views amongst HRCCC members, with some concerns being expressed by several members on the perceived limited influence the HRCCC has had at the regional level. Comments included:

> "Bringing together stakeholders. This results in a broader definition of stakeholders. Facilitative role. However, only small input."
>
> "Trying to do something but getting diffused because of conflicts of interest amongst members, i.e. lack of real support. Very modest role to date"
>
> "It's a social "structure" without backing, it has no teeth. They go in begging to be heard. They are mainly involved in smallish issues that they could handle and not the bigger mainline issues like the land allocation process."
>
> "Where problems - they have addressed them. Tailings dam in upper; sedimentation in the lower. Currently pretty fragmented but as time goes along it will get better."
>
> "Not sure how ICM is feeding into regional managers because of structures not facilitating the process."
>
> "Once get strategy up need to follow that. ICM at present a little tied up in what it can do - we are not really doing anything - never get consensus; 7/8 of committee more on protecting the environment - people coming around.. Because it is voluntary there is no real power only through the Council who are looking to HRCCC for guidance (e.g. Riparian issue). Voluntary process - limited what it can do but working with Councils is OK, but also getting involved as adviser to other activities."
>
> "ICM has not had legitimacy to have had a significant impact."

2.3.4 How well suited is ICM in Queensland to address resource use and management issues?

HRCCC members were asked to express their opinion on how well ICM in Queensland was suited to addressing resource use and management issues within the Herbert River catchment. Most members (i.e. 14) in general considered that ICM was well suited to addressing natural resource issues in the Herbert. Responses are summarised in Table 2.5.

Table 2.5. Perspectives on the suitability of ICM to addressing natural resource issues in the Herbert

Well suited/ideal	Not sure	Not suited	No response
14	2	1	1

The most common comments made in support of ICM's suitability in the Herbert River catchment context related to ICM's strength in its community basis, its inclusiveness of catchment stakeholders and its linkages to local authoritative bodies. For example:

> "Yes, cannot think of anything that would be better. ….Its strength is in its community based approach. Dominance of community members is good."
>
> "All the views are in the HRCCC and listened to."
>
> "Good model for participation."
>
> "Yes, from the grass roots perspective its working."
>
> "Yes it is the first time the whole river top to bottom has had dialogue focused on the whole catchment and people are keen to come to meetings. A community based program. All stakeholders allowed a seat around the table."
>
> Yes, from the grass roots perspective it's working. Little input from the [State] Government. Important for it to amalgamate with HRIT - as CCC gives ideas, HRIT does the doing - so does not really need legislation.
>
> Ideal. Certainly establishing itself. Got to be community driven and include Local Government.
>
> "Well suited. Membership of ICM has been selected so that all relevant user groups have been involved."
>
> "Well suited. Existing advisory bodies (BSES) are biased. ICM represents more than vested interests."

However these comments were qualified by a range of concerns raised by members. These concerns, in particular, related to ICM's lack of enforcing power, its limited resources (e.g. financial, extension staff) and the limitations imposed by the lack of coordination across State Government agencies. Members' comments for example included:

> "I am worried that ICM might not have any teeth, but I support the community basis."
>
> "Sometimes I think it should have more teeth. It exists as a voluntary group but has no enforcing power, it can only make a recommendation. I do not see that a model for ICM that has a big stick approach would work. "
>
> "Good in proceeding as fast as the local authorities will allow it to proceed. There are also limitations imposed by state government bureaucracies (e.g. lack of a generic set of rules that are locally established) and lack of coordination across state government agencies."
>
> "Not only do government departments fight between each other but agencies also

within one department fight with each other."

"I find the conflict between government departments unbelievable."

"ICM is limited by the financial situation. It also allows for a lot of local political intervention. There is a lack of co-ordination amongst stakeholder groups. The local committee lacks the clout to implement things - it needs power to influence state government. We do not want appointed officials on it, rather it needs rank and file representatives."

"Not sure ICM is the vehicle without the statutory backing. It needs to have a good link to local government and the River Improvement Trust process. …. Sees problem in ICM or Landcare groups having the right to actually stop people doing things on the ground - rather it should be an independent body / government responsibility."

2.4 Information Use and Access

2.4.1 Types of information

HRCCC members were asked their opinion on whether specified types of information had been useful in supporting the Herbert ICM program and its activities. Of those members for which a response was recorded, the types of information perceived to be most useful were:

- catchment natural resources
- land use
- options for funding of ICM and other community activities
- government policies and regulations on natural resources and related issues
- government institutional arrangements for ICM, Landcare, natural resource management and related issues.

Importantly, it was also noted by several members that 'local input' or 'knowledge of committee members' was a key source of information to the Herbert ICM process. Details of the responses recorded for this question are summarised in Table 2.6.

Table 2.6. Types of information and its usefulness to the Herbert ICM process.

	Very Useful	Useful	Neither	Not Useful	No Response
a. Catchment natural resources	10	2	0	0	6
b. Population and land use in your catchment?	7	5	0	0	6
c. Local organisations, industry and community groups in your catchment?	1	6	2	0	9
d. Government institutional arrangements for ICM, Landcare, natural resources, and related issues?	4	3	1	0	10
e. Government policies and regulations on natural resources and related issues?	4	4	0	0	10
f. Options for funding of ICM and other community activities?	5	4	0	0	9
g. Group management and administration?	2	3	2	0	11

2.4.2 Herbert River Catchment Atlas

Nearly all members were aware of the existence of the Herbert River Catchment Atlas (Johnson and Murray 1997) which was launched at a HRCCC meeting in June 1997 (see Table 2.7).

Table 2.7. HRCCC member awareness of the Catchment Atlas.

Awareness	Responses
Aware	15
Not aware	1
No response	2

Only one member identified having personally used the Atlas. However, it was noted that the Atlas particularly in its CD-form was being used widely by local schools. Most members were impressed with its potential usefulness, particularly for children and as a general reference for raising awareness of the Herbert catchment and its resources.

2.4.3 Herbert Resources Information Centre

Members were asked if they had used the Herbert Resources Information Centre (HRIC). Nine members had made use of it for a range of purposes (e.g. retrieval of natural resource and land use information for cane growers, industry planning, cane assignment issues, planning transport routes, and local government decision making needs). In general, the HRIC was perceived as a valuable resource for ICM, in particular in a planning context and for interpretative analysis to underpin catchment management decision-making. Several members expressed an interest in visiting the Centre and finding out more about what it is doing and its potential use within the Herbert community.

2.5 Catchment Strategy

2.5.1 Purpose of the Catchment Strategy

Members were asked for what purpose did the HRCCC prepare the Herbert River Catchment Strategy in 1996. Five members identified that they had not been involved in the strategy preparation and were not aware or could not comment on its purpose. For the members who were involved in the strategy preparation or were familiar with the strategy, there was in general concurrence amongst HRCCC members on its key purposes:

- to provide a future direction to the group and guide future actions (e.g. identified issues, prioritised needs, identified stakeholders and their roles, provided a reference point to start from); and
- to get resources and support for ICM in the Herbert (e.g. get funding for Catchment Coordinator and natural resource projects; get commitment of State Government to undertake projects).

2.5.2 Usefulness of the Strategy Development Process.

Similarly, five members who had not been involved in the strategy development did not offer a response on its usefulness. Of the 13 members who were involved in the preparation of the Catchment Strategy, 12 found the process useful, while one member rated it as not being really useful.

A range of reasons were given for the perceived usefulness of the process:

- *inclusiveness and transparency*: bringing all viewpoints on issues together and out into the open
- *establishing direction*: helped focus the group and provided some direction
- *raising awareness*: improving Committee member's awareness of issues and other stakeholder viewpoints
- *identifying areas of agreement*: leading to agreement on some issues and the development of better projects.

However some concerns were expressed regarding the lack of resolution on some key issues, and the failure for the strategy to have a significant impact on what the Committee was currently doing. While the member who did not find the process useful felt that the process had only "identified problems we already knew about".

2.5.3 Approach to Strategy Development

The Catchment Coordinator conducted an initial workshop with committee members to discuss the strategy process and to agree on a list of priority issues to be developed further through small working groups. Each member then identified their area(s) of particular interest to form five working groups. The working groups scoped the issues further and the outcomes were then reviewed by all interested Committee members. The Catchment Coordinator then incorporated all the information and comments from members into a final draft strategy document which was sent for approval by DNR Head Office.

The Draft Catchment Strategy was "launched' by the HRCCC in June 1997 for public comment but so far no real feedback or official comment has been received.

2.5.4 Improving the Process

Members were also asked whether anything should or could have been done to improve the strategy development process. The majority of members did not perceive that in general much else could have been done and were reasonably satisfied with what had been done at the time. For example, comments included:

> "No glaring mistakes."
>
> "Not really, reasonable job at the time."
>
> "No- happy the way it was - gave a good base to start and can only be improved upon."
>
> "No - do not know what else could be done"

However, one member felt the process could have been improved but was not sure in what way:

> "The strategy is a bit "dreamy". It has a tendency to overlook the economic side of things - more balance is needed in looking at whether the strategies are viable for stakeholders, and there is a need to look at the reality of individuals in the catchment context."

Two other members felt that the development process for the Draft Strategy should have included more people beyond just the HRCCC members:

> "There is an issue of the wrong people involved in its development - more community/landholder involvement was needed. It did not make good use of local knowledge in the community."
>
> "Could not have been improved internally, but externally it could have gone a lot wider."

Similarly, one other member expressed dissatisfaction with the DNR approval process:

> "There was a problem with the government approving the strategy - it went into the system and just sat there. The HRCCC could not do anything."

2.6 Public Attitudes, Support and Involvement

2.6.1 Level of Public Awareness on Natural Resource Issues

Members perspectives were sought on the level of public awareness on natural resource issues within the Herbert catchment community on a five point scale from 'very low' to 'very high'. In general, HRCCC members perceived that the rural community's awareness was overall substantially higher than the urban community's awareness. The results are summarised in Table 2.8.

Table 2.8. Perspectives on public awareness of natural resource issues in the Herbert catchment.

Rating	Rural	Urban
Very high	3	1
High	7	2
Moderate	3	6
Low	3	1
Very low	2	7
Don't know	0	1

Members perspectives were also sought on whether public awareness had changed over the last year, and if so, in what way. 15 members felt awareness had changed, while 3 felt there had been no change. Of those members that perceived a change, all considered that the trend was "improving" or "increasing". This improvement was seen by some as being only "slowly" but others felt a more marked change was occurring. The reasons for the improvement were not necessarily seen to be related to the Herbert ICM process, although the HRCCC was perceived as the body taking the issues on. The most common reasons given for change related to specific well publicised or controversial issues such as cattle-to-cane land conversion, land clearing for caneland expansion, owl boxes, fish kills in the river, damming of streams and acid sulphate soils.

There was some divergence of opinion on whether the increase in awareness had been greater for the urban or rural populations.

2.6.2 Level of Public Support for the HRCCC

HRCCC members were asked to rate their opinion on a five-point scale (from very high to very low) of the level of public support for the HRCCC. There was a divergence of opinion on this question amongst HRCCC members as shown in Table 2.9.

Table 2.9 Opinions on the level of public support for the HRCCC.

Rating	No. of Responses
Very high	1
High	3
Moderate	6
Low	6
Very Low	1
Don't know	1

Of those 12 members rating public support as low or moderate, six considered that support was definitely growing. This was in part attributed to HRCCC's on-ground projects and to high profile events in the catchment bringing attention to the HRCCC. However it was also suggested that many people did not really understand what the HRCCC does and that this needed attention.

2.6.3 Effectiveness of Stakeholder Involvement

The HRCCC members were asked to rate on a five point scale (from very effective to very ineffective) the involvement in the Herbert ICM process of a range of stakeholder groups. The results are presented in Table 2.10.

Table 2.10. Opinions on the effectiveness of stakeholder group involvement.

	Very Effective	Effective	Neither	Ineffective	Very Ineffective	Not Applicable	No Response
a. Rural producers	7	7	1	2	0	0	1
b. Local government politicians	3	11	0	3	0	0	1
c. Local government administrators	5	8	1	3	0	0	1
d. State government politicians	1	5	5	5	0	0	2
State Government agencies: e. DPI	1	5	2	7	1	0	2
f. DNR Forestry	1	5	5	4	0	2	1
g. DNR Land Management	0	9	3	3	0	1	2
h. DNR Lands Administration	0	5	6	4	1	1	1
i. DNR Water Resources	1	8	5	2	0	0	2
j. Department of Environment	1	6	6	1	1	1	2
k. Local Government and Planning	0	7	6	2	0	1	2
l. River Improvement Trust	5	12	0	0	0	0	1
m. Drainage Board(s)	4	8	2	1	0	2	1
n. Rural Industry Organisations	3	10	0	0	0	1	4
o. Environmental Organisations	4	5	3	2	1	1	2
p. The Media	2	8	1	5	0	0	2
q. Landcare Groups	3	9	1	2	1	0	2

Overall effective or very effective involvement was attributed most commonly to rural producers, local government politicians and administrators, the Herbert River Improvement Trust, the Drainage Boards, rural industry organisations and Landcare groups. Ineffective or very ineffective involvement was attributed most commonly to Queensland State Government agencies (that is DPI (particularly Fisheries group), DNR Lands Administration group, and DoE), as well as State Government politicians.

2.6.4 Improving Stakeholder Involvement

HRCCC members were asked what could be done at state and local levels to improve the acceptance and involvement of relevant groups and the general public in the HRCCC process. A diversity of opinions were expressed including:

- improve representativeness of HRCCC as for example some stakeholder groups were not involved in the HRCCC (e.g. mirade of conservation groups in the catchment, bee keepers, and Caneland Assignment group)
- need for more effective government agency involvement (e.g. DNR Water Resources, DPI Fisheries, DoE, DoT, DLGP and GBRMPA)
- greater publicisation and promotion of the HRCCC and its activities (e.g. lift the profile in the media)
- government agencies be required to consult with the HRCCC on all their programs in the catchment (not just the other way around)
- ICM given a legislative base.

2.6.5 Satisfaction with Local Government Involvement

The majority of members (i.e. 14) were satisfied with the involvement of local government in ICM in the Herbert catchment. The reasons given were diverse and related to Local Government:

- having active involvement in the ICM Committee since its inception
- providing an important information source
- recognising the HRCCC as a legitimate referral and advisory group, and seeking their advice on issues
- providing ICM with "teeth for implementation".

Comments on local government involvement in the Herbert ICM process included:

> "Local Government is doing a really good job. Always reports well when asked. They've got access to facts/figures and they bring them along"
>
> "Involvement of CCC in their projects (eg. Strategic Plan, Local Government and ICM Project)."
>
> "Bringing a lot of knowledge about the catchment."
>
> "In Hinchinbrook Shire Yes, but No in Herberton Shire which is not involving ICM in anything. ICM/local government project with the Hinchinbrook Shire is helping heaps"
>
> "Councillors see the need to come to the HRCCC for advice. Mayor is now Deputy Chairman of the HRCCC. Also involvement through Hinchinbrook Shire's Strategic Planning Process. This is a change in the practice from last year. Before HRCCC seen just as a reference group, but now it seems to be changing. HRCCC getting more credit. Government putting more pressure on Councils over land use issues."
>
> "Close involvement since inception. No issues local government espouses which ICM opposes. ICM has teeth through local government and if this is to remain then ICM will remain advisory and local government the implementing agency."
>
> "Local Government and ICM supportive of each other in addressing issues. Local government is a regulating authority which can support ICM programs. Local government implements programs for ICM."

HRCCC member opinions on what more Local Government could do to help were varied but with most seeing its past involvement as effective. Comments included:

> "Making the developer much more responsible about what they do"
>
> "Would like to see more teeth in stopping people doing things. (e.g. riparian zone and tree clearing etc. are not only subject to voluntary action)."
>
> "Could do more through the regulatory side."
>
> "Full participation in process; perhaps support administrative aspects of ICM in turn with cane growers."
>
> "Yes would like it to help ICM a lot more, especially at getting things done"
>
> "Not sure it could do much more except be a bit more active in part of the committee. Key for ICM to work as they are the key implementers."
>
> "Level of involvement is satisfactory. Local government provides a broad community

view into ICM rather than the view of a specific vested interest group. Role of local government is advisory to ICM - providing information"

2.6.6 Shire Proposal on Development of New Rural Lands

HRCCC members were asked their opinion on the proposal that farmers opening up new areas of intensive agriculture will require Hinchinbrook Shire Council approval (for conditions) under the new Hinchinbrook Shire Plan. The 13 members for which a response was recorded to this question were all aware of this proposal and supported the Shire Council in principle in having these powers. However, HRCCC member's comments most commonly related to the State Government's failure to effectively use their powers in this area, the Council's capacity or political will to implement them, and technical and interpretative issues. Comments included:

"Applies only to subdivision and land use change. Nothing to stop cattleman clearing/draining and then converting."

"The difficulties are how vigorous the council pursues this. How is it going to work. What are the sanctions and what are the resources to monitor."

"Used to have conditions there (i.e. in 1960's re: viable cane) - but then non-compliance no longer there. Very keen to have conditions on assignments."

"Local government lacks capacity to make decision on land allocation (e.g. Sugarcane). Local Government has been lumbered with a big job because DoE and DPI Fisheries are ineffective and have passed down to local government."

"Good opportunity to really coordinate all agency input into intensification of land use / new developments issues, especially inputs of DNR, DOE, DPI Fisheries, etc.."

"Big step - not sure how council can implement it. Do not have the people to do it. Need CSIRO planner to provide the capability to be proactive."

"Good influence on regulating land management."

"Support new conditions to prevent minority who aren't conscious of the impact of management."

2.7 Factors Influencing the ICM Process

2.7.1 Recent Changes Influencing the HRCCC's Efforts

Ten HRCCC members gave varied responses to this question. Opinions related to project funding successes (e.g. NHT), appointment of a new Chairman of the HRCCC, increased linkages to Local Government, improvement in the cooperation amongst collaborating agencies, and the appointment of new DNR extension staff. Specific comments included:

"The new chairman is very active and 'with it' on ICM. NHT process made us look at priorities more closely. Made us focus more on the confronting issues and ones that have a chance of doing something about - likely to get some outcomes and this will enhance ICM."

"Degree of co-operation shown by collaborating agencies much improved"

"Success in getting project funding (NLP/NHT) and the appointment of DNR staff."

"Greater emphasis on wetlands by the community; dam building may have an influence soon. NHT has led to a lot more time spent on developing funding applications."

"ICM has developed policies which need to be implemented by local government. Hinchinbrook local government is hindered by state government agencies."

"ICM has had an impact on change, rather than the other way around"

2.7.2 Difficulties of ICM Implementation

HRCCC members were asked to rate their opinion on a five point scale (strongly agree to strongly disagree) on a series of statements relating to difficulties in ICM implementation. The statements and responses are presented in Table 2.11 and discussed below.

Table 2.11. Difficulties of ICM Implementation.

	Strongly Agree	Agree	Neither	Disagree	Strongly Disagree	Don't Know	No Response
The implementation of ICM in the catchment is difficult because:							
a. The large size of the catchment (or poor transportation links between parts of catchment)	4	9	0	4	0	0	1
b. The wide variety of values and beliefs among HRCCC members seriously detracts from an effective level of cooperation developing among them	1	6	0	8	2	0	1
c. Some important constituency groups are not represented in the ICM process	0	3	0	9	5	0	1
d. The perception that ICM has been forced on the catchment by the state government	0	0	0	10	6	1	1
e. The lack of an effective level of interest by HRCCC members	1	3	1	7	5	0	1
f. The public's lack of trust in state/local government-sponsored initiatives	1	8	0	4	3	1	1
g. The public's lack of interest in community type activities	1	7	2	7	0	0	1
h. The lack of financial resources within the community	3	3	2	8	0	0	2
i. The lack of agreement among HRCCC members concerning its objectives	0	0	0	14	3	0	1
j. The lack of agreement on feasible solutions	0	5	2	8	2	0	1
k. There is no single acute resource management problems within the catchment	0	8	0	5	1	0	4

a. The large size of the catchment (or poor transportation links between parts of catchment). The majority of members (13) agreed or strongly agreed that ICM implementation in the Herbert River catchment was difficult because of the large size of the catchment. However 4 members disagreed with this statement.

b. *The wide variety of values and beliefs among HRCCC members seriously detracts from an effective level of cooperation developing among them.* Members had divergent views on this statement with 10 members disagreeing or strongly disagreeing, and 7 members agreeing or strongly agreeing.

c. Some important constituency groups are not represented in the ICM process. Members in general disagreed with this statement with 5 members strongly disagreeing and 9 members disagreeing and only 3 members giving an 'agree' rating.

d. The perception that ICM has been forced on the catchment by the state government. Members overall of disagreed with the statement that ICM was difficult because it had been forced on the catchment by the state government with 6 members giving a 'strongly disagree' rating and 10 members giving a 'disagree' rating, and no members agreeing with it.

e. The lack of an effective level of interest by HRCCC members. There was some difference of opinion amongst HRCCC members whether the lack of effective interest by HRCCC members made

ICM difficult but most disagreed. Five members strongly disagreed/disagreed, 1 member neither agreed or disagreed, and 4 agreed/strongly agreed with the statement.

f. *The public's lack of trust in state/local government-sponsored initiatives.* There was a divergence of opinion amongst HRCCC members regarding the statement that the public's lack of trust in state/local government-sponsored initiatives made ICM implementation difficult. Nine members agreed/strongly agreed and 7 members disagreed/strongly disagreed with the statement.

g. *The public's lack of interest in community type activities.* There again was a strong divergence of opinion on whether the public's lack of interest in community type activities made ICM implementation difficult. 8 members strongly agreed/agreed, 2 neither agreed or disagreed, and 7 members disagreed with the statement.

h. *The lack of financial resources within the community.* There was a divergence of opinion on whether the lack of financial resources within the community made ICM implementation difficult or not. 6 members strongly agreed/agreed with the statement, 2 neither agreed or disagreed, and 8 members disagreed with the statement.

i. *The lack of agreement among HRCCC members concerning its objectives.* Members predominantly disagreed with the statement that lack of agreement among members concerning its objectives made ICM difficult. No members agreed or strongly agreed, and 14 members disagreed and 3 strongly disagreed.

j. *The lack of agreement on feasible solutions.* There was a difference of opinion on whether the lack of agreement on feasible solutions made ICM implementation difficult. Most members disagreed with 2 giving a 'strongly disagree' rating and 8 a 'disagree' rating. 2 other members neither agreed or disagreed, while five agreed with the statement.

k. *There is no single acute resource management problems within the catchment.* There was a divergence of opinion on whether the lack of a single acute resource management problem in the Herbert catchment made ICM implementation difficult or not. 8 members agreed with the statement, 5 members disagreed and 1 member strongly disagreed with the statement.

2.7.3 ICM Process Issues

HRCCC members were asked to rate their opinion on a five point scale (from strongly agree to strongly disagree) on five statements relating to the ICM implementation process. The results are presented in Table 2.12 and discussed below.

a. *There is a strong consensus among HRCCC members concerning HRCCC functions.* There was overall general agreement that there was a strong consensus of opinion among HRCCC members concerning HRCCC functions with 11 members strongly agreeing/agreeing, 2 neither agreeing or disagreeing and only one member disagreeing with this statement.

b. *At HRCCC meetings, all HRCCC members participate actively.* Again there was in general a consensus of opinion that all HRCCC members participated actively in meetings with 14 agreeing/strongly agreeing, and only 2 giving a 'disagree' rating.

c. *The local ICM process effectively resolves resource conflicts.* There was a divergence of opinion on whether the local Herbert ICM process was effectively resolving resource conflicts in the catchment. 6 members gave a 'strongly agree' or 'agree ' rating, 4 neither agreed or disagreed, and 4 gave a 'disagree' or 'strongly disagree' rating.

d. *The ICM process is responsive to local needs.* There was a concurrence of opinion amongst HRCCC members that the ICM process was responsive to local needs with 3 members strongly agreeing, 11 members agreeing, and only one member giving a 'disagree' rating.

e. *The HRCCC is solving the priority natural resource management problems in the catchment.* Although there was a difference of opinion amongst HRCCC members on whether the HRCCC was solving the priority natural resource management problems in the catchment, the majority of members were in agreement with this statement. 10 members agreed/strongly agreed, 3 neither agreed or disagreed while 3 members gave a 'disagree' rating to this statement.

Table 2.12. Opinions on the ICM Implementation Process.

	Strongly Agree	Agree	Neither	Disagree	Strongly Disagree	Don't Know	No Response
a. There is a strong consensus among HRCCC members concerning HRCCC functions	2	9	2	1	0	0	4
b. At HRCCC meetings, all HRCCC members participate actively	1	13	0	2	0	0	2
c. The local ICM process effectively resolves resource conflicts	2	4	4	3	1	1	3
d. The ICM process is responsive to local needs	3	11	0	1	0	0	3
e. The HRCCC is solving the priority natural resource management problems in the catchment	1	9	3	3	0	0	2

2.8 Personal Demands and Motivation

2.8.1 Time Devoted to ICM

HRCCC members were asked on average what number of hours per month did they devote to ICM. The majority of members devoted between 5 and 8 hours per month with 3 members spending less than 4 hours per month on ICM matters. However 3 members estimated they spent between 11 and 15 hours per month while the Committee Chairman and Catchment Coordinator devoted more than 16 hours per month (up to 18 hours and up to 180 hours respectively). The distribution of responses on time spent on ICM by HRCCC members is presented in Figure 2.

2.8.2 Demands on Members of ICM Involvement

HRCCC members were asked to rate their agreement/disagreement with three statements relating to the personal demands of ICM involvement on a six point scale (from completely agree to completely disagree). The responses are presented in Table 2.13 and discussed below.

Figure 2. Frequency distribution of time spent on ICM.

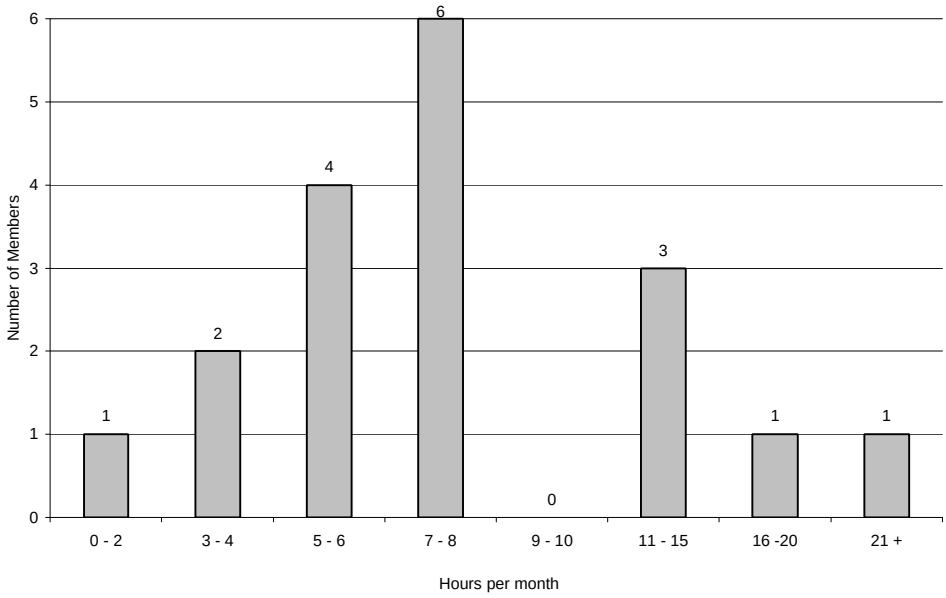

Table 2.13. Personal demands and motivation for ICM involvement.

	Completely Agree	Agree	Moderately Agree	Neither	Disagree	Completely Disagree	N/A	No Response
a. The amount of time I devote to ICM significantly interferes with my own business/job requirements	1	5	1	0	5	4	2	0
b. The amount of time I devote to ICM significantly interferes with my family commitments	1	2	1	0	8	4	2	0
c. My involvement with the HRCCC causes significant out-of-pocket expenses	0	3	0	1	6	6	2	0
d. I find being a member of the HRCCC personally rewarding because I can contribute to the community	9	7	1	0	0	0	1	0
e. I find being a member of the HRCCC rewarding because I care about natural resource management	10	7	0	0	0	0	1	0
f. I find being a member of the HRCCC rewarding because I can meet other members of the community who can influence resource management decision making	7	7	2	0	1	0	1	0
g. A HRCCC member's role is to provide their personal views on resource management issues at CCC meetings	2	8	0	0	5	2	1	0
h. A HRCCC member's role is to represent the resource management views of their constituency group at CCC meetings	2	12	2	0	0	1	1	0
i. A HRCCC member's role is to provide a catchment-wide perspective of natural resource management issues at CCC meetings	5	8	0	0	3	0	0	1

a. The amount of time I devote to ICM significantly interferes with my own business/job requirements. There were wide differences in experience amongst HRCCC members on whether ICM interfered with their own business or job requirements. 4 members 'significantly disagreed', 5 'disagreed', 6 'agreed', one member 'moderately agreed' and 1 'completely agreed' with this statement.

b. The amount of time I devote to ICM significantly interferes with my family commitments. The majority of HRCCC members disagreed with the statement that ICM interfered with their family commitments with 12 members 'completely disagreeing' or 'disagreeing', and only 4 members either 'agreeing', 'moderately agreeing' or 'strongly agreeing'.

c. My involvement with the HRCCC causes significant out-of-pocket expenses. The majority of HRCCC members disagreed with the statement that ICM involvement caused significant out-of-pocket expenses with 12 members 'completely disagreeing' or 'disagreeing', 1 'neither agreeing or disagreeing' and only 3 members 'agreeing'.

2.8.3 Motivation for ICM Involvement

HRCCC members were asked to rate their agreement/disagreement with three statements relating to their motivation to be a member of the Herbert ICM process on a six point scale

(from completely agree to completely disagree). Their responses are presented in Table 2.13 and discussed below.

d. *I find being a member of the HRCCC personally rewarding because I can contribute to the community.* Members were in strong agreement that part of their motivation for involvement in the HRCCC was that they could contribute to the community. 9 members gave a 'completely agree' rating, 1 member a 'moderately agree' rating and 7 members an 'agree' rating for this statement.
e. *I find being a member of the HRCCC personally rewarding because I care about natural resource management.* Again there was a strong concurrence of agreement amongst HRCCC members that they found involvement in the HRCCC personally rewarding because they cared about the environment with 10 members 'completely agreeing' and 7 members 'agreeing'.
f. *I find being a member of the HRCCC personally rewarding because I can meet other members of the community who can influence resource management decision-making.* Overall there was strong concurrence of agreement amongst HRCCC members with this statement with 7 members giving a 'completely agree' rating, 1 member a 'moderately agree' rating, 7 an 'agree' rating and only one member disagreeing with this statement.

2.8.4 Opinions on Catchment Committee Member's Role

HRCCC members were asked to rate their agreement/disagreement with three statements relating to their role as a member of the Herbert River Catchment Coordinating Committee on a six point scale (from completely agree to completely disagree). Their responses are presented in Table 2.13 and discussed below.

g. *An HRCCC member's role is to provide their personal views on resource management issues at CCC meetings.* There was a marked divergence of opinion amongst members on this statement with 7 members giving either a 'completely disagree' or 'disagree' rating and 10 members giving either an 'agree' or a 'completely agree' rating.
h. *An HRCCC member's role is to represent the resource management views of their constituent group at CCC meetings.* There was a strong concurrence of agreement amongst HRCCC members with this statement with 14 members giving a 'completely agree', 'moderately agree' or 'agree' rating and only one member giving a 'completely disagree' rating.
i. *An HRCCC member's role is to provide a catchment-wide perspective of natural resource management issues at CCC meetings.* There was a difference of opinion amongst HRCCC members on this statement, although the majority was in agreement with it. 13 members either gave a 'completely agree' or 'agree' rating, while 3 members gave a 'disagree' rating.

2.9 Other Comments

Members were asked if they would like to add any additional comments. A diverse range of comments were made including:

- *Issue - upper catchment involvement:* it was felt by several members that there was a need to get more happening in the upper catchment, more representation and even the possibility of a more formal sub-group being formed in the upper catchment was proposed on two grounds: (i) logistics of attendance at meetings (as it takes 4-5 hour drive each way from the upper to the lower catchment; (ii) differences in issues and context between the upper and lower parts of the catchment make ICM difficult.
- *Issue - progress:* The need to "keep the momentum up" was flagged with some concern being expressed at the slow rate of progress (rather than its direction) and the tendency to "move ahead in fits and starts". Even when there was good consensus in the Committee on an issue, it was suggested that often the HRCCC did not take it further.
- *Issue - awareness:* The point was made that although awareness of natural resource issues may be high amongst both CCC members and the community, understanding of issues varied significantly. A significant difference in awareness was perceived by some between

urban and rural stakeholders, with the rural community being attributed with higher awareness.

- *Importance of local and active ICM champions:* The importance of an effective Catchment Coordinator was seen by several members to be fundamental to the HRCCC's current and future success. Moreover the input of an active and committed Chairman was also raised as an important ingredient.
- *Linkages with other local statutory bodies:* Effective and strong linkages of ICM to Local Government and the Herbert River Improvement Trust were seen by several members as fundamental to the successful implementation of ICM. The current Hinchinbrook Shire planning process and the close linkages with ICM (including the involvement of HRCCC members) was providing a real opportunity to address the priority natural resource management issues in the catchment.
- *Funding:* The inadequacy and uncertainty of funding for ICM (both the Catchment Coordinator position and on-ground projects) was seen by several members as a major issue.
- *Issue - vested interest:* Concern was expressed regarding the number of members with multiple and conflicting interests and that too few people had too much power within the HRCCC. In particular, there was some concern expressed at the dominance of sugar industry representation on the CCC.

3. COMPARATIVE ANALYSIS OF 1995 AND 1997 SURVEY FINDINGS

3.1 Introduction

This section of the report provides an initial comparative analysis of the opinions of HRCCC members on aspects of ICM from the first HRCCC survey in November 1995 (Shrubsole and McDonald 1996) with those of the second HRCCC survey in December 1997. In the first survey, a mail-out questionnaire, responses from only 12 of the 15 current HRCCC members were received. However, in the second survey responses were recorded for all current HRCCC members in 18 face-to-face interviews.

3.2 HRCCC Membership

The number of members on the HRCCC over the period November 1995 to December 1997 increased from 15 to 18. The additional members on the HRCCC in 1997 are sector representatives for recreational/sporting fishing, the upper catchment community/Landcare, and an additional Hinchinbrook Shire Councillor. The sector groups represented on the HRCCC for both 1995 and 1997 are compared in Table 3.1.

Table 3.1. HRCCC membership in 1995 and 1997.

Stakeholder Group	Representatives in 1995	Representatives in 1997
INDUSTRY:		
CANEGROWERS	1	1
CSR Herbert River Mills	1	1
Cattlemans Union	1	1
Horticulture/Rare Fruits	1	1
Queensland Commercial Fishing Organisation	1	1
COMMUNITY GROUP:		
Hinchinbrook Citizen's Association	1	1
Recreational/Sporting Fishing	-	1
Landcare - lower catchment	1[1]	1[1]
Wildlife Preservation Society of Queensland	1	1
Herberton Shire Community/Landcare - upper	-	1

GOVERNMENT/STATUTORY BODIES		
Catchment Coordinator (DNR)	1	1
Hinchinbrook Shire Council	1	3
Herberton Shire Council	1	1
Herbert River Improvement Trust	1[2]	0.5[2]
Drainage Boards	1	0.5[2]
Hinchinbrook Development Bureau	1	1
Herbert Pest and Productivity Board	1[1]	1[1,3]
TOTAL	15	18

1. Also a member of CANEGROWERS Executive
2. Also a Councillor of Hinchinbrook Shire
3. Also a member of the Herbert River Improvement Trust

3.3 HRCCC Progress and Achievements

3.3.1 Major Achievements of the HRCCC

The major achievements of the HRCCC identified by members in the 1995 and 1997 surveys have been summarised into key points and these are presented in Table 3.2. There is strong similarity in the first three achievements for both surveys. These relate to group formation and some initial products (i.e. strategy development and on-ground activities). However, three additional achievements were identified in the 1997 survey. These additional achievements relate to process (i.e. awareness raising) and CCC function (i.e. coordination and referral/advisory role). Moreover the range of projects identified had broadened substantially from tin mines and tailing dam inventory in the upper catchment in 1995 to include in 1997: a joint project with HRIT at Long Pocket on bank stabilisation, the owl nesting box program, several restoration and revegetation projects (e.g. Wharps area, riparian area management, artificial wetland development, community tree planting), riparian vegetation mapping study, riparian "community" forum, and acid sulphate soils awareness.

Table 3.2. Members opinions of HRCCC achievements.

1995 Achievements	1997 Achievements
• Establishing a group that is bringing key catchment group representatives together to talk and share ideas. • Preparation of an initial draft catchment strategy. • Assisting community groups and agencies to undertake projects (e.g. tin mining sites in upper catchment).	• HRCCC meetings providing a forum that brings people together in the catchment with very different views. • The preparation and launching for public review of the Draft Herbert River Catchment Strategy. • Getting funding and undertaking a range of projects. • Raising awareness of catchment problems amongst HRCCC members and within the community • Taking on a coordinative and integrative role on natural resource issues in region • Recognition as a source of advice on natural resource issues in the catchment.

3.3.2 Satisfaction with Progress

Members were asked in both 1995 and 1997 about their level of satisfaction with progress in the HRCCC on a five point scale from very satisfied to very unsatisfied. Over the period 1995 to 1997, there appears to be a general improvement in satisfaction with progress. In 1995, 55% of members gave a rating of 'satisfied' or 'very satisfied' but in 1997 this had increased to 78% of members. A comparison of the results is presented in Table 3.3.

Table 3.3. Comparison of level of satisfaction on progress in the HRCCC for 1995 and 1997.

Satisfaction Rating	No. (%) of members 1995	No. (%) of members 1997
Very satisfied	1 (8)	1 (6)
Satisfied	5 (42)	13 (72)
Neither	3 (25)	1 (6)
Unsatisfied	1 (8)	3 (16)
Very Unsatisfied	1 (8)	0 (0)
No response	1 (8)	0 (0)

3.4 Problem Characterisation and HRCCC Role

3.4.1 Key Resource Management Issues

The most important resource management issues in the catchment identified by HRCCC members in 1995 and 1997 are compared in Table 3.4. In 1997, members' perspectives on these issues had broadened and become more strategic in scope.

Table 3.4. Comparison of Perceived Key Resource Management Issues in 1995 and 1997.

1995	1997
Rural drainage	Rural drainage
Allocation of sugar caneland	Caneland expansion
Stream bed and bank erosion	River management
Urban flooding	Water quality
Land clearing	Riparian management
	Wetland degradation
	Pest and weed management
	Coordinated extension approach
	Catchment planning

3.5 Public Attitudes, Support and Involvement

3.5.1 Level of Public Awareness on Natural Resource Use Issues

In both surveys members' perspectives were sought on the level of public awareness on natural resource issues within the Herbert River catchment. In 1995, responses were given for the Herbert community as a whole. In 1997, members considered that differentiation between rural and urban communities was appropriate. Table 3.5 compares the results from the two surveys. Overall members considered that public awareness was higher in 1997 than in 1995. For example, 42% of those responding in 1995 gave a moderate to very high rating, while in contrast, in 1997, 72% of members considered rural awareness to be moderate or higher, and 53% of members considered urban awareness to be moderate or higher.

Table 3.5. HRCCC Perspectives on the Level of Public Awareness on natural Resource Issues for 1995 and 1997.

Rating	1995	1997 - Rural	1997 - Urban
Very high	1	3	1
High	0	7	2
Moderate	4	3	6
Low to moderate	1	o	0
Low	6	3	1
Very low	o	2	7
No response	3	0	1

3.5.2 Public Support for the HRCCC

In both 1995 and 1997, HRCCC members were asked to rate their perception of the level of public support for the HRCCC on a five-point scale (from very high to very low). The results are presented in Table 3.6. In both surveys there was a divergence of opinion amongst HRCCC members on this question. However overall members rated support for the HRCCC as low to moderate.

Table 3.6. Comparison of members opinions of public support for the HRCCC for 1995 and 1997.

Rating	1995	1997
Very High	0	1
High	1	3
Moderate	6	6
Low	3	6
Very Low	2	1
Don't know	0	1

3.5.3 Effectiveness of Stakeholder Involvement

In both 1995 and 1997, HRCCC members were asked to rate on a five point scale (from very effective to very ineffective) the involvement in the Herbert ICM process of a range of stakeholder groups. Due to structural changes at State Government level, there have been some title changes to departments. However, functional groups with an interest or role in natural resource management can still be clearly matched. The results are presented in Table 3.7.

In both 1995 and 1997, there was considerable divergence of opinion on the effectiveness of different sector or stakeholder groups in the Herbert ICM process. However some general observations can be made. Rural producers, the HRIT and Drainage Boards were seen to be effectively or very effectively involved in the Herbert ICM process, while State Government politicians and the Department of Lands/DNR Lands Administration were seen by most members to be less effective in the ICM process. In 1995, the DPI (which then included the roles of the current DNR) and the Department of Environment and Heritage (now DoE) also were seen as having an effective involvement in the Herbert ICM process. However in 1997, there was a lowering of perceptions of the effectiveness of these two groups by HRCCC members, with the DPI (particularly the Fisheries group) been seen as in general to be much less effective in the ICM process. In contrast, Local Government administrators and politicians were perceived to have become much more effective in the ICM process in 1997 than in 1995.

Table 3.7. Most common ratings on the effectiveness of different stakeholders in the Herbert ICM.

Effectiveness Rating	Stakeholder Groups 1995	Stakeholder Groups 1997
Effective/very effective	Rural producers DPI (included DNR) Dept. Environment & Heritage HRIT Drainage Boards	Rural producers Local Government Politicians Local Government Administrators HRIT Drainage Boards
Neither/ineffective/very ineffective	State Government politicians Dept. Housing, Local Govt & Planning Dept. Lands Local Government administrators Local Government politicians	State Government politicians DPI (particularly Fisheries) DNR - Land Administration

3.5.4 Improving Stakeholder Involvement

In both the 1995 and 1997 surveys, HRCCC members were asked what could be done at state and local levels to improve the acceptance and involvement of relevant groups and the general public in the HRCCC process. A diversity of opinions were expressed in both surveys, however, there are common elements in both. The members' suggestions are summarised under key points in Table 3.8. The first two points are very similar for both years. In 1995, members also identified the need to get better involvement of local government, funding for projects, and raising public awareness. All of these have been addressed/achieved by 1997 to the satisfaction of HRCCC members (see Table 3.2 and Table 3.7 above). In 1997, however members also identified improving representativeness of the CCC and effectiveness of State Government agency involvement as key issues of concern.

Table 3.8. Member suggestions on ways stakeholder involvement could be improved

1995	1997
• greater publicisation and promotion of the HRCCC and its activities (particularly in the media) • recognising the role of the CCC through legislation • greater involvement of local government • getting funding for on-ground works/projects • raising community/public awareness of natural resource issues. • greater public consultation	• greater publicisation and promotion of the HRCCC and its activities (particularly in the media) • ICM to be given legislative power/base • improve representativeness of the CCC (e.g. some stakeholder groups were not involved in the HRCCC) • more effective government agency involvement • government agencies to consult with the HRCCC on all their programs in the Herbert catchment.

3.6 Factors Influencing ICM Process

3.6.1 Difficulties of ICM Implementation

In both 1995 and 1997, HRCCC members were asked to rate their opinion on a five point scale (strongly agree to strongly disagree) on a series of statements relating to difficulties in ICM implementation. The statements and responses are compared below for both surveys.

a. The large size of the catchment (or poor transportation links between parts of catchment).

In both the 1995 and 1997 surveys, the majority of HRCCC members 'strongly agreed' or 'agreed' that the large size of the catchment made ICM implementation difficult. However 4 members in 1997 disagreed with this statement.

	Strongly Agree	Agree	Neither	Disagree	Strongly Disagree	No Response
1995	0	11	1	0	0	0
1997	4	9	0	4	0	1

b. The wide variety of values and beliefs among HRCCC members seriously detracts from an effective level of cooperation developing among them.

In 1995, the majority of members (75%) 'strongly agreed' or 'agreed' that the wide variety of values and beliefs among HRCCC members seriously detracted from an effective level of cooperation developing, and only 25% disagreed. However in 1997 opinions had shifted and this was not perceived as such an issue with 55% giving a 'disagree' or strongly disagree' rating. This shift suggests a greater acceptance/tolerance of the diversity of views amongst members.

	Strongly Agree	Agree	Neither	Disagree	Strongly Disagree	No Response
1995	3	6	0	3	0	0
1997	1	6	0	8	2	0

c. Some important constituency groups are not represented in the ICM process.

Opinions overall have not changed with the majority of members (approx. 80%) 'disagreeing' or 'strongly disagreeing' that ICM was difficult because important constituent groups were not represented. However 3 members in 1997 'agreed' with this statement and 1 member in 1995 'strongly agreed'.

	Strongly Agree	Agree	Neither	Disagree	Strongly Disagree	No Response
1995	1	0	1	10	0	0
1997	0	3	0	9	5	1

d. The perception that ICM has been forced on the catchment by the state government.

In 1995, there was a divergence of opinion amongst HRCCC members on the statement that ICM implementation was difficult because there was a perception that State Government had forced ICM on the catchment. However the majority of HRCCC members 'disagreed' or 'strongly disagreed' with this statement. In 1997, all respondents 'disagreed' or 'strongly disagreed' that this was an issue.

	Strongly Agree	Agree	Neither	Disagree	Strongly Disagree	No Response
1995	1	1	2	5	2	0
1997	0	0	0	10	6	2

e. The lack of an effective level of interest by HRCCC members.

In both surveys there was a divergence of opinion amongst members on whether ICM in the Herbert was difficult because of the lack of an effective level of interest by HRCCC members. However in 1997 the majority of members (67%) 'disagreed' or 'strongly disagreed' that this was an issue indicating a slight shift in opinion from 1995 to 1997.

	Strongly Agree	Agree	Neither	Disagree	Strongly Disagree	No Response
1995	1	2	3	5	1	0
1997	1	3	1	7	5	1

f. The public's lack of trust in state/local government-sponsored initiatives.

In 1995, the majority of members (67%) were in general agreement with the statement that the public's lack of trust in state/local government-sponsored initiatives made ICM implementation difficult. In 1997, there was a stronger divergence of opinion on this statement. However a greater number of members 'disagreed' or 'strongly disagreed' in 1997 (i.e. 39%) than in 1995 (i.e. 17%).

	Strongly Agree	Agree	Neither	Disagree	Strongly Disagree	No Response
1995	3	5	1	2	0	1
1997	1	8	0	4	3	2

g. The public's lack of interest in community type activities.

In 1995, the majority of members (67%) were in general agreement with the statement that the public's lack of interest in community type activities made ICM implementation difficult. In 1997, there was a stronger divergence of opinion on this statement. However a greater number of members 'disagreed' in 1997 (i.e. 39%) than in 1995 (i.e. 17%).

	Strongly Agree	Agree	Neither	Disagree	Strongly Disagree	No Response
1995	3	5	2	2	0	0
1997	1	7	2	7	0	1

h. The lack of financial resources within the community.

In 1995, the majority of members (67%) were in general agreement with the statement that the lack of financial resources within the community made ICM implementation difficult. In 1997, there was a stronger divergence of opinion on this statement. However a greater number of members 'disagreed' or 'strongly disagreed' in 1997 (i.e. 44%) than in 1995 (i.e. 25 %).

	Strongly Agree	Agree	Neither	Disagree	Strongly Disagree	No Response
1995	3	5	1	2	1	0
1997	3	3	2	8	0	2

i. There is no single acute resource management problems within the catchment.

There is a strong divergence of opinion amongst members on whether ICM is difficult because there are no single acute problems within the catchment, and overall opinions have not really changed over the period 1995 to 1997.

	Strongly Agree	Agree	Neither	Disagree	Strongly Disagree	No Response
1995	1	5	1	5	0	2
1997	0	8	0	5	1	4

3.6.2 ICM Process Issues

In both the 1995 and 1997 surveys, HRCCC members were asked to rate their opinion on a five point scale (from strongly agree to strongly disagree) on five statements relating to the ICM implementation process. The overall responses are compared below.

a. There is a strong consensus among HRCCC members concerning HRCCC functions.

There has been a shift on the overall opinion of the HRCC members on this statement. In 1995, 68% of members 'disagreed' or 'strongly disagreed' that there was a strong consensus among HRCCC members concerning HRCCC functions. While in 1997, 61% of members expressed agreement or strong agreement with this statement.

	Strongly Agree	Agree	Neither	Disagree	Strongly Disagree	No Response
1995	1	3	0	7	1	0
1997	2	9	2	1	0	4

b. At HRCCC meetings, all HRCCC members participate actively.

There was overall agreement in both the 1995 and 1997 surveys by HRCCC members that at HRCCC meetings all members participated actively. However this opinion was more widely held in 1997 with 78% of members 'agreeing' or 'strongly agreeing' compared with 58% in 1995.

	Strongly Agree	Agree	Neither	Disagree	Strongly Disagree	No Response
1995	0	7	3	2	0	0
1997	1	13	0	2	0	2

c. The local ICM process effectively resolves resource conflicts.

In both the 1995 and 1997 surveys, there was a divergence of opinion amongst HRCCC members on whether the local ICM process is effectively resolving resource conflicts in the catchment.

	Strongly Agree	Agree	Neither	Disagree	Strongly Disagree	No Response
1995	0	3	6	3	0	0
1997	2	4	4	3	1	4

d. The ICM process is responsive to local needs.

In the 1995 survey there was a strong divergence of opinion amongst members from 'strongly disagree' to 'agree' on whether the ICM process was responsive to local needs. However in 1997, 78% of HRCCC members either 'agreed' or 'strongly agreed' with this statement. This possibly reflects the overall greater confidence being expressed by members in general in the Herbert ICM process.

	Strongly Agree	Agree	Neither	Disagree	Strongly Disagree	No Response
1995	0	4	5	2	1	0
1997	3	11	0	1	0	3

e. The HRCCC is solving the priority natural resource management problems in the catchment.

There is a divergence of opinion in both the 1995 and 1997 surveys on whether the HRCCC is solving the priority natural resource problems in the catchment. However the results for both surveys suggest there is stronger agreement rather than disagreement amongst members.

	Strongly Agree	Agree	Neither	Disagree	Strongly Disagree	No Response
1995	0	6	2	2	1	1
1997	1	9	3	3	0	2

3.6.3 Demands on Members of ICM Involvement

HRCCC members were asked on average what number of hours per month did they devote to ICM. A similar range of hours spent on ICM was identified in both surveys. The Chairman and Catchment Coordinator spending the most time in both cases.

Hours/month	1995	1997
0-2	0	1
3-4	3	2
5-6	5	4
7-8	0	6
9-10	1	0
11-15	2	3
16-20	0	1
21+	1	1

In both 1995 and 1997 surveys, HRCCC members were asked to rate their agreement/ disagreement with three statements relating to the personal demands of ICM involvement on a six point scale (from completely agree to completely disagree). The responses are compared below.

a. The amount of time I devote to ICM significantly interferes with my own business/job requirements.

Both surveys indicate a difference in experience amongst HRCCC members on whether the time devoted to ICM interfered with their business/job requirements. However overall the distribution of responses was similar in both surveys.

	Strongly/ Completely Agree	**Agree/ Moderately Agree**	**Neither**	**Disagree**	**Strongly/ Completely Disagree**	**No Response**
1995	0	4	2	4	1	0
1997	1	6	0	5	4	2

b. The amount of time I devote to ICM significantly interferes with my family commitments.

Both surveys indicate a difference in experience amongst HRCCC members on whether the time devoted to ICM significantly interfered with family commitments. However the majority of members on both occasions 'disagreed' or 'strongly disagreed' with this statement.

	Strongly/ Completely Agree	**Agree/ Moderately Agree**	**Neither**	**Disagree**	**Strongly/ Completely Disagree**	**No Response**
1995	0	3	1	6	1	0
1997	1	3	0	8	4	2

c. My involvement with the HRCCC causes significant out-of-pocket expenses.

The majority of members in both surveys 'disagreed' or strongly disagreed' that involvement in the HRCCC caused significant out-of-pocket expenses.

	Strongly/ Completely Agree	**Agree/ Moderately Agree**	**Neither**	**Disagree**	**Strongly/ Completely Disagree**	**No Response**
1995	0	1	5	4	1	0
1997	0	3	1	6	6	2

3.6.4 Motivation for ICM Involvement

In both the 1995 and 1997 surveys, HRCCC members were asked to rate their agreement/disagreement with three statements relating to their motivation to be a member of the Herbert ICM process on a six point scale (from completely agree to completely disagree). Their responses are compared below for both surveys below.

d. I find being a member of the HRCCC personally rewarding because I can contribute to the community.

In both the 1995 and 1997 surveys, members were in strong agreement that part of their motivation for involvement in the HRCCC was that they could contribute to the community.

	Strongly/ Completely Agree	Agree/ Moderately Agree	Neither	Disagree	Strongly/ Completely Disagree	No Response
1995	1	7	3	0	0	0
1997	9	8	0	0	0	1

e. I find being a member of the HRCCC personally rewarding because I care about natural resource management.

In both the 1995 and 1997 surveys, members were in strong agreement that being a member of the HRCCC was personally rewarding because they cared about natural resource management.

	Strongly/ Completely Agree	Agree/ Moderately Agree	Neither	Disagree	Strongly/ Completely Disagree	No Response
1995	3	8	0	0	0	0
1997	10	7	0	0	0	1

f. I find being a member of the HRCCC personally rewarding because I can meet other members of the community who can influence resource management decision-making.

In both the 1995 and 1997 surveys, members were in strong agreement that being a member of the HRCCC was personally rewarding because they could can meet other members of the community who can influence resource management decision-making.

	Strongly/ Completely Agree	Agree/ Moderately Agree	Neither	Disagree	Strongly/ Completely Disagree	No Response
1995	2	9	0	0	0	0
1997	7	9	0	1	0	1

3.6.5 Opinions on Catchment Committee Member's Role

In both the 1995 and 1997 surveys, HRCCC members were asked to rate their agreement/disagreement with three statements relating to their role as a member of the Herbert River Catchment Coordinating Committee on a six point scale (from completely agree to completely disagree). Their responses are compared below.

g. An HRCCC member's role is to provide their personal views on resource management issues at CCC meetings.

There was a marked divergence of opinion amongst members in both surveys on whether a member's role is to provide their personal views on resource management issues at CCC meetings.

	Strongly/ Completely Agree	Agree/ Moderately Agree	Neither	Disagree	Strongly/ Completely Disagree	No Response
1995	0	6	3	3	0	0
1997	2	8	0	5	2	1

h. An HRCCC member's role is to represent the resource management views of their constituent group at CCC meetings.

There was strong agreement amongst members in both surveys that a member's role is to represent the resource management views of their constituent group at CCC meetings.

	Strongly/ Completely Agree	Agree/ Moderately Agree	Neither	Disagree	Strongly/ Completely Disagree	No Response
1995	9	0	0	0	0	3
1997	2	14	0	0	1	1

i. An HRCCC member's role is to provide a catchment-wide perspective of natural resource management issues at CCC meetings.

There was in general agreement amongst members in both surveys that a member's role is to provide a catchment-wide perspective of natural resource management issues at CCC meetings.

	Strongly/ Completely Agree	Agree/ Moderately Agree	Neither	Disagree	Strongly/ Completely Disagree	No Response
1995	6	3	1	0	0	2
1997	5	8	0	3	0	1

4. OVERALL DISCUSSION OF THE 1995 AND 1997 HRCCC MEMBER SURVEY FINDINGS

4.1. The HRCCC

In November 1997, the Herbert River Catchment Coordinating Committee (HRCCC) had a local Chairman and 16 members representing community, industry and local government and statutory bodies in the catchment as well as a full-time Catchment Coordinator. Nine of the current members (50%) have been involved with the HRCCC since its inception in March 1993. Two members are from the upper catchment and the remainder lives in the lower catchment. The HRCCC had no State Government agency representatives. Most of the members are active community members with multiple sectoral interests. Eleven of the members are either cane farmers or employed within the sugar industry reflecting the economic and social importance of the sugar industry in the lower Herbert catchment community.

4.2. Key Resource Management Issues

In 1995, the HRCCC members identified the key resource management issues in the Herbert River catchment as rural drainage, allocation of sugar caneland, stream bed and bank erosion, urban flooding and land clearing. In 1997, members' perspectives on these issues had broadened and become more strategic in scope to also include water quality, riparian management, wetland degradation, pest and weed management, a coordinated extension approach, and catchment planning.

4.3. HRCCC Activities and Achievements

In both the 1995 and 1997 surveys, members identified several achievements of the HRCCC relating to group formation and some initial products. These included the HRCCC providing a forum that brings people together in the catchment with very different views, the preparation of the Herbert River Catchment Strategy and getting funding for on-ground projects. However, in 1997 some important additional achievements relating to the ICM process were identified. These included: raising awareness of catchment issues amongst members and the community, the HRCCC being recognised as a source of advice on natural resource issues, and the HRCCC

starting to take on a coordinative and integrative role on natural resource issues in the catchment. In addition, the range of projects identified had broadened substantially from a tin mine and tailing dam inventory in the upper catchment in 1995 to include in 1997: a joint project with HRIT at Long Pocket on bank stabilisation, the owl nesting box program, several restoration and revegetation projects (e.g. Wharps area, riparian area management, artificial wetland development, community tree planting), riparian vegetation mapping study, riparian "community" forum, and acid sulphate soils awareness.

In 1997, most members were positive about these achievements and the group's overall direction, however, some frustration was expressed with the slowness of the overall process. Significantly there is a general improvement in satisfaction amongst members with progress since the 1995 survey. Most members rated the progress of the HRCCC in 1997 as satisfactory due to the difficulty of the issues being addressed, the long term nature of the ICM process, and the slowness of the process of raising community awareness of issues and gaining public acceptance. Three members however rated progress as unsatisfactory, which was attributed largely to the slow rate of progress, the low community awareness of ICM, and the lack of enforcing power on natural resource issues.

Members also made a number of suggestions on ways to improve performance. These included: better publicisation of ICM and the HRCCC within the community, being more proactive (versus opportunistic), improving ICM's legitimacy, better coordination and cooperation amongst state government agencies, having the support of enforcing powers, and ensuring the security of tenure for a Catchment Coordinator and the adequacy of funding for HRCCC activities.

4.4 The HRCCC'S Role

Most members agreed that ICM was well suited to addressing natural resource issues in the Herbert because of ICM's strength in its community base, its inclusiveness of a broad range of catchment stakeholders and its good linkages with local authoritative bodies.

A number of roles that the HRCCC was taking in natural resource management in the catchment were identified. These included bringing together catchment stakeholders, raising awareness of natural resource issues and developing a better understanding of their causes. The HRCCC was seen to be facilitating cooperation across stakeholder groups that was getting things achieved that one group could not have done alone. An important development is that the HRCCC was providing an advisory and influencing role on natural resource issues and planning processes in the catchment, in particular through working in partnership with Local Government and the Herbert River Improvement (HRIT). In addition, the HRCCC had contributed to the improvement of the overall information base on natural resource issues that is available to underpin decision making in the catchment (e.g. riparian vegetation mapping).

There was a divergence of views amongst HRCCC members however on the HRCCC's role in the Herbert River community. Concerns were expressed by several members on the overall limited role the HRCCC had played to-date at the catchment and regional level, in particular, in relation to the identification of solutions to the major resource use problems of the catchment. Moreover members identified ICM's lack of enforcing power, its limited resources (e.g. financial, extension staff) and the limitations imposed by the lack of coordination across State Government agencies as important issues influencing the HRCCC's role in natural resource management.

4.5. The Catchment Management Strategy

The HRCCC released a draft Herbert River Catchment Management Strategy in May 1996 for

public comment. HRCCC members agreed in general that this strategy, firstly, provided a future direction to the group and a guide for future actions (e.g. identified issues, prioritised needs, identified stakeholders and their roles, provided a reference point to start from), and, secondly, helped to get resources and support for ICM in the Herbert (e.g. funding for Catchment Coordinator and natural resource projects, and ensuring the commitment of State Government to undertake projects).

A majority of members rated the Catchment Management Strategy development process as useful because the process was seen to be inclusive and transparent within the Committee. It also raised awareness of issues and others viewpoints within the HRCCC membership, it identified areas of agreement, and helped to focus the HRCCC and establish an overall direction. Some concerns however were expressed regarding the lack of resolution on some key issues, and the failure of the strategy to have a significant impact on what the Committee was currently doing. Most members did not feel that the strategy development process could have been improved with the exception that two members felt that it should have included more people beyond just the HRCCC members.

4.6. Public Attitudes and Support

HRCCC members perceived that the rural community's *awareness* on natural resource issues was overall substantially higher than the urban community's awareness, and that it had increased since 1995; although only slowly. Several members felt that this improvement was related to specific well publicised or controversial issues (such as cattle-to-caneland conversion, land clearing for caneland expansion, owl boxes, fish kills in the river, damming of streams and acid sulphate soils).

Members diverged in their opinion on the level of public support for the HRCCC with 12 members rating public support as low or moderate, whereas 4 rated it as high to very high. The reasons given were HRCCC's on-ground projects and a number of high profile events in the catchment bringing attention to the HRCCC. However it was also suggested that many people did not really understand the HRCCC's objectives and role.

4.7. Stakeholder Involvement

In both the 1995 and 1997 surveys, there was considerable divergence of opinion amongst members on the effectiveness of different sector or stakeholder groups in the Herbert ICM process. However some general observations can be made. Rural producers, the HRIT and Drainage Boards were seen to be effectively or very effectively involved in the Herbert ICM process, while State Government politicians and the Department of Lands/DNR Lands Administration were seen to be less effective in the ICM process. In 1995, the DPI (which then included the roles of the current DNR) and the Department of Environment and Heritage (now DoE) also were seen as having a largely effective involvement in the Herbert ICM process. However in 1997, there was a lowering of perceptions of the effectiveness of these two groups, with the DPI (particularly the Fisheries group) been seen as in general to be much less effective in the ICM process. In contrast, Local Government administrators and politicians were perceived to have become much more effective in the ICM process in 1997 than in 1995.

To improve stakeholder involvement in the Herbert ICM process, members in 1995 made several suggestions. First, there was a need for greater publicisation and promotion of the HRCCC and its activities (particularly in the media). Second, the role of the CCC should be recognised through legislation. Thirdly, the HRCCC needed greater involvement of local government. Fourth, access to greater funding was required for on-ground works/projects. Finally the HRCCC needed to focus on raising the Herbert community's awareness on natural resource issues, and to improve the public consultation process. By 1997, some of these

suggestions had been achieved, that is, local government involvement had increased significantly and the Committee had improved their funding for on-ground works/projects. However members made a number of other important suggestions on how stakeholder involvement could now be improved. These were that the representativeness of the HRCCC needed improvement, there was a need for more effective government agency involvement in the ICM process and this included government agencies being required to consult with the HRCCC on all their programs in the catchment, and finally greater publicisation and promotion within the catchment of the HRCCC and its activities.

4.8. Local Government Involvement

In 1997, most members were now satisfied with the involvement of local government because it had been actively involved in the ICM Committee since its inception, it was proving to be an important information source, it was now recognising the HRCCC as a legitimate referral and advisory group and seeking their advice on issues, and it could provide ICM with "teeth for implementation".

Members were aware of an emerging and positive development in the proposal that farmers opening up new areas of intensive agriculture will require Hinchinbrook Shire Council approval (for conditions) under the new Hinchinbrook Shire Plan. Most members in principle supported the Shire Council in having these powers. However, HRCCC member's expressed concern over the State Government's failure to effectively use their powers in this area, and whether the Council had the capacity or political will to implement them.

4.9. Factors Influencing the ICM Process

In 1997, members identified project funding successes (e.g. NLP/NHT), the appointment of a new Chairman of the HRCCC, increased linkages to Local Government, the improvement in the cooperation amongst collaborating agencies, and the appointment of additional DNR extension staff as key factors having a positive influence on the HRCCC's progress particularly since 1995.

In both 1995 and 1997, the majority of members were in agreement that ICM implementation in the Herbert River catchment was difficult because of the large size of the catchment. Significantly, most members did not support the views that ICM was difficult because some important constituency groups were not represented in the ICM process, or because of the lack of agreement among members concerning its objectives. There was however agreement in both surveys that all HRCCC members participated actively in meetings, and that the ICM process was responsive to local needs. Importantly these opinions appear to be more strongly and widely held in 1997 than in 1995.

The main areas where there was a divergence of opinion among members on key factors influencing the ICM process related to whether ICM was difficult because of the lack of effective interest by HRCCC members, the public's lack of trust in state/local government-sponsored initiatives, the public's lack of interest in community type activities, the lack of financial resources within the community, the lack of agreement on feasible solutions and the lack of a single acute resource management problem in the Herbert catchment. There was also a divergence of opinion amongst members in both surveys on whether the local Herbert ICM process was effectively resolving resource conflicts, and whether the HRCCC was solving the priority natural resource management problems in the catchment

Of importance is a shift in opinion from 1995 to 1997 on several factors perceived to be influencing the ICM process. In 1995, the majority of members agreed that the wide variety of values and beliefs among HRCCC members seriously detracted from an effective level of cooperation developing but in 1997 this was not seen to be an issue. Moreover in 1995,

members were in agreement that ICM implementation in the Herbert River catchment was difficult because of the public's lack of interest in community type activities as well as in state/local government-sponsored initiatives, and because of the lack of financial resources within the community. However in 1997, there was a clear divergence of opinion regarding these factors, with a shift to more members disagreeing than in 1995.

There were three other apparent shifts in the opinion of the majority of HRCCC members on factors influencing the ICM process. In 1995, there was a divergence of opinion amongst members on whether ICM implementation was difficult because it had been forced on the catchment by State Government, but in 1997 members largely disagreed with this view. In 1995, most members disagreed that there was a strong consensus among HRCCC members concerning HRCCC functions, however by 1997, the majority of members now agreed with this statement. In addition, in the 1995 survey there was a strong divergence of opinion amongst members on whether the ICM process was responsive to local needs but, in 1997, most agreed with this statement.

In sum, these views indicate that overall the Committee appears to be working well with overall agreement on their role and function, but some divergence of opinion on how well they are progressing.

4.10 Personal Demands and Motivation

Members were in strong agreement that they found involvement in the HRCCC personally rewarding because they could contribute to the community, they cared about the environment, and that they could meet other members of the community who could influence resource management decision-making.

In both the 1995 and 1997 surveys, members diverged in their experience on whether the time they devoted to ICM interfered with their business/job requirements and whether it significantly interfered with family commitments. However, members in both surveys were in strong agreement on a number of issues: involvement in the HRCCC did not cause significant out-of-pocket expenses; their motivation for involvement in the HRCCC related to the contribution they could make to the community; and that involvement was personally rewarding because they cared about natural resource management and because they could can meet other members of the community who can influence resource management decision-making.

The majority of members agreed that an HRCCC member's role is to represent the resource management views of their constituent group at CCC meetings. However, there was a divergence of opinion on whether an HRCCC member's role is to provide either their personal views on resource management issues or a catchment-wide perspective of natural resource management issues at CCC meetings.

4.11 Other General Comments

There were several additional issues raised by HRCCC members, as general comments. Concern was expressed for better linkages with the upper Herbert catchment, including better representation on the HRCCC and the possibility of the formation of an ICM sub-group in the upper catchment. There was a need to not only raise the Herbert community's awareness of ICM but also to develop a better understanding in the community of the HRCCC's objectives and role as well as the cause-and-effect relationships of catchment resource management issues. The importance of an effective Catchment Coordinator and active committed Chairman were seen to be essential ingredients of an effective ICM process. Closely related to this was the need for both adequacy and certainty of government funding for the Catchment Coordinator position. Moreover strong linkages between ICM and local government and other local

statutory agencies (e.g. RIT) was seen as fundamental for the ICM process being able to effectively address the priority natural resource issues in the catchment

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APPENDIX 1.

1997 QUESTIONNAIRE FOR HRCCC MEMBERS

HERBERT RIVER CATCHMENT

COORDINATING COMMITTEE OPINIONS

HRCCC Members Name: …….

BACKGROUND

1. How long have you lived in this catchment? ……Years

2. What year did you become a member of the HRCCC? ……Years

3. Which of the following groups do you represent on the HRCCC? (please tick)

? Local government
? State government agency
? Sugar industry
? Grazing industry
? Fishing industry
? Horticulture/Rare Fruits
? Conservation
? Tourism
? Community group
? Other (please specify)

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4a. Do you live upstream or downstream from Abergowrie? (please tick)

? Upstream (not including Abergowrie)
? Downstream (includes Abergowrie)

4b. What is your occupation? ……

5a. What have been the major achievements of the HRCCC? (tick)

- ☐ prepared a catchment strategy or plan
- ☐ offered advice to landowners
- ☐ conducted projects
- ☐ Other (please specify)

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What are some of the most significant projects or achievements?:

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5b. Since assuming your current responsibilities, how satisfied are you with progress in the HRCCC? (tick)

- ☐ very satisfied
- ☐ satisfied
- ☐ neither satisfied nor unsatisfied
- ☐ unsatisfied
- ☐ very unsatisfied

15c. Why? What are some of your reasons:

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15d. Is there anything that should be done to improve performance?

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6. From your perspective what currently are some of the key catchment resource management issues?

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7. In respect of the following statements about the role that the HRCCC has played in resource management, can you rate your agreement on a five point scale from:

	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree	Don't know
The HRCCC has:						
a. Helped negotiation among resource stakeholders to accommodate a wide range of resource uses.	?	?	?	?	?	?
b. Helped stakeholders in defining the source of resource problems and solutions to them	?	?	?	?	?	?
c. Helped stakeholders in ensuring their resource management practices are effective, efficient, equitable, accountable.	?	?	?	?	?	?
d. Encouraged research and data gathering and analysis in order that solutions to resource problems can be better understood	?	?	?	?	?	?
e. How well suited is the ICM program in Queensland suited to address complex resource issues within your catchment?	?	?	?	?	?	?

8. From your perspective describe the role that the HRCCC has played in regional resource
management.

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9. From your perspective how well suited is the ICM program in Queensland suited to address resource use and management issues within the Herbert catchment?

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10. We are interested in understanding the types of information needed to support all aspects of an ICM program and its activities. Such information may be available in a number of forms (eg., databases, reports, pamphlets, maps, or through a catchment resource centre).

	Yes/No	Very Useful	Useful	Neither	Not useful
10A. In your involvement in the HRCCC have you used information or data on:					
If yes, how useful was it on a four point scale:					
a. Catchment natural resources.	?	?	?	?	?
b. Population and land use in your catchment?.....	?	?	?	?	?
c. Local organisations, industry and community groups in your catchment?.....	?	?	?	?	?
d. Government institutional arrangements for ICM, Landcare, natural resources, and related issues?	?	?	?	?	?
e. Government policies and regulations on natural resources and related issues?	?	?	?	?	?
f. Options for funding of ICM and other community activities?....	?	?	?	?	?
g. Group management and administration?.....	?	?	?	?	?
h. Other - please specify:					
....	?	?	?	?	?
....	?	?	?	?	?

10B. What types of information would have been useful/of value, if it had been available and why? (identify a to h)

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10C. Are you aware of the Catchment Atlas?..... **Yes/No**

Have you made use of it in any way?

……
……
……
……
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……

10D Have you used the Herbert Resources Information Centre (HRIC)? **Yes/No**
If yes, for what purposes?

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THE HERBERT RIVER CATCHMENT MANAGEMENT STRATEGY

11a. For what purpose did the HRCCC prepare a catchment strategy/plan?

.....
.....
.....
.....
.....
.....
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.....
.....
.....

11b Was the process of development of a catchment strategy/plan useful? Yes/No

If so, in what ways was it useful?

.....
.....
.....
.....
.....
.....
.....
.....

12. Please indicate your level of agreement with the following statements:

		Strongly agree	Agree	Neither	Disagree	Strongly disagree	Don't know
12a	The catchment strategy will contribute to effective resource management	?	?	?	?	?	?
12b	The catchment strategy will assist in resolving resource management conflicts.....	?	?	?	?	?	?
12c	I was effectively involved in the writing of the catchment strategy	?	?	?	?	?	?
12d	My constituency group supports the implementation of the strategy.....	?	?	?	?	?	?

12 e. What was the process the HRCCC used to develop the strategy?:

……

……

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……

12 f. In retrospect, was there anything that should/could have been done to improve the process?

……

……

……

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……

……

……

……

PUBLIC ATTITUDES AND RECENT DEVELOPMENTS

13a. In your opinion, what is the level of public awareness about natural resource issues in the Herbert catchment? (tick)

? very high
? high
? moderate
? low
? very low
? don't know

13b. Has public awareness changed over the last year?…….……Yes/No

13c. If so, how or in what way?……

……
……
……
……
……
……

14a. What level of public support do you believe the HRCCC has? (tick)

? very high
? high
? moderate
? low
? very low
? don't know

14b. How has public support for the HRCCC changed over the past year?

……
……
……
……
……
……
……
……

15. How effective has the involvement of the following groups been to the HRCCC?

	Very effective	Effective	Neither	Ineffective	Very ineffective	Not applicable
a. Rural producers (specify)	?	?	?	?	?	?
b. Local government politicians.....	?	?	?	?	?	?
c. Local government administrators.....	?	?	?	?	?	?
d. State government politicians.....	?	?	?	?	?	?
State government agencies:						
e. DPI.....	?	?	?	?	?	?
DNR						
f. .....Forestry	?	?	?	?	?	?
g.....Land Management.....	?	?	?	?	?	?
h.....Lands Administration	?	?	?	?	?	?
i.....Water Resources	?	?	?	?	?	?
j.....Department of Environment	?	?	?	?	?	?
k.....Local Government and Planning....	?	?	?	?	?	?
l. River Improvement Trust.....	?	?	?	?	?	?
m. Drainage Board(s).....	?	?	?	?	?	?
n. Rural Industry organisations (specify)	?	?	?	?	?	?
o. Environmental organisations.	?	?	?	?	?	?
p. The Media.	?	?	?	?	?	?
q. Landcare Groups	?	?	?	?	?	?
r. Other (please specify)	?	?	?	?	?	?
....	?	?	?	?	?	?
....	?	?	?	?	?	?

16. What could or should be done at state/local levels to improve the acceptance and involvement of relevant groups and the general public in the HRCCC process?

……
……
……
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……

17. a. Are you satisfied with the involvement of local government in ICM in the Herbert?

(Yes/No)

17b. Why?

……
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……
……
..... ……
…

17c. What more could local government do to help ICM? ..

……
..... ……
…
……
……
……

17d. Do you know of the proposal that farmers opening up new areas of intensive agriculture will require Hinchinbrook Shire Council (HSC) approval (for conditions) under the new HSC Plan?

.... **Yes/No**

17e. What is your opinion about the proposal?

……
..... ……
……
……
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……
..... ……
…

18. What have been some of the recent major changes (political, financial, economic, or environmental issues at local, regional or national scales) that have significantly influenced the HRCCC's efforts?

……
……
……
……
……
……

19. The implementation of ICM in this catchment is difficult because:

		Strongly agree	Agree	Neither	Disagree	Strongly disagree	Don't know
19a	The large size of the catchment (or poor transporation links between parts of catchment).....	?	?	?	?	?	?
19b	The wide variety of values and beliefs among HRCCC members seriously detracts from an effective level of cooperation developing among them.....	?	?	?	?	?	?
19c	Some important constituency groups are not represented in the ICM process.....	?	?	?	?	?	?
19d	The perception that ICM has been forced on the catchment by the state government	?	?	?	?	?	?
19e	The lack of an effective level of interest by HRCCC members	?	?	?	?	?	?
19f	The public's lack of trust in state/local government-sponsored initiatives.....	?	?	?	?	?	?
19g	The public's lack of interest in community type activities	?	?	?	?	?	?
19h	The lack of financial resources within the community	?	?	?	?	?	?
19i	The lack of agreement among HRCCC members concerning its objectives	?	?	?	?	?	?
19j	The lack of agreement on feasible solutions.....	?	?	?	?	?	?
19k	There is no single acute resource management problems within the catchment.....	?	?	?	?	?	?

20. Rate your level of agreement with the following statements:

		Strongly agree	Agree	Neither	Disagree	Strongly disagree	Don't know
20a	There is a strong consensus among HRCCC members concerning HRCCC functions	?	?	?	?	?	?
20b	At HRCCC meetings, all HRCCC members participate actively	?	?	?	?	?	?
20c	The local ICM process effectively resolves resource conflicts.....	?	?	?	?	?	?
20d	The ICM process is responsive to local needs.....	?	?	?	?	?	?
20e	The HRCCC is solving the priority natural resource management problems in the catchment	?	?	?	?	?	?

PERSONAL DEMANDS AND MOTIVATIONS

21. On average, how many hours per month do you devote to ICM? ……Hours/months

21. Identify your level of agreement with the following statements according to the following scale:

		Completely agree	Agree	Moderately agree	Disagree	Completely disagree	Not applicable
22a	The amount of time I devote to ICM significantly interferes with my own business/job requirements	?	?	?	?	?	?
22b	The amount of time I devote to ICM significantly interferes with my family commitments	?	?	?	?	?	?
22c	My involvement with the HRCCC causes significant out-of-pocket expenses	?	?	?	?	?	?
22d	I find being a member of the HRCCC personally rewarding because I can contribute to the community	?	?	?	?	?	?
22e	I find being a member of the HRCCC rewarding because I care about natural resource management	?	?	?	?	?	?
22f	I find being a member of the HRCCC rewarding because I can meet other members of the community who can influence resource management decision making	?	?	?	?	?	?
22g	A HRCCC's member's role is to provide their personal views on resource management issues at CCC meetings	?	?	?	?	?	?
22h	A HRCCC member's role is to represent the resource management views of their constituency group at CCC meetings	?	?	?	?	?	?
22i	A HRCCC member's role is to provide a catchment-wide perspective of natural resource management issues at HrCCC meetings	?	?	?	?	?	?

OTHER COMMENTS

20. If there are any further comments you wish to make about ICM, please feel free to do so.

Chapter 3

An Analysis of the Views of the Herbert River Catchment Coordinating Committee Members: November 1998 with Cross Comparisons from 1995 to 1998

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1.0 INTRODUCTION

1.1 Background to the LWRRDC CTC7 R&D Project

In 1994, the Land and Water Resources Research and Development Corporation (LWRRDC) funded research staff of the CSIRO Tropical Agriculture (in Brisbane and Townsville), CSIRO Land and Water (in Perth), and the University of Queensland Department of Geographical Sciences and Planning (in Brisbane) to undertake research on Integrated Catchment Management (ICM) processes[1]. This longitudinal study over five years focuses on the community-driven ICM program in Queensland using the Herbert River Catchment process as a case study. The objectives of the investigation are.

1. Monitor and document the process of implementation of ICM in the Herbert River catchment and identify the social, economic and institutional factors that facilitate or hinder this process.
2. Evaluate key impacts of the implementation of the ICM process in terms of attitude and behaviour changes in the community and changes in the severity or tractability of the resource use conflicts for the catchment.
3. Assess the specific technical and related information needs that are relevant to an effective ICM implementation process in a wet tropical environment.
4. Develop a framework and related methods for evaluating the process of ICM implementation that will facilitate the development of more effective catchment management programs in Australia.

The complexities of catchment management are such that longitudinal studies of processes are essential if the issues of catchment management are to be better understood and appropriate lessons learned. The project acknowledges that, by its nature, ICM requires systematic evaluation (Bellamy *et al.*1999). For example, ICM as a process needs to take many and often conflicting considerations into account. It also operates in a complex environment where uncertainty is more often the rule than the exception. Moreover, indicators of progress are not easily defined and, to date, this area of investigation has largely been neglected (Bellamy *et al.*1999). In responding to these challenges, the project has adopted a multidisciplinary approach and draws on areas of expertise in natural resources science, social science, land use planning, resource economics, and media analysis.

1.2 Objectives of Survey

The LWRRDC CTC7 project seeks to find ways and means to improve the process of planning and implementing community-led ICM in Australia. Crucial to this evaluation is a better understanding of what are the problems faced by the ICM process and how they affect its implementation and ultimately its impact or influence on the management of land and water resources. By way of a longitudinal study of the ICM process in Queensland, the institutional component of the project focuses on finding out how ICM is practised in Queensland generally, and in the Herbert River catchment, in particular.

1 LWRRDC Project Reference: CTC7 - *Evaluation of Integrated Catchment Management in a wet tropical environment*

The institutional component of this R&D project aims to:

- provide a better understanding of the institutional or policy context in which ICM is conducted;
- provide the key baseline for the assessment of the institutional factors that hinder or foster an effective ICM process in the Herbert; and
- contribute key information for the assessment of the technical needs for effective ICM.

As part of a longitudinal study, the first stage of the institutional component of the LWRRDC CTC7 R&D project involved two separate surveys. The first was a state-wide survey of ICM officials in Queensland (i.e. all Catchment Coordinators and Catchment Coordinating Committee Chairpersons) in December 1995. The findings were reported in McDonald and Shrubsole (1996a; 1996b). The other involved surveying the opinions of members of the Herbert River Catchment Coordinating Committee (HRCCC) in November 1995 as reported in Shrubsole and McDonald (1996). A second set of surveys were undertaken covering both ICM officials across the state in October/November 1997 (see McDonald and Bellamy 1998) and the opinions of the HRCCC members in November 1997/February 1998 (see Bellamy *et al.* 1998). This current report presents the results of a third and final survey of the opinions of the HRCCC members undertaken in December 1998.

1.3 Survey Design and Approach

The third survey of HRCCC member's opinions repeated selected items from the previous two surveys as well as a range of new questions focussed on HRCCC activities and ICM issues. The questionnaire is included in this report as Appendix 1. Items in the survey related to members' views on:

(i) Nature and tractability of catchment management issues (Q8-11)
(ii) HRCCC achievements and role (Q12-19)
(iii) Herbert River Catchment Management Strategy – progress and influence (Q20-24)
(iv) The ICM program in Queensland suitability and needs (Q25-28)
(v) Public awareness, community support and involvement in ICM (Q29-35)
(vi) State Government involvement and influence in the ICM process (Q36-42)
(vii) Local government involvement and influence in the ICM process (Q43-48)
(viii) Factors influencing ICM implementation (Q49-56)
(ix) Personal background information, group/organisational involvement and time commitment to ICM (Q1-7, Q57).

The survey was administered to 15 of the current HRCCC members as individual face-to-face interviews based on a pre-set questionnaire. Two other members were unavailable for interview. Some questions asked were open-ended, while others required the interviewee to rate their response on a five-point scale. Interviews were conducted in December 1998 and involved an interviewer supported by a person recording responses. Due to time constraints of some members, selected questions were omitted from some interviews and are recorded as 'no response'.

2.0 1998 HRCCC SURVEY RESULTS

2.1 HRCCC Membership

2.1.1 Representation

In December 1998, there were 15 voluntary local community/sector members of the HRCCC. These members were nominated to represent a range of rural industry, community and

government or other statutory organisations that were considered to have an interest and/or role in natural resource management in the Herbert River catchment, as identified in Table 2.1.

Table 2.1: HRCCC sector group representation.

Industry Organisations	CANEGROWERS (1) CSR Herbert River Mills (1) Cattlemans Union (1) Fruit and Vegetable Grower Association (1) Queensland Commercial Fisherman's Organisation (1)
Community Organisations	SUNFish - Recreational/Sporting Fishing (1) Hinchinbrook Landcare (1) Wildlife Preservation Society of Queensland (1)
Government/Statutory Body	Hinchinbrook Shire Council (3) Herberton Shire Council/Landcare (1) Drainage Boards (1) Hinchinbrook Development Bureau (1) Herbert River Improvement Trust (0.5) Herbert Pest and Productivity Board (0.5)

In addition, a Catchment Coordinator facilitates the process. This position is funded through the federal government's National Landcare Program and based in the Ingham offices of the Department of Natural Resources, the current lead government agency for ICM in Queensland. A representative of the Department of Natural Resources Queensland (ie. the Wet Tropics Region ICM Project Officer) based in Innisfail has also frequently participates in HRCCC meetings in the past year.

2.1.2 Member Profiles

All local community/sector members live in the catchment with one member living in the upper catchment and the other 14 members as well as the Catchment Coordinator living in the lower catchment. The HRCCC membership has been remarkably stable since the HRCCC was first established in 1993 with 9 of the current members (nearly 60%) being the original foundation HRCCC members.

In addition to involvement on the HRCCC, all the members are active community leaders who belong to a wide range of different organisations in the catchment holding executive and other leadership positions. They therefore have multiple allegiances and interests. For example, there is a formal Landcare representative on the HRCCC but in addition six other members are active in one of the catchment's two Landcare groups. The representatives for commercial fishing, recreational/sporting fishing, the fruit and vegetable growers, the Drainage Boards, the Herbert River Improvement Trust, the cattle industry and one of the local government member are also cane producers. In summary, nine of the current HRCCC members are cane farmers (full or part time) and two others are employed within the sugar industry. Each of these members is involved in a range of sugar industry working groups, mill boards, assignment committees, and sugar productivity and pest management and productivity boards. The predominance of sugar industry interests on the HRCCC therefore to a large extent reflects the economic, social and cultural importance of the sugar industry in the lower Herbert River community.

2.2 Catchment Issues

2.2.1 Key Resource Management Issues and their Tractability.

Members were asked to identify what they perceived as the three key catchment land and water management issues facing people in the Herbert. For each issue that a member identified, they

were then asked to rate the tractability of each issue on a 5-point scale (from very low to very high) in terms of:

(i) the degree of technical complexity involved in dealing with the issue.
(ii) the level/intensity of community conflict that influences its resolution.

The issues identified by members are ranked in Table 2.2 and the mean ratings on tractability variables are identified.

Table 2.2. Tractability of key resource management issues.

Issue	Number of responses	Technical Complexity Mean Rating	Intensity of Conflict Mean Rating
Drainage coordination/management on floodplains (eg. levee banks, laser levelling, road and rail infrastructure)	9	3.7	4.1
Water quality (eg. fish kills, sedimentation)	6	4.3	4.2
Riparian vegetation degradation/management	5	2.4	3.2
Wetland degradation/management	5	3.0	3.4
Land use planning, catchment/floodplain systems management	5	3.4	3.8
Waterways management (free flow and river outlets) and flooding (lower catchment)	5	4.6	3.2
Land or remnant vegetation clearing/industry expansion (lower catchment)	4	3.3	4.0
Grazing land degradation/erosion (upper catchment)	1	3	3
Weed management	1	4	3
Water quantity/availability (upper catchment)	1	5	5

Repeat questions from the first survey in1995 on catchment issues and their tractability were included. Several equivalent questions were also included in the 1998 survey of community views on land and water management in the Herbert River catchment. Members were asked to rate in their opinion *how significant* a range of specified natural resource management issues were to the people in the Herbert generally on a five point scale (from very low to very high). The results are shown in Table 2.3

Although there is a diversity of views amongst HRCCC members, the most significant issues (ie. with a mean rating of moderate to very high) identified are rural drainage, rural flooding, water quality problems and wetlands degradation. While water quantity problems, loss of biodiversity, vegetation on river banks were viewed by most members of low to moderate significance.

Table 2.3. Significance of natural resource management issues.

Issue	5. Very high	4. High	3. Moderate	2. Low	1. Very low	Mean Rating	Rank
Land degradation	0	3	4	6	1	2.6	5
Grazing land degradation	1	2	3	6	2	2.6	5
Water quality problems	2	5	4	3	0	3.4	3
Water quantity problems (eg. insufficient water)	1	1	1	5	6	1.9	8
Rural flooding	5	7	1	1	0	4.1	2
Rural drainage	8	5	1	0	0	4.5	1
Vegetation on river banks	0	1	5	6	1	2.5	6
Wetlands degradation	3	2	6	2	1	3.3	4
Loss of biodiversity	1	0	4	6	3	2.3	7

Secondly, members were asked to rate in their opinion, how much a range of specified issues *impacted* on people in the Herbert generally, on a five point scale from very low to very high. The results are presented in Table 2.4.

Table 2.4. Impacts of specified issues on Herbert community.

Issue	5. Very high	4. High	3. Moderate	2. Low	1. Very low	Mean Rating	Rank
High cost of water	0	0	0	8	5	1.6	8
Loss of farm productivity	6	3	3	1	0	4.1	1
Higher production costs	4	3	5	1	0	3.8	2
Poor drinking water	0	1	4	4	4	2.2	7
Emotional stress	1	2	6	4	0	3.0	4
Higher taxes	2	5	3	1	0	3.7	3
Lower fish numbers/fish kills	3	5	3	2	0	3.7	3
Loss of access to recreation	1	3	1	3	5	2.4	5
Loss of confidence in government's ability to manage land and water resources	1	8	3	1	0	3.7	3
Loss of environmental uses or benefits (eg. wildlife habitat)	1	0	4	4	3	2.3	6

Issues identified by members overall as having a significant impact on people in the Herbert (ie. with a mean rating of moderate to high) were loss of farm productivity, higher production costs, higher taxes, lower fish numbers/fish kills, loss of confidence in government's ability to manage land and water resources and emotional stress. While the high cost of water, poor drinking water quality, loss of access to recreation, loss of environmental uses or benefits were viewed by most members to have a low impact.

HRCCC members were also asked to rate their level of agreement or disagreement with a number of statements relating to the difficulties in managing land and water resources in the Herbert. The results are presented in Table 2.5. When greater than 80% of respondents agreed (ie. a rating of either 'agree' or 'strongly agree') or disagreed (ie. a rating of either 'disagree' or 'strongly disagree') with the statement, this was given an overall rating of 'high agreement' or 'high disagreement' respectively. When 60 to 80% of respondents agreed or disagreed with the statement, this was given an overall rating of 'general agreement' or 'general disagreement'. Where there was a clear divergence of opinions amongst members with a spread of responses from disagree to agree (and a mean rating of 2.5 to 3.5), this was given an overall rating of 'split opinion'.

In summary, although there was a diversity of views amongst HRCCC members, most agreed or strongly agreed that managing land and water resources in the Herbert was difficult because of:

(a) 'institutional failure':
- Government strategies are too slow
- Government departments and other agencies are too slow to react to new issues
- The government doesn't want to spend money on solutions

(b) economic issues – that is high costs and low financial capacity in the community:
- Solutions are expensive
- Local people lack the money to spend on solutions.

Table 2.5 HRCCC views on the difficulties in managing land and water resources in the Herbert.

Managing land and water in the Herbert is difficult because:	5. Strongly agree	4. Agree	3. Neither	2. Disagree	1. Strongly disagree	Mean Rating	Overall Rating
Problems aren't well understood	2	3	1	4	0	3.3	Split opinion
Local people lack the money to spend on solutions	1	6	1	2	0	3.6	General agreement
Government strategies are too slow	5	4	0	1	0	4.3	High agreement
Solutions are expensive	3	7	0	0	0	4.3	High agreement
There are few benefits and many costs	2	2	1	4	0	3.2	Split opinion
Local people don't want to spend money on solutions	1	2	4	2	0	3.2	Split opinion
The Herbert catchment covers a large area	0	6	0	4	0	3.2	Split opinion
Local people don't trust government programs	1	2	4	2	0	3.2	Split opinion
Local people aren't that interested in community type activities	3	2	0	4	1	3.2	Split opinion
The government doesn't want to spend money on solutions	1	8	0	1	0	3.9	High agreement
Government departments and other agencies are too slow to react to new issues	5	4	0	1	0	4.3	High agreement
People on the catchment lack access to information needed to respond to/deal with new catchment issues or problems	0	1	1	8	0	2.3	High disagreement

However, most members disagreed with the statement that managing land and water resources in the Herbert was difficult because:

- People on the catchment lack access to information needed to respond to/deal with new catchment issues or problems.

Clearly members perceived that lack of relevant information was not the real problem or constraint for ICM in the Herbert.

Significantly there was a clear divergence of opinion amongst members on whether managing land and water resources in the Herbert was difficult because:

(a) tractability issues:

- Problems aren't well understood
- There are few benefits and many costs
- The Herbert catchment covers a large area

(b) community attitudes, including trust and willingness to be involved:

- Local people don't want to spend money on solutions
- Local people don't trust government programs
- Local people aren't that interested in community type activities.

2.3 The HRCCC: Achievements and Role

2.3.1 What have been the major achievements of the HRCCC to-date?

Members overall considered the HRCCC had made a number of significant achievements including:

(i) *Providing a forum that brings very different people in the catchment together to exchange ideas and providing a catalyst for change*:

"Raising public awareness of the issues. Creating a focal point for change - as a catalyst or idea"

"Provided a forum to give greater exchange of ideas and solutions."

"Forcing broad discussion on issues (eg clearing waterways)"

"Getting all different people together to work things out, Including CSR and the Shire Council. Importantly these are voluntary people rather than appointed people working things out"

"Facilitated bringing together of people on conflict issues - Sitting around the table [at HRCCC meetings] is the important forum"

"Good discussion/relations between the groups (CSR, CG, HSC, RIT, ICM)" - Good effort being made in the HRCCC to work with the different groups."

(ii) *Supporting a range of projects on natural resource management*:

"Getting seed funding for projects"

"Re: Long Pocket project - ICM sourced funds which would not have happened otherwise. It resolved the issue in minimising risk of a catastrophic change in course of river (high flows)"

"Helped Long Pocket project to actually happen and achieved result intended –end result was that the local community was happy"

"Through projects have achieved a much greater involvement in a whole range of environmental issues"

"The HRIC/GIS thing, the survey of mine tailings dams established, and riparian survey, etc - engaged people to collect information for use in the future,"

"The Atlas, tin-mining dam project, vegetation mapping, etc. will help with the implementation of the HRCCC Catchment Strategy"

"Gives people and organisations access to lot more information that was not previously available"

"The Atlas gives people information on the catchment, and people involved use it"

"ICM had a big input into the establishment of the Herbert Resources Information Centre (HRIC)"

"Owl nesting box project received high publicity as well as real ecological benefits."

(iii) *Raising community awareness of catchment NRM issues:*

"Raised awareness of NRM issues in the catchment - public knows who they are."

"Brought awareness of ICM issues to the fore to the public"

"Awareness in the community that there's a group there over-looking what's going on – especially through presentations and representations on issues"

"Raising community awareness of problems & possible solutions"

"Owl boxes - raising community awareness"

"Owl boxes raised public awareness of need for the control of rats."

(iv) *As an influential group on NRM in the catchment:*

a. ICM and Local Government Linkages:

"Influence on ICM local government planning - they jumped straight into it. Created good relation with Hinchinbrook Shire Council."

"ICM gave direction to local government planning"

"Getting direct input into local government planning."

"Influence on strategic plan with local shire (Hinchinbrook Shire Plan),"

b. ICM and Herbert River Improvement Trust linkages:

"Created good relation with the Trust (HRIT)."

"Developed important linkage with the River Improvement Trust – eg though the Long Pocket project"

"Fostering of soft engineering solutions to achieving bank stability had an impact on River Improvement Trust. Trust members are now thinking about other alternatives than rocks"

c. NRM planning and related development in the catchment:

"A major achievement has been the preparation by HRCCC of the Herbert River Catchment Management Strategy:"

"Owl box program - win/win outcome - increased awareness of impacts on wildlife as well as providing Input into Hinchinbrook Pest Management Plan."

"HRCCC as a sounding board for SIIP projects."

"ICM has had a key input into the Coastal Management Plan"

"HRCCC now seen as a source of good technical advice on NRM for the catchment"

Overall most members were fairly positive about the HRCCC achievements. However, two members expressed some concerns regarding some of the high priority catchment issues. One member commented that:

"It hasn't solved anything in the last 12 months."

Although recognising a number of important achievements, another member reflected that

"the HRCCC had continued to avoid dealing with levee bank rationalisation due to potential conflict of interests within the Committee".

2.3.2 The most significant projects undertaken by the HRCCC?

The most significant projects undertaken by the HRCCC that members identified were broad ranging and are identified in Table 2.6.

Table 2.6. Members views on the most significant HRCCC projects.

Project	Number of responses
Owl nesting boxes	10
Getting community involved in Landcare projects (eg. Wharps Estate, creek restoration, tree planting, Waterwatch)	7
Joint project with HRIT at Long Pocket on riverbank rehabilitation	6
Riparian vegetation mapping	4
Herbert River Catchment Management Strategy	4
Mine tailing dam survey	3
Catchment Atlas	2
Support for Herbert Mapping Project which led to the establishment of the Herbert Resources Information Centre (HRIC)	2
Weed control/clearing of waterways	2
Acid sulfate soils awareness	1
ICM/Local Government wetlands study	1

2.3.3. Satisfaction with HRCCC progress?

Members were asked to rate their satisfaction with the progress of the HRCCC on a five-point scale from very satisfied to very unsatisfied. The results are summarised in Table 2.7. HRCCC

members were predominantly satisfied to very satisfied with the rate of progress of the HRCCC, 13 members rated their level of satisfaction as either 'very satisfied' or 'satisfied', one as 'neither satisfied or dissatisfied', one as 'unsatisfied' with progress and there were no ratings of 'very unsatisfied'.

Table 2.7. Satisfaction rating with HRCCC progress.

Satisfaction Level	No. (%)
5. Very satisfied	3 (20)
4. Satisfied	10 (66)
3. Neither	1 (7)
2. Unsatisfied	1 (7)
1. Very Unsatisfied	0 (0)
Mean rating	4.0

The reasons identified for a 'satisfied' or 'very satisfied' rating on progress in 1998 related to:

> "The HRCCC has achieved a lot. Its done very well but we are not perfect - there's more we can do. We need to get everyone onside. We've been the leaders in NRM."
>
> "We've done as much as we could have."
>
> "Lot of enthusiasm and people work together to get things done. Forum for discussing those issues that was not there before."
>
> "HRCCC has a good chairman. Committee has representatives of all sections of the community and all can have a say - all different interests, land uses, and local government. All with a say and having some ownership of decisions being made."
>
> "Starting to make some headway. Only forum like it. Brings all different groups together."
>
> "I originally started thinking it was just another talk show. But ICM has done more than I expected. It has pulled diverse groups together."
>
> "Pulled upper and lower catchment together. Developed own strategy and linked with River management strategy. In general it has been worthwhile."
>
> "Because of the major involvement of ICM in decision making in catchment (eg with local government)."
>
> "There's a group there to deal with issues now (eg water needs)."
>
> "Achieved a fair bit, and seem to be working alright. People get involved and come to meetings."
>
> "Achieving some of the things it was set up for. Achieved reasonable profile in the community."
>
> "Has a reasonable track record at implementing projects and credibility in the eyes of local government."

The member who was neither satisfied nor dissatisfied with progress considered that the HRCCC had "Got some luck on our side that could go either way". The one member who expressed dissatisfaction with progress was concerned that the HRCCC tended to "go over old ground" and was "slow to react to obvious issues/problems".

2.3.4. What should be done to improve the HRCCC's performance?

Suggestions on improving performance from those members who were 'satisfied' and 'very satisfied' with progress included:

(i) More resources/funding to undertake community or general awareness raising projects.

(ii) Broaden representation of views on the HRCCC (eg. direct involvement of local business through the Chamber of Commerce; active involvement of environment interests; representation of government technical expertise).

(iii) Improve input from technical expertise to move the process forward more quickly and effectively (eg. presentations from DEH and DNR).

(iv) More publicity to raise the profile of ICM/HRCCC in the community.

Suggestions on improving performance from the two members who were either 'unsatisfied' or 'neither satisfied nor dissatisfied' with progress related to getting some real "runs on the board" or "more concrete action" (eg. by being more proactive on some of the tougher issues in the catchment such as establishment of structures for drainage management, codes of practice, managing mill mud, etc).

2.3.5. Is the HRCCC heading in the right direction?

Members were also asked whether they considered that the HRCCC was heading in the right direction. The 15 respondents were unanimous in feeling that on the whole the HRCCC was heading in the right direction. Reasons given included:

> "I think so-for it's age, yes. It may need a new direction after it passes its infancy stage - to become more intrusive into conflicting issues like levees."
>
> "All the parties are working together on the problems."
>
> "It has built a lot of credibility, got some runs on the board."
>
> "People say what they think and then work it out."
>
> "As long as we keep representing local community interests."
>
> "Yes, the only thing disappointing is the messing around with the Catchment Management plan - ie its endorsement by State Government. The HRCCC should be picking up and running with it – ie. more structured implementation."
>
> "Do not want it to become the policeman in the district. Getting the balance right is most important."

2.3.6 HRCCC Role in Natural Resource Management

Members rated their agreement/disagreement on seven statements relating to the HRCCC's role in natural resource management on a five-point scale (from strongly agree to strongly disagree). In general there was reasonable concurrence amongst HRCCC members in respect of agreement or disagreement with these statements. The results are summarised in Table 2.8 and briefly discussed below.

a. The HRCCC helped negotiation among resource stakeholders to accommodate a wide range of resource uses?
In aggregate ,members agreed with this statement (mean rating of 4.0). Ten members (77% of respondents) either strongly agreed or agreed with this statement, one neither agreed nor disagreed, and one member disagreed.

b. The HRCCC initiated key collaborative linkages/ arrangements with other organisations to actively address key land and water use issues in the catchment
In aggregate, members agree that the HRCCC is helping initiate key collaborative linkages/ arrangements with other organisations to actively address key land and water use issues in the catchment (mean rating of 4.1). With eleven members (92% of respondents) either 'strongly agreeing' or 'agreeing' with this statement. However one member neither agreed nor disagreed because they felt that although the HRCCC has "working relationships it is not always active in identifying solutions".

c. The HRCCC helped stakeholders in defining the source of resource problems?
In aggregate, members agree that the HRCCC is helping stakeholders define the source of resource problems and solutions to them (mean rating of 3.8). Ten members (83% of respondents) either strongly agreed or agreed with this statement, one neither agreed nor disagreed, and one member disagreed.

d. The HRCCC helped stakeholders in identifying solutions to resource problems? Most members (67% of respondents) 'agreed' or 'strongly agreed' that the HRCCC was helping stakeholders to identify solutions to resource problems. However, there was a significant amount of disagreement amongst members regarding this role with a third 'neither agreeing or disagreeing' or 'disagreeing' that the HRCCC was helping stakeholders in identifying solutions to resource problems (mean rating of 3.6).

e. The HRCCC helped stakeholders in ensuring their resource management practices are equitable and accountable? Overall members were not in agreement with this statement (mean rating of only 3.1). The majority of members (64% of respondents) either 'disagreed' or 'neither agreed or disagreed' with it. Significantly only 4 members (36% of respondents) 'agreed' that the HRCCC was helping stakeholders to ensure that their resource management practices were equitable and accountable.

f. *The HRCCC has encouraged research and data gathering and analysis in order that solutions to resource problems can be better understood?* In aggregate members agreed that the HRCC has encouraged research and data gathering and analysis (mean rating of 4.2). Eleven members (92% of respondents) either 'strongly agreed' or 'agreed' with this statement, with only one 'neither agreeing nor disagreeing'.

g. The HRCCC has helped ensure that the catchment land use planning decision-making process is fair and accountable to all interests? Although the majority of members (64% of respondents) 'agreed' or strongly agreed' that the HRCCC was helping ensure that the catchment land use planning decision-making process is fair and accountable to all interests, there was a clear divergence of opinion amongst members (mean rating of 3.6). Three members (27% of respondents) 'disagreed' and one member 'neither agreed or disagreed' with this statement.

Table 2.8. Level of agreement/disagreement with statements on the HRCCC's role.

Statement	5. Strongly Agree	4. Agree	3. Neither	2. Disagree	1. Strongly Disagree	Mean Rating	Overall rating
a. Helped negotiation among resource stakeholders to accommodate a wide range of resource uses	3	7	1	1	0	4.0	High agreement
b. Initiated key collaborative linkages/ arrangements with other organisations to actively address key land and water use issues in the catchment	2	9	1	0	0	4.1	High agreement
c. Helped stakeholders in defining the source of resource problems	1	9	1	1	0	3.8	High agreement
d. Helped stakeholders in identifying solutions to resource problems	1	7	2	2	0	3.6	General agreement
e. Helped stakeholders in ensuring their resource management practices are equitable and accountable	0	4	4	3	0	3.1	Split opinion
f. Encouraged research and data gathering and analysis in order that solutions to resource problems can be better understood	3	8	1	0	0	4.2	High agreement
g. helped ensure that the catchment land use planning decision-making process is fair and accountable to all interests	3	4	1	3	0	3.6	General agreement

In summary, the majority of members either agreed or strongly agreed that the HRCCC role has been to:

- Encourage research and data gathering and analysis;

- Initiate key collaborative linkages/ arrangements with other organisations;
- Help negotiation among resource stakeholders;
- Help stakeholders in defining the source of resource problems;
- Help stakeholders in identifying solutions to resource problems; and
- Help ensure that the catchment land use planning decision-making process is fair and accountable to all interests

However there was a clear divergence of opinion amongst members on whether or not the HRCCC had helped stakeholders in ensuring their resource management practices were equitable and accountable.

2.3.7 Activities important to Integrated Catchment Management programs

Members were asked to rate the importance of a range of activities as part of ICM in the Herbert. Respondents considered that all the specified activities were an important part of ICM with all statements having a mean rating of moderate importance to very high importance. The ratings are provided in Table 2.9.

Table 2.9. Important activities for ICM programs.

How important is it that the following activities are part of ICM in the Herbert:	5. Very high	4. High	3. Moderate	2. Low	1. Very low	Mean Rating	Overall agreement
a. Encourage community *action* at a catchment level	6	7	2	0	0	4.3	High agreement
b. Raise the level of local awareness and knowledge of environmental issues on the catchment	8	5	2	0	0	4.4	High agreement
c. Encourage Local Government to take an active role in environmental management issues	11	4	0	0	0	4.7	High agreement
d. Encourage coordination of state government programs	5	6	4	0	0	4.1	High agreement
e. Undertake specific on-ground projects with other bodies	2	8	2	3	0	3.6	General agreement
f. Providing a continuing source of advice to local government on catchment issues	9	2	1	1	0	4.5	High agreement
g. Encourage research	3	10	1	0	0	4.1	High agreement
h. Develop solutions for, and better understanding of, environmental problems in the Herbert catchment	4	7	1	1	0	4.1	High agreement
i. Encourage discussion between community interest groups on environmental issues	7	6	0	0	0	4.5	High agreement
j. Separate ICM programs for the Upper and Lower Herbert catchments	6	4	2	1	2	3.8	High agreement
k. Encourage joint projects between community, industry and state and local government	6	2	1	0	0	4.6	High agreement

Activities rated as high to very high importance to ICM in the Herbert are (in order of relative importance):

- Encourage Local Government to take an active role in environmental management issues
- Encourage joint projects between community, industry and state and local government
- Provide a continuing source of advice to local government on catchment issues
- Encourage discussion between community interest groups on environmental issues
- Raise the level of local awareness and knowledge of environmental issues on the catchment
- Encourage coordination of state government programs
- Encourage research

- Develop solutions for, and better understanding of, environmental problems in the Herbert catchment.

However HRCCC considered roles of moderate to high importance were:
- Separate ICM programs for the Upper and Lower Herbert catchments.
- Undertake specific on-ground projects with other bodies.

2.4 Catchment Management Strategy

2.4.1 The current status of the Herbert River Catchment Management Strategy?

Only five members (35% of respondents) were aware of the current status of the catchment management strategy (ie. second interim endorsement). Nine members (65% of respondents) were either unsure or not familiar at all with the strategy and its status.

2.4.2 Is the Strategy being used by the HRCCC?

Nine members (65% of respondents) considered that the strategy was being used by the HRCCC in a number of ways including:

> "Gives committee and catchment Coordinator direction and keeps them focussed on the priority issues in catchment."
>
> "Sets directions"
>
> "Provides a framework to work in and a reference document for eg. chasing subsidies, etc"
>
> "In background, providing direction"
>
> "Guiding principle (to see whether an issue should be dealt with)"
>
> "So broad, can provide useful direction"

However, five members (35% of respondents) did not think that the strategy was being used by the HRCCC for a number of reasons including:

> "Not being used directly (too many around). People don't refer to it - just a set of guidelines".
>
> "Not physically used (maybe used "sublimely")"

2.4.3 Is the Strategy adequate?

Ten of the members felt that the current strategy was adequate. The reasons given included:

> "Could be better. Outdated at moment - needs updating - NRM is changing and needs to be kept as a live document and continually move on"
>
> 'Adequate as a starting point."
>
> "Strategic plan not an operational plan – should do operational plan when agree on implementation"
>
> "It's comprehensive. It's just a requirement"
>
> "Ok in general. Needs more time frames, and action plan"

Three members however considered that it was not adequate, and reasons given were:

> "Things change"
>
> "It is too general and has no teeth"
>
> "It's a first up effort."

2.4.4 What needs to be done to improve the strategy?

The members who did not think that the current strategy was adequate suggested improvements such as:

> "Make it more meaningful (e.g tougher penalties)"
>
> "It needs action statements. "

"Needs updating. Identify more to be done by stakeholder groups"

Comments from other members on ways to improve the strategy include:

"Updating. More regular reviews (eg every 12 months) by all agencies. Tries to achieve too much - probably best to focus on a few priority issues"

"Obviously hasn't come back to members. Hasn't been discussed at meetings"

"Instead of being so general, it needs to be more action - oriented"

"Bring strategy back to the HRCCC and develop an action plan, by asking a few people to work on specific topics"

2.4.5 Role of the Catchment Management Strategy

Members were asked to rate their level of agreement or disagreement with several statements relating to the role and function of the Herbert Catchment Management Strategy. The responses are summarised in Table 2.10.

Table 2.10. Role of the Herbert Catchment Management Strategy.

Statement	5. Strongly Agree	4. Agree	3. Neither	2. Disagree	1. Strongly Disagree	Mean Rating	Overall rating
a. the catchment strategy will contribute to effective resource management in the Herbert?	2	4	1	2	0	3.7	General agreement
b. the catchment strategy will assist in resolving resource management conflicts	1	2	4	2	0	3.2	Split opinion
c. the HRCCC prepared a catchment strategy to ensure future funding support?	4	2	0	2	0	4.0	General agreement
d. the development of the strategy really helped to focus the HRCCC?	1	7	1	0	0	4.0	High agreement
e. the members' constituency groups fully support the implementation of the strategy?	1	4	1	2	0	3.5	General agreement
f. the Catchment Management Strategy is directing the HRCCC activities?	1	3	2	2	0	3.	Split opinion

Overall, most members agreed that:

- the HRCCC prepared a catchment strategy to ensure future funding support,
- the development of the strategy was helping to focus the HRCCC,
- the catchment strategy will contribute to effective resource management in the Herbert,
- their constituency groups fully support the implementation of the strategy.

However members were clearly divergent in their views on whether the catchment strategy will assist in resolving resource management conflicts or whether the Catchment Management Strategy is directing the HRCCC activities.

2.5 The ICM Program

2.5.1 Suitability of the ICM program in Queensland?

Members were asked to rate their opinion of the suitability of the ICM program in Queensland to addressing resource use and management issues within the Herbert catchment. Most members

(86% of respondents) rated it as moderately to very high suitability, but two members (14% of respondents) consider it to be of low suitability. The responses are given in Table 2.11.

Table 2.11. Rating of suitability of the ICM program in Queensland.

Rating	No responses (%)
1. Very high	5 (33)
2. High	5 (33)
3. Moderate	3 (20)
4. Low	2 (14)
5. Very low	0
Mean Rating	3.9

Reasons members gave in support of a low suitability rating included:

"Does not have any legislative power and has limited ways of achieving - more advisory body to local and state government"

"Token gesture - resources are very limited, funding for ICM has been retracted resulting in loss of Coordinators. It's a real shambles – it is Inadequately staffed. One rarely hears about the program from program managers in DNR."

"Thinning out of people statewide. Training needed for coordinators etc in methodologies and extension techniques. Poor communication through the entire network. Landcare/ICM program coordinators too busy in some areas"

Reasons members gave in support of a moderate suitability rating included::

"It's slow but powerful in the end."

"Provides some assistance, but the amount is too small. We could apply for more $s"

"Not a statutory thing makes you cooperate and get people to cooperate"

Reasons members gave in support of a high suitability rating included::

"It has stakeholder involvement – (ie. brings stakeholders together). There maybe conflict but it is good as it lets people see where others are coming from and recognise other viewpoints. Where all have input into strategy. It is an important forum for discussion. Not just a single interest group - nor a lobby group, or a single corporate agency to make money, but it is made up of all these. It is a neutral party on all issues."

"All user groups are involved. Local government involved from the outset. Major resource users, eg. CANEGROWERS, are involved and are driving ICM – but mainly to watch their backs. ICM is driven by local resource users"

"But not many people know about it."

"Takes time. Awareness. Voluntary"

"Only organisation that gets a lot of different groups round the table to address issues – We never had this before in the Herbert"

Reasons members gave in support of a very high suitability rating included::

"ICM work from the bottom up."

"Without it a lot of things wouldn't get done. Things go through with anyone looking at them. Get a lot of different people's views now (eg the Council previously made decisions without hearing the different sides of the issue - eg fisherman, conservationists.)"

"We have a Coordinator and are endeavouring to do right thing - letting local people get on with the job."

"Pulls stakeholders together. It has Government backing with funds."

"The forum process is important and it has a high profile in key local organisation."

2.5.2 Who should be represented on a Catchment Coordinating Committee?

Members were asked their opinion of whom or which groups should be represented on a Catchment Coordinating Committee. The responses are given in Table 2.12.

Table 2.12. Interest groups to be represented on a CCC.

Interest Group	No. Responses
All genuine stakeholders, (ie. anyone with a major interest in NRM in the catchment)	6
Aboriginal interests	4
Local business (eg. Chamber of Commerce)	4
Government agencies (eg. DEH big landholders in the district)	4
Better environment/conservation representation	3
Tourism	1

In general, members considered that all current groups on the HRCCC were important but several members also identified the need to include:

- aboriginal interests,
- local business interests (eg. Chamber of Commerce),
- state government agencies (some being big landholders in the catchment, eg. DOE), and
- tourism interests.

In addition some concern was expressed for better representation of the environment/conservation interest (ie. through more frequent attendance in meetings).

2.5.3 What do you consider are the important qualities of a Catchment Committee member?

14 members provided responses to the question of what are the important qualities of a good CCC member. They identified a range of important "qualities" of a CCC member as identified in Table 2.13.

Table 2.13. Views on necessary qualities of a Catchment Committee member.

Quality	No. responses (%)
Objective, open-minded, broad vision (including benefit of the community at heart, recognises needs of others, sees other point of view, prepared to compromise, able to give a little)	7 (50)
Believes in/is 'passionate about' or genuinely concerned about NRM/ICM issues	6 (43)
Good communication skills/can contribute to group discussion and take information back to own group.	5 (36)
Understands and is prepared to put forward the views of own interest group (ie. representative of own interest group and not only as an individual)	4 (29)
Good interpersonal skills (including willingness to listen to others views)	4 (29)
Vast local experience and aware of what is going on in the catchment	2 (14)
Progressive attitude (including willingness to accept change, learn things all the time)	2 (14)
Outspoken	2 (14)
Available time	2 (14)
Significant player in the catchment (to give Committee clout)	1 (7)
Understanding of the whole focus of ICM (eg. planning)	1 (7)
Prepared to look at the science of issues	1 (7)
Not too radical	1 (7)
Even temperament	1 (7)

2.5.4 The important qualities of a Catchment Coordinator?

Members were asked what they considered were the important qualities of a Catchment Coordinator. 14 members identified several different qualities as shown in Table 2.14.

Table 2.14. Important Qualities of a Catchment Coordinator.

Quality	No. responses (%)
Experience/knowledge of NRM issues and agricultural systems (ie. technical skills, understanding across disciplines, problem solving, eye for myths and legends)	8 (57)
Good communicator and outgoing	6 (43)
Good/highly developed interpersonal skills, able to handle a diverse group of people	5 (36)
Broad minded, tolerant, politically neutral on issues, ability to look at the big picture.	4 (29)
Tactful, able to bite tongue and keep cool	4 (29)
Confident, prepared to stand up and be accounted for	2 (14)
Good conflict resolution skills	2 (14)
Good listener	2 (14)
Strong leader, dedicated	2 (14)
Outspoken with personal drive, active	2 (14)
Organised, time management skills	1 (7)

2.6 Public Attitudes and Support for ICM

2.6.1 Level of Public Awareness on Natural Resource Issues

Members views were sought on the level of public awareness on natural resource issues within the Herbert catchment community on a five point scale from 'very low' to 'very high'. The results are summarised in Table 2.15.

Table 2.15. Perspectives on public awareness of natural resource issues in the Herbert catchment.

Rating	Rural Community No. of responses (%)	Urban Community No. of responses (%)
1. Very high	3 (21)	2 (14)
2. High	4 (29)	0 (0)
3. Moderate	3(21)	3 (21.5)
4. Low	4 (29)	6 (43)
5. Very low	0	3 (21.5)
Mean Rating	3.4	2.4

There was a clear divergence of opinion amongst members regarding the level of public awareness on natural resource issues. However, HRCCC members perceived that the rural community's awareness was overall substantially higher than the urban community's awareness. Foe example, 50% of respondents rated rural community awareness as high or very high but only 14% of members viewed the urban community as having a high or very high awareness of natural resource issues. Similarly 30% of the respondents rated the rural community awareness as low, while nearly 65% of respondents rated the level of awareness of the urban community as low to very low.

2.6.2 Has public awareness changed over the last year?

Members' perspectives were also sought on whether public awareness had changed over the last year, and if so, in what way. The 14 respondents were unanimous in feeling that awareness had improved, however fairly slowly. Reasons given are summarised in Table 2.16.

Table 2.16. Reasons for an improvement in public awareness.

Reason	No. Responses (%)
Lots of big issues/local debate/happenings/bad press recently (eg. fish kills, indiscriminate clearing, acid sulfate problems)	9 (64)
Message slowly getting through (ie. greater public awareness, evolution of the law is quite demanding)	3 (21)
A wet year that raised drainage issues and flooding problems	2 (14)
The Council's land use planning process	1(7)

2.6.3 Level of public support for the HRCCC in the catchment?

Members were asked to rate the level of public support for the HRCCC and their responses are identified in Table 2.17. Overall of the 13 respondents, the majority of members (77%) rated public support as moderate to high.

Table 2.17. Level of public support for the HRCCC.

Rating	No responses (%)
5. Very high	0
4. High	3 (23)
3. Moderate	7 (54)
2. Low	2 (15)
1. Very low	1 (8)
Mean Rating	2.9

2.6.4 Has public support for the HRCCC changed over the past year?

Members were asked whether or not they considered that public support for the HRCCC had changed in the last year. 9 respondents (nearly 70% of respondents) considered that it had improved for several reasons including:

"More aware of the drainage issues "

"Gone from low to moderate last year. Perhaps no longer just seen as a talkfest"

"Started to gradually win people over"

"getting better but low"

"Increasing, because of public debate"

"Increasing steadily (only one ever derogatory comment - about the Palm Ck project)"

"Coverage through things like owl boxes and Waterwatch"

"Increased because people know HRCCC is there and trying to improve their lot"

"Public generally is supportive. No public negative"

However 4 respondents (ie. 30%) felt that public support had not changed over the last year and identified several reasons:

"Not a great deal"

"Needs people to do its ground work"

"Not as yet but will change with IPA"

2.6.5 How can public support for ICM in the Herbert be improved?

Members were asked whether there was any way that public support for ICM in the Herbert could be improved. There were 14 respondents and there suggestions relating to better publicity, proactive action, improved resources and greater local involvement are summarised in Table 2.18.

Table 2.18. Ways in which public support can be improved for ICM in the Herbert.

Suggestion	No. Responses (%)
More publicity and promotion of what the HRCCC is doing	11 (79)
More action, being more proactive (such as field days, demonstrations like artificial wetlands work)	4 (29)
More resources to promote ICM and the HRCCC (eg. more $s)	2 (14)
Getting more people involved	1 (7)

2.6.6 Effectiveness of the involvement of particular stakeholder groups in ICM?

The HRCCC members were asked to rate on a five point scale (from very effective to very ineffective) the effectiveness of the involvement in the Herbert ICM process of a range of stakeholder groups. The results are presented in Table 2.19.

Table 2.19. Opinions on the effectiveness of stakeholder group involvement.

	5. Very Effective	4. Effective	3. Neither	2. Ineffective	1. Very Ineffective	Mean Rating
a. Local government	7	4	0	0	0	4.6
b. State Government agencies:						
- DNR	1	8	0	2	0	3.7
- DPI (Fisheries)	0	0	0	1	1	(1.5)
Department of Environment	0	2	0	4	1	2.4
c. Federal Government agencies	2	1	0	0	0	-
CSIRO/LWRRDC						-
AIMS	3	0	0	0	0	-
GBRMPA	0	0	0	1	0	-
Wet Tropics Manag. Auth.	0	2	0	1	1	-
	0	2	0	0	0	-
d. Industry Organisations	2	3	0	0	0	-
CSR	1	2	0	1	0	-
CANEGROWERS	3	1	1	1	0	-
Cattlemens Union	1	1	0	0	0	-
QCFO	0	1	1	0	0	-
e. Conservation/environ groups	1	2	3	4	0	3.0
f.. The Media	0	8	1	1	1	3.5
g. Landcare Groups	1	9	0	1	0	3.9
h. Sporting Fishermen	1	1	0	0	0	-
i. Herbert River Improvement Trust	1	0	0	0	0	-

Although there was a divergence of opinion amongst respondents, overall most members considered that the effective/very effective groups involved in ICM in the Herbert were Local Government, DNR, Federal agencies (including CSIRO, GBRMPA and AIMS), industry organisations (especially CSR, CANEGROWERS, Cattlemen Union), the media, Landcare, and sporting/recreational fishermen. While ineffective or very ineffective involvement was considered to be from DOE, DPI (Fisheries) and conservation/environmental groups.

2.6.7 Improving the acceptance and involvement of relevant interest groups in the HRCCC process.

HRCCC members were asked what could or should be done to improve the acceptance and involvement of relevant interest groups in the HRCCC process. A diversity of opinions were expressed by the HRCCC members including:

> "Representatives should be more accountable. Coordinator should have meetings with each of the members on a regular basis."
>
> "Get the public involved more."
>
> "Representatives should use proxies when they cannot be present."

"Should be picking up issues and getting industry group management to make presentations to the Committee from their viewpoint."

""Attendance and representation are very important. Members should appoint deputies when they can't come."

"Need to get the Conservation groups more involved."

"Ask Chamber of Commerce and Tourism industry to have a representative."

2.7 State Government Involvement

2.7.1 Satisfaction with the involvement of state government agencies.

The HRCCC members were asked if they were satisfied with the overall level of involvement of state government agencies in ICM in the Herbert**.** Of the 11 respondents, seven were satisfied with the level of state government involvement but 4 were not.

Reasons given for dissatisfaction with state government involvement included:

"State is not involved except for the Catchment Coordinator and Wet Tropics Coordinator. There is lack of support for ICM at the district level e.g. from DNR (Townsville). The Department sees ICM as a low priority"

"State Government needs to provide better funding and resources"

"Need more back up data. Senior people to refer to and more money out"

"State Government has only *ad hoc* and reactive involvement without commitment.. There is an attitudinal problems – (eg DPI – cannot see why they should approve a strategy they haven't had involvement with)."

Reasons given for satisfaction with the level of state government involvement included:

"Anything we want to know, they are there to help us"

"Come and advise on specific problems and give presentation but could do more (but issue is that are constrained by politics of ICM to do this)"

"DNR is OK. Government in general could have been better ,but perhaps the HRCCC could have done more to encourage them (especially DEH in this respect)"

"At local level OK, but not at state level"

"DNR – we are using their facilities, contacts"

"Main Roads consulting with us on drainage issues relating to road bridges and railways. DPI is OK. Forestry haven't been following their own codes of practice"

2.7.2 Importance of state government involvement to ICM

Members were asked to comment on the importance of state government involvement to the success of ICM in the Herbert. 9 members (82% of respondents) considered that state government involvement was very important or critical to the success of ICM in the Herbert. The reasons included:

"Technical support has been absolutely critical"

"Very important. – eg. paying for Coordinator and a portion of the projects undertaken"

"Locally very important. State level is very important e.g. endorsement of strategy"

"Very important because you need to go through them to get things done"

"Very important in providing resources and data"

Two other members had specific issues relating to state government involvement:

"Need to help a lot more (eg. training for coordinators and regional workshops and networking amongst ICM groups."

""As long as there's a good relationship, government doesn't need to be involved. Give direction. Avoid duplication. People in contact with catchment groups are particularly

2.7.3 What more could state government do to help ICM in the Herbert?

Members were asked to comment on what more could state government do to help ICM in the Herbert. Respondents identified several ways in which State Government could improve its support for ICM in the Herbert, including:

> "To support a full time coordinator which should not be the responsibility of the NHT. This would lead to better direction. Need a longer term guarantee of support."
>
> "Increase $s for Coordinator and for projects."
>
> "Fund a Coordinator for five years, not just hand-to-mouth contracts."
>
> "More resources and funding."
>
> "The state government often uses issues to crucify local people which doesn't help ICM."
>
> "Provide a member to represent the Environment department."
>
> "Need to endorse Catchment Strategic plan and put more effort into working on issues. Perhaps provide some workshops on particular key issues - good example is local government study.

However three respondents did not seem to consider that there was much that needed to be done:

> "Nothing in particular."
>
> "Probably not much more here in the Herbert - otherwise it might detract from community involvement."

2.7.4 Importance of coordination between state government agencies

Members were asked to rate on a five-point scale (from very low to very high) the importance to ICM in the Herbert of coordination between state government agencies on issues relating to land and water resources management. All respondents considered this coordination of moderate to very high importance with a mean rating of 4.6 (ie. high to very high importance). The results are presented in Table 2.20.

Table 2.20. The importance of coordination between state government agencies to ICM.

Rating	No responses (%)
5. Very high importance	8 (67)
4. High	3 (25)
3. Moderate	1 (8)
2. Low	0
1. Very low importance	0
Mean Rating	4.6

The reasons given by respondents for a very high rating included:

> "Lack of cooperation leads to confusion and conflict. Pomona is a good example - in terms of what is a water course etc."
>
> "Give community confidence to get some information from the different departments"
>
> "Need to coordinate roads, rail trams etc. Can't always assume it would happen."
>
> "Need to go to several different departments who each wear different hats."
>
> "You need to satisfy all the regulations/frameworks of agencies. You can use their people/maps etc to help ICM"
>
> "Need to get better performance of agencies"

The reasons given by respondents for a high or moderate rating included:

> "They tend to have a one track mind (eg. DPI Fisheries) and they blow in and blow out again."
>
> "Hynenachne is a good example of problems - one is recommending to plant it, another sees it as a weed."
>
> "Waterwatch etc. They know rules and regulations about Acts."

"All agencies need to put their view - to get balanced view."

2.7.5 The benefit in practice of cooperation with government departments

Members were asked to rate on a five point scale (from 1 = not beneficial to 5 = extremely beneficial) how beneficial in practice cooperation with government departments (eg. DNR, DPI, DEH) has been to ICM in the Herbert. There was a divergence of opinions amongst members but the mean overall rating show that cooperation had been quite beneficial in practice. Significantly no respondent considered that it had not been beneficial. The ratings are presented in Table 2.21.

Reasons for a very or extremely beneficial rating included:

"Cooperation has helped provide a Coordinator and links"

"Could not have achieved things without cooperation of (eg. Main Roads and Transport for drainage/bridges railways)."

Reasons for a slightly or quite beneficial rating included:

"Been some synergy by getting them to talk to one another has been a major issue (eg funding applications)"

"It hasn't happened much."

"Getting closer now. Depends on the people"

"Not a problem on the Committee but has been a big issue outside it, where cooperation hasn't necessarily been good"

"Come when want them to come without being pushy"

"Until Simon started participating in the last 6 months, no one from Government came to meetings. There was no commitment""

Table 2.21. Perceived benefit of Government cooperation in practice to ICM.

Rating	No responses (%)
5. Extremely beneficial	1 (8)
4. Very beneficial	3 (25)
3. Quite beneficial	3 (25)
2. Slightly beneficial	5 (42)
1. Not beneficial	0
Mean Rating	3.0

2.7.6 Level of community/public participation in government

Members were asked to rate on an eight point scale from their experience in the Herbert catchment, what sort of community/public participation in government decision making (a) in practice *mostly occurs* and (b) *should occur* in relation to a range of specified natural resource management activities or processes. The seven point scale were:

1. *No interaction* between the government department and the community
2. *Informing* the community of the decisions that have been made
3. *Consulting* the community through advertisements and invitations for formal submissions with the final decision being made by the department
4. *Involving* the community in workshops and meetings to help define the problem and scope the community's issues with the final decision being made by the department
5. *Shared* planning and decision making between the government department and the community
6. *Decisions made by the community*
7. *Community control and management*
8. Multiple variations of 1-7 above.

Members had a diversity of opinions and the results are presented in Tables 2.22 and 2.23 and discussed briefly below.

Table 2.22. Opinions on the level of public/community participation mostly occurs..

Activity or process	1.	2.	3.	4.	5.	6.	7	8.
(a) land use planning	1	3	5	1	1	0	0	0
(b) environmental protection	5	5	1	0	0	0	0	0
(c) land clearing guidelines	4	2	1	2	1	0	0	0
(d) coordination of drainage	2	0	2	1	2	2	0	1

Table 2.23. Opinions on the level of public/community participation should occur.

Activity or process	1.	2.	3.	4.	5.	6.	7	8.
(a) land use planning	0	0	2	3	7	0	0	0
(b) environmental protection	0	0	2	4	6	0	0	0
(c) land clearing guidelines	0	1	2	2	7	0	0	0
(d) coordination of drainage	0	1	0	7	2	2	0	0

(a) *Land use planning.* Although there was a diversity of opinions, the majority of members (over 70% of respondents) considered that in practice the level of public participation in the Herbert for catchment land use planning occurs mostly through two participatory approaches:

- *Consulting* with the community (eg. through advertisements and invitations for formal submissions) but with the final decision being made by the organisation concerned, or
- *Informing* the community of the decisions that have been made.

However, the majority of members (83% of respondents) felt that public participation in land use planning should occur through greater community involvement, that is:

- *Shared* planning and decision making between the government department and the community, or
- *Involving* the community in workshops and meetings to help define the problem and scope the community's issues with the final decision being made by the department.

(b) *Environmental protection.* Although there was a diversity of opinions, the majority of members (over 90% of respondents) considered that in practice the level of public participation in the Herbert on environmental protection occurs mostly through:

- *No interaction* between the government department and the community; or
- *Informing* the community of the decisions that have been made.

However, the majority of members (83% of respondents) felt that public participation in the Herbert on environmental protection should involve greater community involvement, that is:

- *Shared* planning and decision making between the government department and the community.
- *Involving* the community in workshops and meetings to help define the problem and scope the community's issues with the final decision being made by the department

(c) *Land clearing guidelines.* There was a divergence of opinions on the level of public participation in the Herbert on the development of land clearing guidelines. However, the majority of members (60% of respondents) considered public participation for this issue has occurred mostly through:

- *No interaction* between the government department and the community; or
- *Informing* the community of the decisions that have been made.

However, seven members (58 % of respondents) felt that public participation in the Herbert on land clearing guidelines should involve greater community involvement, that is: through:

- *Shared* planning and decision making between the government department and the community.

While a further four members (32% of respondents) considered the level of public participation should be either:

- *Involving* the community in workshops and meetings to help define the problem and scope the community's issues with the final decision to be made by the department concerned; or
- *Consulting* the community through advertisements or formal submissions with the final decision to be made by the department concerned.

(d) *Coordination of drainage.* There was a distinct divergence of opinion amongst members on the level of public participation that actually occurs in the Herbert catchment with regard to the coordination of drainage in practice. Some members considered that there was no interaction while others considered that decisions were mostly made by the community. However, the majority of members (nearly 60% of respondents) considered the level of public participation for this issue should be through:

- *Involving* the community in workshops and meetings to help define the problem and scope the community's issues with the final decision being made by the department concerned.

A further 4 members (33% of respondents) considered that decision on coordination of drainage should be through:

- Decisions made by the community themselves, or
- Community control and management.

Overall HRCCC members considered that for each of the four issues there should be much greater community influence in decision-making than what occurs at present. Several members also commented that the level of community involvement/public participation in decision-making needs to vary depending on the particular issue of concern between 'Consulting', 'Involving', and 'Shared planning and decision making'.

2.8 Local Government and ICM

2.8.1 Satisfaction with the involvement of local government

Members were asked to comment on their satisfaction with the level of involvement of local government in ICM in the Herbert. Of the 10 members responding to this question, all expressed satisfaction with the level of local government involvement. Local Government was seen to be involved in a number of ways, including:

> "Working together on projects, issues, funding applications, putting together riparian vegetation guidelines, and guidelines for conversion to intensive agriculture."
>
> "ICM had an input into the Shire Strategic Plan.– Local Government consult ICM for advice - Hinchinbrook Shire Council supports ICM in the Herbert."
>
> "Yes, the Shire Councils send representatives to meetings. They have powers to set conditions."
>
> "Yes especially the case study on planning in Hinchinbrook Shire. It is a fairly symbiotic arrangement"

"Highly involved (eg Shire strategic plan), the Integrated Pest Management Plan. Local Government gets involved in meetings - and it is valuable"

"Two councillors (including the Mayor) and Shire Engineer attend meetings"

"The Hinchinbrook Shire Planning study was very useful. Council looks to the ICM group for direction on land and water management issues."

"ICM has supportive Councils - including one Mayor involved in the group. Also many projects administered by Councils."

"I am not sure how they've gone with the Local Government Planning schemes - it if has been implemented it's great"

Importantly, local government involvement was perceived by all members to be of high or critical importance to the success of ICM in the Herbert, and that effectively, ICM could not really function well without local government involvement.

2.8.2 What local government can do to help ICM

Members were asked to comment on what more local government could do to help ICM in the Herbert catchment. In general, members felt that local government was doing all that had been asked of them by the HRCCC. However specific comments on what more they could do included:

"If do what have in place and carry through with it, not much more could do"

"The Council has said they would do stuff, but this has yet to be proven. When any development application is made, they should consult the HRCCC."

"Going well and well supported by council. Done all that was asked."

"Local Government should give their program of work in advance to committee, particular in relation to resources - sharing of planning applies to industry as well."

"More money should be diverted to floodplain management issues (instead of halls, swimming pools)."

"Not really - continue support involved in meetings. Perhaps support for funding of activities."

"Could be doing more as a land manager (where education etc fails). They should have environmental strategies."

2.8.3 Opinions of the Hinchinbrook Shire Agricultural Planning Process

Members were asked their opinions of the new/proposed Hinchinbrook Shire Agricultural Planning Process. All members who were aware of the new planning process supported it.

Members were also asked if they considered that it was fair to all interests. The nine respondents to this question all considered it to be fair to all interests. The reasons given included:

"It appears to be fair but six different bodies have to give approvals - could be time-consuming."

"Yes if it is done properly."

"It is fair - although some people may think not."

"Yes – it only affects new applications."

"Providing it is discussed with people involved."

Members were then asked if they thought that the new process would change the way land and water resources are used and managed in the Shire/catchment. The nine respondents felt that it would change the way land and water resources are managed in the Shire/catchment for a variety of reasons including:

"Yes, for the better. It will be done on a more coordinated sustainable manner."

"It will - needed a long time ago."

"Yes – it has to (ie in relation to new developments)."

"Only with new development. Problem with policing. There will be powers under new legislation to de-assign land."

"Yes – now someone else can take the flack."

"Yes it will (eg acid sulfate soil risk areas). It will give codes of practice a bit of bite"

"Yes it will change it in the lower catchment."

2.9 Influences on ICM

2.9.1 Difficulties of ICM implementation

HRCCC members were asked to rate their opinion on a five point scale (strongly disagree to strongly agree) on a series of statements concerning difficulties of ICM implementation. The statements relate to members views on ability to control and the tractability of resource issues, views on government, community involvement or willingness to participate, and reaching community consensus. The findings are presented in Table 2.24 and discussed below.

When greater than 80% of respondents agreed (ie. a rating of either 'agree' or 'strongly agree') or disagreed (ie. a rating of either 'disagree' or 'strongly disagree') with the statement, this was given an overall rating of 'high agreement' or 'high disagreement' respectively. When 60 to 80% of respondents agreed or disagreed with the statement, this was given an overall rating of 'general agreement' or 'general disagreement'. Where there was a clear divergence of opinions amongst members with a spread of responses from disagree to agree (and a mean rating of 2.5 to 3.5), this was given an overall rating of 'split opinion'.

Ability to Control/Tractability of Resource Issues. Members were asked to consider five statements relating to the ability of the community to control ICM implementation or the tractability of resource issues in terms of the difficulty they posed to ICM implementation (on a five point scale from strongly agree to strongly disagree). The results are presented in Table 2.24.

Table 2.24. Level of influence on ICM implementation of factors relating to the community ability to control.

The implementation of ICM in the catchment is difficult because:	5. Strongly Agree	4. Agree	3. Neither	2. Disagree	1. Strongly Disagree	Mean Rating	Rating
a. The large size of the catchment (or poor linkages between parts of catchment)	1	9	0	2	0	3.8	High agreement
e. The perception that ICM has been forced on the catchment by the state government	0	0	0	9	3	1.8	High disagreement
j. The lack of financial resources within the community - upper	1	9	0	0	0	4.1	High agreement
k. The lack of financial resources within the community - lower	0	6	1	4	0	3.2	Split opinion
n. There is no single acute resource management problems within the catchment	0	1	0	8	0	2.2	High disagreement

There was a strong consensus amongst respondents that ICM was difficult to implement because of:

- The large size of the catchment (or poor linkages between parts of catchment).
- The lack of financial resources within the community in the upper catchment.

Similarly there was a strong consensus of opinion amongst respondents that they clearly disagreed with the statements that ICM was difficult because of:

- A perception that ICM has been forced on the catchment by the state government, or
- There is no single acute resource management problem within the catchment.

However there was a clear divergence of opinion amongst members on whether or not the lack of financial resources within the community of the lower catchment made ICM implementation difficult.

Views on Government. Members were asked to consider four statements relating to members' views on trust and coordination in government and its influence on ICM implementation. The results are presented in Table 2.25.

Table 2.25. Level of influence on ICM implementation of factors relating to trust and coordination in government.

The implementation of ICM in the catchment is difficult because:	5. Strongly Agree	4. Agree	3. Neither	2. Disagree	1. Strongly Disagree	Mean Rating	Rating
c. State government agencies do not cooperate with each other	3	6	2	1	0	3.9	High agreement
g. State government agencies do not listen to the Herbert community concerns	0	4	2	5	0	2.7	Slit opinion
i. The public's lack of trust in state/local government-sponsored initiatives	1	1	2	7	0	2.6	General disagreement
o. The lack of coordination between state government agencies in addressing issues	2	2	1	2	0	3.6	General agreement

There was a general consensus of opinion amongst respondents that ICM was difficult to implement because of:

- The lack of cooperation between State government agencies, and
- The lack of coordination between state government agencies in addressing issues.

There also was a strong concurrence of opinion amongst members that they *disagreed* with the statement that ICM was difficult because of:

- The public's general lack of trust in government-sponsored initiatives.

However there was a clear divergence of opinion amongst members on whether or not the implementation of ICM implementation was difficult because of the failure of State government agencies to listen to the Herbert community concerns.

Community Involvement/Willingness to participate. Members were asked to consider three statements relating to members' views on influence of community involvement and willingness to participate on ICM implementation. The results are presented in Table 2.26.

Table 2.26. Level of influence on ICM implementation of factors relating to community involvement and willingness to participate.

The implementation of ICM in the catchment is difficult because:	5. Strongly Agree	4. Agree	3. Neither	2. Disagree	1. Strongly Disagree	Mean Rating	Rating
d. Some important constituency groups are not represented in the ICM process	1	4	2	5	0	3.1	Split opinion
f. The public's lack of interest in community type activities	1	4	2	4	1	3.0	Split opinion
h. The lack of an effective level of interest by HRCCC members	0	3	2	7	0	2.7	General disagreement

In general, there was a consensus amongst respondents that they disagreed with the statement that ICM was difficult in the Herbert catchment because of the lack of an effective level of interest by HRCCC members. However there was a clear divergence of opinion amongst members on whether or not the implementation of ICM implementation was difficult because of:

- The lack of representation of some important constituency groups in the ICM process, or
- The lack of public interest in community type activities.

Reaching Consensus.
Members were asked to consider three statements relating to members' views on the difficulty posed to ICM implementation by the level of community consensus. The results are presented in Table 2.27.

Table 2.27. Level of influence on ICM implementation of factors relating to community consensus.

The implementation of ICM in the catchment is difficult because:	5. Strongly Agree	4. Agree	3. Neither	2. Disagree	1. Strongly Disagree	Mean Rating	Rating
b. The wide variety of values and beliefs among HRCCC members seriously detracts from an effective level of cooperation developing among them	0	2	1	7	2	2.3	General disagreement
l. The lack of agreement among HRCCC members concerning its objectives	0	4	2	6	0	2.8	Slit opinion
m. The lack of agreement on feasible solutions to catchment issues	0	6	1	4	0	3.2	Slit opinion

In general there was a consensus amongst respondents that they disagreed with the statements that ICM was difficult in the Herbert catchment because of the wide variety of values and beliefs among HRCCC members seriously detracts from an effective level of cooperation developing among them. However there was a clear divergence of opinion amongst members on whether or not the implementation of ICM implementation was difficult because of:

- The lack of agreement among HRCCC members concerning its objectives.
- The lack of agreement on feasible solutions.

In summary, there was a strong consensus amongst respondents that the implementation of ICM was difficult because of:

- The large size of the catchment (or poor linkages between parts of catchment).
- The lack of financial resources within the community in the upper catchment.
- The lack of cooperation between State government agencies.

There was also a strong consensus amongst respondents that ICM implementation was *not* made difficult because of:

- The lack of a single acute resource management problem within the catchment (eg. to focus attention), or
- A perception that ICM has been forced on the catchment by the state government, or
- The presence of a wide variety of values and beliefs among HRCCC members that was seriously detracting from an effective level of cooperation developing amongst them; or
- The public's general lack of trust in government-sponsored initiatives.

The relationship between ICM and Landcare in the Herbert catchment

Members were asked in their opinion what they considered was the relationship *in practice* between ICM and Landcare in the Herbert. Nine respondents considered that there is a strong or close relationship between Landcare and ICM in the Herbert River catchment. Comments included:

> "Very strong. - Coordinator runs both. There is an overlap in that the HRCCC does Landcare activities. Credit is split. - Nearly 50% of HRCCC is in Landcare."
>
> "Very close. Significant overlap of people. ICM is Landcare's secretariat."
>
> "Its very good - ICM arrange/raise things and Landcare is the "doer".
>
> "Close - separate committee. Landcare focuses move on on-ground works and involves small groups of landholders. ICM focuses on overall catchment issues."
>
> "Strong (eg. the Wharp's tree planting program, Waterwatch). ICM raises issues as a group, while Landcare get "fingers dirty."

"Lots of interaction because many people belong to both. But ICM needs separate a identity."

"Good. Landcare just started up again. ICM has actually in past done Landcare things but now ICM is moving to more policy areas and Landcare is more hands on."

"There is a good relationship. Landcare is dealing with smaller issues, and it is helping implement the catchment strategy."

However two other members were not as convinced that the relationship was close and comments included:

"No communication but they all talk about the same things."

"Landcare is just crawling along and is the poor relation to ICM. Starting to crank it up, but not doing enough."

Members were also asked what they considered *should be* the relationship between ICM and Landcare in the Herbert. Most respondents considered that the relationship should be strong and complementary. Comments included:

"ICM as the planning agency/Landcare as the doers"

"Complementary, with Landcare doing the onground stuff"

""ICM/Landcare could be combined. Landcare does on-ground works."

"The current relationship is OK. But ICM isn't getting the recognition it deserves from this."

"ICM should be planners. Landcare the doers"

"In the future will be under one umbrella"

"As is, it works well"

"The current relationship is- appropriate"

"Linkage OK in lower catchment, but needs to be stronger in upper"

2.9.2 Member's perspectives of ICM and its influence

Members were asked to rate their opinion on a five point scale (from strongly agree to strongly disagree) on a range of statements relating to responsibility and ability to control, trust and confidence in government, level of awareness and fairness in land and water resources management. These were all considered potential influences on the implementation of ICM in the Herbert catchment.

When greater than 80% of respondents agreed (ie. a rating of either 'agree' or 'strongly agree') or disagreed (ie. a rating of either 'disagree' or 'strongly disagree') with the statement, this was given a rating of 'high agreement' or 'high disagreement' respectively. When 60 to 80% of respondents agreed or disagreed with the statement, this was given a rating of 'general agreement' or 'general disagreement'. Where there was a clear divergence of opinions amongst members with a spread of responses from disagree to agree (and a mean rating of 2.5 to 3.5), this was given a rating of 'split opinion'.

Responsibility. 'Responsibility' includes views on assigned responsibility for dealing with land and water management issues. Members were asked to rate their level of agreement or disagreement with five statements relating to responsibility and their responses are provided in Table 2.28.

There was a strong consensus among respondents that

- ICM should remain a voluntary activity by community members, and
- Many environmental problems come from the way people manage their properties

However there was a clear divergence of member's opinions on whether:

- Catchment management should be paid for by the government;
- Many environmental problems come from the way people manage their properties;
- Laws should be changed to make landholders more responsible for the consequences of their activities.

Table 2.28. Member views on responsibility and control.

Statement	5. Strongly Agree	4. Agree	3. Neither	2. Disagree	1. Strongly Disagree	Mean Rating	Rating
Catchment management should be paid for by the government	1	8	1	5	0	3.3	Split opinion
ICM should remain a voluntary activity by community members	2	11	2	0	0	4.0	High agreement
Many environmental problems come from the way people manage their properties	3	11	0	1	0	4.1	High agreement
The government expects too much from local communities in catchment management	2	4	3	6	0	3.1	Split opinion
Laws should be changed to make landholders more responsible for the consequences of their activities	2	4	1	8	0	3.0	Split opinion

Overall members clearly felt that the community had a responsibility regarding land and water management. However views on government responsibility and the degree of control necessary for addressing land and water management were unclear.

Trust in Government. Views on government include member's perspectives on trust and perceived competence in government. Members were asked to rate their level of agreement or disagreement with five statements relating to trust in government and their responses are provided in Table 2.29.

Table 2.29. Views on trust in government.

Statement	5. Strongly Agree	4. Agree	3. Neither	2. Disagree	1. Strongly Disagree	Mean Rating	Rating
The government needs to give more resources to voluntary groups	4	10	0	1	0	4.1	High agreement
Different government agencies often give conflicting advice/information on land and water management issues	6	7	1	0	1	4.1	High agreement
There should be better government incentives for landholders to address environmental issues/problems	6	7	0	0	0	4.5	High agreement
ICM programs should have legislative backing	1	7	2	4	1	3.2	Split opinion
The government gives plenty of resources to voluntary groups	0	2	0	10	1	2.2	High disagreement

There was a strong consensus among respondents that:
- The government needs to give more resources to voluntary groups
- Different government agencies often give conflicting advice/information on land and water management issues; and
- There should be better government incentives for landholders to address environmental issues/problems

However there was a clear divergence of member's opinions on whether the ICM program should have legislative backing. Significantly there was a consensus amongst respondents that they disagreed with the statement that the government gives plenty of resources to voluntary groups.

In general there was a clear agreement amongst members that there was a need for better incentives for landholders and greater resourcing of community groups for catchment management. However HRCCC members views on legislative control of ICM were not clear.

Awareness and Fairness. "Awareness and fairness' includes members views on level of awareness and perceived fairness (both procedural and outcome). Members were asked to rate their opinion on a five point scale (from strongly agree to strongly disagree) on a range of statements relating to fairness and awareness issues. Members responses are presented in Table 2.30.

There was a strong consensus of opinion amongst respondents on the importance of procedural fairness, that is:

- If the decision making process is fair, people should accept the final planning or land allocation decision.
- The new proposed land allocation decision process for the Hinchinbrook Shire is fair to all interests.
- Land should be managed for the public good because it belongs to everyone.

Table 2.30. Views on fairness and level of awareness.

Statement	5. Strongly Agree	4. Agree	3. Neither	2. Disagree	1. Strongly Disagree	Mean Rating	Rating
There aren't any environmental problems that need urgent action	1	3	0	2	7	2.2	General dis-agreement
Landholders have the right to use their land as they see fit	0	2	1	8	4	2.1	High dis-agreement
Land should be managed for the public good because it belongs to everyone	2	7	2	1	1	3.6	High agreement
All sections of the community have the right to have a say on planning proposals	2	8	1	3	0	3.6	General agreement
If the decision making process is fair, people should accept the final planning or land allocation decision	0	10	0	1	0	3.8	High agreement
Land use planning should maximise the overall economic income of the community	2	4	0	5	1	3.1	Split opinion
The new proposed land allocation decision process for the Hinchinbrook Shire is fair to all interests	2	9	0	0	0	4.2	High agreement

There was also a general level of consensus relating to the fairness of outcomes of decision-making that:

- All sections of the community have the right to have a say on planning proposals.

However members were clearly divergent in their views on whether land use planning should maximise the overall economic income of the community.

Importantly, there was a consensus amongst respondents that they disagreed that

- there weren't any environmental problems that need urgent action, or
- landholders have the right to use their land as they see fit.

In summary there was clear agreement amongst members on the need for both fairness of process in land allocation and planning decisions and broad community involvement. However views on the fairness of outcomes were less clear.

2.9.3 Cost sharing

Members were asked for every $100 spent on catchment management and Landcare, how much of it they thought *SHOULD* be contributed by each tier of government, industry and individual farmers. Their responses are presented in Table 2.31.

Table 2.31. Views on cost sharing on catchment management and Landcare.

Party	Mean Amount in $s (Range)	Rank
(a) The Commonwealth Government?	29.5 (20-50)	1
(b) The Queensland Government?	29.1 (20-50)	2
(c) Local Government on the Herbert Catchment?	17.0 (10-30)	3
(d) Industry?	13.9 (0-30)	4
(e) Individual farmers?	9.8 (0-20)	5
TOTAL	$100	

Overall members considered that all parties (ie. all three tiers of government, industry and individual farmers) should contribute to catchment management. However on average members felt that the Commonwealth and State Governments should contribute considerably more than other parties with individual farmers contributing the least. Comments in support of these views of respondents included:

> "ICM is a State responsibility."
>
> "Cost should be shifted slightly to local government (through the rates system)"
>
> "Commonwealth Government should pay the bulk. Local Government, industry and individual farmers to all have some "local" contribution"
>
> "Commonwealth is the "big picture" and they and the state should be equal. However, too much in the past has been left to Government to come in and clean up afterwards - industry should contribute more."
>
> "Because of NHT and the sale of Telstra, the Commonwealth and Queeensland Government should contribute the greatest. However Local Government have powers and should back with $s too"
>
> "Costs should be shared. Industry should contribute more – much more - especially at the local level"

2.9.4 Personal demands.

Members were asked to identify on average, how many hours per month they devoted to ICM. The results are presented in Table 2.32.

Table 2.32. Hours spent on ICM, 1998

No. of Hours per Month	No. Responses
<2	0
3-6	4
7-10	3
11-15	0
16-19	1
20-30	3
>30	2
Average (Voluntary only)	11.4

The Catchment Coordinator for the Herbert ICM and the State Government representative from DNR participating in HRCCC meetings are fully employed on ICM matters and spend over 100 hours per month. The average number of hours devoted by the voluntary members to the Herbert ICM process was 11.4 hours (ranging from 3 hours per month to 25-30 hours).

3. COMPARATIVE ANALYSIS OF 1995, 1997 AND 1998 SURVEY FINDINGS

3.1 Introduction

This section of the report provides a comparison of the opinions of HRCCC members on specific aspects of ICM in the three surveys of HRCCC survey members conducted in November 1995 (McDonald and Shrubsole 1996), November 1997 (Bellamy *et al.* 1998) and the current survey. The main focus of the discussion is to identify any changes or differences in member's perspectives.

3.2 HRCCC Membership

Changes in Membership
The membership of the HRCCC between 1997 and 1998 declined by two representatives; one being a Councillor from the upper catchment (deceased) and the other a community organisation in the lower catchment, which had ceased to be an operative group in the community by 1998. The stability and continuity of the membership remained between 1997 and 1998 with 9 of the 16 members being the original foundation members of the HRCCC. By June 1999, a new representative from the State government Environmental Protection Agency (EPA) had been invited to join the Committee. Previously the EPA (formerly the Department of Environment) had been involved as Technical advisers to the HRCCC. The invitation to join the Committee arose in response to difficulties with the EPA in getting their endorsement for the Catchment Management Strategy. The Department of Natural Resources, however, has still only formally involved as technical advisory capacity to the Committee.

The Upper Herbert River Catchment Group
A Sub-Committee of the HRCCC was formally formed for the upper catchment in December 1998 to discuss and raise issues of particular relevance to the upper catchment. This sub-committee, the Upper Herbert River Catchment Group, arose because community members in the upper catchment felt that they were not equally represented on the HRCCC. The HRCCC membership has been overwhelmingly dominated by members from the lower catchment and has inevitably tended to have a focus on issues affecting the lower floodplain. In addition, there were logistical issues relating to the long distance between the upper and lower catchments (ie. a 4-5 hour drive). The new sub-Committee has 16 members selected to represent a broad range of catchment stakeholders from the community, industry and government as identified in Table 3.1.

Table 3.1. Upper Herbert River Catchment Group representation.

Industry Organisations	Mining industry Cattle industry/AG FORCE (2) Dairy industry Timber industry Red Bend Irrigators
Community Organisations	Herberton community Innot Springs community Ravenshoe community and tourism Coolgarra mining area Mt. Garnet Landcare Conservation (2)
Government	Herberton Shire Council Queensland National Parks and Wildlife Service Environmental Protection Agency

3.3 Problem Characterisation

3.3.1 Key resource management issues

The most important resource management issues in the catchment identified by HRCCC members in 1995, 1997 and 1998 are compared in Table 3.2. In general, member's perspectives on natural resource management issues had broadened and become more strategic in scope since 1995. Rural drainage, flooding, river management and sugar industry expansion and related land clearing have remained key issues for the HRCCC members across all surveys. However since 1997 additional issues identified were water quality (particularly relating to fish kills, and stream sedimentation), riparian vegetation and wetlands management, pest and weed management, land use planning and a coordinated approach to catchment management. While in 1998, with closer linkages to the upper catchment community seeming to develop, two further issues largely important to the upper catchment were also identified as grazing land degradation/erosion and water availability issues.

Table 3.2. Comparison of Perceived Key Resource Management Issues by the HRCCC 1993-1998.

November 1995	November 1997	November 1998
Rural drainage	Rural drainage	Drainage coordination/ management on floodplains
Stream bed/bank erosion	River management	Waterways management and flooding
Urban flooding		Sugar industry expansion
Allocation of sugar caneland	Caneland expansion	Land clearing
Land clearing		Water quality
	Water quality	Riparian vegetation management
	Riparian management	Wetland degradation/ management
	Wetland degradation	Weed management
	Pest and weed management	
	Coordinated extension approach	
	Catchment planning	Land use planning, catchment management
		Grazing land degradation/erosion
		Water quantity/availability (upper)

In 1998, HRCCC members were asked a repeat question from the 1995 survey relating to their perspective of the significance of specified of natural resource management issues affecting people in the Herbert. In both surveys they rated their opinion on a five-point scale from very high significance (5) to very low significance (1). The results are compared in Table 3.3. In general, member's perspectives on the relative importance of these specified issues have remained predominantly the same.

Table 3.3. Significance of natural resource management issues affecting people in the Herbert catchment.

Issue	1995 Mean Rating	1998 Mean Rating
Land degradation	2.8	2.6
Grazing land degradation	2.8	2.6
Water quality problems	3.1	3.4
Water quantity problems	2.4	1.9
Rural flooding	3.5	4.1

In early 1999, the new Upper Herbert River Catchment Group identified and prioritised the key issues for the upper catchment as detailed in Table 3.4. Although there are some commonalities with those issues identified by the formal HRCCC, the focus of the issues identified by the upper catchment sub-committee is quite different in that they are largely concerned with specific land and water management issues rather than including broader planning and public good issues.

Table 3.4. Key issues in priority order for the Upper catchment.

1. Weeds in general (ie. noxious weeds, ponded pastures, stream blockers)
2. Erosion (ie. cost effective measures)
3. Water conservation (ie. crop water requirements, changed water requirements (eg. for dairy, cane), best practices water harvesting, storage)
4. Water quality (ie. turbidity, chemical, sediment)
5. Land clearing (ie. best practice in native forest, management (fire, grazing, timber), potential cropping areas)
6. Soil fertility (ie. potential for cropping – forage and fruit, salinity, manganese, nitrification)
7. Wetland/wildlife preservation (ie. birds/maintenance of habitat (natural, artificial), feral animals)
8. Land subdivision (ie. more and larger approvals, water quality implications, licensing, multiplier effects of dams)
9. Creek and river restoration (ie. repair and cleaning)

3.3.2 Key impacts of issues

A comparison of the perceived impacts of issues by members for 1995 and 1998 are presented in Table 3.5. Some significant differences can be seen in the member's perceptions of impacts of issues between 1995 and 1998 both in terms of the relative importance of specific impacts as well as their rank level. In 1995 all impacts were rated by members as moderate or high. In contrast, in 1998 several impacts were rated overall as low to very low. In particular poor drinking water quality, high cost of water, loss of access to recreation and loss of environmental uses or benefits were all rated more lowly as impacts, while loss of farm productivity was ranked relatively higher in 1998. In the case of poor drinking water and the high costs of water, the significant drop in perceived level of impact probably relates to the fact that due to the problem of water turbidity the Hinchinbrook Shire Council established a new source of water supply for the lower catchment (ie. groundwater bores). In addition, members in 1998 were more concerned than previously with the likely impact of land and water management issues on farm productivity, but they rated loss of access to recreation and loss of environmental uses or benefits as of lower concern than previously.

Table 3.5. Perceptions of impacts of specified issues on Herbert community.

Issue	1995 Mean Rating	1995 Rank	1998 Mean Rating	1998 Rank
High cost of water	3.3	10	1.6	10
Loss of farm productivity	3.5	7.5	4.1	1
Higher production costs	3.9	3	3.8	2
Poor drinking water	4.1	1	2.2	9
Emotional stress	3.7	4.5	3.0	6
Higher taxes	3.7	4.5	3.7	4
Lower fish numbers/fish kills	3.4	9	3.7	4
Loss of access to recreation	3.5	7.5	2.4	7
Loss of confidence in government's ability to manage land and water resources	4.0	2	3.7	4
Loss of environmental uses or benefits	3.6	6	2.3	8

3.4 HRCCC Progress and Achievements

3.4.1 Major achievements of the HRCCC

The major achievements of the HRCCC identified by members in the 1995, 1997 and 1998 surveys have been summarised into key points and these are presented in Table 3.6.

There is considerable commonality in the achievements identified by members in each of the surveys. However, the achievements recognised broadened have overall broadened since the

1997 survey to encompass community impact (e.g. awareness raising) and HRCCC role as a recognised and influential body on natural resource management issues in the catchment.

3.4.2 Significant projects

Across the three surveys there was a significant increase in the number and type of project that the HRCCC became engaged in as shown in Table 3.7. They broadened from tin mines and tailing dam inventory in the upper catchment in 1995 to include in 1997 and 1998 a joint project with Herbert River Improvement Trust (HRIT) at Long Pocket on bank stabilisation, the owl nesting box program, a Catchment Atlas, several restoration and revegetation projects, riparian vegetation mapping study, weed control, riparian "community" forum, acid sulphate soils awareness, and a cooperative project to link ICM and local government planning.

Table 3.6. Members opinions of HRCCC achievements.

1995 Achievements	1997 Achievements	1998 Achievements
• Establishing a group that is bringing key catchment group representatives together to talk and share ideas. • Preparation of an initial draft catchment strategy. • Assisting community groups and agencies to undertake projects (e.g. tin mining sites in upper catchment).	• HRCCC meetings providing a forum that brings people together in the catchment with very different views. • The preparation and launching for public review of the Draft Herbert River Catchment Strategy. • Getting funding and undertaking a range of projects. • Raising awareness of catchment problems amongst HRCCC members and within the community • Taking on a coordinative and integrative role on natural resource issues in region • Recognition as a source of advice on natural resource issues in the catchment.	• Providing a forum that brings very different people in the catchment together to exchange ideas and providing a catalyst for change • Supporting and brokering funding for a wide range of projects on natural resource management (including the development of a catchment management strategy) • Raising community awareness of catchment NRM issues • As an influential group on NRM in the catchment

Table 3.7. Comparison of key projects undertaken by the HRCCC, 1995-1998.

November 1995	November 1997	December 1998
• Funding for tin mine and tailing dams inventory.	• Project with HRIT at Long Pocket wash away. • Several Owl nesting box program • Joint restoration and revegetation projects (e.g. Wharps area, riparian area management, artificial wetland development, tree planting). • Riparian vegetation mapping study • Riparian "community" forum. • Acid sulphate soils awareness.	• Mine tailing dam survey (upper) • Joint project with HRIT at Long Pocket on riverbank rehabilitation • Owl nesting boxes • Getting community involved in Landcare projects (eg. Wharps Estate, creek restoration, tree planting, Waterwatch) • Riparian vegetation mapping • Acid sulfate soils awareness • Herbert River Catchment Management Strategy • Catchment Atlas • Support for Herbert Mapping Project which led to the establishment of the Herbert Resources Information Centre (HRIC) • Weed control/clearing of waterways • ICM/Local Government wetlands study

3.4.3 Satisfaction with progress

Members were asked in both 1995, 1997 and 1998 about their level of satisfaction with progress in the HRCCC on a five-point scale from very satisfied to very unsatisfied. Over the period 1995 to 1998, there appears to be a general improvement in satisfaction with progress. In 1995, 55% of members gave a rating of 'satisfied' or 'very satisfied'; in 1997 this had increased to 78% of members, and by the end of 1998 risen to 86% of respondents. A comparison of the results is presented in Table 3.8.

Table 3.8. Comparison of level of satisfaction on progress in the HRCCC for 1995, 1997 and 1998.

Satisfaction Level	1995 No. (%)	1997 No. (%)	1998 No. (%)
Very satisfied	1 (9)	1 (6)	3 (20)
Satisfied	5 (45)	13 (72)	10 (66)
Neither	3 (27)	1 (6)	1 (7)
Unsatisfied	1 (9)	3 (16)	1 (7)
Very Unsatisfied	1 (9)	0 (0)	0 (0)

3.4.4 Improving the HRCCC's performance

Members were asked in both the 1997 and 1998 surveys their views on the ways that the HRCCC could improve its performance. As Table 3.9 shows, member's views had not substantially changed with the most common issues being raising the profile of ICM and the HRCCC in the community through more targeted publicity as well as the adequacy and security of funding to support the ICM process. In both surveys maintaining legitimacy with appropriate and broad representation was also a major issue for a number of members.

Table 3.9. Comparison of view on improving performance, 1997 to 1998

1997	1998
• Better publicisation of ICM and the HRCCC in the community, • Adequacy and security of funding • Ensuring ICM's legitimacy (through representation) • Better coordination and cooperation amongst state government agencies • Support of legislative powers/backing	• More publicity to raise the profile of ICM/HRCCC in the community. • More resources/funding to undertake community or general awareness raising projects. • Broaden representation of views on the HRCCC (eg. direct involvement of local business through the Chamber of Commerce; active involvement of environment interests; representation of government technical expertise). • Improve input from technical expertise to move the process forward more quickly and effectively.

3.5 HRCCC Role

In both 1997 and 1998, members were asked their level of agreement with a range of statements on the HRCCCs role, as detailed in Table 3.10. There was again much commonality in member's views on the role of the HRCCC across both the 1997 and 1998 surveys with most members agreeing or strongly agreeing that the HRCCC's role has been to:

- Encourage research and data gathering and analysis;
- Initiate key collaborative linkages/ arrangements with other organisations;
- Help negotiation among resource stakeholders; and
- Help stakeholders in defining the source of resource problems;

However, there was substantially less agreement in 1998 than in 1997 regarding whether the HRCCC's role was to:

- Help stakeholders in identifying solutions to resource problems; or
- Help stakeholders in ensuring their resource management practices are equitable and accountable.

Table 3.10. Comparison of level of agreement/disagreement with statements on the HRCCC's role for 1997 and 1998.

Statement	1997 Mean Rating	1997 Rating	1998 Mean Rating	1998 Rating
a. Helped negotiation among resource stakeholders to accommodate a wide range of resource uses	3.7	High agreement	4.0	High agreement
b. Initiated key collaborative linkages/ arrangements with other organisations to actively address key land and water use issues in the catchment	-		4.1	High agreement
c. Helped stakeholders in defining the source of resource problems	(3.8)	High agreement	3.8	High agreement
d. Helped stakeholders in identifying solutions to resource problems	(3.8)	High agreement	3.6	General agreement
e. Helped stakeholders in ensuring their resource management practices are equitable and accountable	3.8	High agreement	3.1	Split opinion
f. Encouraged research and data gathering and analysis in order that solutions to resource problems can be better understood	4.1	High agreement	4.2	High agreement

3.6 Public Attitudes, Support and Involvement

3.6.1 Level of public awareness on natural resource use issues

In all three surveys members' views were sought on the level of public awareness on natural resource issues within the Herbert River catchment as detailed in Table 3.11. In 1995, responses were given for the Herbert community as a whole. In 1997 and 1998, members views differentiated between rural and urban communities.

Overall members considered that public awareness in the rural community has improved substantially since 1995 but were less convinced of an improvement in urban awareness. For example, 42% of those responding in 1995 gave a moderate to very high rating to public awareness, while in contrast, 72% of members in 1997 and 71% in 1998 considered rural awareness to be moderate or higher. However members were less convinced of urban awareness in 1998 than in 1997 with 53% of members in 1997 rating urban awareness as moderate or higher, but this rate dropped to only 35% in 1998.

Table 3.11. HRCCC Perspectives on the Level of Public Awareness on natural Resource Issues for 1995, 1997 and 1998.

Rating	1995	1997 - Rural	1997 - Urban	1998 - Rural	1998 - Urban
Very high	1 (8)	3 (17)	1 (6)	3 (21)	2 (14)
High	0 (0)	7 (58)	2 (12)	4 (29)	0 (0)
Moderate	5 (42)	3 (17)	6 (35)	3(21)	3 (21.5)
Low	6 (50)	3 (17)	1 (6)	4 (29)	6 (43)
Very low	0 (0)	2 (11)	7 (41)	0 (0)	3 (21.5)
Average	2.7	3.3	2.4	3.4	2.4

3.6.2 Public support for the HRCCC

In each of the 1995, 1997 and 1998 surveys, HRCCC members were asked to rate their perception of the level of public support for the HRCCC on a five-point scale (from very high to very low). The results are presented in Table 3.12 below. Although there was a divergence of

opinion amongst HRCCC members on this question in all surveys, overall members perceived that support for the HRCCC had increased from a low to moderate level. In 1995 and 1997, 58% and 59% of members respectively rated public support as moderate or higher but in 1998 it had risen to 77% of respondents reflecting an increased confidence by members in public support for ICM.

Table 3.12. Comparison of members opinions of public support for the HRCCC for 1995 to 1998 (numbers and percentages).

Rating	1995	1997	1998
Very High	0 (0)	1 (6)	0
High	1 (8)	3 (18)	3 (23)
Moderate	6 (50)	6 (35)	7 (54)
Low	3 (25)	6 (35)	2 (15)
Very Low	2 (17)	1 (6)	1 (8)
Mean	2.5	2.8	2.9

3.6.3 Improving stakeholder involvement

In each of the three surveys, HRCCC members were asked what could be done to improve the acceptance and involvement of relevant groups and the general public in the HRCCC process. A diversity of opinions were expressed in each surveys. However, there are some common elements as well as some distinct differences. The members' suggestions for each survey are summarised in Table 3.13..

In both 1995 and 1997 members identified the need for a legislative base for ICM. However this issue was not raised in 1998, which may relate to the evolving linkage of ICM and local government planning schemes in the Herbert in this period. In 1995, members also identified the need to get better involvement of local government, funding for projects, and raising public awareness. All of these were addressed/achieved by 1997 to the satisfaction of HRCCC members (as identified previously). In 1997 and 1998, members also identified improving representativeness of the HRCCC and effectiveness of State Government agency involvement as key issues of concern. In addition, in 1998 members identified that representatives had a duty to be accountable to their constituents by arranging proxies when they personally were unable to attend HRCCC meetings.

Table 3.13. Member suggestions on ways stakeholder involvement could be improved.

1995	1997	1998
• Greater publicisation and promotion of the HRCCC and its activities (particularly in the media) • Recognising the role of the CCC through legislation • Greater involvement of local government • Getting funding for on-ground works/projects • Raising community/public awareness of natural resource issues. • Greater public consultation	• Greater publicisation and promotion of the HRCCC and its activities (particularly in the media) • ICM to be given legislative power/base • Improve representativeness of the CCC (e.g. Some stakeholder groups were not involved in the HRCCC) • More effective government agency involvement • Government agencies to consult with the HRCCC on all their programs in the Herbert catchment.	• Include representatives from Chamber of Commerce and tourism industry. • Improve representation of conservation interests on the CCC • Representatives should be more accountable and use proxies when they cannot be present • More effective government agency involvement

3.7 Factors Influencing ICM Process

3.7.1 Difficulties of ICM implementation

In the 1995, 1997 and 1998 surveys, HRCCC members were asked to rate their opinion on a five point scale (strongly agree to strongly disagree) on a series of statements relating to difficulties in ICM implementation. The statements and responses are compared below for the three surveys.

a. The large size of the catchment (or poor transportation links between parts of catchment).

In all surveys, the majority of HRCCC members 'strongly agreed' or 'agreed' that the large size of the catchment made ICM implementation difficult. However 4 members in 1997 disagreed with this statement and 2 in 1998.

	Strongly Agree	Agree	Neither	Disagree	Strongly Disagree	Mean Rating	Rating
1995	0	11	1	0	0	3.9	High agreement
1997	4	9	0	4	0	3.8	High agreement
1998	1	9	0	2	0	3.8	High agreement

b. The wide variety of values and beliefs among HRCCC members seriously detracts from an effective level of cooperation developing among them.

In 1995, the majority of members (75%) 'strongly agreed' or 'agreed' that the wide variety of values and beliefs among HRCCC members seriously detracted from an effective level of cooperation developing, and only 25% disagreed. However members' opinions have shifted such that they did not perceive this as such an issue with 55% giving a 'disagree' or strongly disagree' rating in 1997 and rising to 75% of respondents in 1998.. This shift suggests a greater acceptance/tolerance of the diversity of views amongst members.

	Strongly Agree	Agree	Neither	Disagree	Strongly Disagree	Mean Rating	Rating
1995	3	6	0	3	0	3.8	General agreement
1997	1	6	0	8	2	2.8	Split opinion
1998	0	2	1	7	2	2.3	General disagreement

c. Some important constituency groups are not represented in the ICM process.

Overall there has been an apparent shift in member's opinions on whether ICM was difficult because important constituent groups were not represented in the ICM process. Specifically, the majority of members (approx. 80%) in both the 1995 and 1997 surveys 'disagreed' or 'strongly disagreed'with the statement, while in 1998 there was a clear slit opinion amongst members with only 42% of respondents 'diagreeing' or strongly disagreeing'. While only 1 member 'strongly agreed' with this statement in 1995, 3 members 'agreed' in 1997 and.4 members 'agreed' and 1 strongly agreed' in 1998.

	Strongly Agree	Agree	Neither	Disagree	Strongly Disagree	Mean Rating	Rating
1995	1	0	1	10	0	2.3	High Disagreement
1997	0	3	0	9	5	2.1	High Disagreement
1998	1	4	2	5	0	3.1	Split opinion

d. The perception that ICM has been forced on the catchment by the state government.

In 1995, there was a divergence of opinion amongst HRCCC members on the statement that ICM implementation was difficult because there was a perception that State Government had forced ICM on the catchment. However the majority of HRCCC members 'disagreed' or 'strongly disagreed' with this statement. In contrast in 1997 and 1998, all respondents 'disagreed' or 'strongly disagreed' that this was an issue.

	Strongly Agree	Agree	Neither	Disagree	Strongly Disagree	Mean Rating	Rating
1995	1	1	2	5	2	2.5	General disagreement
1997	0	0	0	10	6	1.6	High disagreement
1998	0	0	0	9	3	1.8	High disagreement

e. The lack of an effective level of interest by HRCCC members.

Across the three surveys there was a divergence of opinion amongst members on whether ICM in the Herbert was difficult because of the lack of an effective level of interest by HRCCC members. However in 1997 and 1998, the majority of members 'disagreed' or 'strongly disagreed' that this was an issue indicating a slight shift in opinion from 1995 to 1997.

	Strongly Agree	Agree	Neither	Disagree	Strongly Disagree	Mean Rating	Rating
1995	1	2	3	5	1	2.8	Split opinion
1997	1	3	1	7	5	2.3	General disagreement
1998	0	3	2	7	0	2.7	General disagreement

f. The public's lack of trust in state/local government-sponsored initiatives.

There was a clear shift of opinion on this statement over the three surveys. In 1995, the majority of members (67%) were in general agreement with the statement that the public's lack of trust in state/local government-sponsored initiatives made ICM implementation difficult. In 1997, there was a stronger divergence of opinion amongst members on this statement with 39% 'disagreeing' or 'strongly disagreeing'. But by 1998 there was general disagreement with 64% disagreeing with the statement.

	Strongly Agree	Agree	Neither	Disagree	Strongly Disagree	Mean Rating	Rating
1995	3	5	1	2	0	3.8	General agreement
1997	1	8	0	4	3	3.0	Split opinion
1998	1	1	2	7	0	2.6	General disagreement

g. The public's lack of interest in community type activities.

In 1995, the majority of members (67%) were in general agreement with the statement that the public's lack of interest in community type activities made ICM implementation difficult. In 1997 and 1998, there was a stronger divergence of opinion amongst members on this statement. However a greater number of members 'disagreed' in 1997 or 'strongly disagreed' (i.e. 39%) and 1998 (42%) than in 1995 (i.e. 17%).

	Strongly Agree	Agree	Neither	Disagree	Strongly Disagree	Mean Rating	Rating
1995	3	5	2	2	0	3.8	General agreement
1997	1	7	2	7	0	3.1	Split opinion
1998	1	4	2	4	1	3.0	Split opinion

h. The lack of financial resources within the community.

In 1995, the majority of members (67%) were in general agreement with the statement that the lack of financial resources within the community made ICM implementation difficult. In 1997, although there was a stronger divergence of opinion on this statement, a greater number of members (i.e. 44%) 'disagreed' or 'strongly disagreed' than in 1995 (i.e. 25 %). However, in the 1998 survey members were asked to express their views on this statement separately for the upper and lower catchment communities. Notably, there was a clear split opinion amongst members on whether the lack of financial resources within the lower catchment community made ICM implementation difficult, but a clear agreement that in the upper catchment it did make ICM implementation more difficult.

	Strongly Agree	Agree	Neither	Disagree	Strongly Disagree	Mean Rating	Rating
1995	3	5	1	2	1	3.6	General agreement
1997	3	3	2	8	0	3.1	Split opinion
1998- upper	1	9	0	0	0	4.1	High agreement
1998 - lower	0	6	1	4	0	3.2	Split opinion

i. There is no single acute resource management problems within the catchment.

There is an apparent shift in opinion of members from 1995 to 1998 on whether the absence of a single acute resource management problem (eg. of the magnitude of salinity) made ICM nore difficult. There is a clear split opinion amongst members in 1995 and 1997. However in 1998 there was clearly disagreement with this statement with nearly 90% of respondents 'disagreeing'.

	Strongly Agree	Agree	Neither	Disagree	Strongly Disagree	Mean Rating	Rating
1995	1	5	1	5	0	3.2	Split opinion
1997	0	8	0	5	1	3.2	Split opinion
1998	0	1	0	8	0	2.2	High disagreement

3.7.2 Demands on members of ICM involvement

In each of the surveys HRCCC members were asked on average what number of hours per month did they devote to ICM as presented in Table 3.14. There is a clear increase in the average time spent by members on ICM matters over the period 1995 to 1998. In 1995 and 1997, the majority of members (ie. 75% of respondents in 1995 and 72% in 1997) spent 10 hours or less per month on ICM matters. However by 1998, this had dropped to only 30% of respondents with approximately 46% of members committing more than 16 hours per month to ICM.

Table 3.14. Comparison of hours spent on ICM, 1995-1998

Hours/Month	Responses 1995	Responses 1997	Responses 1998
<2	0	1	0
3-6	8	6	4
7-10	1	6	3
11-15	2	3	0
16-20	0	1	3
> 20	1	1	3
Average			11.4

APPENDIX 1.

1998 Questionnaire for HRCCC Members

HERBERT RIVER CATCHMENT COORDINATING COMMITTEE MEMBER

OPINIONS

HRCCC Member's Name: …….

BACKGROUND

1. How long have you lived in this catchment?

……Years

2. What year did you become a member of the HRCCC?

……Years

3. Which of the following groups do you represent on the HRCCC? (please tick)

? Local government
? State government agency
? Sugar industry
? Grazing industry
? Fishing industry (commercial)
? Horticulture/Rare Fruits
? Sporting/recreational Fishing
? Tourism
? Community group
? Conservation
? Other (please specify)

……

……(b)

4. (a) **Are there any other groups, organisations or committees that you are involved with in the Herbert?**

……

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……

……

(b) **What is your role/position or level of involvement in them?**

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5. Does the organisation you represent have any regulatory/statutory or other linkages with other organisation involved in the Herbert?

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6. Do you live upstream or downstream from Abergowrie? (please tick)

? Upstream (not including Abergowrie)

? Downstream (includes Abergowrie)

7. What is your occupation?

……

CATCHMENT ISSUES: NATURE AND TRACTABILITY

8. From your perspective we would like to know what are the three key catchment land and water management issues facing people in the Herbert?

Issue	Degree of Complexity	Intensity of Conflict
1. (a1)	(b1)	(c1)
2. (a2)	(b2)	(c2)
3. (a3)	(b3)	(c3)

For each issue identified, can you rate on a 5-point scale:

1 - very low
2 low
3 - moderate
4 high
5 very high
6 - not applicable/don't know

1. the degree of complexity involved in dealing with the issue

2. the level/intensity of community conflict in relation to it

Use the following scale:

1 - very low
2 low
3 - moderate
4 high
5 very high
6 - not applicable/don't know

9.

In your opinion, HOW SIGNIFICANT are each of the following natural resource management issues (1) to you personally, and (2) to the people in the Herbert generally?	**Affects you personally**	**Affects people in Herbert**
(a) Land degradation	(a1)	(a2)
(b) Grazing land degradation	(b1)	(b2)
(c) Water quality problems	(c1)	(c2)
(d) Water quantity problems (Insufficient water)	(d1)	(d2)
(e) Rural flooding	(e1)	(e2)
(f) Rural drainage	(f1)	(f2)
(g) Vegetation on river banks	(g1)	(g2)
(h) Wetlands degradation	(h1)	(h2)
(i) Loss of biodiversity	(i1)	(i2)
(j) Other/s .....(j0) ……(k0)	(j1) (k1)	(j2) (k2)

10.

In your opinion, how much do each of the following IMPACT on, (1) you personally, and (2) people in the Herbert generally?	**Affects you personally**	**Affects people in Herbert**
(a) High cost of water	(a1)	(a2)
(b) Loss of farm productivity	(b1)	(b2)
(c) Higher production costs	(c1)	(c2)
(d) Poor drinking water quality	(d1)	(d2)
(e) Emotional stress	(e1)	(e2)
(f) Higher taxes	(f1)	(f2)
(g) Lower fish numbers/fish kills	(g1)	(g2)
(h) Loss of access to recreation	(h1)	(h2)
(i) Loss of confidence in government's ability to manage land and water resources	(i1)	(i2)
(j) Loss of environmental uses or benefits (eg. wildlife habitat)	(j1)	(j2)
(k) Other/s .....(k0) .....(l0)	(k1) (l1)	(k2) (l2)

11. Using the scale below, rate how much you agree or disagree with the following statements:

1 - strongly disagree
2 - disagree
3 – neither agree nor disagree
4 - agree
5 – strongly agree
6 - not applicable/don't know

Managing land and water in the Herbert is difficult because:	**Rating**
(a) Problems aren't well understood	
(b) Local people lack the money to spend on solutions	
(c) Government strategies are too slow	
(d) Solutions are expensive	
(e) There are few benefits and many costs	
(f) Local people don't want to spend money on solutions	
(g) The Herbert catchment covers a large area	
(h) Local people don't trust government programs	
(i) Local people aren't that interested in community-type activities	
(j) The government doesn't want to spend money on solutions	
(k) Government departments and other agencies are too slow to react to new issues or problems	
(l) People in the catchment lack access to the information needed to respond to/deal with new catchment issues or problems	

THE HRCCC: ACHIEVEMENTS AND ROLE

12. (a) **What have been the major achievements of the HRCCC to-date?**

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(b) **Why?**

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13. (a) **In your opinion, what are the most significant projects undertaken by the HRCCC?**:

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(b) **Why?**

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14. How satisfied are you with the overall progress of the HRCCC? (tick)

- ☐ very unsatisfied
- ☐ unsatisfied
- ☐ neither satisfied nor unsatisfied
- ☐ satisfied
- ☐ very satisfied
- ☐ don't know

15. Why? What are some of your reasons

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16. Is there anything that should be done to improve the HRCCC's performance?

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17. .....In your opinion, is the HRCCC heading in the right direction?.

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18. In respect of the following statements about the role that the HRCCC has played in resource management, can you rate your agreement on a five point scale from:

1 --strongly disagree
2 --disagree
3 – neither agree nor disagree
4 --agree
5 –strongly agree
6 --not applicable/don't know

	Rating
(a) The HRCCC has helped negotiation among catchment stakeholders to resolve land and water management issues	
(b) The HRCCC has initiated key collaborative linkages/arrangements with other organisations to actively address key land and water use issues in the catchment	
(c) The HRCCC has helped stakeholders in defining the source of resource problems	
(d) The HRCCC has helped stakeholders in identifying solutions to resource problems	
(e) The HRCCC has helped stakeholders in ensuring their resource management practices are equitable and accountable.	
(f) The HRCCC has encouraged research and data gathering and analysis in order that solutions to resource problems can be better understood	
(g) The HRCCC has helped ensure that the catchment land use planning decision-making process is fair and accountable to all interests	

19. How important is it to you that the following activities are part of Integrated Catchment Management in the Herbert:

1 - very low importance
2 - low
3 - moderate
4 - high
5 - very high importance
6 - not applicable/don't know

	Your Rating
(a) Encourage community *action* at a catchment level	
(b) Raise the level of local awareness and knowledge of environmental issues on the catchment	
(c) Encourage Local Government to take an active role in environmental management issues	
(d) Encourage coordination of state government programs	
(e) Undertake specific on-ground projects with other bodies	
(f) Providing a continuing source of advice to local government on catchment issues	
(g) Encourage research	
(h) Develop solutions for, and better understanding of, environmental problems in the Herbert catchment	
(i) Encourage discussion between community interest groups on environmental issues	
(j) Separate ICM programs for the Upper and Lower Herbert catchments	
(k) Encourage joint projects between community, industry and state and local government	

THE HERBERT RIVER CATCHMENT MANAGEMENT STRATEGY

20. What is the current status of the Herbert River Catchment Management Strategy?

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21. **(a)** Is the Herbert catchment management strategy being used by the HRCCC? **Yes/No**

(b) If so, for what purpose and is it useful?

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22. **(a)** In your opinion, is the Herbert catchment management strategy adequate? **Yes/No**

(b) Why do you think this?

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23. What needs to be done, if anything, to improve the strategy?:

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24. Please indicate your level of agreement with the following statements:

1 --strongly disagree
2 -- disagree
3 – neither agree nor disagree
4 -- agree
5 – strongly agree
6 --not applicable/don't know

(a) The catchment strategy will contribute to effective resource management in the Herbert	
(b) The catchment strategy will assist in resolving resource management conflicts	
(c) The HRCCC prepared a catchment strategy to ensure future funding support	
(d) The development of the strategy really helped to focus the HRCCC	
(e) My constituency group fully supports the implementation of the strategy	
(f) The Catchment Management Strategy is directing the HRCCC activities	

THE ICM PROGRAM

25. (a) **From your perspective how well suited is the ICM program in Queensland to addressing resource use and management issues within the Herbert catchment?**

? very low
? low
? moderate
? high
? very high
? don't know

.....(b)

Why?……
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26. **In your opinion, who/what types of interest groups should be represented on a Catchment Coordinating Committee?**

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27. **What do you consider are the important qualities of a Catchment Committee member?**

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28. **What do you see are the important qualities of a Catchment Coordinator?**

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Public attitudes and support for ICM

29. In your opinion, what is the level of public awareness about land and water resource issues in general in the Herbert catchment for the rural community and the urban community?

(a) **Rural**		(b) **Urban**	
?	very low	?	very low
?	low	?	low
?	moderate	?	moderate
?	high	?	high
?	very high	?	very high
?	don't know	?	don't know

30. (a) **Has public awareness changed over the last year?**
Yes/No

(b) If so, how or in what way?

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31. What level of public support do you believe the HRCCC has in the catchment?

? very low
? low
? moderate
? high
? very high
? don't know

32. (a) Has public support for the HRCCC changed over the past year? Yes/No
(b) If so, how or in what way:

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33. Is there any way that you think public support for ICM in the Herbert can be improved?

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34. How effective has the involvement of the following groups been to ICM in the Herbert Catchment?

1 - very ineffective
2 - ineffective
3 - neither effective or ineffective
4 - effective
5 - very effective
6 - not applicable/don't know

	Rating
(a) Local Government	
(b) State Government Agencies (specify) …… (b1t) …… (b2t)	 …… (b1) …… (b2)
(c) Federal Government Agencies (Specify) …… (c1t) …… (c2t)	 …… (c1) …… (c2)
(d) Industry Organisations	(d1)
(e) Conservation/Environment Groups	(e1)
(f) The Media	(f1)
(g) Landcare Groups	(g1)
(h) Other Community Groups	(h1)
(i) Any Other (please specify) …… (i1t) …… (i2t)	 …… (i1) …… (i2)
(j)Any Other (please specify) …… (j1t) …… (j2t)	 …… (j1) …… (j2)

(k) Any comments?

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35. What could or should be done to improve the acceptance and involvement of relevant interest groups in the HRCCC process?

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STATE GOVERNMENT INVOLVEMENT

36. (a) Are you satisfied with the overall level of involvement of state government agencies in ICM in the Herbert? Yes/No

(b) How is the state government involved in ICM in the Herbert?

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37 In your opinion, how important is this involvement to the success of ICM in the Herbert?

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38. What more could state government do to help ICM in the Herbert?

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39. On a five point scale:

1 - very low importance
2 - low
3 - moderate
4 - high
5 - very high importance
6 - not applicable/don't know

(a) **Can you rate the importance to ICM in the Herbert of coordination between state government agencies on issues relating to land and water resources management?**

(b) **Can you give reasons for your rating?**

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40. (a) **How beneficial IN PRACTICE has cooperation with government departments (eg. DNR, DPI, DEH) been to ICM in the Herbert?**

1 – not beneficial
2 – slightly beneficial
3 – quite beneficial
4 – very beneficial
5 – extremely beneficial
6 --not applicable/don't know

(b) **Can you give reasons for your rating?**

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Using the following seven point scale:

1. *No interaction* **between the government department and the community**
2. *Informing* **the community of the decisions that have been made**
3. *Consulting* **the community through advertisements and invitations for formal submissions with the final decision being made by the department**
4. *Involving* **the community in workshops and meetings to help define the problem and scope the community's issues with the final decision being made by the department**
5. *Shared planning and decision making* **between the government department and the community**
6. *Decisions made by the community*
7. *Community control and management*
8. Multiple variations of 1-7 above
9. Don't know

41. From your experience in the Herbert catchment, what sort of community/public participation in government in practice mostly occurs in relation to

	Mostly occurs
(a) land use planning	
(b) environmental protection	
(c) land clearing guidelines	
(d) coordination of drainage	

42. From your experience in the Herbert catchment, what sort of community/public participation in general should occur in relation to

	Should occur
(a) Land use planning	
(b) environmental protection	
(c) land clearing	
(d) coordination of drainage on rural lands	

LOCAL GOVERNMENT AND ICM

43. (a) Are you satisfied with the involvement of local government in ICM in the Herbert?

Yes/No

(b) How is local government involved in ICM in the Herbert?

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44. In your opinion, how important is this involvement to the success of ICM in the Herbert?

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45. Is there anything local government could do to help ICM?

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46. Do you support the proposed/new Hinchinbrook Shire Agricultural Planning Process

Yes/No

47. Is it fair to all interests?

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48. In your opinion, do you think the new process will change the way land and water resources are used and managed in the Shire/catchment?

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INFLUENCES ON ICM

49. Please indicate your level of agreement with the following statements:

1 strongly disagree
2 - disagree
3 – neither agree nor disagree
4 - agree
5 – strongly agree
6 --not applicable/don't know

The implementation of ICM in this catchment is difficult because:	Your Rating
(a) The large size of the catchment (or poor linkages between parts of catchment)	
(b) The wide variety of values and beliefs among HRCCC members seriously detracts from an effective level of cooperation developing among them	
(c) State government agencies do not cooperate with each other	
(d) Some important constituency groups are not represented in the ICM process	
(e) The perception that ICM has been forced on the catchment by the state government	
(f) The public's lack of interest in community type activities	
(g) State government agencies do not listen to the Herbert community concerns	
(h) The lack of an effective level of interest by HRCCC members	
(i) The public's lack of trust in state/local government-sponsored initiatives	
(j) The lack of financial resources within the community - upper	
(k) The lack of financial resources within the community - lower	
(l) The lack of agreement among HRCCC members concerning its objectives	
(m) The lack of agreement on feasible solutions to catchment issues	
(n) There are no single acute resource management problems within the catchment	
(o) The lack of coordination between state government agencies in addressing issues	

50. In your opinion, what is the relationship IN PRACTICE between ICM and Landcare in the Herbert?

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51. In your opinion, what SHOULD BE the relationship between ICM and Landcare in the Herbert?

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52. Rate your level of agreement with the following statements:

1 -- strongly disagree
2 -- disagree
3 – neither agree nor disagree
4 -- agree
5 – strongly agree
6 -- not applicable/don't know

	Your Rating
(a) There is a strong consensus among HRCCC members concerning HRCCC functions	
(b) At HRCCC meetings, all HRCCC members participate actively	
(c) The local ICM process effectively resolves resource conflicts	
(d) The ICM process is responsive to local needs	
(e) The HRCCC is solving the priority natural resource management problems in the catchment	
(f) The process of allocating land use in the catchment is fair to all	
(g) All sections of the community have equal access to information on land management and planning	

53. Rate how much you agree or disagree with the following statements:

1 -- strongly disagree
2 -- disagree
3 – neither agree nor disagree
4 -- agree
5 – strongly agree
6 -- not applicable/don't know

		Your Rating
(a)	The government needs to give more resources to voluntary groups	
(b)	Catchment management should be paid for by the government	
(c)	ICM should remain a voluntary activity by community members	
(d)	Many environmental problems come from the way people manage their properties	
(e)	The government expects too much from local communities in catchment management	
(f)	Laws should be changed to make landholders more responsible for the consequences of their activities	
(g)	Different government agencies often give conflicting advice/information on land and water management issues	
(h)	There should be better government incentives for landholders to address environmental issues/problems	
(i)	There aren't any environmental problems that need urgent action	
(j)	ICM programs should have legislative backing	
(k)	The government gives plenty of resources to voluntary groups	
(l)	Landholders have the right to use their land as they see fit	
(m)	Land should be managed for the public good because it belongs to everyone	
(n)	All sections of the community have the right to have a say on planning proposals	
(o)	If the decision making process is fair, people should accept the final planning or land allocation decision	
(p)	Land use planning should maximise the overall economic income of the community	
(q)	The new proposed land allocation decision process for the Hinchinbrook Shire is fair to all interests	

For every $100 spent on catchment management and landcare,

54. How much of it do you think IS being contributed by:

(a) The Commonwealth Government?	
(b) The Queensland Government?	
(c) Local Government on the Herbert Catchment?	
(d) Industry?	
(e) Individual farmers?	
TOTAL	$100

55. How much of it do you think SHOULD be contributed by:

(a) The Commonwealth Government?	
(b) The Queensland Government?	
(c) Local Government on the Herbert Catchment?	
(d) Industry?	
(e) Individual farmers?	
TOTAL	$100

56. Please Comment on why you have chosen these amounts?

……
……
……
……
……
……

PERSONAL DEMANDS AND MOTIVATIONS

57. On average, how many hours per month do you devote to ICM? ……Hours/months

Other Comments

58. If there are any further comments you wish to make about ICM, please feel free to do so.

Chapter 4

Organisational Linkages on Natural Resource Management in the Herbert River Catchment, 1992-1998

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1. INTRODUCTION

Stakeholder representation and participation is well recognised as an essential element of legitimate and successful natural resource management policy initiatives (eg. Lang 1990; RAC 1993; Gardner and Stern 1996). The degree to which there is adequate and responsive communication and coordination between stakeholders of these initiatives is a key factor underlying the effectiveness and fairness of their outcomes.

Fundamental to the conception of the Integrated Catchment Management (ICM) policy initiative in Queensland is that it will rely on existing authorities/organisations and varied programs of federal, state and local governments and private sector activities to accomplish ICM objectives and implement the catchment management strategy (eg. Department of Primary Industries 1991; Rowland and Begbie 1997). In this institutional context, the system of organisational structures and linkages is a critical mechanisms for facilitating the exchange of information and supporting a coordinated and inclusive approach to catchment management decision-making.

A broad range of community, industry and government organisations with some level of responsibility or an interest in resource use management and planning are present in the Herbert River Catchment. This study investigates the change in the system of organisational structures and linkages on natural resource management within the Herbert River catchment from the inception of the Herbert River Catchment Coordinating Committee in 1993 to 1998.

2. METHODS FOR MONITORING ORGANISATIONAL LINKAGES

1.1 Data Sources

The investigative methodology for this longitudinal study was based on:

- Periodic semi-structured interviews with key members of the Herbert River Catchment Coordinating Committee (HRCCC) to identify government, industry and community organisations with an interest or functional role in natural resource management in the catchment;
- Review of documentation (eg. annual reports, strategic plans, consultancy reports) on local government, statutory authorities and industry organisations s in the Herbert River catchment from 1992/93 to 1998/99 to identify linkages and their presentation of natural resource management issues; and
- Review of the minutes of HRCCC meetings and supporting documentation from its inception in March 1993 to December 1998 to identify linkages and related programs.

2.2 Organisational Mapping

The information from the three sources was synthesised to produce organisational mapping of the system of organisational structures and linkages on natural resource management for 1993, 1995 and 1998 for the Herbert River catchment. Organisations were identified under the following groups:

- Federal government
- State government
- Local government
- Industry
- Community
- Collaborative/Joint Ventures

Linkages between organisations were classified as:
- Regulatory/statutory
- Membership
- Secretariat support
- Coordinative/collaborative arrangement/venture
- Proposed joint funding arrangement

Figures 1, 2 and 3 identify the organisations with some role or responsibility on natural resource management in the Herbert River Catchment in 1993, 1995 and 1998 respectively.

3. RELEVANT COMMONWEALTH AND STATE AGENCIES ACTIVE IN THE HERBERT RIVER CATCHMENT, 1993-1998

The key roles and responsibilities of the federal and state government agencies and the related legislation actively engaged in the Herbert River catchment in 1993 are briefly outlined in Table 1.

An examination of Figures 1, 2 and 3 shows that Commonwealth and State Government organisational structures on natural resource management have evolved since the inception of ICM in the Herbert. In 1993, their functional role was predominantly concerned with regulation in respect of land, water, vegetation and coastal management and the provision of research. Over time the number of organisations with an interest has increased and the functional role of these linkages has expanded from this regulatory and research role to also encompass joint funding of collaborative ventures (eg. Herbert Resources Information Centre, Sugar Industry Infrastructure Package).

4. LOCAL GOVERNMENT, INDUSTRY AND COMMUNITY ORGANISATIONS AND THEIR LINKAGES ON NATURAL RESOURCE MANAGEMENT, 1993-98.

The functional roles and responsibilities of the key local government and related statutory authorities, and industry and community organisations in the Herbert River catchment and their involvement in and presentation of natural resource management issues in organisational documentation are briefly outlined below

4.1 Local Government

Local Governments in Queensland are constituted under the *Local Government Act* with responsibilities for:
- Operation of water supply and sewerage treatment works; solid waste disposal; local roads; urban stormwater drainage under the *Local Government Act*.
- Town planning and sub-division; building approvals; camping grounds; regulation of quarrying activities; impact assessment under the *Local Government .(Planning and Environment) Act*.
- Management of erosion prone areas and coastal management control districts under the *Beach Protection Act.*

Figure 1. Organisations in the Herbert Catchment with an Interest or Role in Natural Resource Management in 1993

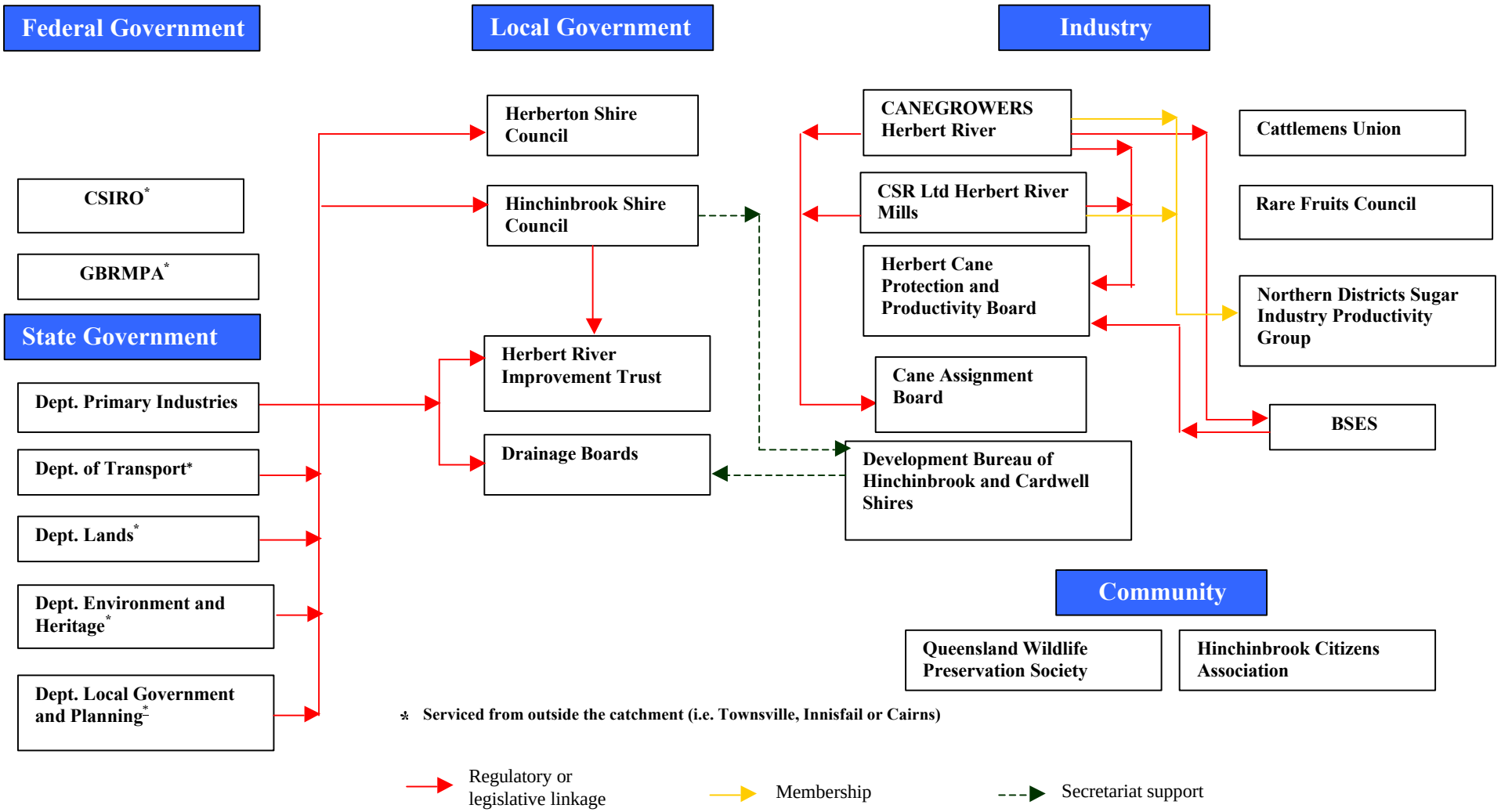


Figure 2. Organisations in the Herbert Catchment with an Interest or Role in Natural Resource Management in 1995

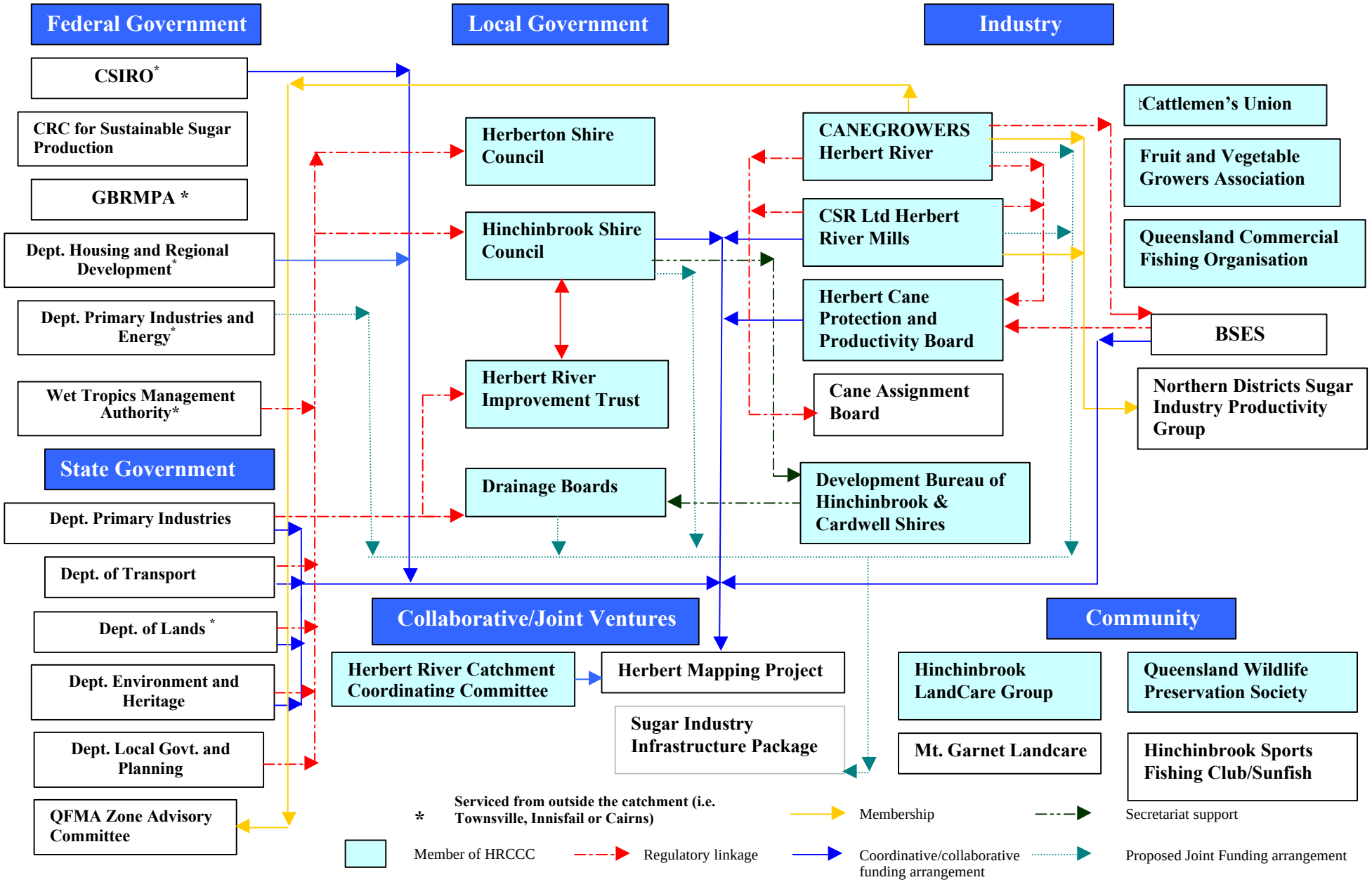


Figure 3. Organisations in the Herbert Catchment with an Interest or Role in Natural Resource Management in 1998

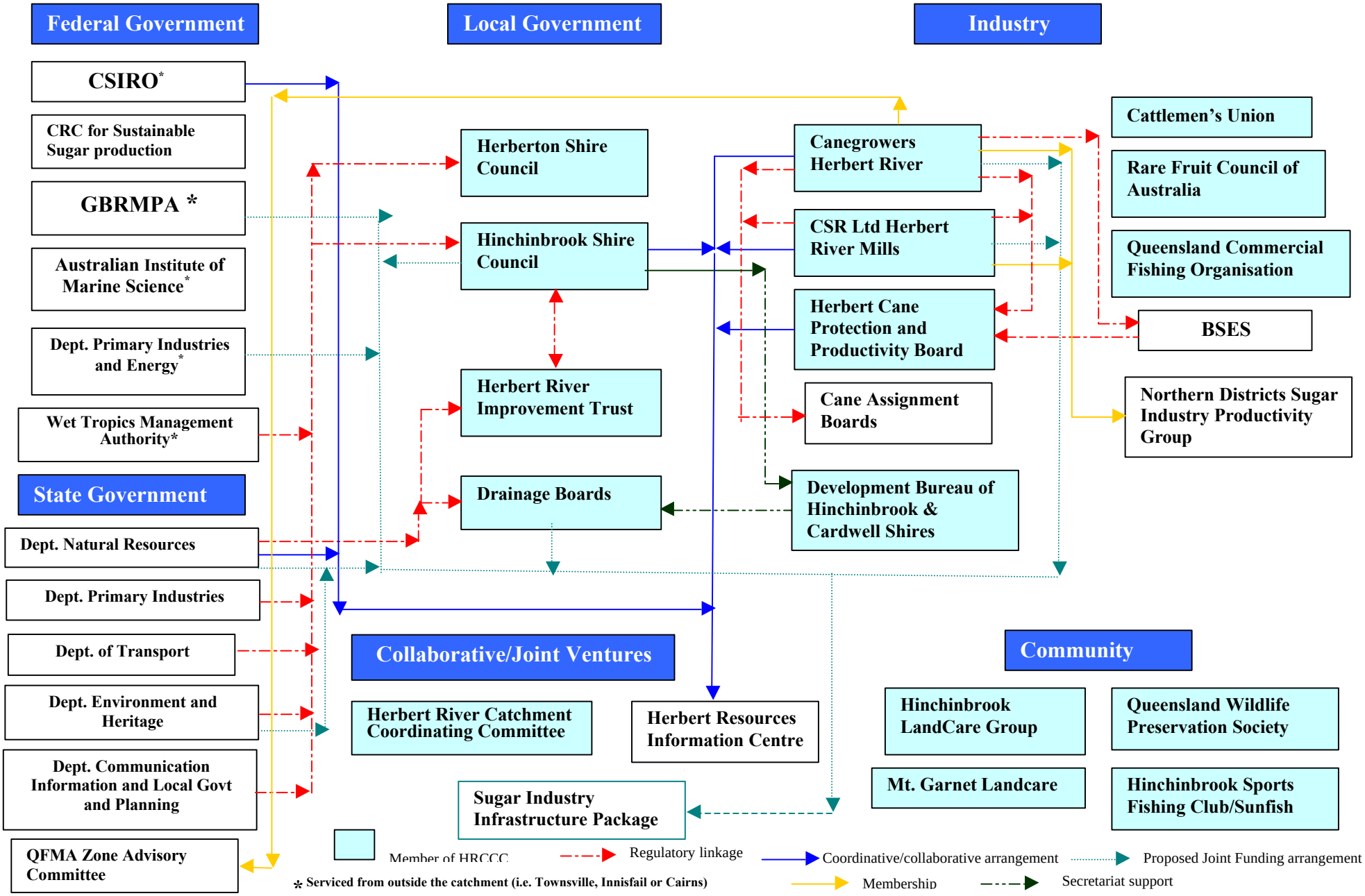


TABLE 1. Roles and Responsibilities of Commonwealth and Sate Agencies with an Interest in Natural Resource Management in the Herbert River Catchment in 1993.

ORGANISATION	MAJOR AREAS OF RESPONSIBILITY	LEGISLATION
COMMONWEALTH GOVERNMENT		
Great Barrier Reef Marine Park Authority	Management of Great Barrier Reef Marine Park (GBRMP); water quality monitoring in Park waters; conducting and arranging research and investigations; preparing zoning plans for individual sections of the Park; providing or arranging education, advisory and information services	GBRMP Act 1975
Wet Tropics Management Authority	Protection and management of the Wet Tropics World Heritage Area	Wet Tropics World Heritage Protection and Management Act 1993
Commonwealth Scientific and Industrial Research Organisation	To carry out scientific research for assisting Australian industry, furthering the interests of the Australian community, and contributing to the achievement of Australian national objectives or the performance of the national and international responsibilities of the Commonwealth. It's work covers a broad range of areas of economic or social value to the nation, including agriculture, minerals and energy, manufacturing, communications, construction, health and the environment.	Science and Industry Research Act 1949
STATE GOVERNMENT		
Department of Primary Industries (DPI)	Management of rivers and water resources; allocation of water resources licensing and permits to pump water (surface and groundwater); stream gauging; management of sand and gravel extraction and licensing	Water Resources Act
	Implementation of Integrated Catchment Management	
	Co-ordination of Landcare	
	Land resource assessment and research	
	Control of soil erosion	Soil Conservation Act
	Management of State Forest and Timber Reserves	Forestry Act
	Protection, conservation and management of fisheries resources of Queensland; designation and management of fisheries reserves	Fisheries Act
Department of Environment and Heritage (DEH)	Conservation and management of State marine parks Day-to-day management of GBR Marine Park	Queensland Marine Parks Act; Great Barrier Reef Marine Park Act (Common.)
	Control of pollution and protection of water quality; licensing of point source discharges	Clean Waters Act
	Approvals for canal development	Canals Act
	Management of national parks and joint management with aboriginal groups; conservation of fauna	Nature Conservation Act; National Parks and Wildlife Act (Common.)
	Control of reclamation, dredging and structures below high water mark	Harbours Act (part)
	Declaration and management of Recreation Areas	Recreation Areas

ORGANISATION	MAJOR AREAS OF RESPONSIBILITY	LEGISLATION
	Co-ordination of Impact Assessment studies	Management Act State Development Public Works Organisation Act
	Protection of items of cultural heritage	Queensland Heritage Act
	Identification, assessment and management of contaminated land	Contaminated Land Act
Department of Lands	Reservation and management of Crown lands for public purposes; leasing of Crown lands and setting lease conditions; reclamation of lands below high water	Land Act
	Definition of legal coastal cadastral boundaries	Surveyors Act
	Control of noxious plants and animals	Rural Lands Protection Act
Department of Transport (DOT)	Licensing commercial boating activities, small craft facilities; strategic port planning; reclamations of lands below high water	Marine Act/Harbours Act
	Regional transport planning, construction and maintenance declared roads	Transport Infrastructure (Roads) Act
Department of Housing, Local Government and Planning (DHLGP)	State planning policies, land use strategic planning and development; approval of local authority town planning schemes; impact assessment guidelines	Local Govt. (Planning and Environment) Act
	Integrated Development Approval System	---
	Regional planning advisory committees	---
	Establishment and management of integrated resort developments	Integrated Development Resort Act
Dept. of the Premier, Economic and Trade Development	Facilitation of major projects and strategic planning	State Development and Public Works Organisation Act
River Improvement Trust	Protection, repair and improvement of beds and banks of rivers; prevention and mitigation of flooding	River Improvement Trust Act
Drainage Boards	The construction, maintenance, protection and administration of drainage works under its control and management in gazetted drainage board areas	Water Resources Act
Beach Protection Authority	Control of coastal land use and development in a zone 100 metres landward of the mean spring AHD	Beach Protection Act
Bureau of Sugar Experimental Stations (BSES)	To conduct research into sugar cane growing and sugar milling and to communicate these results to growers and millers.	BSES Board under the Sugar Experimentations Act

Local Government is involved in resource and environmental management and planning by way of referred powers from the State Government. The nature of powers given to local governments in Queensland extends from powers to make by-laws or ordinances, to licensing, to the carrying out of works, and to impact assessment and effective decision-making on development. Moreover, strategic plans prepared by local authorities have force of law in Queensland.

The Herbert River catchment is located within the local authority boundaries of Hinchinbrook Shire Council and Herberton Shire Council.

Hinchinbrook Shire Council
The Hinchinbrook Shire (HSC) is a dominantly rural shire that covers an area of 2,600 sq. km and a population of 13,434 persons in 1996. In 1993, the Hinchinbrook Shire Council's responsibilities on regional development and land use planning focussed on community service delivery in accordance with the *Local Government Act* (ie. transport infrastructure, water supply, sewerage, rural and urban drainage), town planning and subdivision including impact assessment in accordance with the *Local Government (Planning and Environment) Act*, and management of erosion prone areas and coastal management control districts in accordance with the *Beach Protection Act*.

The Hinchinbrook Shire Council's Annual Reports for 1992/93 identify the "Protection of the Environment" program which included street cleaning and watering, beach restoration and protection, flood and river management (see Herbert River Improvement Trust), anti-litter enforcement, pest/noxious plant destruction, community amenities and cemeteries maintenance. In 1997/98 this program had broadened to include environmental management activities (HSC 1997):

- "Revegetation of damaged riverbanks and planting at Longpocket in association with the local Catchment Coordinating Committee resulted in a major land protection scheme being put in place. The "soft" aspects of tree planting in the scheme achieved not only a buffer against floods but enhancement to the area and an aesthetically pleasing appearance" (HSC 1997, p.19).
- "Tyto" wetlands project – creation of a wetland reserve "to provide for an environmentally acceptable standard of disp[osal of sewerage effluent as an alternative to existing treatment practices through the development of wetland areas/methods".

Importantly the Council gazetted a new strategic plan in 1997 under the new *Integrated Planning Act* that "captures current day planning processes which will provide greater flexibility in Council's decision-making when assessing land-use applications". The new plan is discussed in detail in Vella (1999) including its links to ICM in the Herbert.

4.2 Herbert River Improvement Trust

The Herbert River Improvement Trust (HRIT) is a statutory authority constituted under the provision of the *River Improvement Trust Act 1940* by Order-in-Council dated 8 May 1942. Its key functions are to protect and improve the beds and banks of rivers; to repair and prevent damage to the bed and banks of rivers; and to prevent or mitigate flooding of land by riverine flood. The primary role of the HRIT is to plan, design, finance, undertake and maintain stream improvement works for the benefit of the community within the Hinchinbrook Shire area. The *RIT Act* provides the HRIT with the powers to undertake these functions, including ability to raise funds, enter onto land, occupy land, enter into contracts, and carry out works. The HRIT is sponsored by the Hinchinbrook Shire Council and its jurisdiction essential covers the lower Herbert River floodplain..

Membership in 1998 comprised a Chairman appointed by the Governor in Council, two representatives appointed by the Hinchinbrook Shire Council, and a 'special interest member' appointed from the DNR.

The HRIT supported a Herbert River Catchment and Management Scoping study to provide a blueprint for addressing river management issues. Since 1994/95 its Annual Reports have identified a key aim of maintaining "a close liaison with the local ICM Committee and consulting with them on relevant issues". The Trust also jointly supported a land protection scheme with the Herbert River Catchment Coordinating Committee (HRCCC) at Long Pocket on the Herbert River which received funding from the National Landcare programme following an application from the HRCCC. This project involved revegetation of damaged riverbanks.

4.3 Drainage Boards

Under the *Water Resources Act* Drainage Boards are constituted with the responsibility for the construction, maintenance, protection and administration of drainage works under its control and management in gazetted drainage board areas.

There are four formal 'gazetted' drainage boards (Ripple Creek/Seymour, Foresthome, Loder Creek and Mandam) and three informal boards (Lagoon Creek, Ti Tree Creek and Macknade) that operate within the lower catchment in the Hinchinbrook Shire and cover approximately 11,000 hectares. These boards assess drainage applications in their respective areas.

The structure and functional roles of drainage boards are currently being reviewed under the Sugar Industry Infrastructure Package (SIIP) with the intent of amalgamating formal and informal boards.

4.4 Development Bureau of Hinchinbrook and Cardwell Shires

The Development Bureau is an incorporated body responsible to the Hinchinbrook Shire Council. It is responsible for promoting rural development activities in the region of the Hinchinbrook and Cardwell Shires. It also acts as a secretary and administrator of 3 District Drainage Boards in the Hinchinbrook Shire and the local Chamber of Commerce. It has a primary focus on tourism and related activities as well as employment programs in the region.

The Bureau is an incorporated body managed by a Board of Management and in 1998 comprised 21 members:

- An Executive Committee of 4 members
- 6 elected members from the Hinchinbrook Shire
- 6 elected members from the Cardwell Shire
- 2 appointed members from the Hinchinbrook Shire
- 2 appointed members from the Cardwell
- 1 appointed member from North Queensland Economic Development Board (NORQEB)

In 1997/98 it received financially support from both the Hinchinbrook and Cardwell Shire Councils, and in the past it has also had financial support from NORQEB. In addition, it receives secretariat fees from the Drainage Boards and the Hinchinbrook Chamber of Commerce. Other important sources of funding are membership fees from individuals, businesses and industry in the region, as well as project funding from various Government Agencies (eg. Dept. Tourism, Small Business and Industry).

The Bureau's focus has remained much the same since 1991. Importantly, the Bureau has continued to lobby for integrated approach to drainage in the Herbert catchment, and it has been actively involved in ICM in the Herbert River Catchment as a founding member of the Herbert River Catchment Coordinating Committee in 1993. It has also been involved in issues of drainage of agricultural lands

through both on-farm advice and through the establishment of formal and informal Drainage Boards and Committees in the lower Herbert River community.

4.5 Herbert River District CANEGROWERS

CANEGROWERS is a statutory organisation established under the *Primary Producers' Organisation and Marketing Act 1926* as the formal body representing all canegrowers in Queensland. It is financed by a levy on growers based on tonnes of cane supplied. The Herbert River District Canegrowers' Executive aims to promote the prosperity of all canegrowers in the Herbert River catchment by addressing common district issues and problems and also providing client service for individual growers (CANEGROWERS Victoria Area Annual Report 1993). It has two Mill Supplier's Committees – one for the Macknade Mill area and one for the Victoria Mill area – and it is responsible for the Harvesting Equity Tribunal and the Caneland Assignment Committees. It also provides secretary and administrative support for the Mandam Drainage Board, the Hinchinbrook Landcare Group and in the past the Herbert River Catchment Coordinating Committee. The CANEGROWER Executive also has a representatives on the Queensland Fish Management Authority Zone Advisory Committee – the regulatory agency for Queensland Fishing.

Key issues identified in the 1992 and 1993 Annual Reports of the Mill Supplier Committees were:

- industry expansion and the introduction of a Continuous Crushing Agreement and rostered harvesting;
- water management and a submission to the Commonwealth and Queensland Governments for drainage infrastructure (ie. SIIP);
- cane transport and handling (in particular siding capacity limitations transport servicing issues);
- the cane price formula based on the measurement of CCS; and
- Commonwealth Government proposal for the deregulation of the industry including the phasing out of tariff support.

Important activities in which the District Executive was involved in 1993 included:

1. *Support for the formation of the HRCCC under the Queensland's Government Integrated Catchment Management program.* CANEGROWERS had direct representation in ICM in the Herbert through one Executive member and indirect representation through the Landcare representative and the Canegrowers Executive Manager who acted as Secretary for the HRCCC. Its role was described as:
2. "*The HRCCC provides industry and community groups with representation on a body that is focussed on coordinating land use and water management in the catchment and dealing with issues that have impact*" (p.8).
3. *Sugar Industry Infrastructure Package (SIIP).* A collaborative bid was made with the millowner, CSR Limited, and the support of the Water Resources section of the DPI, Hinchinbrook Shire Council, the combined Drainage Boards, the HRIT and the HRCCC, for funding for projects in the Herbert River district for both water management (drainage) and cane transporting infrastructure. The bid was partially successful in that water management projects in existing cane areas were granted conditional approval for funding subject to the formation of a Water Management Board covering the project's entire area and the provision of one third local funding of the project's total estimated cost of $5.82M. The CANEGROWERS concluded that "the conceptual ideas are in general in line with those in the Cameron McNamara Rural Drainage Plan".
4. *Land Opening Project – Lower Stone (Wharps Holding).* The CANEGROWERS Executive worked with the Department of Lands, Hinchinbrook Shire Council and CSR Limited to open up 1100 hectares of land for future sugarcane farming. A provisional allocation of land has been made to applicants.
5. *Herbert Mapping Project.* A joint venture was being negotiated with several government departments, CSR, CSIRO, Hinchinbrook Shire Council and the HCPPB for more accurately

mapping the area which would "be of enormous benefit for planning anything to do with the use of land including drainage, the location of sidings, roads, etc." (p.9).

In 1994 and 1995, the major issues identified in the Herbert District CANEGROWERS Annual Report related predominantly to cane supply and mill capacity issues:

- The emerging problem of the reliability of mill crushing capacity with the "season being plagued with mill performance difficulties that tested the endurance of harvesting crews and prompted groups to consider risk sharing arrangements with rotation agreements" (Canegrowers Annual Report 1995, p.2).
- Estimating accuracy was continuing to be a concern in the management of harvesting equity.
- Cane transport and handling needs of growers and contractors, including lengthy delays in obtaining approvals for new cane railway line to Crystal Creek.

Other local issues raised in the Annual Report included:

- Involvement in the development of a district code of practice for sustainable cane growing. Cane land expansion and conditions for granting assignment needed to "reflect an appropriate level of care for the environment" with:
  - "local issues such as the mahogany glider protection plan and riparian zones for new cane areas being addressed in conditions for the allocation of assignment".
  - Collaboration in a BSES-monitored trial to assess the potential for rat baits to harm non-target species such as owls.
- CANEGROWERS had contributed $22K to the Herbert Mapping Joint Venture (or 6.3% of the cost) which provides it with full right to all mapping products. A flow on result of this venture was the decision to establish a Herbert Resources Information Centre (HRIC).
- The preliminary design for SIIP water management projects were completed and an Impact Assessment Study (IAS) and Environmental Management Plan (EMP) was being prepared.

The 1994 Annual Report notes the appointment of a Catchment Coordinator funded by NLP and the State's Integrated Catchment Management Program. The primary function of the Committee was described as "to work towards the development of a land and water management strategy for the catchment" while the HRCCC itself "provides a venue for industry, community groups and local governments with an interest in land and water management issues in the catchment to focus on those issues"(Annual Report 1994, p.4). Expenditure on administrative support for the HRCCC was recorded as $5042 and $5043 in 1994 and 1995 respectively.

By end of 1997, the main issues identified in the Annual Report were:

- Recommendations on Industry Structure evolving from the Sugar Industry Review Working Party Report, especially:
  - the focus on localising the commercial arrangements for raw sugar production through a negotiated contract with the millowner in place of the annual Award;
  - The loss of the Tariff; and
  - the move towards export parity pricing of raw sugar sales to domestic refiners.
- Recommendation for the negotiation of a single-district crushing season agreement, a single Local Award and a single district CCS. The important issues involved are season length, risk management and appropriate financial incentives, cane transport infrastructure and inter mill transfers.

Other local issues raised included:

- The sustained improvement in district yield and the increase in the assigned area presented challenges to mill crushing capacity. Therefore the district did not participate in any expansion in

1997, and it was agreed that the assigned area in 1998 will be the maximum area until further allocations are considered.
- Broader community expectations are creating greater pressure for the sugar industry to manage its impacts and downstream effects, and so the industry has been proactive in conducting an environmental audit.
- The District Executive provides secretarial support for the Hinchinbrook Landcare Group and is supporting a NHT application for tree planting.
- The District Executive also provides secretarial and administrative support to the HRCCC and been actively involved including providing funding support for the CD version of the Herbert River Catchment Atlas. The report notes that the HRCCC "provides a forum for community and industry groups interested in catchment issues to exchange views on overall catchment management strategies" (Canegrowers' Annual Report 1997, p. 9).
- The delay again in the implementation of water management projects under SIIP attributed to a combination of resource limitations, landholders concerns regarding design and the need to alter designs to ensure that they impact less on the sensitive fish habitat areas. Constraints being imposed by the regulations covering fish habitat and mangrove protection.
- Following damage by the January 1998 flood, catchment management issues were emerging in regard to tramlines, drainage and levee bank coordination.

Recently Herbert River CANEGROWERS have developed a protocol with DPI Fisheries for cane farming activities and work adjacent to tidal areas which allows different levels of permit relating to impacts of activities on marine plants (eg. mangroves).

4.6 Herbert Cane Protection and Productivity Board

The Herbert Cane Protection and Productivity Board (HCPPB) is a statutory authority under the *Sugar Industry Act 1991* responsible for administering regulations concerning plant quarantine, pest and disease control in the sugar industry. It was formed in April 1993 following an amalgamation of the compulsory Victoria Mill area Board and the voluntary Macknade Mill area Board. Its jurisdiction covers the whole lower Herbert River floodplain sugar growing area and it has a regulatory linkage to the BSES. The HCPPB comprises 9 members:
- 3 representatives of canegrowers from the Macknade Mill area;
- 3 representatives of canegrowers from the Victoria Mill area;
- 3 representatives of the millowner CSR Ltd.;
- 1 officer of the BSES.

The Board's funding is based on an equal contribution from growers and millers based on a levy on total tonne of cane delivered annually.

In 1993, the key focus as identified in the HCPPB Annual Report for 1993 was pest, weed and disease control, a study of rat damage in cane, and farm extension on productivity. The key issues for cane productivity were cane varieties, rodent control (particularly the importance of baiting, weed control and harbourage manipulation as a component of rat control), and the spread of Sicklepod. The area damaged by rodents in 1993 encompassed an area of 5260 hectares of cane for a calculated loss of 28,265 tonnes of cane. However, the damage by rats in 1997 was estimated as 6576 tonnes with another 10,701 tonnes lost due to pig damage.

In 1998, the HCPPB had expanded its services into laser levelling using the latest technology, caneland mapping by remote sensing and GIS for assessing productivity and its variation in the region, and encouragement of a philosophy of an environmentally sustainable production, including Integrated Pest Management (IPM) and Integrated Catchment Management (ICM).

The HCPPB mission as identified in the HCPPB's Strategic Plan 1998-2002 is:

> *To enhance the productivity of the sugar industry in increasing the quantity and quality of sugar cane grown in the Herbert Valley in an environmentally sustainable and economically viable manner.* (HCPPB, October 1997).

To this end, the HCPPB role in 1998 is identified as:

- Actively encourage the adoption of farming techniques and practices which improve the cane growing environment to maximise the productivity of cane varieties, in a sustainable way.
- Accommodate requests from the BSES and other research organisations for assistance and cooperation with research activities.
- Provide the necessary advice to control losses from pests and diseases.
- Encourage growers to accept the philosophy of Integrated Catchment Management.
- Provide the necessary training to the Board's staff in response to technological advances.
- Extend research findings to improve industry productivity and profitability.
- Determine productivity trends, using GIS technology.
- Long term financial and managerial support to the Herbert Resource Information Centre (ie. HRIC).
- Encourage and advise practices that will maintain and enhance sugar quality.
- Provide a laser survey-design service to the local industry.
- Encourage sound environmental practices to ensure long term industry sustainability.

The key issues identified in the Strategic Plan for 1998 (CPPB 1997 Annual Report) were:

- Drainage and conservation of water
- Reduction of ratoon stunting disease
- Integrated Pest Management (IPM) strategies for rodent control
- Planting methods and practices
- Land usage
- Productivity analysis and productivity reports
- Sustainable agriculture/environmental integrity
- Noxious (plant and animal) pest control.

4.7 Caneland Assignment Boards

While the Queensland Sugar Corporation (QSC) is responsible for implementing the *Sugar Industry Act 1994*, it has delegated much of the responsibility for mill-area decision-making to Local Boards. The Local Board acts as an 'agent' for the QSC and receives and determines applications for new and increased assignment (Shrubsole 1997). A caneland assignment provides an entitlement to have cane harvested, crushed and paid for under a collectively bargained Award arrangement with existing mill capacity (CANEGROWERS Victoria Area Annual Report 1996, p.6).

In the Herbert River District, each of the two CSR mills – Victoria and Macknade –has its own Local Board. Shrubsole (1997) found that since 1993 the Local Boards in the Herbert River District have incorporated environmental considerations into decision-making on cane assignment through (i) forming *ad hoc* technical review committee in 1995; (ii) requiring all applicants to submit a property management plan, and (iii) developing conditions of assignment. Shrubsole *et al.* 1999 provides a more comprehensive analysis of the cane land allocation process in the Herbert River catchment.

4.8 Northern Districts Sugar Industry Productivity Group

Essentially a lobby group for improved drainage in sugar areas in the 1970s and 1980s. By the early 1990s it ceased being very active and overtaken by other processes such as ICM and the SIIP.

4.9 Sunfish

Initially Sunfish was established as the Queensland Sport and Recreational Fishing Council, which during its 20th year of operation underwent an official name, change to Sunfish. Sunfish is the peak body representing over 882,000 recreational anglers throughout Queensland and is composed of representatives from State organisations such as the Queensland Game Fishing Association, the Australian National Sportfishing Association, the Queensland Amateur Fishing Clubs Association, the Australian Underwater Association Queensland Branch, the Freshwater Stocking and Fishing Association of Queensland, 10 Regional Branches and Individual Membership.

The Branch structure of Sunfish allows local fishers to play an active role in local fishery management and issues. Sunfish is an apolitical body, which liaises with the Queensland Government, and statutory bodies on recreational fisheries issues. It works closely with the Department of Primary Industries Fisheries Branch and the Queensland Fish Management Authority

5.0 COLLABORATIVE GROUPS/VENTURES

5.1 Herbert River Catchment Coordinating Committee (HRCCC)

Integrated Catchment Management (ICM) in the Herbert River Catchment operates under the Queensland Government's ICM policy framework (DPI 1991). An ICM Strategy for Queensland was released by the Queensland State Government in October 1991 outlining broad policy and structural arrangements. It provides a framework for fostering cooperation and coordination between landholders and other resource users, community groups and government agencies from all levels (i.e. federal, state and local) involved in the use and management of natural resources. The strategy promotes ICM as a participative and consultative process that takes a strategic and planned approach to tackling important natural resource management issues. The Queensland Department of Natural Resources is the lead government agency for implementing the Strategy. Other state government agencies, such as the Department of Primary Industries, Department of Environment and Heritage, and the Department of Local Government and Planning, also play a role in promoting and supporting relevant aspects of the ICM policy initiative. As ICM in Queensland is a voluntary community-based policy initiative that has no legislative basis, its success will ultimately reflect the ability of relevant public and private interests to voluntarily effect required action.

An ICM process commenced in the Herbert Catchment in 1992 with the formation of a Catchment Steering Committee of community leaders and government agency representatives, which established the Herbert River Catchment Coordinating Committee (HRCCC) in early 1993. A full-time Catchment The HRCCC involves representatives of a broad range of rural industry, community and local government and other statutory organisations that have an interest and/or role in natural resource management in the catchment. As such, the membership reflects the influential groups, power structures, and prominent community interests in the catchment. In 1998, the HRCCC had a local Chairman and 16 other members representing community, industry and local government and statutory bodies in the catchment (see Fig. 3). A full-time Catchment Coordinator facilitates the process.

Significantly, until 1999 the HRCCC had no formal State Government agency representatives although locally-based officers from the Department of Natural Resources frequently participate in meetings.

The Catchment Coordinator is funded from the federal government's National Landcare Program with additional support provided by the Department of Natural Resources. In addition, local stakeholder groups including Local Government and sugar industry bodies have provided in-kind support in terms of office accommodation, administrative support and their HRCCC member's time. State and federal government grants that are awarded through a competitive bidding process also provide financial support for many on-ground HRCCC activities. Through involvement in HRCCC meetings and activities, ICM in the Herbert Catchment is attempting to engage a range of key stakeholders in ESD.

The HRCCC has identified its role as (HRCCC 1998):

(i) Coordinate government agencies and the community to pursue common goals;
(ii) Seek community involvement in Catchment management;
(iii) Identify and rectify natural resource degradation;
(iv) Promote ways to prevent and reduce natural resource degradation;
(v) Promote the wise use of all natural resources within the Catchment;
(vi) Identify key indicators of biodiversity and monitor as a measure of catchment health;
(vii) Encourage the retention of significant natural habitats within the Catchment.

In May 1997, the HRCCC released a Herbert River Catchment Management Strategy for public comment (HRCCC 1998). This strategy is intended to provide a strategic framework for the future management of the Herbert River catchment's natural resources. It was prepared by HCCC members through a series of working groups and internal workshopping. The strategy identifies a broad range of priority management and planning issues. These issues involve not only interaction between many components of the catchment, but also many individuals and organisations with an interest in the catchment.

Bellamy and Johnson (1999) have identified the key achievements of ICM in the Herbert River catchment as:

(i) Initiating a range of focussed or single-issue land management projects to establish credibility and raise awareness of ICM process and natural resource management in general with the Herbert community (rather than focussing on issues of strategic importance to catchment management).
(ii) Achieving recognition as a legitimate community referral agency for the state and local government authorities on proposed developmental and infrastructure projects and other natural resource issues in the catchment.
(iii) Development of a Herbert River Catchment Management Plan that provides the essential elements of a 'sustainable' vision for the catchment.
(iv) Establishing a lead role within the Herbert River community as a principal broker negotiating funding for industry and community groups to undertake natural resource management projects and activities in the catchment.
(v) Providing an effective community forum for discussing and progressing catchment issues, including revealing the range of different stakeholder perspectives on these issues as well as highlighting potential areas of community conflict.
(vi) Information provider and disseminator through HRCCC meetings providing a 'community forum', initiating focussed activities that locally have a relatively high profile, as well as through the existing communication networks of HRCCC member organisations.

5.2 Herbert Mapping Project

The Herbert Mapping Project (HMP) was a cooperative mapping project started in 1993 in to collect geographic information relevant to industry, the community and researchers on the Lower Herbert River catchment. The HMP mapped the Herbert River flooplain at a scale of 1:10 000. This data capture process resulted in an orthophoto map series and some subsequent digital data as a by-product.

The data sets collected included sugarcane blocks, digital elevation model, houses, hydrology, rail, roads, topography, and waterbodies.

5.3 Herbert Resources Information Centre

The HRIC is a rural, collaborative, community focussed GIS. It has six signatory partners to a 10 year agreement - CSR Sugar Mills; Herbert Cane Protection and Productivity Board, CSIRO, Hinchinbrook Shire Council; Canegrowers Herbert River; and Queensland Department of Natural Resources.

The HRIC aims to provide essential resource information to assist in the planning and decision making activities of key venture partners. The core business of the HRIC is to manage and coordinate the joint venture resources for the:

- identification, collation, and capture of geographic information;
- support of Joint Venture Partners and community based resource planning and management initiatives, through the provision of geographic information, GIS expertise, and technology;
- management and maintenance of HRIC digital data sets;
- maintenance of a high level of GIS technical skills; and
- provision of training for Joint Venture Partners and the wider community.

5.4 Sugar Industry Infrastructure Package

The Queensland Sugar Industry Infrastructure Package (SIIP) is an initiative of the Federal Government, Queensland Government and the Sugar Industry to increase sugar production. Approximately $3.3M has been made available for infrastructure development in the Herbert River district under a project jointly funded by CANEGROWERS Herbert River District, CSR Herbert River Mills and Hinchinbrook Shire Council. The total scheme intends to develop and implement a program of structural works and non-structural measures which will provide for enhanced sugarcane production by improving drainage conditions for existing and future cane growing lands. Phase I relates to existing cane areas and Phase II mainly to expansion areas.

Within the five schemes which constitute the Phase I Herbert Existing Cane Area Water Management Project, a combined total of up to 15600 hectares of existing caneland currently suffers productivity losses due to flooding and waterlogging associated with heavy rainfall events (SIIP 1993; 1995; 1998). Four of the schemes (Macknade Scheme, Foresthome Scheme, Lagoon, Loder & Ti-tree Creeks Scheme, Mandam Scheme) concern coastal canelands adjoining mangrove wetlands. While the fifth, the Ripple Creek-Seymour River Scheme, concerns canelands adjacent to a freshwater wetland on an old distributary channel.

The primary purpose of the Phase I project is to increase cane production on the Herbert River floodplain by addressing the needs of the existing canefarmers with regard to wet season crop losses and yield decline associated with poor residual drainage and waterlogging. The intent is that this will be achieved through the coordinated implementation of drainage improvements including improved capacity drains and outfalls, and controlled inter-catchment transfers (SIIP 1995). Funding for Phase I was approved conditional upon:

- Approval of an Impact Assessment Study and associated Environmental Management Plan for the project by the SIIP Central Review Committee.
- The formation of a Water Management Board under Section 9 of the Water Resources Act 1989 to undertake construction of works and ongoing scheme management;
- One third funding of the total project cost being contributed by the local community.
- Negotiations are still continuing in late 1998 with implementation/approval not expected until 1999.

The Phase II project proposal involves:

(i) the expansion of the 'Hinchinbrook Rural Drainage Plan' (originally produced in 1984) "to facilitate orderly, properly drained new farm uptakes in proposed expansion areas; and

(ii) aerial photography and data capture of existing cane blocks as a future satrting point for future cane farm development proposals by the Hinchinbrook Council (Herbert SIIP Project – Phase II, 1997)

A consultancy will be let shortly for the new land and water management plan, and it is anticipated that it will have strong links to the Hinchinbrook Shire Planning Scheme.

5.5 Agricultural Planning for the Hinchinbrook Shire

The 'Agricultural Planning for Hinchinbrook Shire' package provides information to landholders on planning for material change of use under the Integrated Planning Act 1997 for the Hinchinbrook Shire and to assist cane growers in planning for further assignment. A Property Development Plan is required by the Hinchinbrook Shire Council as part of the application for converting land to intensive agriculture. Intensive agriculture in this context means the use of more than 5 hectares of land for the intensive production of crops including the growing of cane, watermelons and bananas.

The Shire Council cannot refuse an application but may impose reasonable and relevant conditions on the proposal. In addition Local Sugar Assignment Boards require Property Development Plans for applications for increases in assignment or any variation of assignment description that includes land not currently in their 'Present Assignment Description'.

The HRIC, Canegrowers and BSES assist individual farmers to design a farm layout. The applicant then submits the plan to a Technical Committee made up of DNR, DPI, DEH and BSES staff who appraise the plan against legislative requirements, such as the Water Resources Act, Environment Protection Act and Policies, the Nature Conservation Act, 'The Codes of Practice for Sustainable Cane Growing in Queensland', Local Board conditions and other applicable guidelines. The process is illustrated in Fig. 4 and the organisations involved and the organisations involved and their linkages in Fig. 5.

The important development in this package is the formal linking and coordination of the approach to land use planning between State Government, Local Government and industry in the lower Herbert River catchment.

Figure 4. Agricultural Planning Process

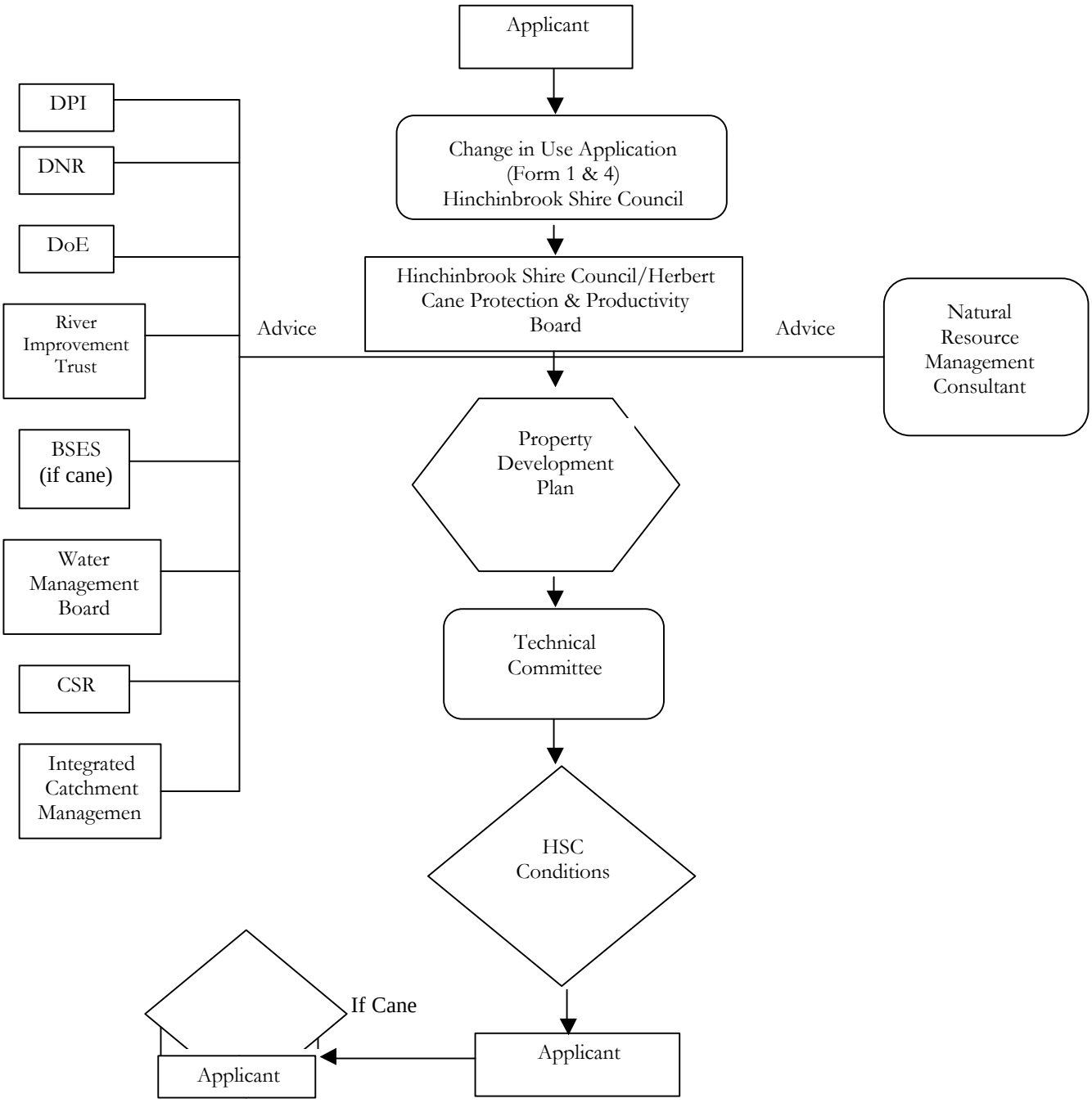
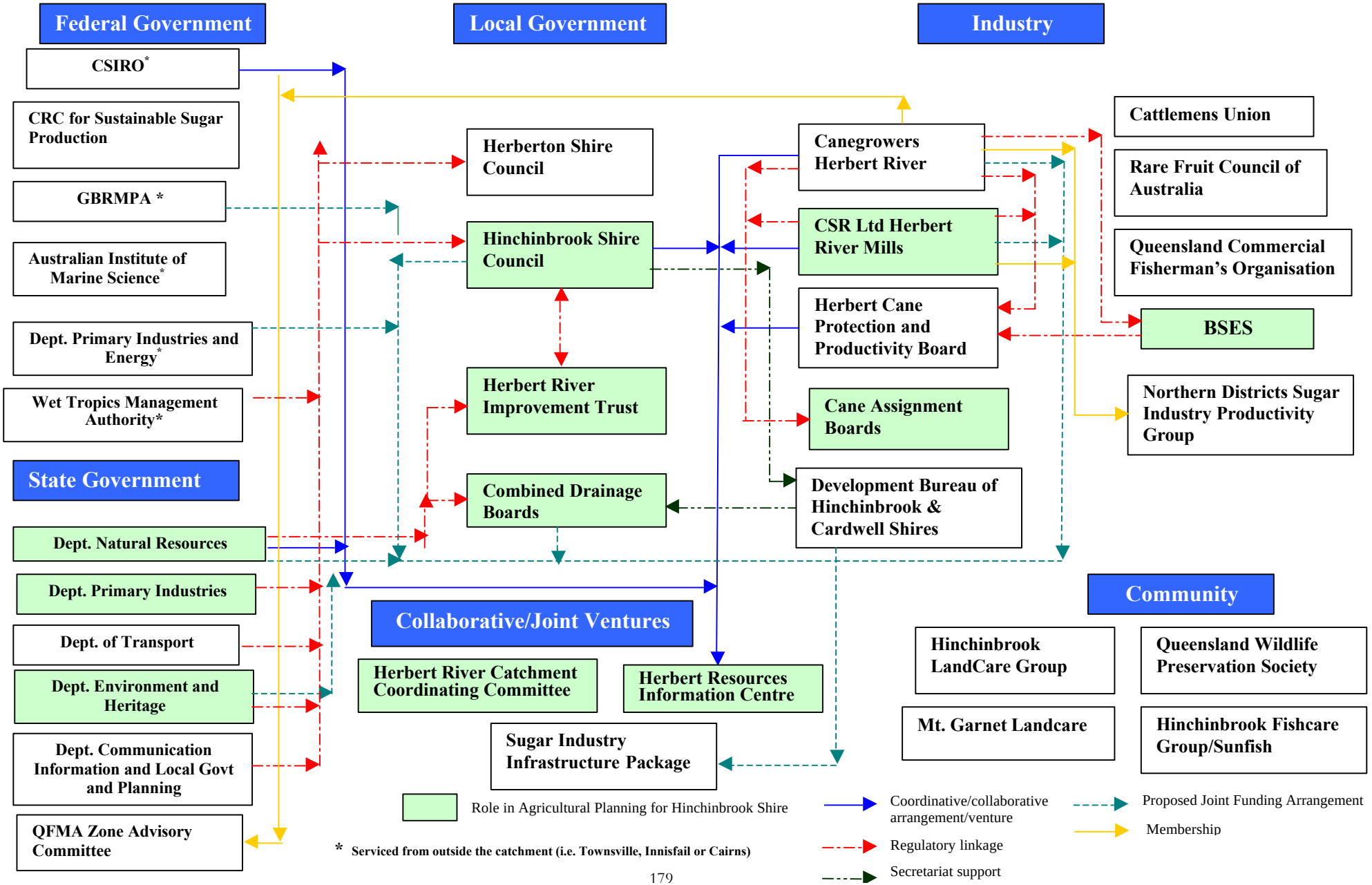


Figure 5. Organisations involved in the new Agricultural Planning Process for the Hinchinbrook Shire in 1999



6. EVOLUTION IN ORGANISATIONAL ROLES AND LINKAGES ON NRM IN THE HERBERT RIVER CATCHMENT

This study shows that there have been significant changes in the system of organisational linkages on natural resource management in the Herbert River catchment since the inception of an ICM process in 1992. Key elements of these changes include:

- *Increased number of linkages:* A demonstrable increase has occurred in the number of linkages (both regulatory and non-regulatory) between (a) local government and related statutory bodies and industry and other community organisations in the Herbert catchment and (b) these Herbert River organisations and state and federal agencies.
- *Increased linkages based on collaboration*: There has been an emergence of a number of significant coordinative, collaborative and/or joint funding initiatives for NRM purposes. The Herbert Mapping Project and the establishment of the HRCCC in 1993 appear to have provided the catalyst for further collaborative ventures on NRM.
- *Local Government developing a significant role in NRM:* A significant increase has occurred in the role and responsibility of local government in catchment management and planning. This has emerged through (a) an influential role based on active membership on the HRCCC and (b) regulatory and statutory processes (including major changes to the Hinchinbrook Shires Planning Scheme and HRIT activities).
- *Emergence of the HRCCC as an coordinative and informative forum for NRM issues*: The ICM process in the Herbert River catchment through the activities of the HRCCC has provided a key integrative forum for facilitating information exchange and more inclusive debate on NRM issues that had not existed before in the catchment.
- *Broadening of the focus of industry organisations to encompass NRM concerns*: several industry organisations (notably the Herbert Cane Protection and Productivity Board and CANEGROWERS) have shifted their focus from a almost exclusive concern with productivity and efficiency issues and impacts to a recognition (at least in principle) of the importance of natural resource management to the long term sustainability of the industry. In the case of the HCPPB a demonstrable change has occurred in its functional role from a prime focus on productivity to also encompass and promote environmental sustainability.
- *Improvement in NRM data capture and delivery mechanisms*: There has been an emergence of collaborative ventures between local government, industry and state and federal government agencies to improve the capture of relevant data on NRM issues (eg. Herbert Mapping Project and a Catchment Atlas) and provide locally accessible mechanisms for integrating data and information delivery or service provision.

In sum, the system of organisational structures and linkages on natural resource management in the Herbert River Catchment has evolved to be more coordinated and more inclusive of key stakeholder groups with the establishment of the HRCCC in 1993. Significantly, the HRCCC is providing a key integrating and informing functional role on NRM within this system.

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Chapter 5

ICM and Sustainable Agriculture: Moving from rhetoric to practice

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Summary: Operationalising the concept of sustainability through community-based approaches to Integrated Resource Management (IRM) poses enormous challenges for both the agricultural communities and government agencies concerned. This paper reviews some of the challenges to change in agriculture and key impediments to the implementation of community-based IRM approaches. A relatively new community-led Integrated Catchment Management (ICM) process in an agricultural community in north Queensland is examined in terms of some of the lessons learned that may be relevant to other similar IRM processes. It reveals a pragmatic, opportunistic and adaptive approach to implementation rather than a process of 'rational' planning. In this case study, the strategy was emergent as the various actors came to know the problem and its context and their capability of dealing with it. We conclude by identifying some essential characteristics of an agricultural context that an IRM process can utilise to assist a community to adapt to and manage change for sustainable agriculture.

1. INTRODUCTION

Agriculture, as both a major "user" of natural resources and a "supplier" of environmental services, is a key sector in the move toward ecologically sustainable development (ESD) (Steenblik *et al.* (1)). In attempting to operationalise the goals of ESD, a number of Australian states have introduced and fostered community-based approaches to integrated resource management (IRM). The impetus for implementation has come from:

- the degradation of land, water and vegetation resources in many rural areas due to a combination of unrealistic expectations and inappropriate management over a long time period (eg., SEAC (2));
- federal government commitment to a range of international and national agreements and strategies on the environment (eg., National Strategy for Ecological Sustainable Development, Intergovernmental Agreement on the Environment; National Strategy for the Conservation of Australia's Biological Diversity);
- the move to greater diversification in the use of, and values placed upon, natural resource systems;
- the fragmentation of decision making and responsibilities for natural resource management across a multiplicity of public and industry agencies (including all three tiers of government);
- trends in state and federal governments toward the devolution of responsibilities for environmental stewardship to the local level (eg., ANAO (3)); and,
- increasing community expectations for greater involvement in decision-making and higher standards of accountability in environmental protection.

Translating the principles of IRM into practice has proved difficult and poses enormous challenges for both agricultural communities and responsible agencies. These challenges are compounded by the current crisis in agriculture as evidenced by deteriorating terms of trade coupled with financial inability to implement sustainable management practices (PMSEC 1995; ANAO 1997). The management of agricultural lands in Australia will continue to be undertaken in an environment of increasing demands for agricultural outputs (IC (5)). However, any intensification or expansion of agriculture is very likely to have environmental implications. At the same time, Australia as an agricultural exporter faces increasingly environmentally conscious international markets.

This paper examines how a community-led Integrated Catchment Management (ICM) process is attempting to facilitate the move towards sustainable agriculture. It reveals a pragmatic, opportunistic and flexible approach to ICM such that the strategy is emergent as the various actors come to know the problem and its context and their capability of dealing with it. We conclude by proposing how ICM or similar approaches may in the future contribute to best practice in agriculture.

2. THE RHETORIC

The well recognised core principles of ESD are to maintain ecological integrity, biological diversity and natural capital. The principles of sustainable agriculture however are much more focussed and narrowly defined. As recommended by the Standing Committee on Agriculture the five principles of sustainable agriculture 'against which policies at all levels of government could be judged' are (SCA (6)):

1. Farm productivity is sustained or enhanced in the long term.
2. Adverse impacts on the natural resource base of agriculture and associated ecosystems are ameliorated, minimised or avoided.
3. Residues resulting from the use of chemicals in agriculture are minimised.
4. The net social benefit derived from agriculture is maximised.
5. Farming systems are sufficiently flexible to manage risks associated with the variables of climate and markets.

Notably, these principles do not make specific reference to the maintenance of biological diversity. With over 80% of Australia's agricultural land in private hands (SEAC (2); ANAO (3)), the protection of biodiversity and the maintenance of ecological integrity and natural capital have to be seen as an integral part of agricultural land management if ESD is to remain a national goal. Agriculture must not be considered in isolation of other resource uses, rather it needs to be considered within a broader regional or catchment context. Recognition of these issues has led to increasing calls for integrated systems approaches to resource management (eg. RAC (7)).

In parallel with the move to ESD, the emerging paradigm of IRM is one which recognises the interdependencies of natural systems, political systems, social systems, and technology. This new paradigm recognises:

- an integrated systems approach;
- a long term perspective and broad spatial scale focus;
- the concept of 'the whole being more than the sum of the parts';
- technical solutions to biophysical complexity;
- the need to deal with both complexity and uncertainty;
- non-linear processes and connectivity between problems;
- people as part of the problem and not external to it;
- the need for coordination of decision-making amongst stakeholders in government, industry and the community; and
- the need for active involvement of the whole community that leads to community ownership of the problem and its solution, and ultimately the adoption of sustainable resource use and management practices.

This new paradigm has emerged from a recognition of the failures of current approaches (RAC (7)), and from insights from domains other than agriculture. These insights are challenging assumptions underlying the more traditional 'rational' approaches to management and provide an emerging learning paradigm based on an adaptive approach to ecosystem management and collaborative decision-making.

A number of Australian states are attempting to implement IRM approaches, such as ICM in Queensland, Total Catchment Management (TCM) in NSW and catchment management in Victoria. Although approaches to implementation and organisational structures for IRM vary significantly across the different states of Australia, the rhetoric underlying these approaches requires the integration process to move beyond a purely coordination function to one that involves roles and responsibilities for both the implementation and the monitoring of integrated planning strategies and decisions on resource management at the catchment level.

3. RESPONDING TO THE RHETORIC

Australian agriculture is taking a number of positive steps towards addressing public and private concerns for the environment. At industry level, it has, for instance, conducted environmental audits of farming activities (eg, cotton, sugar) and developed industry best management practices (eg., sugar, dairy). At a national level, the 1992 Intergovernmental Agreement on the Environment, commits all state and territory governments, the Commonwealth Government and Local Government to the principles of ESD. However land degradation continues to be the major issue for resource use and management in Australia (SEAC (2); IC (5)).

3.1 Challenges to Change in Agriculture

In responding to the rhetoric on sustainability and in attempting to achieve real change, Australian agriculture faces a number of significant challenges. These include:

- inadequate incentives for the adoption of more sustainable agricultural practices resulting in poor linkage of land and water management issues to market signals such that short term incentives for the adoption of more sustainable agricultural practices are lacking (AACM (8); ANAO (3));
- agricultural "technology" is typically single issue or problem oriented and does not necessarily lend itself to a systems focus;
- "selling" the adoption of environmental management practices and "selling" commercial innovations in agriculture are different processes;
- options for achieving change are long term and do not match the typical business and political timeframe of agriculture and government processes;
- the diversity in, and the dominant individualistic approach of, farm enterprises mitigates against the achievement of "integration" (eg. a pastoralist's decision-making is predominantly focussed within farm gates) except where there is a clear off-farm focus around processing infrastructure (such as the sugar industry);
- significant difficulties are associated with balancing public and private costs and benefits of IRM and the associated issue of "who should pay"; (ANAO (3))
- Australia's national origins give rise to a culture that places a high value on the right of individual landowners to determine land use, which creates a major obstacle to internalising the external costs of agriculture (Reeve (9));
- the 'not in my back yard' syndrome in the agricultural community (AACM (8));
- the effects of changes in management on complex natural systems take a long time to appear, and they are frequently hard to directly link to causes; and,
- declining funding and general resourcing with state and federal governments scaling down their support for agriculture, while industry funding is still not recognising its natural resource management obligations.

3.2 Challenges for IRM Implementation

For IRM approaches to move beyond principle and to effect action, they must also overcome significant impediments to implementation. These include:

- the lack of certainty and/or coordination of many government priorities, policy and institutional arrangements relating to natural resource use and management;
- the lack of government support for IRM (for example state government rhetoric is not matched by the resources provided, and Commonwealth funding is allocated to States frequently on a basis unrelated to the programs they are trying to address (AACM (8));
- the lack of tangible incentives for institutional reform or behavioural change that will effect changes that move either organisations or land managers towards sustainable development (AACM (8));

- the absence of institutional and statutory underpinning for IRM approaches in many states to indicate long term government commitment and financing (eg., ICM in Queensland and WA);
- poor recognition of local government as an integral part of catchment management in state and federal policies (AACM (8));
- the current limited capacity (ie., human, financial, and knowledge-base) at the local level to address natural resource management problems and implement action;
- the lack of appropriate cost-sharing mechanisms to accompany the transfer of resource management responsibilities to regional and community groups (ANAO (3)); and,
- significant disparities in wealth and power at the local level that makes it difficult to put IRM into effect in a more inclusive way.

In addition to these impediments, attempts to address sustainability within existing community and institutional frameworks have met with mixed success due to their inability to account for, amongst other things, multiple objectives, multiple players, poorly defined objectives, unclear outcomes and multiple pathways (eg., Syme *et al* (10)). Much of the literature on ICM has focussed on its conceptualisation and alternative organisational structures, but it lacks practical guiding principles for effective implementation of an integrated systems-based approach. Many IRM approaches have tended to be *ad hoc* responses to urgent and emerging problems rather than being focussed on achieving strategic change. In other words, operationalising the concept of sustainability remains a significant challenge given that in many ways IRM does not fit the traditional 'rational' planning approach to decision making.

4. THE REALITY: A COMMUNITY RESPONSE IN THE WET TROPICS

The Queensland initiative on ICM which commenced in 1991 is a policy or planning process that has no legislative basis but is implemented through administrative and financial arrangements by the state government. As such, its success will ultimately reflect the ability of relevant public and private interests to voluntarily effect required action.

In the following sections we examine how an agricultural community in north Queensland has attempted to bridge the gap between rhetoric and practice within an ICM context and in so doing comment on how this experience may lead to best practice in the future. The discussion draws on research findings from a LWRRDC-funded project to evaluate the implementation of an ICM process in the Herbert River catchment of north Queensland.

4.1 The Context: ICM in the Herbert River Catchment, Queensland

The Herbert River catchment has an area of nearly 10,000 km^2 and is located on the southern end of the wet tropical coast of north Queensland. It drains directly into the Hinchinbrook Channel, part of the Great Barrier Reef Marine Park. Agriculture is the dominant land use in the catchment consisting of mainly beef production on native pastures in the upper catchment and intensive sugarcane production on the lower coastal plain. Other significant land uses are forestry, conservation areas (ie. significant parts are within the Wet Tropics World Heritage Area), and smaller areas for horticulture and fodder cropping. There are no 'critical' issues in the catchment of the magnitude of for example salinity, rather the key natural resource management issues prior to the ICM initiative related to:

(a) concerns for the potential impact of agriculture on the Great Barrier Reef and nearshore environments (eg., mangroves and seagrass beds in the Hinchinbrook Channel) and the potential implications for conservation, tourism and commercial fishing; and

(b) community conflicts relating to flooding and drainage issues, as well as future land development for sugarcane and its potential impact on production particularly in the lower Herbert catchment.

The sugar industry dominates the lower Herbert both socially and economically, with the two processing mills being owned and operated by CSR Ltd. The contrasts in the physical and socio-economic contexts of the upper and lower parts of the catchment are very strong, with little interaction between authorities or community members. Landcare has been active in the upper catchment pastoral areas for some time but has not succeeded in obtaining a foothold within the lower catchment. The sugar industry in general, however, has been a dominant player in ICM in the lower Herbert since its inception.

ICM in the Herbert River catchment is a voluntary process initiated by key actors in the local community. Commencing in 1993 with the formation of the Herbert River Catchment Coordinating Committee (HRCCC), it is a relatively new process which is still in its formative stages. The impetus for ICM in the Herbert catchment was twofold: (a) broad community-based concern over the ineffectiveness of the fragmentation of government decision-making on river management issues and the perceived need for better community participation, and (b) the personal and political agendas of influential stakeholders in the lower Herbert catchment, who to a large extent were motivated by a desire for 'a piece of the action' (ie. ICM in Queensland), including potential funding opportunities for 'pet projects'.

Current representation on the HRCCC includes industry (sugar, cattle, fishing, horticulture), local government and other statutory bodies, conservation and community interests. Most of the 15 members have multiple allegiances and/or responsibilities. The HRCCC has no state government departmental representation, however the Catchment Coordinator (CC) is an NLP-funded position based in the Department of Natural Resources (the lead government agency for ICM in Queensland).

The HRCCC have identified a challenging set of objectives as detailed in its Draft Catchment Strategy (HRCCC (11)) recently released for community comment, namely:

- coordinate government agencies and the community to pursue common goals;
- seek community involvement in catchment management;
- identify and rectify natural resource degradation;
- promote ways to prevent and reduce natural resource degradation;
- promote the wise use of all natural resources within the Catchment;
- identify key indicators of biodiversity and monitor as a measure of catchment health; and
- encourage the retention of significant natural habitats within the Catchment.

4.2 The Process To-date: An emergent strategic approach

Initially, ICM in the Herbert was hampered by diverse HRCCC member perspectives on ICM and a lack of a common understanding of what the HRCCC might realistically be able to achieve. There was also a lack of shared understanding of natural resource management issues in the Herbert and their relative importance. As previously noted, personal objectives and 'pet projects' frequently clouded the agenda. The process was also inhibited by an initial lack of clear direction and strong leadership within the HRCCC, including a one-year delay in the appointment of a full time CC until April 1994. The CC adopted an initial aggressively proactive role within the HRCCC in setting the agenda to gain personal credibility with the 'established' Herbert community leaders of the HRCCC. Over time the CC has moved to play a more facilitatory role within the HRCCC, particularly with the appointment in 1996 of a new Chairman who has taken a more proactive approach in setting and negotiating the role and

agenda for ICM in the Herbert. Hence the HRCCC has undergone what might be called a process of 'evolving reality' largely in response to the novel situation members found themselves in.

In addressing this situation, the HRCCC adopted a pragmatic and opportunistic approach to ICM implementation. This approach has focussed in the first instance on building a credible and influential relationship with the Herbert community. This is demonstrated in a number of ways:

(i) The composition of the HRCCC membership recognises the *influential groups, power structures, and local interest groups* in the Herbert community, including recognising the situation that community actors (both individuals and agencies) generally have multiple allegiances and/or responsibilities. Although the ICM initiative originated in the lower catchment, the HRCCC from the start actively sought the involvement of representatives from the upper catchment. In respect of the latter, the HRCCC negotiated funding for on-ground works to address issues relating to derelict mining dams which were a potentially divisive issue between the upper and lower catchment communities (ie., poor domestic water quality and reduced river capacity due to increased sedimentation in the lower catchment).

(ii) To *raise awareness of ICM within the Herbert community and get 'runs on the board'*, the HRCCC has undertaken and supported a number of *ad hoc* but focussed land management activities including: (a) raising the profile and even 'creating' resource management issues in the catchment, eg. the HRCCC fostered the construction of over 50 owl boxes on farms for rat management and promoted them as a key element of integrated pest management for improved sugarcane production and nature conservation; (b) supporting on-farm tree planting of commercial hardwoods and rainforest species on odd-shaped or difficult caneland blocks; (c) undertaking with canegrowers the removal of para grass blocking drainage lines and replanting with riparian vegetation; (d) developing artificial wetlands both on-farm (with canefarmers) and on public lands (eg. jointly with the CSR mill and Hinchinbrook Shire Council to establish a wetland using sugar mill waste).

(iii) The HRCCC initially focussed its on-ground action on *symptoms of natural resource problems rather than causes* such as the revegetation of riparian lands rather than tackling the more contentious issue of management of remnant vegetation on private lands. For example, during a highly politicised controversy about the clearing of Mahogany Glider habitat, given the highly emotive nature of the issue within the local community and state government politicisation of the issue, the HRCCC chose not to fully engage in the community conflict. It was perceived to be beyond their control and there was significant internal conflict within the HRCCC membership. It opted in the first instance to lobby state government for a technical expert to be based in Ingham to provide appropriate expert advice and improve the communities capacity to deal with these issues in the future before they reach a crisis situation. Secondly it negotiated with landholders a flexible system of riparian zone width assessment.

(iv) More recently the HRCCC has adopted *a lead role as broker for external funding of community projects* that would initiate a move toward addressing the fundamental causes of natural resource management problems in the longer term. For example, the HRCCC undertook a process to develop a catchment management strategy predominantly to ensure eligibility for the catchment community for state and commonwealth project funding. The HRCCC also acted as the broker and coordinator for all new proposals submitted for National Heritage Trust funding from the catchment providing the catalyst for community activity in Commonwealth and state-funded initiatives.

(v) The HRCCC commencing to be *an information provider and distributor* within the Herbert catchment with some mixed success in terms of outcomes. For example, in attempting to improve and integrate the available knowledge-base in the catchment on ICM related issues and to improve the communities' capacity to deal more proactively with natural resource management issues, the HRCCC has initiated or contributed jointly with other local

government and industry organisations to a number of activities, such as: the preparation of a Herbert Catchment Atlas for use in schools and the general community; publicised the issue of the risk of acid sulphate soils including distributing available pamphlets in the community; initiated and conducting a Wetlands Forum in the catchment with key invited speakers from government, the research community and industry; and formally linking into the Herbert Resource Information Centre (HRIC) which is providing a community-based and sponsored resource to coordinate spatial/non-spatial, technical and socio-economic information on the catchment to underpin local decision-making.

The HRCCC's perception of its role appears to have evolved over time from one of delivering natural resource outcomes and solving natural resource management issues on the ground to a more strategic role (McDonald and Bellamy (12)). This emerging role involves establishing a decision-making culture relating to natural resource use and agricultural development based on ICM principles as 'a way of doing business', and providing a strategic direction on resource management for the catchment.

The HRCCC's response to the difficult task of moving the Herbert community toward more sustainable agriculture and development in general has been one of adopting: (a) an initial approach of predominantly *ad hoc* responses to opportunities or urgent issues that arose in the catchment which involved engagement in on-ground works; and (b) a concurrent emergent role that is more coordinative and strategic in focus, in particular one of raising and progressing issues rather than developing prescriptive solutions. Notably, the Herbert community is moving its prime focus from a concern with disaster management (ie. issues of river management including flood mitigation and drainage) to one that embraces the broader concept of natural resource management (McDonald and Bellamy (12)). This has been achieved largely through raising the HRCCC's profile amongst established and influential catchment actors, such that it is now becoming a central player in decision-making on natural resource management issues in the Herbert community.

To date the key achievements of ICM in the Herbert may be summarised as (McDonald and Bellamy (12)):

(i) Initiating a range of focussed or single issue land management projects to get runs-on the board and raise awareness of ICM with the Herbert community (rather than focussing on issues of strategic importance to catchment management).
(ii) Recognition as a key community referral agency for the state and local government authorities on proposed projects and other natural resource issues and projects in the catchment.
(iii) Development of a draft Herbert River Catchment Management Plan for public review and comment that provides the essential elements of a 'sustainable' vision for the catchment.
(iv) Establishing a role as principal broker for negotiating funding for others to undertake natural resource management projects and activities in the catchment.
(v) Serving as an effective community forum for discussing, 'airing' and progressing catchment issues, including revealing the range of different stakeholder perspectives on these issues as well as highlighting potential areas of community conflict.

The strategy for ICM implementation that has emerged in the Herbert ICM's first 4 years meets many of the elements of what Mintzberg (13) refers to as a visionary approach to deal with an uncertain world in a flexible way, to set the broad outlines of a strategy, and to provide the basis for adaptive learning. In essence, the strategy for ICM implementation has evolved through pragmatism, opportunism and adaptiveness on the part of the HRCCC.

4.2 The Response: 'The art of muddling through'

The Herbert ICM process has many common elements with Lindblom's (14) concepts of learning in complex policy contexts. It has not been a controlled process of rational planning but a messy one of trying to cope with a complex and dynamic world and much uncertainty regarding the problem at hand and the means of dealing with it and the goals to be aiming for. It has been essentially a process of learning over time with the various actors working it out by mutual adjustment, that is a process in which learning informs planning and strategies emerge as the key actors come to understand the problem and its context and their capability of dealing with it (Mintzberg (13)). The Herbert process being much more one that can be described as 'the art of muddling though ' than a 'science'. Reflecting on this experience, an IRM process may contribute to a move towards sustainable agriculture by:

- *Fostering communication* across sectoral and community interests facilitated through the establishment of an effective community based forum that reveals the diversity of perspectives and the importance attributed to specific catchment issues.
- *Providing a framework/structure that fosters cooperation* amongst community and industry groups and government organisations that leads to more equitable decision making and more sustainable natural resource outcomes on the ground.
- *Facilitating coordination* of effort across government, industry and community organisations to achieve outcomes that have benefits to a broad range of catchment stakeholders as well as the environment, and which could not be achieved by any one group alone.
- *Integrating* IRM principles into Local Government planning that provides a basis for implementing a strategic direction for the catchment.
- An IRM implementation process that supports an *emergent strategic approach* of adaptive learning involving key and influential community actors and moves the community towards a sustainable process of integrated planning of natural resource use.

There are still very significant challenges for ICM in the Herbert. In particular it has a long way to go to achieve tangible outcomes in respect of the key natural resource management issues. However, significant progress is being made in a long term process. The Herbert catchment is not unique, and its experiences in implementing ICM are relevant to other similar community-led IRM approaches; in particular, those catchments where there is not one critical issue of the magnitude of salinity, but rather a diversity of significant land and water management and biodiversity protection issues relating to sustainable agricultural development.

5. MOVING FROM RHETORIC TO PRACTICE: TOWARDS BEST PRACTICE

What is unsustainable in agriculture is a lot easier to establish than what is sustainable. The challenge therefore for IRM and sustainable agriculture is to deal with a situation in which the goal posts are shifting, and the goals are unclear, multiple and contested. This paper has identified a number of challenges to change in agriculture. However, significant opportunities exist for IRM to contribute to sustainable agriculture arising from a number of attributes of an agricultural context. These include:

- the strong culture of mutual support and information exchange in agricultural systems;
- locally-based industry regulations (eg. sugar assignment system) and industry codes of practice (eg. land clearing in grazing areas) which could be supported by incentive systems.
- the current move to operationalise the principles of ICM in local government planning schemes (McDonald and Bellamy (12));
- extension and other industry networks and new opportunities in information technology that can improve the capacity of communities to address resource management issues (including access to technical knowledge, people and group management skills, policy understanding);

- the traditional agricultural business concept of managing an asset that can be developed to establish strong market linkages for land and water resources management with enterprise outcomes.

The challenge for IRM is to utilise these opportunities to assist agricultural communities to adapt to and manage change and move towards sustainable agriculture.

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Chapter 6

Breaking down the fences: Engaging stakeholders in integrated catchment management

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ABSTRACT: Management for ecological sustainability cannot be achieved alone by fencing off protected areas within an overall managed landscape (eg. in parks, enclosures). It requires an approach that also addresses the issues associated with transaction costs and the uncertainty and interconnectedness of the behaviour of natural and human systems in a managed landscape. In response to these issues, all Australian governments have endorsed community-based integrated approaches to resource management. These approaches are based on a collaborative partnership between government and the community and as such involve multiple stakeholders with multiple and often conflicting objectives.

This paper examines an integrated approach to catchment management and the challenges of effectively engaging multiple stakeholders. It describes the issues experienced by an Integrated Catchment Management (ICM) organisation in Northern Queensland and the strategy adopted by that organisation to foster stakeholder involvement in ecological sustainable development (ESD). An examination of a number of activities undertaken by the organisation demonstrates how catchment resource use issues are being addressed and the means of engaging stakeholders in ecologically sustainable resource management. In conclusion, we consider, the distribution of outcomes of ICM and their implications for offering incentives for catchment stakeholders to engage in management and planning practices that will potentially impact on the ecological sustainability of the catchment system as a whole.

INTRODUCTION

An emerging paradigm for natural resource management is based on the two core concepts of ecosystem management and an integrated and adaptive approach to planning and management (Holling 1995, Wallace *et al.* 1996, Gardner and Stern 1997, Bellamy *et al.* 1999). These concepts have significant implications for the practice of conservation and the management of natural resources for ecological sustainability. The new paradigm implies a move away from a single-species, single-unit or single-use management focus toward a systems approach designed to ensure the long-term health of ecosystems and the preservation of biodiversity that extends across traditional management boundaries. The implications are also that ecological sustainability cannot be achieved alone by fencing off protected areas (eg. in parks, enclosures) within an overall managed landscape. The conservation of biodiversity and sustainable use of natural resources needs to be an integral part of an overall strategy for natural resource management that encompasses all elements of the landscape or regional ecosystem and its interaction with human management and use.

Under the new paradigm, sustainable use and management of ecosystems and other elements of biological diversity requires cooperative processes in planning and on-ground implementation of management strategies. These cooperative processes are expected to be inclusive of all managers responsible for the management of the multitude of inter-linked units of the landscape. Managers include not only individual landholders or resource users within a catchment or a regional ecosystem, but also organisations in all spheres of government, industry and the community with some role and responsibility or interest in the use, management and conservation of the natural resource. In response to the needs of the emerging paradigm, all state governments in Australia have endorsed integrated approaches to the planning and management of natural resources based on collaborative partnerships between government, industry and the community (Syme *et al.* 1994, Bellamy and Johnson 1999). Although implementation contexts and policy mechanisms may vary greatly, all of these approaches involve multiple stakeholders and are inherently characterised by multiple and often conflicting objectives and values. As such they invariably require negotiation and bargaining processes as stakeholders attempt to address conflicts from a broader systems perspective extending across traditional decision-making boundaries.

This paper examines an integrated approach to catchment management and the challenges of effectively engaging multiple stakeholders. It describes the issues experienced by an Integrated Catchment Management (ICM) organisation in Northern Queensland and the strategies being

used by that organisation to foster stakeholder involvement in Ecological Sustainable Development (ESD). An examination of a number of activities undertaken by the organisation demonstrates the challenges of addressing resource use issues at a catchment scale and engaging stakeholders in the process.

ECOLOGICAL SUSTAINABLE DEVELOPMENT AND MANAGED SYSTEMS

The three fundamental underlying assumptions of ESD are environmental sustainability, social well-being and economic development. In the first place, ESD places a burden of responsibility on all decision-makers including national, state and local governments, local communities, industry and individuals to take a long term perspective and commitment to achieving ecological sustainability. Secondly, it requires that social, economic and environmental issues are considered as essential components of natural resource management and planning. To this end, collaborative approaches based on systems thinking and systemic behaviour are increasingly being advocated to change the culture of decision-making of individuals, organisations and communities (Ison *et al.* 1997, Chambers 1997, Bellamy *et al.* 1999). The core principles of this systems approach are:

(i) the long-term sustainable use and management of natural resources;
(ii) the application of technically-sound environmental, economic and social assessment methods and understanding;
(iii) the coordination of government, industry and community policies and decision-making processes; and
(iv) the reconciliation of conflicting values, interests and expectations of stakeholders involved in the use and management of resources through more transparent structures of negotiation and bargaining.

The central challenges of a systems-based approach therefore include firstly addressing the issues associated with the heterogeneity, uncertainty, nested nature and interconnectedness of the behaviour of natural and human systems, and secondly ensuring that the distribution of the costs and benefits of resource management are appropriate.

Operationalising ESD

In the past, natural resource management and planning has invariably relied on top-down centralised governance. This has been typically expert-driven, single-agency initiated and enforced, frequently regulatory-based, and technocratic in practice (Wallace *et al.* 1996, Bellamy and Johnson 1999, Dale and Bellamy 1998). The organisational structure of federal and state government agencies typically involves centralised decision-making in which legislation and regulatory arrangements are passed by the respective governments with the objective of regulating and managing the use of natural resources at the management unit level, such as a farm, reserve, local government area, catchment or region. Examples of these approaches include conservation within protected areas (eg. parks and reserves), emission permits, water entitlements, land clearing permits, and tax/subsidy measures designed to equate social and private costs and benefits of resource use.

Approaches to natural resource policy based on centralised governance however have not generally lead to changes in the behaviour of individuals and communities toward more sustainable resource use and development (Vanclay and Lawrence 1995, IC 1997, Dale and Bellamy 1998). A review of the literature identifies a number of failures of centralised governance responses including:

(i) simplistic solutions and linear cause-and-effect assumptions that fail to deal with the uncertainty, complexity, and multi-dimensionality of the problems being addressed (Funtowicz and Ravetz 1990, RAC 1993, Dovers 1996);
(ii) the failure to recognise ESD as a continuous evolving process rather than a particular system state for which to aim (Bellamy *et al.* 1999);
(iii) the failure to address the distribution of costs and benefits of policy impacts (ANAO 1997, MDBC 1996);
(iv) flawed policy responses that de-emphasise the consideration of affected interests in favour of "objective" analyses and suffer from a lack of popular acceptance (Renn *et al.* 1995);
(v) an almost exclusive reliance on systematic observations and general theories that tends to ignore the local and anecdotal knowledge of the people most familiar with the problem and risk producing outcomes that are socially and economically unworkable (Renn *et al.* 1995);
(vi) uncoordinated, comparmentalised or sectorally-based implementation of policy, programs and planning initiatives (Bellamy and Johnson 1999);
(vii) the lack of appropriate institutional arrangements to facilitate participation that is inclusive of all interests in the community (Lang 1990);
(viii) the weaknesses of the strategies adopted to resolve conflict (Dorcey 1991); and
(ix) the failure to move beyond the development of management plans to on-ground implementation (Dale and Bellamy 1998).

In Australia "the incorporation of ecological sustainablility into policy has been ad hoc, incomplete and tentative" with continuing land degradation the major barrier to sustainable resource use and development (IC 1997, p.48). Despite favourable attitudes and known solutions, appropriate practices in many cases are not being adopted at the farm or management unit level (Vanclay and Lawrence 1995, ANAO 1997, IC 1997). This apparent contradiction has been attributed to a wide variety of social, economic, cultural, perceptual and situational reasons. Curtis and Lockwood (1998) contend that "most natural resource degradation results from the activities of people and improvement will only happen when people alter their behaviour" and that this requires "understanding of the organisation, beliefs and aspirations of people" (p.2).

To-date the achievement of a balance between environmental sustainability and social and economic objectives have been one of the major challenges to operationalising ESD. In practice, the social objectives have been frequently sidelined. In response, stakeholder-based approaches are emerging as a new approach to decision-making based on an adaptive approach to ecosystem management, social learning processes and collaborative decision-making (Wallace *et al.* 1996, Chambers 1997, Ison *et al.* 1997, Bellamy *et al.* 1999). Local groups in the community that have an identifiable 'stake' in the future of the community are linking together to create a vision for the future which has a set of goals and measurable criteria or indicators. This approach has the potential to engage stakeholders in ESD and enable the community to move forward together so that decisions are based on a shared set of values.

Issues in Engaging Stakeholders in ESD

As Renn *et al.* (1995) point out, " There is no such thing as a single 'public interest'. Rather, society consists of individuals with unique sets of interests, some of which are identical to those of others, and collectivities of people which form shared interests" (p.2). A stakeholder is "anyone who has an interest in or is affected by an issue, activity or transaction and therefore has a natural right to participate in decisions relating to it" (FAO and UNEP 1997, p.25). Stakeholders include not only those people having or needing access to, or use, or control of a

resource, but importantly also those who are affected by the use of a resource by others, and those who wish to influence the decisions of others with regard to the use of a resource for scientific, ethical or other reasons. Stakeholders include both present as well as future generations.

Approaches that are inclusive of all stakeholders however are proving challenging to put into practice both in Australia (Syme *et al.* 1994, Bellamy *et al.* 1999) and internationally (Dorcey 1991, Gunderson *et al.* 1995, Gardner and Stern 1996). In this section of the paper we discuss four key issues that constitute fundamental challenges to the implementation of stakeholder-based approaches:

- *participation*, that is dealing with the vast heterogeneity of interests and social values of the multiple stakeholders concerned.
- *coordination,* that is coping with the fragmentation of roles and responsibilities for natural resource management across multiple organisations within and between all three spheres of government (federal, state and local), industry and the community.
- *reducing uncertainty,* that is dealing with the uncertainty and ignorance which is an inherent characteristic of the interaction of human and natural systems (Funtowicz and Ravetz 1990).
- *cost-sharing,* that is addressing the distribution of public and private costs and benefits and their social impact.

Participation

The shift in focus of theories of social organisations from the individual to the community and the increasing emphasis on partnerships between the government and community in natural resource management and planning imply increased empowerment of local communities (Orstom 1990, Gardner and Stern 1997, Chambers 1997). Participatory approaches that foster purposeful and meaningful stakeholder involvement are perceived as potential or partial solutions to empowering communities to engage in ESD (Hollick 1993, Renn *et al.* 1995). As Gardner and Stern (1997) observe:

> *The needs to understand the actor's perspective, attract people's attention and gain their commitment, monitor and adjust programs, and design interventions that are within people's limits of tolerance all point to participatory processes as a solution* (p.169).

Participation is concerned with interaction among individuals, interest groups and institutions. Central to the philosophy of participation is a focus on both shared values and interests and learning processes:

> *By participating with others in democratic decision-making, people learn they have things in common. By bonding together, they can achieve goals and meet their needs. They also discover that other groups and individuals have interests and values in direct contradiction to their own. Resolving the conflict is not always the main purpose of participation, but acknowledging it is important.* (Renn *et al.* 1995, p. 8).

Participatory processes designed to engage a broad spectrum of stakeholders with often conflicting objectives are perceived to have a number of significant benefits (Syme and Sadler 1994, Hanna *et al.* 1995, Moote and McClaren 1997, Gardner and Stern 1997, Chambers 1997) including:

- prevention or amelioration of conflict;
- promotion of perceptions of fairness that lead to the design of policy or programs that lead to a more appropriate distribution of the costs and benefits of resource management in practice;
- attracting stakeholder attention to issues and setting more realistic expectations of the outcomes of a policy initiative or planning process;
- gaining commitment of multiple actors and the development of trust in the planning process or policy initiative;

- enhancing understanding of a policy initiative or planning process and a broader view of the key issues;
- enhancement of stakeholder information exchange and learning;
- improving stakeholder acceptance or ownership of the results or outcomes;
- generating feelings of personal satisfaction and control;
- designing interventions that are within people's limits of tolerance;
- supporting continuous stakeholder involvement and providing effective feedback mechanisms; and
- reducing the costs of information gathering, coordination, monitoring and achieving compliance.

Although a philosophy of participation has become widely accepted, there are considerable challenges in its implementation. Martin and Sherington (1997) caution that there is a significant gap between the rhetoric and reality in participatory approaches:

> *Participation has become institutionalised into a requirement in project design, rather than an indication of the more radical reversal of approach and attitude advocated in the participatory research. ….. Implementation of the empowerment agenda has been limited.* (Martin and Sherington 1997, p. 197).

Despite these challenges, we contend that participatory decision-making has the potential to provide a viable alternative to centralised, top down approaches to natural resource management. The principal intent of participatory decision-making in natural resource management through partnerships between government and community is to help organise an effective interaction program or process to achieve ESD goals. Perceived influence in decision-making is a fundamental element affecting such partnerships (Syme *et al.* 1997). Moreover, meaningful influence over the direction of a planning process or policy is a core principle of participatory approaches (Gardner and Stern 1997).

Coordination

Closely linked to the concept of participation in natural resource management and planning processes is a philosophy of coordinated government processes conducted in partnership with the community (Lang 1990, RAC 1993, Holling 1995, Gardner and Stern 1997, Dale and Bellamy 1998). Hall *et al.* (1977) define coordination as "the extent to which organisations attempt to ensure that their activities take into account those of other organisations" (p.457).

The degree to which there is communication and coordination between government and other relevant organisations is one of the fundamental factors underlying the effectiveness of partnerships in planning (Syme *et al.* 1997). Coordination in this sense is a way of trying to avoid overlaps in responsibility and conflicting messages from different organisations. Moreover, coordination may lead to significant reductions in transaction costs relating to data collection, analysis, design and implementation of regulations, communication, and conflict resolution (Hanna *et al.* 1995). In particular, Marshall *et al.* (1997) regard the reduction in transaction costs associated with negotiation over the use or management of resources over which there are no clear property rights as a major economic benefit from the process. Transaction cost savings are identified as being associated not only with bargaining for property rights over resources but with the flow of information and with the enforcement of solutions to resource degradation problems.

In light of the integrative nature of the new paradigm of natural resource management, coordination of policy and planning processes is therefore a fundamental challenge of stakeholder-based approaches to ESD.

Managing Uncertainty

Most resource management and planning contexts are faced with incomplete knowledge that leads to uncertainty or ignorance (Funtowicz and Ravetz 1990, Dovers 1996). Dealing with uncertainty and ignorance is a central challenge of ESD. As Funtowicz and Ravetz (1990) state, the challenge is that facts are uncertain, values in dispute, stakes high and decisions urgently needed. Also, there is considerable uncertainty about others' actions or behaviours.

There are many different forms of 'ignorance', which have different implications for resource management policy and planning (Dovers 1996). Dovers (1996) observes that neither type nor level of ignorance will be uniform across individuals, stakeholder groups, communities or organisations, "either in the sense of differing levels of access to, or possession of knowledge, or in the sense of varying perspectives, values or preferences" (p.17). Ignorance may be realised, unrealised, socially constructed or technically based. Effective management of ignorance and uncertainty across and within stakeholder groups in terms of type, level, equity of access and use, and their variation over time are fundamental challenges of the meaningful and equitable engagement of stakeholders in natural resource management and planning processes.

Cost-sharing

There is growing expectation in government and the community that stakeholders with common interests will share responsibility for sustainable natural resource management and planning for the long-term health of our natural resource base (ANAO 1997, IC 1996, 1997, MDBC 1996). Communities and governments are making long term investments in natural resource management infrastructure and other on-ground works. There is considerable social conflict however relating to the fairness of cost-sharing arrangements, that is, whether paying for sustainable natural resource management is a private, public or shared responsibility among resource users, the community and the three spheres of government.

An acceptable cost-sharing mechanism may improve the basis for negotiation for resource use planning and management by providing a principled and objective approach to determining the public and private benefits of on-ground works, such as revegetation, the fencing off of sensitive areas and water supply (MDBC 1996). To this end, cost shares represent the true split of benefits between individual landholders and the public (MDBC 1996, p.13). Benefits may relate to increased production, social and environmental benefits, and other goods and services produced by the works, while costs may relate to implementing and maintaining the works, production foregone, and monitoring the results of the works (MDBC 1996, p.5). Types and levels of benefits and costs, particularly environmental and social, will vary spatially across the landscape and over time, which introduces significant challenges to the achievement of the social justice aspects of ESD.

It is argued that communities and resource users will only accept cost-sharing arrangements and on-ground works after trusting partnerships have been developed, and after satisfactory levels of education and demonstration have been achieved (MDBC 1996, p.14). Stakeholder perceptions of levels of public and private benefits derived from policy implementation (eg. involving on-ground works) and the fairness of necessary cost-sharing arrangements will have an important influence on negotiation in natural resource management and planning.

A way forward?

Stakeholder-based approaches to sustainable resource use and management are still experimental, and much is to be learned from systematic study of such programs and their interactions with people, groups and organisations. The significant challenges posed by participation, coordination, uncertainty and transaction costs associated with the management of natural resource problems have influenced the effectiveness of these approaches. The next section of this paper examines

these issues in the context of a community-led stakeholder-based approach to integrated catchment management.

BREAKING DOWN THE FENCES: A COMMUNITY-BASED APPROACH

Integrated Catchment Management in Queensland

As one of the key platforms for operationalising the concepts of ESD, the Queensland Government established a stakeholder-based approach to natural resource planning and management through an Integrated Catchment Management (ICM) policy initiative. The overall purpose of ICM in Queensland is "to integrate the management of land, water and related biological resources to achieve their sustainable and balanced use" (DPI 1991). The ICM program is intended to promote and facilitate community involvement in the development and implementation of a coordinated approach between resource users, community groups and government agencies to the planning and management of natural resources.

The implementation of ICM in Queensland is based on the establishment of Catchment Coordinating Committees (CCCs) which provide a forum for discussion between various stakeholder interests in the catchment. CCCs work with and through existing organisations and agencies and as such do not have specific legislative support. The principal intent of the ICM approach as implemented by the Queensland Government may be summarised as (DPI 1991, Rowland and Begbie 1997):

- *Voluntary*: participation in ICM is voluntary for both community and government.
- *Community-based*: all structures have a majority of community members with formation of catchment coordinating committees (CCCs) being dependent on interest from the community and other sectors.
- *Partnership*: ICM is based on a partnership between the levels of government, industry and the community with all sectors and key stakeholders involved. As the CCCs do not have any legislative framework or statutory base, implementation of ICM strategies relies on negotiated and voluntary action by responsible agencies and individuals.
- *Participative*: all processes used in coordinating and integrating management of the catchment should be participative and consultative.
- *Strategic*: ICM is intended to be a strategic and long-term planned approach to achieving action in addressing priority natural resource management issues in the catchment that cross organisational boundaries.

To-date ICM programs have been implemented in 34 rural catchments in Queensland covering nearly 80% of the area of the state. The impact of land use on water quality, soil erosion and sedimentation of watercourses, salinity induced through clearing of vegetation, loss of habitat on land in rivers and streams, the impact of land and water use on freshwater and marine ecosystems, the spread of weeds by water and competition for land and water resources have been identified as important issues requiring a new catchment approach. These issues involve not only interaction between many components of a river catchment, but also many individuals and organisations, including landholders and other resource users, government agencies, local authorities, conservation groups and rural industry groups, each with a responsibility for different parts of a catchment or specific activities within it. Importantly, they require decision-making that extends across traditional property and other administrative unit management boundaries.

In the following sections, we draw on findings from a 5-year longitudinal study undertaken to monitor and evaluate the implementation of the ICM process in the Herbert River catchment of wet tropical north Queensland (Bellamy and Johnson 1999, Bellamy *et al.* 1999) to shed some light on some of the issues relating to stakeholder engagement in this community-based approach

to ESD. A brief overview of the Herbert River catchment and initial progress in the ICM process are provided in a companion paper in this volume by Johnson and Bellamy (1999).

Herbert River ICM Process

Background
ICM in the Herbert River catchment is a community-led and voluntary process in a formative stage initiated by key interests in the catchment. The impetus for the establishment of the Herbert River Catchment Coordinating Committee (HRCCC) in 1993 related to two key factors. Firstly, broad community-based concern over the ineffectiveness of fragmented government decision-making on river management issues, and the failure of past studies to move beyond the development of plans and lead to action on the ground to resolve these issues. Secondly, the perceived need within the catchment for more active and meaningful community involvement in decision-making on these issues, that is beyond a basic consultative approach.

The objectives of the ICM process in the Herbert Catchment have evolved since its inception to encompass a broader and more 'holistic' set of objectives as identified by the HRCCC in its draft Catchment Management Strategy (HRCCC 1996, p.i):

- Co-ordinate government agencies and the community to pursue common goals
- Seek community involvement in catchment management
- Reflect the requirements of the wider community within the Catchment
- Identify and rectify natural resource degradation
- Promote ways to prevent and reduce natural resource degradation
- Promote the wise use of all natural resources within the Catchment
- Identify key indicators of biodiversity and monitor as a measure of catchment health
- Encourage the retention of significant natural habitats within the Catchment.

Although these broad objectives are couched in terms that suggest an overall policy framework for the catchment, ICM has no legislative jurisdiction in Queensland. Success therefore will depend to a considerable extent on the degree to which the Herbert ICM process can engage public and private interests in a substantive way to voluntarily effect required action.

Engaging stakeholders in ICM in the Herbert River Catchment
The approach to the implementation of ICM in the Herbert River catchment in its early stages has been pragmatic and opportunistic motivated initially by a perceived need to raise the awareness of the organisation and natural resource management issues in the catchment and to "get runs on the board" (Bellamy and Johnson 1999). As such the Herbert River ICM process provides an opportunity to examine some of the broader issues relating to the engagement of stakeholders in ESD identified earlier in this paper.

The Herbert River Catchment Coordinating Committee
As previously noted the principal intent of a stakeholder-based approach to natural resource management like ICM in the Herbert Catchment is to help organise an effective stakeholder interaction program or process to achieve ESD goals. This requires broad stakeholder recognition of the legitimacy of the HRCCC as a community-based organisation concerned with facilitating a move toward ESD in the Herbert River catchment. To this end, the HRCCC involves representatives of a broad range of rural industry, community and local government and other statutory organisations that have an interest and/or role in natural resource management in the catchment (Table 1). As such, the membership reflects the influential groups, power structures, and prominent community interests in the catchment. In 1998, the HRCCC had a local Chairman and 16 other members representing community, industry and local government and statutory bodies in the catchment. A full-time Catchment Coordinator facilitates the process.

Nine of the current members (50%) have been involved with the HRCCC since its inception in March 1993. Most of the members are active community members with multiple sectoral interests or 'hats'. Eleven of the seventeen HRCCC members are either sugarcane farmers or employed within the sugar industry reflecting the economic, social and cultural importance of the sugar industry in the lower Herbert catchment community.

Table 1: HRCCC Sector Group Representation.

Industry:	**Community:**	**Government/Statutory Authority:**
CANEGROWERS (1) CSR Herbert River Mills (1) Cattlemans Union (1) Horticulture/Rare Fruits (1) Queensland Commercial Fishing Organisation (1)	Recreational/Sporting Fishing (1) Landcare (1) Wildlife Preservation Society of Queensland (1)	Hinchinbrook Shire Council (3) Herberton Shire Council (1) Herbert River Improvement Trust/Drainage Boards (1) Hinchinbrook Development Bureau (1) Herbert Pest and Productivity Board (1)

Significantly, in 1998 the HRCCC has no formal State government agency representatives although officers from the Department of Natural Resources may participate in meetings. The Catchment Coordinator is funded from the federal government's National Landcare Program with additional support provided by the Department of Natural Resources, the lead government agency for ICM in Queensland. In addition, local stakeholder groups including Local Government and sugar industry bodies have provided in-kind support in terms of office accommodation, administrative support and their HRCCC member's time. State and federal government grants that are awarded through a competitive bidding process also provide financial support for many on-ground HRCCC activities. Through involvement in HRCCC meetings and activities, ICM in the Herbert Catchment is attempting to engage a range of key stakeholders in ESD.

Table 2 identifies some of the activities undertaken by the HRCCC and the types of stakeholders that have been engaged by them. It is important to note, however, that the HRCCC does not work in isolation from government agencies, community groups or industry support organisations. The HRCCC works to co-ordinate the activities of all interested organisations and influence catchment decision-making on natural resource issues. As a result the possible outcomes from many of the activities undertaken by the HRCCC cannot be attributed solely to the endeavours of the HRCCC but to a cooperative effort from a number of organisations. We briefly discuss in the remainder of this section of the paper some of these activities in more detail.

Catchment Management Planning

The HRCCC's approach to ICM focussed in the first instance on establishing a legitimate role and building a credible and influential organisation dealing with natural resource management. To this end, the HRCCC prepared a Catchment Management Strategy that provides a vision for the future management of the Herbert River catchment's natural resources (HRCCC 1996). It was prepared by HRCCC members through a series of working groups and internal workshopping and released for public comment in June 1997. The strategy suggests a "community-based approach to solving problems – an approach that integrates the needs of individuals, community groups and industry" (HRCCC 1996, p.1).

Table 2. Examples of the range of stakeholders engaged in HRCCC Activities and the level of community influence

HRCCC ACTIVITY	Catchment Community	Individual Land Managers	Rural Industry Organisations	Local Government, Statutory Bodies	State Government Agencies	Research/Industry Support Organisation
Catchment Planning:						
• Management Strategy	✓	✓	✓	✓	✓	✓
• Catchment Atlas	✓					✓
Riparian/wetland Management:						
• Community forum	✓	✓	✓	✓	✓	
• Riparian Mapping				✓	✓	✓
• On-farm advice		✓			✓	✓
• Artificial wetland development		✓	✓	✓	✓	
Land Use Change/Caneland expansion:						
• Wharps area rural drainage		✓	✓	✓	✓	
• Shire Planning Scheme	✓			✓	✓	
Water Quality:						
• Tin mining dam inventory	✓	✓		✓	✓	
• Acid Sulfate Soils Awareness	✓	✓			✓	
River Management:						
• Bank stabilisation (Long Pocket)		✓		✓		
Pest/Weed Management						
• Owl Boxes	✓	✓		✓		✓

The strategy itself is issues-based and it identifies a broad range of priority management and planning issues, which are summarised in Table 3. Specifically, the strategy discusses key management and planning issues, identifies what needs to be done, who should take responsibility for undertaking the work and how the issue is to be addressed. An example of a strategy and the stakeholders to be involved is provided in Table 4. The strategy's issue focus is consistent with Laut and Taplin's (1989) view that an emerging trend for catchment management would be to concentrate on *issues* rather than on establishing a holistic strategic management approach in the catchment. Importantly, it clearly identifies the need for a coordinated effort amongst stakeholders in order to address these issues and move the community towards achieving ESD.

In a survey of HRCCC members conducted in 1997, Bellamy *et al.* (1998) found that the strategy was considered to provide an overall direction to the group and a guide for future actions. For example, it identifies issues, prioritises needs, identifies stakeholders and their roles, and in general provides an initial reference point for the HRCCC. In addition, the strategy helped to get resources and support for ICM in the Herbert River catchment, such as continued funding for a Catchment Coordinator and natural resource management projects. Once State Government endorsement is obtained, members expected it would provide the basis for gaining commitment of responsible State Government agencies to undertake projects in the Herbert catchment to address these issues. Importantly, the development of the Catchment Management Strategy is perceived by members to have been of value because of a number of qualities and outcomes of the development process that include:

1. *inclusive and transparent* to all members involved; bringing all viewpoints across organisations on issues together and out into the open.
2. *establishing a clear direction* for the HRCCC; helping to focus the HRCCC as an organisation and providing an overall vision for the catchment.
3. *raising awareness* of catchment issues; especially improving Committee member's awareness of issues as well as other stakeholder's viewpoints on those issues.
4. *highlighting areas of common ground*; by identifying areas of agreement across diverse sector groups on some catchment issues, it provided a basis for the Committee to move ahead and develop better natural resource management and planning projects.

The final endorsement of the strategy is currently being negotiated with the relevant State government agencies. Planned improvements to the strategy will address their concerns relating to better recognition of indigenous land issues and an apparent over emphasise on state government activities and responsibilities in addressing some catchment issues, that is the need better recognition of local community responsibilities and action

Table 3. Issues and key strategies identified in the Herbert River Catchment strategy (HRCCC 1996).

Key Issues	Recommended Strategies	
Land Management (LM) • Inappropriate land use allocation and its impact on resources and natural systems • Impacts of land management on productivity • Impacts on other values of land and adjacent land and water resources	LM1 LM2 LM3 LM4	Coordinate land use planning to achieve balanced use of land, water and related natural resources Encourage best management practices in all rural industries Implement arrangements to reduce adverse impacts of agricultural drainage on natural systems and existing developments Reduce adverse impacts of non-agricultural land uses.
Water Management (WM) • Full and over-allocation of existing resources • Increasing demands on finite surface and groundwater supplies • Limited monitoring of water quantity and quality • Threats to quality of surface and groundwater supplies	WM1 WM2 WM3 WM4 WM5	Assess available resources and develop appropriate allocation policies in consultation with stakeholders Promote efficient use of water resources within the Catchment Promote the coordinated planning and implementation of water management schemes in the catchment Reduce contaminant inputs to surface and groundwater systems from point and diffuse sources Establish and promote water monitoring priorities and standards for the catchment.
Stream Management (SM) • Lack of awareness of stream values shown in development actions • Stream bank erosion and stream migration • Sedimentation • Impact of uncoordinated levee banks and flood mitigation schemes • Impacts of degradation of riparian zones • Instream habitat degradation such as weed invasion and loss of water holes	SM1 SM2 SM3 SM4 SM5 SM6	Continue implementation of a strategic approach to stream management Facilitate appropriate protection and management of riparian zones throughout the catchment Ensure development and engineering works associated with streams take account of all stream functions and issues Identify and protect sensitive areas, to retain the function and health of our stream systems Develop fisheries and habitat management plan for the stream systems of the catchment, involving stakeholder groups and the broad community Provide community awareness, support and involvement in stream management
Habitat Management (HM) • Threats to significant terrestrial and aquatic habitats and species • Loss of wetland and instream habitat quality and subsequent impacts on fish stocks • Fragmentation of remaining habitats through loss of connectivity (ie. corridors)	HM1 HM2 HM3 HM4 HM5	Promote the values of habitat retention and restoration to the broader community through awareness, technical support and incentives Maximise the habitat values of existing protected areas Ensure the retention of significant habitat values outside protected area reserves Protect and rehabilitate wetland habitats on the Floodplain Re-establish and manage riparian vegetation on watercourses throughout the catchment and ensure retention of existing riparian vegetation.

Table 4. Example of the format for a strategy as identified in the Herbert River Catchment Management Strategy (HRCCC 1996).

#		*	
CCC	Catchment Coordinating Committee	1.	Immediate, commences within 6 months
DEH	Department of Environment and Heritage	2.	Short-term, commences within 12 months
DNR	Department of Natural Resources		
DPI	Department of Primary Industries		
LG	Local Government (Hinchinbrook and Herberton Shire Council		

What is to be done?	Who can do it?[#]	Priority[*]
Strategy HM1: Promote the values of habitat retention and restoration to the broader community through awareness, technical support and incentives		
a) Provide technical support in the areas of: • land development planning • habitat retention • habitat management	DEH, DPI, DNR	1 1
b) Encourage all levels of Government to provide for habitat management through realistic incentives and/or sufficient funding.	CCC, LG	
c) Develop and promote awareness programs to highlight the values of habitat retention and implement through farm planning	DEH, CCC, DPI, DNR	2

Riparian and wetland management

The HRCCC has identified wetlands destruction and riparian zone management as some of the major issues needing to be addressed at a catchment level. The mangroves and wetlands of the Herbert River Catchment are of national and local significance. However their distribution has been dramatically reduced since European settlement due to the expansion of agriculture, particularly the rapid expansion of the sugar industry on the coastal floodplain of the Herbert River. Significantly, Vella (1997) found that the conservation of wetlands and mangroves has been ineffective in the Herbert floodplain because of fragmented management arrangements, a failure to address environmental issues in the rural land development process and limited ability of government authorities to control harmful land management practices particularly on freehold land. This potentially could lead to high transaction costs in negotiating the appropriate management of riparian areas with relevant authorities. To this end, the HRCCC has facilitated artificial wetland development on-farm (with sugar cane producers) and supported their development on public lands (eg. jointly with the local sugar miller and the Hinchinbrook Shire Council to establish a wetland using sugar mill liquid waste and treated sewerage effluent).

The HRCCC has been successful in bidding for funding, through DNR, and implementing the mapping of riparian vegetation on the Herbert River floodplain (Petroeschevsky 1997). This information has been used to encourage the adoption of a flexible system of riparian zone width assessment with landholders and which is now being incorporated within the new Hinchinbrook Shire Council planning scheme for the lower catchment. It is also underpinning the development of a catchment rehabilitation plan. In addition the HRCCC, initiated a Riparian Community Forum in the catchment involving key invited speakers from government, the research community and industry to raise awareness of the need for better riparian and wetland management on the Herbert River floodplain.

Integrated pest management

Closely associated with activities to manage vegetation in riparian zones have been activities to encourage farmers to engage in ecologically sustainable pest management practices. A specific activity undertaken by the HRCCC has been the establishment of approximately 55 owl boxes throughout the lower catchment. Owl populations on the Ingham coastal lowlands, including

both the Barn Owl (*tyto alba*) and the Barking Owl (*ninox connivens*) have dropped noticeably over the last five years (John Young 1998 *pers. comm.*). Reduced populations have been attributed to the clearing of native vegetation to accommodate the expanding sugar industry resulting in the destruction of nesting habitats and hunting perches. In addition, the possibility of secondary poisoning linked to rat baits has been suggested (John Young 1998 *pers. comm.)*. By establishing nesting boxes and hunting perches for owls in areas which have virtually been cleared of native vegetation, hunting perches have been provided which has increased the owls' hunting range and increased their chance of survival in a changed habitat.

Halvorsen (1998) reports that "a single owl family can eat over 2,000 rats per year" (p.6). Aside from the number of rats an owl family can physically remove from the environment, there is some potential for owls to disrupt the breeding cycle of rats, further reducing their population. Rat damage to cane in the Herbert River District has been estimated by the Herbert Cane Protection and Productivity Broad (HCPPB) to range from 28,265 tonnes in 1993 to 6,576 tonnes in 1997. The farm-gate value of the damage to cane in the Herbert District is estimated to have been $763,155 in 1993 and $177,552 in 1997, or, 7% of the value total cane production in the district in 1993 and 1% of the value of production in 1997. The cost of establishing 55 owl boxes across the lower catchment has been estimated by the HRCCC as $4,000. The HCPPB as well as DNR have made contributions towards the cost. In addition, community members have made contributions in the form of voluntary labour.

The value of reduced rat damage to cane production does not need to be significant to show a return to the investment to establish owl boxes across the catchment. Specifically, the value of the avoided cost of lost cane production would need to be approximately $350 per annum (constant 1998 prices) over a 20 year period to offset the initial establishment costs and periodic maintenance work (assuming a discount rate of 0.06 per cent). Possibly the primary value of establishing owl boxes around the cane growing district is that they have raised the awareness of the catchment community to the advantages of encouraging farming practices to manage riparian vegetation as a wildlife habitat. Not only was this activity undertaken with the objective of promoting ecologically sensitive farming practices by cane farmers, it also represents a coordinated effort with the HCPPB, DNR, local wildlife enthusiasts and landholders.

Land development planning

A major achievement for the HRCCC has been its role in influencing the incorporation of ICM principles into the new Hinchinbrook Shire Planning Scheme (McDonald and Bellamy 1997). This Plan makes a strong commitment by local government to natural resource management on rural lands for the first time. It establishes a broad intent to conserve natural resources such as wetlands and riparian lands that will be implemented through development assessment and environmental impact assessment. Most importantly the scheme defines sugar production as intensive agriculture which is a regulated use in the scheme. If the political will is there to implement this plan to its full potential, it will enable the Shire Council to conserve significant habitats and implement ICM objectives by placing conditions on new agricultural land development.

Significantly, this development has contributed to the improved communication and coordination of effort between local government, state government agencies and stakeholder groups within the catchment, which has reduced the possibility of high transaction costs when the plan is implemented. It is currently being formalised as a streamlined process for agricultural land development involving the HRCCC, Hinchinbrook Shire Council, the Department of Natural Resources, the Department of Environment and the Local Sugar Board (DNR 1998).

Water quality
Water quality has increasingly been recognised within the local community as a major issue of concern, both in relation to town water supplies in the lower catchment and the potential detrimental impact on the adjacent Great Barrier Reef lagoon. To address this issue the HRCCC has supported two key activities. The HRCCC first negotiated funding for an inventory in the upper catchment of relict alluvial mines and tailing dams, which could adversely affect downstream water-users, natural drainage in the Lower Herbert, and the biodiversity of aquatic habitats. This was a potentially divisive issue between the upper and lower catchment communities resulting from poor domestic water quality at certain times in the lower catchment, as well as concerns that increased sedimentation from abandoned mine waste was reducing the river capacity and contributing to greater flooding problems. Secondly, the HRCCC has promoted and publicised the risk of acid sulphate soils in the lower floodplain in the public media (eg. in the local newspaper), by distributing informative pamphlets to residents and by facilitating a community workshop. Of particular importance is the risk of acid sulphate soils in the coastal wetlands of the Herbert floodplain. Disturbance of wetlands as a result of drainage works and agricultural development in the Herbert coastal wetlands has led to acidification of adjacent waters (with pH levels as low as 2 or 3) and have been locally linked to fish kills.

The outcome
These issues show that ICM in the Herbert River Catchment is contributing to improvement in the engagement of catchment stakeholders in ESD through increased community participation and better coordination of decision-making on natural resource management and planning in the catchment which could lead to reduced transaction costs when management plans are implemented. In addition, ICM in the Herbert has contributed to improved understanding and communication of information on natural resource management issues amongst catchment stakeholders. However a major challenge to achieving significant ESD outcomes relates to cost-sharing, that is, the distribution of public and private costs and benefits and their social implications. Importantly those who bear the costs of sustainable resource management may not either directly or indirectly reap the benefits. In addressing natural resource management issues, private benefits accrue to resource users and other private individuals, while public benefits accrue to the broader community (ANAO 1997, MDBC 1996). This issue poses real challenges for a voluntary community-based process like ICM in Queensland in achieving real on-ground outcomes. The next section of this paper uses a case study of the economic evaluation of activities to manage riparian vegetation undertaken by the HRCCC to discuss this challenge. This discussion is based on the findings of a more detailed economic evaluation of ICM as an organisation in the Herbert River catchment reported in Robinson *et al.* (1999).

Costs and benefits of riparian vegetation management: a case study

Although previous studies (CANEGROWERS 1998, LWRRDC 1996, SEAC 1996) have listed the potential benefits of revegetating riparian areas, few studies have established the distribution of the costs and the potential benefits (Robinson *et al.* 1999). This is important information because authorities cannot rely on moral suasion alone to encourage farmers to undertake the required investment. Farmers need to know what are the likely initial outlays, the likely loss of income and the potential return. In situations where farmers cannot be shown to benefit then there is potentially room for assistance.

Riparian vegetation management and the Herbert River Catchment
Protecting riparian vegetation has been a contentious issue for the HRCCC. McDonald and Bellamy (1997) cite a number of planning issues that need to be addressed by the HRCCC in relation to the management of vegetation in riparian zones. These include: should there be a

buffer zone along watercourses or preferred flow-paths? What constitutes a watercourse? How wide should the buffer zone be? And what management requirements apply to the buffer? There is currently no legislation to protect riparian vegetation beyond the top of the stream bank, except on leasehold land. Although there is no legislation to protect riparian vegetation on freehold land, it is recommended that, for the wet tropical coast, the vegetated riparian zone should be at least 20m each side of the banks of all minor watercourses, wetlands and drainage lines, and at least 40m each side of major watercourses (DNR 1998, p.13).

A report on the state of the rivers and streams in the Herbert River catchment describes the general state of vegetation in riparian zones as being poor to very poor (DNR 1996). The poor quality of the vegetation is attributed to the narrowness of the vegetation that has not been cleared for agricultural purposes and to the level of exotic plants present within the area (p.ii). Two issues arise for management of riparian vegetation: increasing the area and improving the quality of the vegetation.

A recent mapping project of riparian vegetation areas in the lower Herbert River catchment, supported and partly funded by the HRCCC, recommends that the riparian zone requirement be re-addressed to be sensitive to the local circumstances and needs. Specifically, it is suggested that the width of the buffer zone should be a product of consideration towards the risk of flood and bank erosion (Petroeschevsky 1997). This recommendation is supported by the DNR (1998) which suggests that riparian vegetation zone boundaries should be determined by consideration to ecological factors including a combination of topography, vegetation type as well as its effectiveness in flood conditions.

As the majority of agricultural land in the lower catchment is freehold land, the only course of action available to authorities managing these areas is to improve landowner and community awareness of the importance of maintaining vegetation in riparian zones. Activities undertaken by the HRCCC to address the management of vegetation in riparian zones meet their stated objectives of encouraging the retention of significant natural habitats within the catchment and also of promoting ways to prevent and reduce natural resource degradation (see Table 3).

Overview of costs and benefits

There is considerable support for riparian zone vegetation management from natural resource research organisations including SEAC (1996), LWRRDC (1996), DNR (1996, 1998) and sugar industry support organisations including the CANEGROWERS (1997, 1998), Sugar Research and Development Corporation and the Bureau of Sugar Experimental Stations. Management of riparian zones to encourage the retention, revegetation or rehabilitation of these areas with appropriate vegetation is believed to contribute towards:

- Stabilising the banks of rivers and creeks and helping to reduce slumping and undercutting. In addition, some of the energy of water flow during flooding is absorbed by riparian vegetation that can reduce erosion and scouring of adjacent land.
- Providing a natural habitat and source of nutrients for river plants and wildlife.
- The provision of shade which inhibits the growth and spread of grass and exotic plants. This results in the improved drainage of natural watercourses, which might otherwise be choked by exotic weeds and grasses. By reducing the light and heat reaching the stream, riparian vegetation improves the habitat for fish and crustaceans. In addition, the reduction in the growth of grass reduces the population of rats in these areas protecting the cane from destruction by rats.
- Water quality improvements. Riparian zones provide a buffer between terrestrial and aquatic ecosystems preventing nutrient and insecticide run-off into watercourses. Water quality improvements may reduce the number and/or size of fish-kills.

- In addition to these potential benefits it is claimed that rivers and creeks which have retained vegetation are aesthetically appealing and provide a valuable asset for local enjoyment as well as for eco-tourism.

There are, however, significant costs associated with the management of vegetation in riparian zones that need to be considered. These include the cost of establishing or rehabilitating vegetation in the area as well as loss of production from land, currently under crop, which would need to be revegetated. In the lower catchment, loss of agricultural production would be primarily sugar cane. This agricultural land, because of its proximity to a river or creek, is generally regarded as highly productive. In the upper catchment, grazing properties would potentially lose stock access to a water source.

To off-set reduced production resulting from loss of farm land in the lower catchment, there is the possibility of reduced rat damage to cane and a reduction in the infestation of cane land by exotic weeds. In addition, riparian vegetation can absorb some of the force from flood waters, reducing cane loss attributable to scouring and deposition of sediments. CANEGROWERS (1997) estimates the potential value of the avoided loss of cane production resulting from scouring, which has a probability of occurring during a major flood event (1:10 years), to be $1,000 for a 100 ha farm. Some protection of river or creek banks from erosion and protection of farmland from scouring and sediment deposition is possible in the Herbert River catchment if riparian zones are suitably vegetated (Kinhill Cameron McNamara 1991). These benefits are not necessarily enjoyed by all cane farmers but by those located in susceptible areas where washaways and scouring have historically been a problem. The period over which the cane is waterlogged and the maturity of the cane would determine the magnitude of the cane loss following a major flood event.

In some areas, the riparian vegetation provides a buffer, acting as a barrier between aquatic and terrestrial ecosystems. Water quality improvements are cited as a benefit of riparian vegetation, which can act as a sink for agricultural run-off and inhibit the growth of exotic aquatic weeds that can deplete oxygen levels in streams. These water quality improvements could potentially reduce the magnitude of fish kills.

Qualitatively, there are potentially significant benefits if vegetation of riparian zones is established where there is none, rehabilitated where it is not sufficiently wide or requires more appropriate vegetation or rehabilitated if it is infested with exotic plants. To quantify and estimate a monetary value for all of the potential benefits is difficult because detailed information about the willingness of people to pay for these benefits, which are not marketed, is currently unavailable. However, estimates can be made of the potential productivity benefits and of some water quality benefits. The costs associated with the initial establishment of vegetation in riparian zones and of reduced production resulting from land being taken out of production also can be estimated.

The potential benefits associated with the establishment of vegetation in riparian zones do not accrue to specific persons or groups of people. Specifically, a farmer undertaking investment to increase or establish the vegetation of a riparian zone on his/her property is not able to exclude others from enjoying the benefits associated with the establishment of this area. These potential benefits include improved water quality flowing down stream, or catching fish in a natural habitat on the farm. In addition, the removal of exotic plants from the area is likely to not only improve the drainage of water through an individual farmer's property but could also improve flows upstream. In brief, the farmer does not have a property right over the benefits (externalities) created as a result of establishing or rehabilitating vegetation of a riparian zone on his/her property. Neither is the farmer able to exclude others from enjoying all of the benefits he/she

has created. This raises the issue of "user pays" where those who enjoy the benefits from vegetation of riparian zones are not necessarily the same people as those incurring the costs. The distribution of the costs and benefits associated with establishing vegetation in riparian areas is contentious.

The estimated cost of establishing vegetation in riparian zones
There are two primary sources of cost associated with the establishment of appropriate vegetation in riparian zones. The first is the cost of planting trees in these areas (assuming trees are appropriate). The second is the opportunity cost of the land. This cost is primarily on-farm loss of production as land is taken out of agricultural production (in the lower catchment this is assumed to be sugar cane production). Estimates of the cost of establishing vegetation in riparian zones require assumptions to be made about the extent to which an area requires re-establishment or rehabilitation. In particular, many riparian areas will require some level of restoration rather than complete revegetation.

A number of assumptions have been made to estimate the cost of establishing vegetation in a riparian area. In the interests of reasonable brevity, these assumptions are provided in Table 5. More detailed discussion about these assumptions is provided in Robinson *et al.* (1999). Estimation of the possible income loss to individual farmers as caneland is taken out of production, to establish riparian vegetation, highlights the possible disparity in the ability of growers to absorb the loss. The potential income loss and the ability of the grower to absorb the loss will impact on the willingness of a grower to engage in environmentally sustainable farm management practices.

Table 5. Assumptions underlying cost estimates for vegetating a riparian zone

Cost Component	Cost Assumption	Range of Estimate
Extent of Vegetation Required	a) Total re-vegetation (5,000 trees per ha)	3,000 – 5,000 trees per ha
	b) Some re-vegetation and Rehabilitation (2,000 trees per ha)	1,000 – 3,000 trees per ha
	c) Minor tree planing (500 trees per ha)	100 – 1,000 trees per ha
Cost of planting and maintaining trees	$3.00 per tree	$2 - $4 per tree
Width of buffer zone	40metres	15 - 40metres

The estimated income loss, expressed as a proportion of total income from the growing of sugar cane, across the entire cane growing district is relatively small (approximately 0.5 of one per cent per annum). However, if the income loss is expressed as a percentage of an individual farmer's total income, the loss can be shown to be significant. A number of scenarios have been developed to show the magnitude of the estimated relative income loss to cane farmers according to the size of their cane assignment. Three sizes of cane assignment have been considered distinguishing between cane farmers with an assignment which reflects the financial position of farmer who is marginally viable (40 ha assignment); secondly, a farmer who has a slightly larger assignment and is able to absorb some of the income loss (65ha assignment), and thirdly, a farmer who has a 100 ha assignment and is able to achieve economies of scale and where the income loss is likely to be absorbed. If these individual farmers had a one-kilometre length of their farm riparian to the Herbert River or Stone River and were required to vegetate a 40 metre zone which was currently under cane, they would incur a loss of their annual income. The results are provided in Table 6. Table 6 shows that if a cane farmer with a 40ha assignment to grow cane was to take 4ha out of production to revegetate a riparian zone, then his/her income loss would be 10 per cent of his/her total income from cane production per annum. On the other hand, a cane farmer with a 65 ha assignment would incur an income loss per annum of 6 per cent and for

a farmer with a 100 ha assignment, the per annum income loss is estimated to be 4 per cent of total income from cane. Thus the costs to farmers of taking the riparian zone out of cane (that is, the opportunity cost of the land) is not equitably distributed across all growers.

Table 6. Likely cost to cane farmers to revegetate a 4ha riparian zone

Size of Cane Assignment (ha)	Cost to Establish Vegetation ($)	Percentage annual Income Loss (%)
40	60,000	10
65	60,000	6
100	60,000	4

Summary of findings

For an individual cane farmer required to totally revegetate a 4ha riparian area and for whom the only benefit is a reduction in damage by rats, the return on his/her investment over a period of 20 years, using a discount rate of 6 per cent is estimated to be $206.00. This is not substantial. Indeed, it would take 20 years for the farmer to show a positive return. This situation has important implications for the HRCCC and for all organisations promoting the revegetation of riparian areas. The investment is not significantly attractive for farmers and additional incentives may need to be offered.

There are other benefits however, many of which are potentially enjoyed by the catchment community and society as a whole. These benefits include those associated with improved water quality, specifically an improvement in fish habitat and a reduction in the size and number of fish kills as well as the aesthetic improvement of water courses. Summary information about the magnitude of potential costs and benefits is provided in Table 7.

The implications arising from these estimates, which it is stressed are based on a number of simplifying assumptions, is that there are considerable costs associated with the establishment of vegetation in riparian zones. The cost to individual landowners is potentially significant. The benefits arising from re-vegetating these areas are not contained solely on an individual farm and an individual farmer cannot prevent others from enjoying the benefits from these areas. It would therefore appear to be appropriate for authorities wishing to encourage the establishment of vegetation in riparian zones to offer incentives to individual farmers.

Table 7. Summary estimates of potential costs and benefits of riparian vegetation

COSTS		**BENEFITS**	
Component of Cost	**Estimated Value**	**Identified Benefits**	**Estimated Value**
Re-vegetation (105 km)	$2,055,100	Integrated Pest Management – reduced rat damage to cane	$171,460 per annum
		Improved water quality – reduced fish kills	$19,500 per annum
Loss of cane production	$27,165per annum	Reduced cane loss from scouring	$97,200 (1:10 years)
		Reduced cane loss from weed inundation	$54,000 (1:7 years)
		Aesthetic benefits including increased owl population	Not valued

CONCLUSIONS

The principal challenge for the HRCCC has been to 'break down the fences' and facilitate a move toward a coordinated effort that extends across traditional land management decision-making boundaries so that the priority natural resource issues in the catchment can be addressed. The

community-based ICM process has revealed that although there is significant agreement amongst the diverse stakeholder interests in the catchment on the key issues that need to be addressed, understanding on the underlying causes and potential solutions vary considerably. The HRCCC has to-date largely focussed on issues for which in general there is much common ground on the way to proceed amongst stakeholder groups. It has yet to take a lead role, however, in progressing some of the more contentious resource management issues within the community (eg. drainage coordination, and fish kills in the lower floodplain adjacent to areas of intensive use). In an evaluation of the initial progress after four years of ICM in the Herbert, Bellamy and Johnson (1999) have identified the key HRCCC achievements as:

(i) Initiating a limited range of focussed land management projects to establish credibility and raise awareness of ICM process and natural resource management in general with the Herbert community (rather than focussing on issues of strategic importance to catchment management).
(ii) Gaining recognition as a legitimate community referral agency for the state and local government authorities on proposed developmental and infrastructure projects and other natural resource issues in the catchment.
(iii) Development of a Herbert River Catchment Management Plan that provides the essential elements of a 'sustainable' vision for the catchment.
(iv) Establishing a lead role within the Herbert River community as principal broker negotiating funding for industry and community groups to undertake natural resource management projects and activities in the catchment.
(v) Providing an effective community forum for discussing and progressing catchment issues, including revealing the range of different stakeholder perspectives on these issues as well as highlighting potential areas of community conflict.
(vi) Information provider and disseminator through HRCCC meetings providing a 'community forum', initiating focussed activities that locally have a relatively high profile, as well as through the existing communication networks of HRCCC member organisations.

Although progress may be perceived to be slow and limited to-date, these achievements indicate that significant improvements have occurred. These improvements are laying the foundation for a fundamental change in the attitudes and behaviours of key community leaders, as well as the overall approach to the management and planning of the catchment resources.

In summary, the Herbert River ICM process has revealed that the potential benefits from a community-based ICM approach to engaging stakeholders in ESD primarily relate to three key factors. The first relates to better coordination and communication in stakeholder planning processes. Improved coordination has a range of potential impacts including better identification of the underlying dimensions of natural resource problems, improved communication on natural resource issues amongst catchment stakeholders and better negotiation over ways of addressing problems. These in turn can potentially provide a basis for the avoidance of infrastructure damage and a reduction in downstream impacts of resource use. Secondly there is potential for a significant reduction in transaction costs with increased collaboration between catchment stakeholder groups. This will lead, for example, to greater exchange of information on natural resource issues and related decision-making through the HRCCC providing an effective community forum, as well as improved processes for negotiation over property rights leading to the potential avoidance of legal or regulatory action. In brief ICM can be regarded as a vehicle to reduce transaction costs which will in turn improve the allocation of resources. Finally, ICM has the potential to reduce uncertainty amongst stakeholders through, for example, raised awareness of others views, raised awareness of natural resource issues amongst stakeholders, better exchange of information, an improved technical knowledge base, and greater cooperation amongst catchment stakeholder groups. In this regard, information about the distribution of the

potential costs and benefits associated with activities to improve the condition of natural resources could assist ICM organisations to apply for funding to support or improve the uptake of on-farm natural resource management. As such, ICM can support the development of greater community trust in decision-making process. In conclusion, through fostering focussed activities, the ICM process has engaged the members of the Herbert community in practices, which if they continue to be more widely adopted will contribute significantly to a move toward ESD in the long term.

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EVALUATION OF INTEGRATED CATCHMENT MANAGEMENT IN A WET TROPICAL ENVIRONMENT: COLLECTED PAPERS OF LWRRDC R&D PROJECT CTC7

Compiled by Jennifer A. Bellamy

VOLUME 5

IMPLEMENTING ICM IN THE HERBERT RIVER CATCHMENT: COMMUNITY VIEWS

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1999

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Chapter 1

Report on the Workshop on Integrated Catchment Management Processes. 7 April 1995, Mercure Inn, Townsville

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INTRODUCTION

A new research project, based on a case study in the Herbert River catchment of north Queensland, is focussing on the development of an improved range of strategies for planning and implementing more effective catchment management programmes in Australia. The research is being jointly undertaken by: the CSIRO Division of Tropical Crops and Pastures; the CSIRO Division of Water Resources/Australian Research Centre for Water in Society (ARCWIS); the Department of Geographical Sciences and Planning, University of Queensland; and the Department of Primary Industries, Queensland. It is funded by these organisations with the support of the Land and Water Resources Research and Development Corporation (LWRRDC).

This report provides a summary of the outcomes of a workshop held on 7 April 1995 at the Mercure Inn, Townsville. The workshop involved a range of participants from within the Herbert community, industry, state and local government, and key research bodies, who had an interest in Integrated Catchment Management (ICM) in Queensland, and in the Herbert Catchment ICM process, in particular.

Workshop Aim

The principle aims of the workshop were to:

(i) Inform participants of the new research on ICM processes being undertaken in the Herbert catchment; and

(ii) Gain input from a diversity of stakeholders of ICM on what they consider are the most important factors for an effective ICM process.

Workshop Process

In order to gain an understanding of the breadth and diversity of perspective on ICM processes rather than a consensus view, participants were organised into four groups (see Appendix A) as broadly representative of:

1. Herbert River community/industry groups
2. State Government agencies
3. Research institutions
4. Herbert River constituency groups.

Three main workshop sessions were held during the course of the day (see Appendix B). At each session, a separate question was addressed by the four groups:

Session 1: Land and water management issues

In your opinion, what are the land and water management issues in the Herbert and why?

Session 2: Institutional issues

In your opinion, what are the government, industry and community organisational issues in successful ICM, and why?

Session 3: Moving forward

In your opinion, what issues are important in increasing effective government, industry and community involvement in ICM, and how?

At the end of each session, each participant group was asked to present to the full forum a summary of their discussions. A final session reviewed some key questions arising from the day's discussions.

SESSION 1: LAND AND WATER MANAGEMENT ISSUES

Participants were first asked to respond to the question, *"In your opinion, what are the land and water management issues in the Herbert and why?"*. This session sought to ascertain what the participants perceived to be the priority land and water management issues in the Herbert catchment at this time, and most importantly, the reasons why these issues were of importance or concern. The responses to these questions have been summarised under ten broad categories, which are not necessarily mutually exclusive but reflect the breadth of the key participant perspective presented at the workshop.

Note: the broad categories are not in any particular order of priority.

1. Lack of effective long term planning of water management with land development

Agricultural production and expansion, urban development, and tourist facilities influence/impact on:

(a) *water quality* in rivers/streams and groundwater systems, as well as offshore zones. For example, chemical pollution, increased nutrient loads in both surface and ground water resources, increased turbidity due to fertilisers, effluent, and "other" effluent from aquaculture and sugar mills lead to increased treatment costs, potential environmental problems (such as loss of river and coastal ecosystems, algal blooms, lowered water utility value), and impacts on vegetation and fauna (such as reduction in 'habitat' value).

(b) *quantity of water available* (e.g. inadequate surface supply, changed flooding patterns, increasing demand for irrigation of cane in dry cycles, and changed/reduced recharge rates for (deep) aquifers) which lead to social conflicts and consequent undesirable impacts including economic hardships, quality of life, and environmental problems.

The general view presented was that there is a need for the development of strategies for long term planning for improved water quality and quantity management with land use and development.

2. Lack of co-ordinated drainage strategies for the catchment

The lack of long term planning of drainage in a co-ordinated way within the catchment with the expansion of cane lands, development of forestry areas, and the building of levees has led to a range of land management problems related largely to altered flowpaths causing localised flooding and prolonged impounding of water. The impacts include:

- loss of crop production
- land degradation
- habitat destruction
- potential impacts on ground water resources/tables
- potential acid sulphate soil problems

A need was recognised for (a) the identification and management of detention areas or sumps, and (b) the development of co-ordinated "environmentally friendly" outlets through mangrove areas for drainage off adjacent canelands.

3. Flood protection

There is no general consensus on how much flood protection is required in the lower Herbert catchment. In general, there is: (a) a lack of resources to provide flood protection to many areas; and (b) unreasonable expectations by some members of the community re: the reality of what can be done to provide protection.

Primary causes of localised flooding are: (a) the construction of roads through farms which act as "defacto levees", and alter flow paths and/or impound water for a period of time; and (b) river aggradation (silting). In general it is a vicious cycle (e.g. altered flows cause flooding and vice versa; while aggradation increases the likelihood of further flooding).

The consequences of flood protection are: (a) inequitable flood patterns; and (b) social conflicts.

4. Riparian zone management

There is a need for flexibility in guidelines for managing the interface between "the farm" and the riparian zone. On the one hand, there is a need for retention and/or restoration of riparian vegetation to: (a) maintain/reduce loss of habitat and (b) provide stream bank stability. On the other hand, a number of trade-offs need to be taken into account: (a) riparian areas ultimately drain to a stream and the outlet has to be "agriculturally viable", and (b) pest management adjacent to riparian zones has to be balanced against the need for retention of vegetation to stabilise stream bank areas.

5. Habitat management and protection

A need was proposed for prevention of loss/modification and/or fragmentation of habitat, as well as the maintenance of corridors, for the protection and preservation of:

- rare and threatened species
- fisheries resource
- Wet tropics/world heritage areas (including the GBR)
- biodiversity
- system function
- amenity.

This issue arises because of, for example:

- increasing public pressure/expectations, particularly with the clearing of land
- differences in perception or opinion, in particular relating to rates of change
- differing perceptions of the role of the catchment, for example, a habitat or a base for production
- increasing alienation/fragmentation of land for other "productive" uses.

Another view expressed was that there is a lack of understanding within the community etc. of the full range of values of water courses, such as:

- drains
- fishing spots
- habitats
- water sources
- amenity areas
- recreation areas.

The need for maintenance of recreational use of land was seen to be threatened by: (a) the alienation of land for other uses, and (b) habitat modification. A need was therefore

recognised for all interests to get together to 'quantify' these values, so that everyone becomes aware of them. However, it was noted that not all these values are tangible. One view proposed that the River Trust should be 'facilitated' to manage the river in view of *all* of these values, and that the Trust needed to be "promoted to be publically accountable".

It was perceived that this issue could be addressed by ICM through the development of a 'Catchment Master Plan', i.e. through a land use planning process.

6. Increased soil erosion and sedimentation in river system

Soil erosion and particularly sedimentation in river systems is a major problem caused by, for example:

- lack of vegetation cover
- river bank collapse
- loss of riparian vegetation
- stock concentration along water courses/river banks in the upper catchment
- road construction
- old mining areas.

However, major slips in the gorge also contribute to sedimentation in the river and this begs the question of what is "normal" erosion.

The effects of increased soil erosion and sedimentation include:

- river aggradation (e.g. building of islands in the river)
- impacts on the hydraulic capacity of the river system
- "breakdowns" of river banks (which leads to land loss, infrastructure damage, economic loss)
- increased coastal ecosystem sedimentation (e.g. impact on reefs).

The residual effects of historical alluvial tin mining in the upper catchment are:

- increased river sedimentation downstream
- downstream/lower catchment impacts on water quality and in particular domestic/urban water supply.

7. Pest management planning

There is a State legislative requirement for the management of pests (i.e. plants and animals). The consequences of inadequate planning and management include:

- undesirable impacts on cane and pasture productivity
- environmental considerations.

Another view expressed was that pest management adjacent to riparian zones has to be balanced against the need for retention of vegetation to stabilise these areas.

8. Long term sustainability of agriculture

The loss of agricultural land (e.g. to urban use, tourism, parks), declining soil fertility, and fragmentation of agricultural lands are major land use 'conflict' that impacts on the long term sustainability of agriculture. The effects of loss of agricultural land include: (a) loss of production and consequently profitability; and (b) conservation losses.

Overgrazing by the pastoral industry particularly in the upper catchment was perceived by some to impact on the pastoral industry viability and land resource sustainability. In particular there is a need for better drought management strategies for the industry.

9. Land development/conservation conflicts

Caneland expansion and clearing for rural development purposes lead to:

- increased runoff
- increased flooding
- changes to drainage patterns
- loss of wetlands, sumps
- nutrients in runoff.

One view presented was the need for a cultural change in respect of agriculture from"every man for himself" to "regulation and polluter pays" principles. However there is: (a) a "lack of integration" of producers and consumers, and (b) a lack of "common interest" between rural and urban communities. Farmers however tend to carry the burden for environmental protection. Consumers do not "naturally" make the link between production and consumption. The impact of environmental controls must be on *all* communities, not only farmers.

Another view presented was that landholders may not be concerned with the "common resource", that is they do not often look beyond their own boundaries and therefore lose the bigger picture. This was considered to be in part due to inadequate understanding of the causes and consequences, such as, loss of aquatic habitat or biodiversity.

10. Community values and conflicts

One view expressed was that changing community goals as well as evolving value systems are a key influence on the degree and nature of conflict over land and water management issues in the Herbert River catchment.

SESSION 2: INSTITUTIONAL ISSUES

Participants responded to the Question: *In your opinion, what are the government, industry and community organisational issues in successful ICM and why?* This question sought to obtain participants' attitudes to the organisational constraints to achieving ICM in the Herbert River. This was interpreted widely to include the characteristics of the approach to ICM adopted in Queensland, as well as the attitudes and activities of the major stakeholders government and community. The workshop was not guided strongly in any direction but it was anticipated and hoped that the participants would touch on the identified elements of the evaluation framework including:

- the objectives of the ICM program
- financial resources and commitment
- coordination amongst implementing agencies
- policies, plans and decision rules of relevant agencies
- recruitment of staff
- opportunities for public involvement

The four focus groups attacked the problem in different ways and their responses have been summarised under three headings:

1. Attitudes and Perspective of Stakeholders
2. Commitment and Support for ICM
3. Coordination and Implementation

1. THE ATTITUDES AND PERSPECTIVE OF STAKEHOLDERS

1.1 General Issues

- there is a need to create a common understanding of ICM - understanding the big picture on all of this as to why ICM is needed
- by creating a better understanding of important community benefits from ICM, projects will help to unify community support and assist the development of projects which can be modified to obtain a win win outcome
- ICM should not be seen as a separate entity (i.e. process rather than institution), but as a "way of doing business"

1.2 Stakeholders

- who are the key stakeholders?
- have we clearly identified their responsibilities?
- there is significant variability between local governments in the region
- special interests groups have to be part of ICM, especially industry, as: (a) they are the users of land and natural resources, (b) they have specific interests which have broader implications, and (c) what they do impacts on others
- there is too much reliance now on the individual in the catchment
- it still boils down to personality/personal motivation - do the groups involved share a common vision?

1.3 Conflicts of interest

- between state government departments/agencies, e.g DPI - Forestry, Water Resources, Land Management
- in the community about development: ICM, growers, conservationists
- concern about international interest: exports, conservation agreements (such as the World Heritage Area)
- national - federal intervention and economic policy
- over land tenure and individual v's community rights
- there are also conflicts among "experts" about biophysical processes and also on which mechanisms to use (e.g. statutory, etc.)

2. COMMITMENT AND SUPPORT FOR ICM

2.1 General Issues

- the most essential task is to gain long term commitment to the process (i.e. in it for the long - haul)
- the (Qld ICM) model is expecting the local community to be able to do it all (pick up on all this information)
- there is the need for local government support because it is the most important action agency, and it has its own representation and structure
- need for federal and state governments to foster cooperation within the community on specific issues such as river management and wetlands retention
- need for community support for funding of projects
- the government requires support of at least 70 - 75% of the community to go ahead, so ICM won't help a divided community
- there is a lack of resources and the government is cutting back on their commitment ($s; employees)
- it seems that government is the hardest to get on side and committed to ICM (more so than agriculture industry and community)

- need support from local government agencies - problems with lack of local control, and authority always come form the top "Brisbane Boffins"
- there is not enough of an educational program within bureaucracy - how can we start to do this ?
- need commitment from the top officials of institutions to participate in order to make ICM work
- is "ICM" relevant to Joe Blow?
- need to ensure continuity of political commitment at local, state and federal levels
- clear "drive" from community level
- need for Valuer General recognition to provide rate relief

2.2 Commitment to Implementation

- there are problems with the voluntary Queensland approach to integrated catchment management, which currently is ad hoc and has only "advisory" status
- difficulty in reaching consensus in such an approach - how then to implement? to deal with peer pressure? to educate? That is compared with regulatory TCM in NSW, land use controls, the Environmental Protection Act, and planning schemes
- need political will to implement legislation
- need land tenure and use controls on leasehold lands (e.g. "lands" policy - freehold - use "rights")
- industry codes of practice as an offset to legislation

Causes of these problems include: lack of expertise; identified lines of communication; people only understand ICM from the issues that affect them; and the general lack of stakeholder's commitment, including government departments.

3. COORDINATION AND IMPLEMENTATION

3.1 Coordination

- there is an urgent need for co-ordination for efficient use of resources, i.e. achieving a movement in the same direction/to appreciate all aspects
- doing things in isolation (e.g. individual government agencies)
- are those on (the ICM) committee the right people (e.g. to link back to their organisation)? Are they legitimate representatives of their stakeholder group?
- local authority - should go back to local government
- need to co-ordinate land and water management controls
- provide community input through advisory groups

3.2 Means

- can ICM outcomes be put in a strategic plan? (statutory)
- identify the appropriate mechanisms for each ICM outcome
- use existing mechanisms wherever possible
- there is a problem of do they know when to use their mechanisms and when to influence? Need to identify who has the mechanisms and influences, and gain their support (re: when to use them - "empower" them)
- there is a question as to whether there should be a lead government agency (i.e. DPI in Qld), or a suite of collaborating agencies?
- the effectiveness of ICM depends on communication - "inter and intra"

3 3 Processes

- there is a need to establish the credibility of the process in the long term - monitoring assessment of ICM and effects (e.g. why do it if no identified outcomes?)

- who - administers? pays?
- there are equity questions - is compensation payable?
- who is responsible for the on-going management of the ICM program:
    - is there a lead agency? Is there structure?
    - does ICM process have credibility at: department level and community level?
    - are the resources available to effect action?
    - does ICM need legislative authority?
    - organisational politics influencing representation: following party lines
    - territoriality
    - ICM needs recognition as a "peak body"

3.4 Planning

- use shire planning - development controls
- impact on infrastructure on adjacent lands (eg. roads)

SESSION 3: MOVING FORWARD

After having discussed land and water management issues and organisational influences it was fitting to conclude the group sessions by focussing on factors considered influential in stimulating involvement in ICM. Hence, in Session 3, participants were asked the question: *In your opinion, what issues are important in increasing effective government, industry and community involvement in ICM, and how*? How to encourage the participation of different interests in a combined effort on a whole catchment scale certainly constitutes a burning question. To help prompt discussions, participants were asked to consider how to increase ICM's perceived significance and stakeholder motivation in the Herbert and, to do this, the four "Cs" of establishing *confidence, credibility, commitment and continuity* were highlighted.

Note: the following categories constitute broad groupings and are not mutually exclusive.

1. Establish confidence and credibility.

Important broad issues needing to be considered when attempting to increase involvement include ways to increase or secure:

- accountability
- clear identification of all stakeholders
- broad representation of stakeholders (not just the major vested interests), including support from community, industry and government
- defined responsibilities
- resources for concrete action

This will require being active/proactive in the community, using the media, and harnessing the talent and drive of those already committed to the ICM process. One specific suggestion for establishing credibility was to focus on (and aim to ensure) examples of effective ICM implementation are provided from within the catchment or elsewhere. One possible focus could be the establishment of a specific, measurable project within the catchment to highlight progress (eg. a flood plain level system).

Another example put forward was to highlight precursors to modern ICM (such as the local drainage boards) and to show how the situation *before* (eg. conflict, poor productivity) was less appealing than *after* their inception (eg. a "win-win" situation, improved production).

Other activities could include prioritising issues and subsequently convening community workshops on those deemed to be relevant (eg. levee banks), involving action/implementing agencies in the ICM process, and ensuring that *all* relevant industries (such as agriculture, tourism and other industries) are involved in examining strategic (long-term) water supply needs.

A related point here is that ICM denotes a "living process". While attending meetings is an important part of the overall process, there are many other activities and considerations (such as community workshops) which need to be entertained.

2. Foster and maintain commitment and motivation

Commitment and motivation to be involved in ICM can be enhanced by identifying the need for ICM; that is, by fully examining/uncovering local issues. Statutory bodies required to fulfil the aims of ICM should also be identified around this time.

The steering committee (CCC?) could be the main body to identify issues and to focus on key outcomes attainable through ICM. Efforts should be made to make the issues as transparent as possible in order to gain a common understanding for all.

At every stage, progress must be demonstrated to stakeholders at all levels of involvement. Commitment and motivation could also be enhanced by starting on and demonstrating an issue which is small, topical and measurable. An example is nutrient tracing through the catchment, which can essentially be a ? win-win? illustration. Thus, as with the means to achieve confidence and credibility noted above, results must be demonstrated.

Other suggestions include:

- setting up terms of reference for ICM (to be done by the CCC)
- gaining media (and other) publicity
- running awareness sessions
- providing the opportunity for local people/identities to address the CCC.

3. Ensure continuity

Such efforts need to cater for loss of motivation and burnout, and to adequately deal with related issues such as the fact that ICM is often (certainly in its initial stages) more process than product and may lack biophysical outcomes for a considerable time.

The fact that CCC members may have "too many hats" also needs to be resolved (eg. by efficient use of proxy). This is particularly the case when noting the recommendation that the CCC should meet regularly (in order to be effective). A further recommendation to help cater for over commitment is to (when possible) focus on doing small jobs one at a time.

One factor which needs consideration is the selection process of CCC members, with a recommended onus being on seeking people who are enthusiastic.

The role of the coordinator/facilitator clearly is vital in maintaining continuity (especially when considering the lack of any other DPI presence in Ingham). The position should be well-funded.

4. Promote education and awareness

Examples are to:

- publicise ICM goals and activities and "sell" ICM results (and praise)
- place an onus on achieving some visible outcomes (whether process or product)
- invite the media to ICM activities
- project ICM's role/responsibility to the community - emphasise that it is more that just "another committee" and aim to ensure ICM does have some use-value to those who seek advice
- set up a means for landholders and other stakeholders to obtain such advice
- use key individuals as a catalyst for change
- communicate that ICM does not signify "loss of power"
- participate in school projects (eg. via a CCC sub committee)
- aim to gain resources from the community, industry and government

5. Act to resolve conflict

One major point noted is that conflict resolution needs to be accepted as having a central role within ICM. Indeed, conflict is inevitable due to inherent tensions/ contradictions in ICM processes such as prioritisation and evaluation of issues/problems.

Ideas put forward here for lessening the need for "obtrusive" conflict resolution included increasing awareness, gaining accurate data and information early on, ensuring people go to the right information source, and carefully examining the consequences of management options.

Another group put forward the key to resolving/lessening conflict as the achievement of commitment to ICM by all participants. This could be realised by building trust between people, endeavouring to build a comfortable social group, finding common ground and components of community value, and identifying tradeoffs and incentives.

It was also noted that legislation and arbitration/mediation could be employed (only) as a final resolution for conflict.

6. Streamline technical support

This could possibly be achieved using GIS as a means for information coordination and for forming a land management database with sound information and data. A GIS users group could be formed to assist here.

7. **Achieve clear and measurable objectives** (including quantifiable benefits)

These should be concrete, have assigned responsibilities (eg. for monitoring), and contain defined milestones (eg. monitoring and evaluation dates).

Prospective benefits that are credible and can be assessed should be emphasised.

8. Investigate possible government mechanisms

For example, possibilities include using:

- Co-ordinator General
- local government strategic plans (while recognising possible limitations)
- catchments as units of regional planning
- voluntary contracts between local governments, Port Arthur, DEH, DPI
- Trunts inlet model

9. Develop industry codes of practice

Assess, for example, how ICM codes of practice may be related to those of the EPA and NRM (correct?).

10. Give due weight to all considerations (whether social, economic or environmental)

Most of these appear at least initially to apply to the operations of the CCC. For example, there is a need to:

- attach community and economic values to planning options
- recognise the influence of sugar prices
- consider the local politics and other contextual social influences inherent in all discussions (while, at the same time, attempting to keep things focussed)
- balance competing objectives
- account for issues in the upper catchment
- ensure local government talk on a catchment basis (as has happened)
- ensure administrative assistance
- share secretarial duties
- get information out to the wider community
- delegate responsibilities from CCC representatives (to members of their various bodies?)

assess the potential (via a state/national review of ICM) for setting up a whole-of-government advisory group .

APPENDIX A - WORKSHOP PARTICIPANTS

Group 1: Herbert Community and Industry Groups

Bill Barnes	Herbert River Catchment Co-ordinating Committee Herbert River Improvement Trust
Roy Pace	Cane Productivity Board CANEGROWERS
Ray Quabba	Herbert River Catchment Co-ordinating Committee CANEGROWERS Cane Productivity Board
Peter Sheedy	CANEGROWERS

Group 2: Government Agency Representatives

Steve Gilbert	Department of Lands, Townsville
Peter James	Department of Lands, Townsville
Peter Lindwall	Department of Housing, Local Government and Planning, Townsville
Lynn McTaggart	Department of Housing, Local Government and Planning, Townsville
Mike Merrin	ICM Co-ordinator, Johnstone River ICM

Group 3: Research Agencies

Jon Brodie	Great Barrier Reef Marine Park Authority, Townsville
Jeremy Conversi	Sinclair Kinglit Mertz, Townsville
John Taylor	CSIRO, Division of Tropical Crops and Pastures, Brisbane
Peter Zahnlieter	Sinclair Kinglit Mertz, Brisbane

Group 4: Herbert Catchment Constituency Groups

Alan Harvey	Hinchinbrook Shire Council, Ingham
Dave Horsley	Herbert River Catchment Co-ordinating Committee; CSR Pty. Ltd, Ingham.
Richard Humphries	Herbert River Catchment Co-ordinating Committee; Herberton Shire Council
Rob Hunt	ICM Co-ordinator, Herbert River ICM, Ingham

Project Researchers

Jenny Bellamy	CSIRO, Division of Tropical Crops and Pastures, Brisbane.
James Butterworth	CSIRO, Division of Water Resources, and Australian Research Centre for Water in Society, Perth
Andrew Johnson	CSIRO, Division of Tropical Crops and Pastures, Townsville
Geoff McDonald	Department of Geographical Sciences and Planning, University of Queensland, Brisbane
Geoff Syme	CSIRO, Division of Water Resources, and Australian Research Centre for Water in Society, Perth
Daniel Walker	CSIRO, Division of Tropical Crops and Pastures, Townsville

APPENDIX B:

AGENDA

9:00 - 9:45	Aim of workshop; Introductions; Aim of project; The Herbert Catchment (Chair : Jenny Bellamy)
9:45 - 10:00	Workshop process (Chair : Geoff Syme)
10:00 - 10:20	Tea break
10:20 - 11:35	Session 1: Land and Water Management Issues (Chair : Andrew Johnson)
11:35 - 12:50	Session 2: Organizational Issues (Chair : Geoff McDonald)
12:50 - 1:45	Lunch
1:45 - 3:00	Session 3: Moving Forward (Chair : James Butterworth)
3:00 - 3:20	Tea break
3:20 - 4:00	Review/summary (Chair : Geoff Syme, Geoff McDonald, Jenny Bellamy)

APPENDIX C: SESSION QUESTIONS

Group:

HERBERT CATCHMENT ICM PROJECT

SESSION: Land and Water Management Issues

In your opinion, what are the land and water management issues in the Herbert and why?

ISSUE _____
_____
_____
_____

WHY _____
_____
_____
_____
_____
_____

Should ICM deal with this issue? Yes/No

Group:

HERBERT CATCHMENT ICM PROJECT

SESSION: Institutional Issues

In your opinion, what are the government, industry and community organizational issue in successful ICM, and why?

ISSUE _____
_____
_____
_____

WHY _____
_____
_____
_____
_____
_____

Should ICM deal with this issue? Yes/No/Maybe

Group:

HERBERT CATCHMENT ICM PROJECT

SESSION: Moving Forward

In your opinion, what issues are important in increasing effective government, industry and community involvement in ICM, and why?

ISSUE _____
_____
_____
_____

WHY_____
_____
_____
_____
_____
_____

Chapter 2

Land and Water Management in the Herbert River Catchment: A Survey of Rural and Urban Residents

James E. Butterworth, Geoffrey J. Syme and Blair E. Nancarrow

Australian Research Centre for Water in Society, CSIRO Land and Water, Perth, W.A. 6014

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EXECUTIVE SUMMARY

This study examined landholders' existing attitudes, beliefs and behaviours relating to land and water management in the Herbert River Catchment. The central aim was to provide an initial understanding of social factors with the potential to influence the implementation of Integrated Catchment Management (ICM), and whether and how such factors vary according to where people live and what their interests are.

A community survey formed the basis for the study. The survey was designed as a self-administered questionnaire and the mail-out method was the means of administration. Telephone contacts were also used to inform potential participants about the study and increase the response rate.

The questionnaire contained items concerning:

- levels of importance, perceived impacts, awareness and attitudes towards land and water management issues;
- perceived ability to control land and water management issues;
- tractability or "manageability" of potential issues;
- intentions to participate in relevant activities;
- awareness of government strategies;
- attitudes towards government's performance;
- use of information sources;
- group involvement.

The study area included the whole catchment. A range of landholders were contacted including those in the upper and lower catchment; in rural and urban areas; with different occupations including cane farming, grazing and mining; and with urban properties in eight settlements.

Most analyses were based on comparisons among four samples, namely upper rural, lower rural, upper urban and lower urban. These categories also collapsed into combined upper and lower, and rural and urban samples.

Of the 800 telephone calls made, 718 people agreed to take part. The number of returned and completed questionnaires was 477, providing an overall response rate of 66 percent.

Some main conclusions drawn from the study were as follows.

- Land degradation, water quantity problems, water quality problems and nature conservation issues were generally seen as highly important.
- Higher taxes and loss of confidence in the ability of government to manage natural resources were rated as high impacts. Other impacts included higher production costs, lower fish numbers and loss of environmental uses/benefits.
- Loss of farm productivity was considered a high impact by rural producers in the lower catchment.
- Any difficulty in managing land and water in the Herbert was considered to be related to the size and inability to travel throughout the catchment (between upper and lower areas), the fact that solutions are not easy and expensive, low trust of government programs, the wide variety of existing opinions, and insufficient understanding of problems.
- Most participants had heard most about Landcare, which was also the best-known government strategy. Those who had heard about ICM (more than 37 percent), and knew most about ICM were most likely to be rural producers in the lower catchment.
- Many agreed that things could and should be done to help improve the environment. However, action may be restricted by a widespread perception of lack of finances to plan more than a year ahead and the belief that locals do not have money available to spend on solutions.
- Many agreed that governments should work out better ways to fix land and water problems, and that incompetent government activities had been witnessed locally. Further, many could recall a government action that had damaged their livelihood.
- Many agreed they would be prepared to help in local projects, and that it was likely they would look into ways to improve the environmental condition of their properties.
- The likelihood of participating in land and water management activities appeared heightened by interest in local community issues and beliefs that: land degradation was important; thinking about issues for the Herbert was not too difficult; and government strategies (generally Landcare, and ICM) do have some personal use. More frequent use of the river/creeks, concern about the personal impacts of higher production costs and the rating of nature conservation issues as important were also related to intentions to participate.
- The most frequently used sources of information included the Herbert River Express, friends/colleagues, the local "grapevine", neighbours, and (the television program) Landline. Landline was considered the most reliable source.
- Compared with non-members, members of existing groups were more likely to consider constraints to

managing land and water in the Herbert to be the wide variety of local opinions, and the difficulty in thinking about issues for an area this size. Members were also more prepared to assist in local projects, and more likely to become (or stay) involved in a Landcare or catchment group and to see personal benefits accruing from group involvement.

Implications for ICM in the Herbert were drawn from study conclusions. For example, the low level of trust of government programs and the fact that many agreed that laws should be changed to ensure landholders become more responsible for their actions seem key issues facing ICM. Finally, the low level of perceived conflict in the Herbert appears to have positive implications for ICM.

1.0 INTRODUCTION

1.1 Evaluation of Integrated Catchment Management in a Wet Tropical Catchment

In 1994, the Land and Water Resources Research and Development Corporation (LWRRDC) funded research staff of the CSIRO Tropical Agriculture (in Brisbane and Townsville), CSIRO Land and Water (in Perth), and the University of Queensland, Department of Geographical Sciences and Planning to undertake research on Integrated Catchment Management (ICM) processes[1]. This longitudinal study over five-years is focussing the ICM program in the Herbert River catchment in North Queensland as a case study. The objectives of the investigation are.

1. Monitor and document the process of implementation of ICM in the Herbert River catchment and identify the social, economic and institutional factors that facilitate or hinder this process.
2. Evaluate key impacts of the implementation of the ICM process in terms of attitude and behaviour changes in the community and changes in the severity or tractability of the resource use conflicts for the catchment.
3. Assess the specific technical and related information needs that are relevant to an effective ICM implementation process in a wet tropical environment.
4. Develop a framework and related methods for evaluatig the process of ICM implementation that will facilitate the development of more effective catchment management programs in Australia.

The complexities of catchment management are such that longitudinal studies of processes are essential if the issues of catchment management are to be understood and appropriate lessons learned. The project acknowledges that, by its nature, ICM requires systematic evaluation. For example, ICM needs to take many (often conflicting) considerations into account, and operates in an environment where uncertainty is more often the rule than the exception. Moreover, indicators of progress are not easily defined and, to date, this area of investigation has largely been neglected.

In responding to these requirements, the project has adopted a multidisciplinary approach and draws on areas of expertise in natural resources sciences, social science, land use planning, economics, and media analysis.

The study reported here is the first stage of the community assessment component of the project.

1.2 Grounds for the Study

The impetus for this study comes from both ICM's focus on community involvement and an increasing emphasis on the need to evaluate effectiveness of this involvement within the ICM

[1] LWRRDC Project Reference: CTC7 - *Evaluation of Integrated Catchment Management in a wet tropical environment*

context. In other words, the key issues needing to be addressed are what ICM - as a largely community-based enterprise - delivers beyond isolated and 'unintegrated' resource management activities, and, as a result, what changes occur.

Like similar strategies in other States, Queensland ICM states that land and water management on a catchment basis needs to be community-driven with strong grounding at the local level. ICM objectives (particularly in non-statutory form) are generally considered achievable only to the extent that local communities have contributed to their development and are motivated to carry them out.

To date, ICM in Queensland is still in early stages of development. Most community-run catchment coordinating committees and other involved groups are yet to arrive at a position where progress can be adequately assessed. Community research is therefore required to assist the development of methods for evaluating effectiveness and, more generally, to help generate a better range of strategies for more effective catchment management programs throughout the country.

1.3 Objectives

A community survey of residents in rural and urban areas in the catchment formed the basis for the study. A questionnaire was developed to understand landholders' existing attitudes, beliefs and behaviours relating to land and water management in the catchment. The central aim was to provide an initial understanding of social factors with the potential to influence the implementation of ICM, and whether and how such factors vary according to where people live and what their interests are.

The study is longitudinal, with the findings reported here forming the Stage 1 baseline survey. A further survey will be undertaken before the completion of the project. To this end, the study (a) provides indications of existing community attitudes and behaviours, and (b) serves as a baseline to assess variation in attitudes and behaviours relating to the progress of ICM over time.

2.0 STUDY AREA

With a catchment area of more than 10,000 square kilometres, the Herbert River rises in the Great Dividing Range west of Innisfail and flows southeast to the sea to the south of Hinchinbrook Island. The upper catchment includes areas of tropical forest and grain cropping, a number of small active and inactive tin mines, but most of the area is devoted to grazing on native pastures. In the more populated lower catchment, sugar cane production is the dominant land use on the extensive alluvial and coastal plains. Completely dividing the upper and lower areas, approximately 15 percent of the catchment is in the Wet Tropics World Heritage Area. The catchment contains the shires of Herberton and Hinchinbrook and settlements including Ingham, Herberton, Allingham, Ravenshoe, Halifax, Lucinda, Taylors Beach, and Mount Garnet.

The upper and lower catchments are two distinctly different geographical areas. They also differ according to types of rural industry and the intensity of production, climatic and soil characteristics, and population size. As such, there are likely to be other distinctions, for example, along social, economic and recreational lines. Of course, this also applies for rural and urban areas.

2.1 ICM issues

The Herbert River Catchment Coordinating Committee was formed in 1993 on a voluntary basis by local community interests. The impetus for its formation was based on the recognition of the need for better community participation in decision-making relating to river management issues.

Before undertaking this study, the principal land and water management issue in the Herbert was identified as a lack of effective long-term planning and integration of water management with land development (Bellamy *et al.*, 1995). Consequently, prominent water quality problems include increased sedimentation, turbidity and nutrient loads in the river, and riparian zone management issues such as the need to improve riverbank stability and reduce loss of habitat. Water quantity concerns include inadequate or poor quality surface supply, increased demand for irrigation, flood protection, and changed flooding patterns. Additionally, a lack of coordinated drainage strategies has produced several impacts including loss of crop production and land degradation.

In consultation with landholders, agency personnel, and project team members, some more likely impediments to an effective ICM program were suggested as:

- differences between the upper and lower catchment;
- a lack of 'ownership' of the problem(s) (including public concern over perceived impacts of land use on the Great Barrier Reef; (rare) flora and fauna conservation issues such as biodiversity preservation and the mahogany glider);
- financial issues such as 'who pays for any required actions?';
- historical factors such as ad hoc land allocation and the fact that agencies had traditionally been concerned with land *use* rather than land *management*;
- community perceptions of (a) relevant government agencies as 'issue avoiders', and (b) of planning as interfering with the spirit of free enterprise, with ICM being viewed as a 'planning approach';

3.0 METHODOLOGY

3.1 The Mail-out Method

As mentioned, the intention of the survey was to gauge existing attitudes and behaviours, and serve as a benchmark for assessing any future attitude and behaviour change. Therefore, given the catchment's complexity (eg. geographical and social) and the number of required comparisons (between different populations in the catchment and across time), it was decided that the sample size should be as large as was feasible. Consequently, for logistic reasons, the survey was designed as a self-administered questionnaire and the mail-out method was selected as the means of administration.

At this benchmark stage, a further reason for preferring a mail-out survey over other approaches is that this method provides benefits such as better protection of anonymity. There is also less intrusion on those who may not be familiar with ICM and other land and water management issues.

Discussed below, the sampling framework also included (initial and follow-up) telephone contacts as a component of the mail-out method. This component was added to gauge willingness to participate, inform potential participants of the purpose of the study and increase the response rate (ie. the number of returned questionnaires).

3.2 Designing and Pretesting the Survey

To ensure that the major issues were addressed, a range of stakeholders were involved in defining the content of the questionnaire. This occurred primarily through interactions with members of the study team, most notably Dr Dan Shrubsole.

Through this input, a number of items from the recently conducted survey of Herbert River Catchment Coordinating Committee (HRCCC) members were included in the questionnaire. Comparisons between HRCCC members' opinions and those of the wider community will be detailed in a following publication.

In the last eighteen months, two community workshops held in Townsville and Ingham provided feedback and direction on the community assessment objectives, including the definition of relevant issues.

Pretests of the questionnaire were conducted in Perth. Draft versions of the survey were also sent for comment to a number of stakeholders, including residents in both the upper and lower catchment areas.

3.3 Survey Items

The final draft of the questionnaire contained items concerning:

- levels of importance, perceived impacts, awareness and attitudes towards various land and water management issues;
- perceived ability of landholders to control land and water management issues;
- tractability or "manageability" of potential issues;
- intentions to participate in land and water management and other group activities, and perceived impediments to participation;
- awareness of government strategies (including Property Management Planning, Landcare, ICM), and the HRCCC;
- attitudes towards government's performance regarding land and water management issues;
- use of information sources, including the media;
- group involvement, interest in community issues, and life satisfaction;
- demographic information.

The questionnaire is included in the report as Appendix 1.

3.4 Sampling Framework - Land use and Sample Locations

A range of landholders were contacted including those in the upper and lower catchment; in rural and urban areas; with different occupations including cane farming, grazing and mining; and with urban properties in eight settlements.

The maximum number of telephone contacts was set at 800. While this was also potentially the maximum sample size, a response rate of this size was unlikely given that some of those contacted would be unwilling to participate.

The sampling framework outlined below follows the logical order in which sample locations and sizes were selected.

3.4.1 Upper Catchment Rural

The upper catchment includes approximately 100 agricultural businesses and a much smaller number of mining enterprises. In addition to the main grazing industry, there is some dairy and small crops enterprises (mostly potatoes, corn etc.) and tree cropping.

Adhering to the approximate number of agricultural businesses (exact numbers could not be obtained), the maximum "upper rural" sample size was set as 100.

3.4.2 Upper Catchment Urban

The three selected settlements in the catchment were Herberton, Ravenshoe, and Mount Garnet. The main criterion for this sample was to gain sufficient data from each of the selected sites. Based on the criteria of population size (1991 Census), maximum "upper urban" sample numbers were set as:

- Herberton (about 1000 residents - sample 50);
- Ravenshoe (about 900 residents - sample 45);
- Mount Garnet (about 400 residents - sample 30).

3.4.3 Lower Catchment Urban

Following the sampling criterion of including settlements larger or equivalent in size to the towns surveyed in the upper catchment, the following five towns were surveyed. Based on population size, maximum "lower urban" sample numbers were set as

- Ingham (about 5100 residents - sample 100);
- Allingham (about 1000 residents - sample 50);
- Lucinda (about 800 residents - sample 40);
- Halifax (about 550 residents - sample 35);
- Taylor's Beach (about 400 residents - sample 30);

To be more representative, it was recognised that a greater number of people in Ingham ideally should complete the survey. While the designated figure could be as high as approximately 380, given other sample numbers, such a figure was considered unfeasible given available resources.

In sum, the total urban sample (across towns and both areas of the catchment) was set at 380.

3.4.4 Lower Catchment Rural

There are more than 850 cane growing businesses in the lower catchment. Other land uses include grazing (about 20 businesses) and some horticulture.

The first issue to be canvassed was the number of rural businesses to be contacted in the lower catchment. In line with the proportion of rural business aiming to be surveyed in the upper catchment (100), as one prerequisite, this figure could have varied between approximately 290 and 340 depending on whether the proportion against total shire numbers or the number of people living in the towns was selected. Of course, the main prerequisite was attaining the maximum sample size of 800 and, as such, achieving reasonable correspondence with the urban total of 380.

The selected figure of 320 corresponded with both prerequisites.

In sum, the total rural sample (across both areas of the catchment) was set at 420.

Finally, given the focus on land and water management issues, compared with urban sample numbers, the "over sampling" of the two rural areas was recognised as requirement of the survey.

3.5 Participant Selection

3.5.1 Increasing the Response Rate

In early July 1996, a CSIRO interview team was assembled in Perth. Interviewers contacted catchment residents by telephone, briefly discussed the purpose of the study and asked people if they were willing to participate. Those who agreed were subsequently mailed the questionnaire, while those who refused were asked if they would mind answering a few basic questions before hanging up (see section 4.1.1 below).

It was decided to use preliminary phone calls to help maximise the response rate to the mail-out questionnaire. In this way, the questionnaire could be mailed only to those who agreed to be involved and, rather than arriving unannounced, it was anticipated that personal contact would help to develop some familiarity with the aims of the study.

Additional means to heighten the response rate included announcing the study in a number of local newspapers before commencing the survey. Finally, reminder (follow-up) calls to participants who had not returned the questionnaire within the time designated were also included as a component of the sampling methodology.

The questionnaire was mailed along with a covering letter, a map of the catchment area and an information sheet titled, "Land and Water Management in the Tropics". The information sheet was developed by the study team as a further means to raise awareness of the overall study.

3.5.2 Contact Information

Contact information for catchment residents was obtained and collated from a number of sources, principally CSIRO Division of Tropical Crops and Pastures in Townsville, the Herberton Shire Council, the Department of Natural Resources in Mareeba, and Telstra White Pages (on CD ROM).

For each resident, information included telephone numbers, surname, first name or initials, street or postal address and, in some cases, title (Mr, Ms etc.).

Information was organised into four spreadsheets, one for each of the four samples noted above. Employing a random sampling procedure, interviewers selected residents to be contacted according to a designated number (eg. every fourth person). This was determined by the number of telephone contacts required compared with the entire sample pool (ie. the total number of residents listed on each spreadsheet). Residents were called up to three times if there was no answer.

Finally, the sampling strategy did not attempt to gain equal numbers of males and females. Given the questionnaire's focus, a sample selection favouring males appeared likely. It was notable, for example, that the clear majority of contact details in the lower rural sample were for men. Further, many women agreed to participate in the study but stated that they would ask their husbands to complete the questionnaire. The results section (4.11) shows that number of males and females did vary between samples, with the difference being greater for the two rural samples. Any differences were not considered problematic.

4.0 RESULTS

4.1 Final Sample Numbers

Of the 800 telephone calls made, those who agreed to take part numbered 718, while 82 refused. The refusal rate (around 10 percent) was low.

Compared with the original number proposed, the number of questionnaires mailed out for the four samples were:

- upper rural - 92 (100)
- lower rural - 282 (320)
- upper urban - 128 (125)
- lower urban - 216 (255)

The small discrepancy for the upper urban figures (ie. more were contacted than originally planned) was produced by transferring four potential contacts from Ingham to Mount Garnet. Contacting residents in Ingham proved more difficult than in the upper urban areas and, because of the set duration of the contact period, the two potential sample sizes were altered slightly during this period.

4.1.1 Refusals

If people declined to complete the questionnaire, there were asked if they would mind answering a few short questions before hanging up. Of the 31 people who agreed, many were elderly, retired/pensioners who felt they could not make any contribution to the study. It is likely that these factors influenced other refusal results below (eg. group membership, fishing frequency).

In brief, those who refused (and agreed to answer a few questions) had an average age of 63 years. Only 3 people were aged 30 or under, 18 people were aged 65 or above, and 23 were aged more than 50. In addition:

- most (26) stated they were not affected by any land and water management issues;
- most (26) did not belong to any local groups or associations;
- over half had not heard of the HRCCC;
- when asked "How often do you go fishing for recreation?", most (25) responded "Seldom" (4) or "Never" (21).

4.1.2 Returned Questionnaires

The number of returned and completed questionnaires was 477, providing an overall response rate of 66.4 percent (or 59.6 percent compared with the total number of telephone calls). Compared with average return rates on mail-out surveys (often as low as 20 percent), this rate was considered excellent.

In actuality, the number returned was 509. However, of these, 32 had not been completed. Various reasons were given, including only recently moving to the area, ill health, lack of time, no desire to participate, lack of knowledge, and not feeling capable of completing the task. One person noted that describing the situation in the upper catchment on the paper provided was impossible (stated problems included pest invasion, tree clearing, soil loss, and creek degradation).

In brief, it should also be noted that five of the questionnaires returned from the upper rural sample were from people who lived out of the catchment but who held property within the catchment area. Each of these participants had previously been asked to respond to the questionnaire in terms of their property. In addition, for some items relating to community

interest, the questionnaire was modified slightly so that responses were in terms of *that* community.

Questionnaires were returned from 145 and 332 people in the upper and lower catchment respectively (or 30.4 and 69.6 percent of the whole sample). Of these, 250 were classified as rural and 227 as urban (respectively, 52.4 percent and 47.6 percent of the whole sample). A breakdown of the number of questionnaires returned and response rates appears in the following table.

Catchment	Type of Holding	Number Returned	Response Rate (%)	Towns Surveyed	Number Returned	Response Rate (%)
UPPER	RURAL	59	64.1			
	URBAN	86	67.2	Herberton	38	76.0
				Mt Garnet	18	54.5
				Ravenshoe	30	66.7
LOWER	RURAL	191	67.7			
	URBAN	141	65.3	Allingham	28	60.1
				Ingham	45	61.6
				Halifax	17	54.8
				Lucinda	26	66.7
				Taylors Beach	24	88.9
TOTAL		**477**	**66.4**			

Among these figures, the very high return rate from Taylors Beach is notable (88.9 percent).

The table also shows that the number of returned questionnaires from the lower urban towns is one short of the total (141). This is explained by the fact that one resident from Cordelia expressed interest in participating in the study and was subsequently mailed the questionnaire.

4.2 Presentation of Findings

Results of the data analysis are presented here for each question in the survey. Results for the whole sample and cross comparisons (eg. between upper and lower catchment samples) are shown where relevant. The term, "whole sample" represents the total number of completed and returned questionnaires (477) and the number of people responding to a particular question (generally lower but close to 477).

The report extensively uses the term, **"the four samples"**, which - as used above - denotes the upper urban, upper rural, lower urban, and lower rural samples. Generally, each item in the questionnaire was first examined for any statistically significant response differences existed between these samples.

Responses to many following questions, were rated on 5-point scales. To present findings consistently, there are some modifications for response formats in this report. Unlike the questionnaire, for example, the scale of positive responses (such as very high, strongly agree) to negative responses (such as not at all useful, strongly disagree) is generally rated from 5 to 1 respectively. Where relevant, the presentation of results in the report may also differ from the items as they appear in the questionnaire.

In the following tables, the figure "**N**" denotes the number of responses given for a particular question. For any question, a number of people chose not to respond.

Finally, interviewees could provide up to three responses for open-ended questions. Therefore, percentages will not add to 100 but show the number of people giving a particular response (compared with the whole sample). For these questions, categories were also formed to maintain both detail and ease of presentation. Therefore, some categories may not be mutually exclusive.

4.2.1 Statistical tests

A number of statistical tests were used throughout the report. These included correlation analysis; appropriate analysis of variance for multiple group contrasts, paired samples t-tests (to compare mean scores); reliability, regression and factor analysis; cross tabulations (for categorical data such as group membership); and, where appropriate, non-parametric tests.

4.3 Advantages of, and key issues facing people, living in the Herbert River Catchment

Both following questions were open-ended, with each allowing up to three responses.

What do you think are the major advantages of living in the Herbert?

As stated, percentages will not add to 100 but show, compared with the total number of people who provided at least one response (431), how many gave a particular response. Some of the more prominent advantages are noted in the following table.

Advantages	N	Percent
Good climate	152	35.3
Lifestyle (stress free; country atmosphere)	138	32.1
Close access to many recreation sites (eg. beaches; rainforest)	83	19.3
Quality of the people (eg. caring, friendly, easy going, helping)	71	16.5
Healthy environment (eg. less pollution)	63	14.6
Personal safety / security (eg. better for children; low crime)	57	13.2
Small community / low population	56	13.0
Very quiet / peaceful	55	12.8
Good environment (unspoiled, natural, abundant wildlife)	54	12.5
Close to large centres (but also far enough away)	35	8.1
Good area for production (eg. sugar; soil; natural rainfall)	18	4.2
Good facilities	14	3.2
It's home	14	3.2
Good quality drinking water	11	2.6
Close knit community	10	2.3
Affordable land	7	1.6

In total, the sample provided 888 responses. 838 (or nearly 90 percent) are noted in the table.

The advantages clearly speak for themselves. In brief, the area offers a good climate, excellent recreation opportunities, and a relaxed and healthy rural lifestyle. Communities are friendly and cooperative and provide a safe environment. Other advantages include proximity to (and enough distance from) Townsville and Cairns, and the area's productive capacity.
Of interest, 16 of the 18 responses stating the area was good for production were from the lower catchment. Similarly, 11 of the 14 who saw good facilities as an advantage were from the lower catchment.

Generally, what do you think are some of the key issues facing people in the Herbert?

For this open-ended question, 409 people gave at least one response. More prominent key issues are noted in the following table.

Key Issues	N	Percent
Unemployment (particularly long term)	169	41.3
Clearing of marginal land/poor land management (including cane land expansion; tree clearing; "fauna versus farming")	60	14.7
Lack of diversity in industry/need for a new major industry (including over-reliance on sugar industry; economic downturn)	59	14.4
Water quantity (eg. Availability; lack of storage; lack of groundwater)	39	9.5
Lack, and need for improvement, of community services/facilities	38	9.3
Lack of opportunities for young people	31	7.6
Fishing issues (eg. overfishing, habitat loss, swamp drainage)	25	6.1
Pollution (water and air)	24	5.9
Flooding in the lower catchment	23	5.6
Lack of entertainment	21	5.1
Poor drinking water quality	20	4.9
Poor quality roads / poorly maintained roads	18	4.4
Tourism - lack of any tourism development	17	4.2
Drainage (eg. dissatisfaction with new proposals, run off too fast from new assignments)	13	3.2
Environmental issues (eg. affect lifestyle and potential for jobs)	11	2.7
Cane Prices	10	2.4
Conservationists/greenies ("ratbags")	10	2.4
Poor political representation	10	2.4
Continuous crushing of cane	10	2.4

In total, 786 responses were provided, of which 608 (more than 77 percent) appear in the table.

Unemployment was clearly the most pressing issue and, relatedly, opportunities for young people was the sixth most frequent response. Concerns about land management (primarily land clearing), lack of diversity and over-reliance on one industry, water availability and inadequate community services were also frequently mentioned.

Interestingly, for the issue regarding lack of diversity in industry, 54 of the 59 responses were from the lower catchment. Similarly, 12 of the 13 responses concerning drainage were from the lower catchment. Conversely, 24 of the 38 responses regarding community services, and 14 of the 18 responses regarding poor quality roads were from the upper catchment.

4.4 Issue Importance

For each of the four issues (below), ratings were gained for the importance felt personally and that perceived to be felt by others in the Herbert. A five-point scale ranging from very high to very low importance was used.
Both personal importance and importance to others were included to find any differences between samples and across issues. It was anticipated that the two ratings (self and others) may differ, and that knowledge of such differences would be important for establishing the importance of land and water management issues across the catchment. Future studies could also examine whether differential ratings for self and others highlight situations such as a "tolerance" for public policy and resource management approaches but a lack of willingness to be personally involved.

This and the following component of the questionnaire (Impacts of Issues, section 4.5) were derived from the survey of HRCCC members. Developed in consultation with catchment residents and other stakeholders, these items correspond with four general issues of importance (ie. land degradation, water quality problems, water quality problems, and nature conservation issues), and the potential influences of these issues on life in the Herbert. For the latter, fifteen impacts were generated, including high cost of water, loss of farm productivity, and poor drinking water quality.

In your opinion, how important are the following issues (1) to you personally, and (2) to people in the Herbert generally?

Land degradation

		importance to you personally		importance to people in the Herbert	
Response	**Rating**	**N (450)**	**Percent**	**N (438)**	**Percent**
very high importance	5	186	41.3	128	29.2
high	4	105	23.3	117	26.7
moderate	3	103	22.9	134	30.6
low	2	38	8.4	42	9.6
very low importance	1	18	4.0	17	3.9
		TOTAL 450	100.0	TOTAL 438	100.0
		Mean = 3.9		Mean = 3.7	

Both mean scores (3.9 and 3.7) indicate that land degradation was generally seen as highly important for both self and others. This was less so in terms of the importance for others in the Herbert, with moderate importance being chosen by more participants. Indeed, while the mean scores are similar, the importance of land degradation was seen as significantly lower for others than that attributed personally. On further scrutiny, this difference resulted entirely from the lower ratings of importance provided by many in the two rural samples. For example, whereas the ratings for both urban samples did not change, the mean for the upper rural sample dropped from 4.1 to 3.4. Consequently, ratings of the importance to others differed between the rural and urban samples.

There were no other significant differences between the samples.

Water Quantity Problems

		importance to you personally		importance to people in the Herbert	
Response	**Rating**	**N (456)**	**Percent**	**N (437)**	**Percent**
very high importance	5	226	49.6	190	43.5
high	4	89	19.5	99	22.7
moderate	3	86	18.9	97	22.2
low	2	27	5.9	32	7.3
very low importance	1	28	6.1	19	4.3
		TOTAL 456	100.0	TOTAL 437	100.0
		Mean = 4.0		Mean = 3.9	

Water quantity problems generally seen as high importance for both self and others (means 4.0 and 3.8). As for land degradation, compared with personal importance, the importance of water quantity problems for others was generally seen as different. Interestingly, mean scores dropped for both rural samples, and rose slightly for the upper urban sample (and was virtually unchanged for the lower urban sample). For example, the mean for the upper rural sample dropped from 4.3 to 3.9. Consequently, ratings of the importance to others differed between the rural and urban samples.

For personal importance, compared with both upper catchment samples, the lower rural sample was less likely to see water quantity problems as important (mean 3.8). Related to this finding, and as indicated by many responses to the question on key issues (page 10), such problems were generally viewed in terms of the availability and lack - rather than abundance - of water. However, people in the lower rural sample who noted that flooding and/or drainage were key issues (21 people or 11 percent of this sample) also tended to see water quantity problems as

having higher importance (mean 4.1, which was comparable with that of the combined upper catchment sample).

Water Quality Problems

		importance to you personally		importance to people in the Herbert	
Response	**Rating**	**N (462)**	**Percent**	**N (440)**	**Percent**
very high importance	5	250	54.1	204	46.4
high	4	103	22.3	109	24.8
moderate	3	61	13.2	77	17.5
low	2	30	6.5	40	9.1
very low importance	1	18	3.9	10	2.3
		TOTAL 462	100.0	TOTAL 440	100.0
		Mean = 4.2		Mean = 4.0	

Water quality problems were generally seen as highly important for both self and others (means 4.2 and 4.0). As for land degradation and water quantity, compared with personal importance, the importance of water quality problems was seen as significantly lower for others. However, unlike the previous findings, mean scores dropped for all four samples (rural and urban).

The same significant difference between the samples was found for personal importance and importance to others. Compared with the combined rural sample, those in the combined urban sample were more likely to place higher ratings of importance on the issue of water quality (means were between 4.1 and 4.3).

Nature Conservation Issues

		importance to you personally		importance to people in the Herbert	
Response	**Rating**	**N (450)**	**Percent**	**N (438)**	**Percent**
very high importance	5	147	32.7	84	19.3
high	4	104	23.1	83	19.0
moderate	3	141	31.3	173	39.7
low	2	38	8.4	67	15.4
very low importance	1	20	4.4	29	6.7
		TOTAL 450	100.0	TOTAL 438	100.0
		Mean = 3.7		Mean = 3.3	

Nature conservation issues were generally seen as having high to moderate importance for both self and others (means 3.7 and 3.3). As for the three previous issues, compared with personal importance, importance was generally seen as significantly lower for others. Mean scores dropped for all samples, particularly the upper rural and lower urban samples.

In terms of personal importance, compared with the lower rural sample, those in the lower urban sample were more likely to see nature conservation issues as important.
Unlike the three previous issues, there were no differences between the samples when examining importance to others. This occurred because, compared with personal importance, the mean score dropped most substantially for the lower urban sample, and was virtually identical with the lower rural sample.

In summary, the importance of land degradation, water quality problems, water quantity problems, and nature conservation issues were generally seen as high. For example, while the

lowest mean scores were for nature conservation issues, these were still on the high side of moderate. Finally, water quality problems were considered the most important issue.

4.5 Impacts of Issues

In your opinion, how much do each of the following impacts (1) affect you personally, and (2) affect people in the Herbert generally?

From high cost of water to loss of scenery, participants rated the following 15 impacts in terms of the degree to which they and others were affected. A five-point scale ranging from a very high to very low degree was used and, in addition, the response "not at all" was also included as an extra category. As the following tables indicate, this category was coded as zero and included in analysis of responses. As such, the midpoint of the scale is 2.5, or low to moderate.

High cost of water

		affects you personally		affects people in the Herbert	
Response	**Rating**	**N (462)**	**Percent**	**N (431)**	**Percent**
Very high degree	5	91	19.7	115	26.7
High	4	57	12.3	105	24.4
Moderate	3	91	19.7	122	28.3
Low	2	83	18.0	62	14.4
Very low degree	1	77	16.7	23	5.3
Not at all	0	63	13.6	4	.9
		TOTAL 462	100.0	TOTAL 431	100.0
		Mean = 2.6		Mean = 3.5	

In terms of personal effect, the frequencies and mean scores indicate a spread of scores across the scale. However, it is noticeable that (for this and many following issues) more participants were placed towards the high end of the scale when considering the impact on other people in the Herbert. Indeed, for the whole sample, the mean scores indicate that the effect of high water costs was seen as higher on others than that experienced personally (moderate to high compared with low to moderate).

This issue produced a number of significant differences. First, compared with the three other main samples, the lower urban sample was more likely to consider the cost of water as having an effect personally. Indeed, at 3.4, the mean score returned for this sample was between moderate and high which contrasts particularly with the upper and lower rural samples which returned means of 2.0 and 2.1 respectively. Second, compared with both rural samples, the upper urban sample (mean 2.8) was also more likely to consider the cost of water as having an effect personally. As these results suggest, compared with the combined rural sample, the combined urban sample was more likely to see the cost of water as having an effect personally.

In terms of the effect on others, those in the lower rural sample were less likely to see the cost of water as having an effect than both urban samples

The table shows that, in terms of personal effect, the mean score for the whole sample was moderate. However, with a mean of 3.7, the effect on the lower rural sample was closer to high and contrasts significantly with the three other samples, all of which were below 3. As expected, most of those not at all affected were from the urban sample (nearly 70 percent).

Loss of farm productivity

		affects you personally		affects people in the Herbert	
Response	**Rating**	**N (457)**	**Percent**	**N (437)**	**Percent**
very high degree	5	116	25.4	148	33.9
high	4	77	16.8	143	32.7
moderate	3	82	17.9	91	20.8
low	2	70	15.3	38	8.7
very low degree	1	65	14.2	14	3.2
not at all	0	47	10.3	3	.7
		TOTAL 457	100.0	TOTAL 437	100.0
		Mean = 2.9		Mean = 3.8	

Again, while a spread of scores was noticeable for personal impacts, for the impact on others, the frequencies and mean scores reveal that more respondents were placed towards the top end of the scale. As such, for the whole sample, the effect of lost farm productivity was considered higher on other people in the Herbert than that experienced personally. However, as was touched upon for the effects of water prices, this was not so for the lower rural sample which returned a similar mean score. Therefore, this group had more stability when rating impacts for self and others. This finding appears again for a number of the following items.

From this result it appears feasible that lost farm productivity is likely to be more of an issue for cane growers than other rural producers or urban residents in the catchment.

Finally, one interesting finding was that the lower urban sample was more likely than both rural samples to consider lost farm productivity as having an effect on others. In this way, a number of other findings below also suggest that, compared with the upper urban sample, the lower urban sample was the more "urban" of the two (ie. distinguishable as different to rural). For those in the upper urban sample, the effects of issues such as lost productivity more closely resembled those of the rural samples. Therefore, people living in Ravenshoe, Herberton and Mount Garnet may be more integrated with the rural community.

Higher production costs

		affects you personally		affects people in the Herbert	
Response	**Rating**	**N (455)**	**Percent**	**N (431)**	**Percent**
very high degree	5	160	35.2	182	42.2
high	4	108	23.7	152	35.3
moderate	3	65	14.3	71	16.5
low	2	44	9.7	17	3.9
very low degree	1	43	9.5	5	1.2
not at all	0	35	7.7	4	.9
		TOTAL 455	100.0	TOTAL 431	100.0
		Mean = 3.4		Mean = 4.1	

As might be expected, impacts of higher production costs were more likely to be personally experienced by participants in both rural samples, particularly those in the lower catchment. Indeed, for this sample, the mean (4.3) shows that - on average - these costs are felt from a high to very high degree. Conversely, as anticipated, most of those not at all affected were from the urban sample (more than 80 percent).

Frequencies and mean scores demonstrate that more participants were placed towards the top end of the scale for the impact on others. As such, for the whole sample, the effect of higher production costs was considered higher on others than that experienced personally (high, compared with moderate to high). Again, however, this was not the case for the lower rural sample which returned a similar mean score for both questions.

As for the issue of lost farm productivity, it appears that increased production costs are likely to be more of an issue for cane growers than others in the catchment.

Poor drinking water quality

		affects you personally		affects people in the Herbert	
Response	**Rating**	**N (467)**	**Percent**	**N (435)**	**Percent**
Very high degree	5	187	40.0	199	45.7
High	4	78	16.7	106	24.4
Moderate	3	49	10.5	73	16.8
Low	2	53	11.3	36	8.3
Very low degree	1	51	10.9	17	3.9
Not at all	0	49	10.5	4	.9
		TOTAL 467	100.0	TOTAL 435	100.0
		Mean = 3.3		Mean = 4.0	

With mean scores between moderate and high, both scales indicate that many participants considered the impacts of poor drinking water quality to be very high. However, one notable difference is the number of participants who did not consider they were personally affected (nearly 75 percent of whom were rural producers). In general, the impact was considered higher on others in the Herbert.

Significant differences between samples were in relation to personal impacts. While other samples returned more moderate mean scores, the mean for the lower urban sample was close to high (the difference between the rural and urban sample was also significant). In fact, those in Ingham rated the problem as high to very high. Therefore, urban residents in the lower catchment were more likely to be affected by poor drinking water. This finding provides an indication of why this sample gave high ratings for the importance of water quality problems (discussed earlier). This being noted, the poor quality of drinking water appears to be at least a moderate problem throughout the catchment.

Shortage of irrigation water

		affects you personally		affects people in the Herbert	
Response	**Rating**	**N (453)**	**Percent**	**N (431)**	**Percent**
Very high degree	5	104	23.0	129	29.9
High	4	54	11.9	95	22.0
Moderate	3	62	13.7	105	24.4
Low	2	66	14.6	56	13.0
Very low degree	1	90	19.9	39	9.0
Not at all	0	77	17.0	7	1.6
		TOTAL 453	100.0	TOTAL 431	100.0
		Mean = 2.5		Mean = 3.5	

As with previous issues, the first noticeable result for the impacts of irrigation water shortage is the significant difference between those experienced personally and by others. Mean scores for the whole sample were between low to moderate, and moderate to high respectively.

There were no differences among the four samples regarding personal impacts. However, for impacts on others, the upper urban sample had a significantly higher mean score than all other samples, particularly the lower rural sample (4.2 and 2.9 respectively).

Declining human health

		affects you personally		affects people in the Herbert	
Response	**Rating**	**N (452)**	**Percent**	**N (424)**	**Percent**
very high degree	5	143	31.6	122	28.8
high	4	63	13.9	72	17.0
moderate	3	94	20.8	113	26.7
low	2	55	12.2	64	15.1
very low degree	1	66	14.6	42	9.9
not at all	0	31	6.9	11	2.6
		TOTAL 452	100.0	TOTAL 424	100.0
		Mean = 3.2		Mean = 3.3	

For both personal impacts and those experienced by others, the means scores indicate declining human health to be considered as a moderate problem. The fact that more than 45 percent of the sample considered they and others were affected to a high or very high degree is also noteworthy. Notably, most of those not at all affected were from the urban sample (nearly 80 percent).

Interestingly, while the difference in mean scores appears negligible, it was statistically significant. This was due principally to a more marked increase in the mean scores between the two urban samples, while both rural samples tended to be more stable.

Next, compared with the upper rural sample, the two lower catchment samples were more likely to report being affected by declining health. This was also the case when comparing only the upper urban and lower urban samples. For effects on others, compared with the upper rural sample, those from the lower urban sample were more likely to consider these as high.

Loss of independence to make business decisions

		affects you personally		affects people in the Herbert	
Response	**Rating**	**N (444)**	**Percent**	**N (413)**	**Percent**
very high degree	5	117	26.4	108	26.2
high	4	71	16.0	102	24.7
moderate	3	76	17.1	108	26.2
low	2	60	13.5	48	11.6
very low degree	1	58	13.1	31	7.5
not at all	0	62	14.0	16	3.9
		TOTAL 444	100.0	TOTAL 413	100.0
		Mean = 2.9		Mean = 3.4	

On average, loss of independence was rated as having a moderate impact personally and a moderate to high impact on others. Once again, this difference was significant. However, as for preceding impacts there was no difference between means for the lower rural sample. While it might be anticipated that urban residents would be more likely to see loss of independence as having a greater impact on others (namely rural producers), this was also the case for the upper rural sample.

Following on from this finding, compared with all other samples, those in the lower rural sample were more likely to state loss of independence as a problem. The mean score for this sample was 3.4, with the three other means being below 3.

In terms of the impacts on others, no significant differences were evident.

Emotional stress

		affects you personally		affects people in the Herbert	
Response	**Rating**	**N (448)**	**Percent**	**N (411)**	**Percent**
Very high degree	5	87	19.4	77	18.7
High	4	69	15.4	77	18.7
Moderate	3	100	22.3	152	37.0
Low	2	85	19.0	73	17.8
Very low degree	1	64	14.3	21	5.1
Not at all	0	43	9.6	11	2.7
		TOTAL 448	100.0	TOTAL 411	100.0
		Mean = 2.8		Mean = 3.2	

Both mean scores for the impact of emotional stress were around the moderate mark, with the effect on others being significantly higher.

There was only one significant difference among the four samples. Compared with both upper catchment samples (mean scores both 2.4), the lower rural sample considered emotional stress to have more of a personal impact (mean 3.1). As previously, ratings for personal impacts and those on others were more uniform within the lower rural sample.

Conflicts with other local people

		affects you personally		affects people in the Herbert	
Response	**Rating**	**N (451)**	**Percent**	**N (413)**	**Percent**
Very high degree	5	47	10.4	54	13.1
High	4	34	7.5	49	11.9
Moderate	3	74	16.4	146	35.4
Low	2	110	24.4	93	22.5
Very low degree	1	120	26.6	60	14.5
Not at all	0	66	14.6	11	2.7
		TOTAL 451	100.0	TOTAL 413	100.0
		Mean = 2.1		Mean = 2.8	

The two mean scores for the impact of conflicts with other local people ranged roughly from low to moderate, with the effect on others being significantly higher. While the ranges for both rural samples tended to be smaller (when compared with the urban samples), the differences were significant.

For the four samples, the only difference in means was between the lower rural and upper urban samples. The lower sample was more likely to consider conflict as having a personal effect (although to only just over a low degree). This difference also translated into a distinction between the lower and upper catchments, with the former also being more likely to consider conflict as having a personal effect.

There were no other significant differences between samples.

Higher taxes

		affects you personally		affects people in the Herbert	
Response	**Rating**	**N (453)**	**Percent**	**N (425)**	**Percent**
very high degree	5	221	48.8	212	49.9
high	4	111	24.5	125	29.4
moderate	3	63	13.9	63	14.8
low	2	22	4.9	11	2.6
very low degree	1	23	5.1	8	1.9
not at all	0	13	2.9	6	1.4
		TOTAL 453	100.0	TOTAL 425	100.0
		Mean = 4.0		Mean = 4.2	

Compared with all other potential impacts put forward in the questionnaire, the effect of higher taxes (closely followed by loss of confidence in government to be discussed below) was considered to have the highest impact. This was around high for both mean scores and, despite their similarity, the effect on others was significantly higher. As for many previous issues, this occurred even though there was no difference between means for the lower rural sample.

Compared with both upper catchment samples, the lower rural sample was more likely to feel personally affected by higher taxes (the mean score for this sample was 4.3 and, for the lower urban sample, 4.0). There were no differences between samples for the effects of higher taxes on others.

Lower fish numbers

		affects you personally		affects people in the Herbert	
Response	**Rating**	**N (454)**	**Percent**	**N (429)**	**Percent**
very high degree	5	164	36.1	141	32.9
high	4	85	18.7	119	27.7
moderate	3	83	18.3	112	26.1
low	2	55	12.1	32	7.5
very low degree	1	32	7.0	20	4.7
not at all	0	35	7.7	5	1.2
		TOTAL 454	100.0	TOTAL 429	100.0
		Mean = 3.4		Mean = 3.7	

While both mean scores for the impact of lower fish numbers were similar and between moderate and high, the *perceived* impact on others was significantly higher. Again, there was only a slight (non-significant) difference between means for the lower rural sample.

Differences among the four samples were the same for personal impacts and for those on others. The major difference was seen by combining the samples into upper and lower groups, with the mean impact for those in the lower catchment approaching high and for the upper catchment slightly below moderate (means were 3.7 and 2.8 respectively). In particular, those living in Taylors Beach (and, to a lesser extent, Lucinda and Halifax) were likely to consider the impacts as high (mean 4.4).

Clearly, and not surprisingly, fishing appears to be more of a recreational activity in the lower catchment, especially for those living closer to the coast.

Loss of access to recreation

		affects you personally		affects people in the Herbert	
Response	**Rating**	**N (450)**	**Percent**	**N (429)**	**Percent**
Very high degree	5	140	31.1	137	31.9
High	4	100	22.2	108	25.2
Moderate	3	97	21.6	118	27.5
Low	2	42	9.3	35	8.2
Very low degree	1	38	8.4	20	4.7
Not at all	0	33	7.3	11	2.6
		TOTAL 450	100.0	TOTAL 429	100.0
		Mean = 3.4		Mean = 3.6	

For loss of access to recreation, more than 50 percent of the sample considered impacts experienced personally and by others as high or very high. Both mean scores were between moderate and high, with the latter being significantly higher. The means for all samples tended to rise.

The only significant difference concerned impacts on others. Lower urban participants considered the impacts of loss of access as higher than both upper catchment samples.

Loss of confidence in government's ability to manage land and water resources

		affects you personally		affects people in the Herbert	
Response	**Rating**	**N (453)**	**Percent**	**N (427)**	**Percent**
Very high degree	5	197	43.5	169	39.6
High	4	98	21.6	105	24.6
Moderate	3	112	24.7	114	26.7
Low	2	26	5.7	24	5.6
Very low degree	1	13	2.9	14	3.3
Not at all	0	7	1.5	1	.2
		TOTAL 453	100.0	TOTAL 427	100.0
		Mean = 3.9		Mean = 3.9	

As can be seen, both mean scores for the impact of loss of confidence in government were high and the same (to one decimal place), and there was no significant difference between them. Therefore, unlike previous impacts, loss of confidence in government was high in both rural and urban areas throughout the catchment.

All means for all samples centred around high (between 3.7 and 4.1). The means just noted provided the only difference between the samples, with the lower urban sample considering the impacts on others to be higher than the lower rural sample.

While both mean scores for the impact of loss of environmental uses/benefits were similar (generally moderate), the perceived impact on others was - unusually - significantly lower.

The only other differences were between the upper rural and lower urban sample, with the latter tending to rate the personal impact as higher (means were 3.1 and 3.7 respectively) and the impact on others also as higher (means were 3.0 and 3.5 respectively). In particular, those living in Taylors Beach (and, to a lesser extent, Halifax) rated the personal impact as higher (mean 4.3). The average rating provided by Ingham residents (3.2) was the second lowest of the 8 settlements (only Mount Garnet was lower).

Loss of environmental uses or benefits

		affects you personally		affects people in the Herbert	
Response	**Rating**	**N (450)**	**Percent**	**N (421)**	**Percent**
very high degree	5	128	28.4	86	20.4
high	4	89	19.8	73	17.3
moderate	3	124	27.6	163	38.7
low	2	58	12.9	66	15.7
very low degree	1	30	6.7	24	5.7
not at all	0	21	4.7	9	2.1
		TOTAL 450	100.0	TOTAL 421	100.0
		Mean = 3.4		Mean = 3.2	

Loss of scenery

		affects you personally		affects people in the Herbert	
Response	**Rating**	**N (449)**	**Percent**	**N (420)**	**Percent**
very high degree	5	114	25.4	71	16.9
high	4	76	16.9	55	13.1
moderate	3	116	25.8	154	36.7
low	2	52	11.6	66	15.7
very low degree	1	58	12.9	57	13.6
not at all	0	33	7.3	17	4.0
		TOTAL 449	100.0	TOTAL 420	100.0
		Mean = 3.1		Mean = 2.9	

Both mean scores for the impact of loss of scenery were similar (moderate) and, as for the impact of lost environmental uses, the perceived impact on others was also significantly lower. However, a drop in ratings was only apparent for the lower urban and, to a lesser extent, the upper rural sample.

For personal impacts, compared with the other three samples, the lower urban sample tended to rate loss of scenery as having a higher impact (mean 3.6). All other samples had mean scores of 3 or below. Again, of the lower urban sample locations, those living in Taylors Beach rated the impact as highest (mean 4.1).

For others, compared with the upper rural sample, the lower urban sample rated the impact as higher (means were 2.5 and 3.2 respectively).

4.5.6 Summary

For personal impacts, from highest to lowest, the seven highest impacts included higher taxes, loss of confidence in government's ability to manage land and water resources, higher production costs, lower fish numbers, loss of environmental uses/benefits, loss of access to recreation, and poor drinking water quality. In particular, higher taxes and loss of confidence in government were highly rated.

Loss of farm productivity was also considered a high impact for the lower rural sample. Interestingly, conflict with other local people was considered the lowest impact for the whole sample.

For impacts on others, from highest to lowest, the seven highest impacts included higher taxes, higher production costs, poor drinking water quality, loss of confidence in government, loss of

farm productivity, lower fish numbers, and loss of access to recreation. Higher taxes and higher production costs were the two issues with a mean score higher than 4.

4.6 Tractability

This component of the questionnaire examined how manageable (or practical) catchment management might be, given perceptions of possible impediments to effectively managing land and water in the catchment.

Participants were asked to rate how much they agreed or disagreed with a series of statements, with each underlining a potential obstacle to managing land and water. The fourteen statements are as follows.

Managing land and water in the Herbert is difficult because...

(1) problems aren't well understood

Response	Rating	N (458)	Percent
strongly agree	5	100	21.8
agree	4	224	48.9
neither agree nor disagree	3	71	15.5
disagree	2	48	10.5
strongly disagree	1	15	3.3
	TOTAL	458	100.0
Mean = 3.8			

The mean score (3.8) and the fact that nearly 50 percent of the whole sample agreed, shows general agreement with this statement. There was no significant difference among the four samples.

(2) solutions aren't easy

Response	Rating	N (463)	Percent
strongly agree	5	109	23.5
agree	4	265	57.2
neither agree nor disagree	3	36	7.8
disagree	2	45	9.7
strongly disagree	1	8	1.7
	TOTAL	463	100.0
Mean = 3.9			

The mean score (3.9) and the fact that more than 57 percent of the whole sample agreed, indicates general agreement with this statement. While there was no significant difference specifically among the four samples, compared with the upper catchment, those in the lower catchment sample were more likely to agree that solutions are not easy (means were 3.7 and 4 respectively).

(3) there aren't any problems that need urgent action

Response	Rating	N (458)	Percent
Strongly agree	5	14	3.1
Agree	4	29	6.3
Neither agree nor disagree	3	55	12.0
Disagree	2	209	45.6
Strongly disagree	1	151	33.0
	TOTAL	458	100.0
Mean = 2.0			

Notably, nearly 90 percent of the sample chose to disagree or strongly disagree that there are no problems requiring urgent action. No significant differences were evident for this statement, with all samples showing a large amount of disagreement.

(4) local people lack the money to spend on solutions

Response	Rating	N (463)	Percent
Strongly agree	5	79	17.1
Agree	4	211	45.6
Neither agree nor disagree	3	82	17.7
Disagree	2	64	13.8
Strongly disagree	1	27	5.8
	TOTAL	463	100.0
Mean = 3.5			

As the frequencies and mean score indicate, nearly 63 percent of the sample agreed or strongly agreed that local people lack money to spend on solutions.

There were a number of significant differences among the four samples. First, compared with the other three samples, participants in the lower urban sample were less likely to agree (the mean score was close to the midpoint of 3, while upper catchment means were both 3.9). In addition, the lower rural sample was also less likely to agree than both upper catchment samples, thus indicating a difference between the two catchments generally.

In review, while the lower urban sample was less likely to agree (including when compared with the lower rural sample), as a whole, lower catchment participants were significantly less likely to agree than those in the upper catchment. Put another way, those in the upper catchment were *more* likely to agree that local people lack money to spend on solutions. Of interest, this was particularly the case for Mount Garnet residents (mean 4.4).

(5) government strategies are a waste of time

Response	Rating	N (460)	Percent
strongly agree	5	62	13.5
agree	4	107	23.3
neither agree nor disagree	3	183	39.8
disagree	2	88	19.1
strongly disagree	1	20	4.3
	TOTAL	460	100.0
Mean = 3.2			

Nearly 40 percent of the sample chose to neither agree nor disagree with this statement, and there was also a reasonable spread of scores across the scale. There was no significant difference among the four samples. Therefore, throughout the catchment, the issue of whether government strategies are a waste of time is likely to bring out a broad range of responses, including many along the lines of neither agree nor disagree.

(6) solutions are expensive

Response	**Rating**	**N (463)**	**Percent**
strongly agree	5	104	22.5
agree	4	256	55.3
neither agree nor disagree	3	63	13.6
disagree	2	35	7.6
strongly disagree	1	5	1.1
	TOTAL	463	100.0

Mean = 3.9

The means score (3.9) and the fact that more than 55 percent of the whole sample chose to agree, indicates general agreement that solutions are expensive. There was no significant difference among the four samples. Perhaps of some note, the 5 people who chose to disagree strongly were from the urban samples.

(7) there are few benefits and many costs

Response	**Rating**	**N (459)**	**Percent**
strongly agree	5	45	9.8
agree	4	114	24.8
neither agree nor disagree	3	96	20.9
disagree	2	171	37.3
strongly disagree	1	33	7.2
	TOTAL	459	100.0

Mean = 2.9

The table shows that the whole sample appeared somewhat split between those who agreed and those who disagreed that there are few benefits and many costs. This being noted, the statement averaged out as one in which the whole sample neither agreed nor disagreed (mean 2.9). Finally, no significant difference was evident among the four samples. However, on a more specific level, residents of Ingham were more likely to agree than Ravenshoe residents.

(8) local people don't want to spend money on solutions

Response	**Rating**	**N (460)**	**Percent**
Strongly agree	5	47	10.2
Agree	4	172	37.4
Neither agree nor disagree	3	137	29.8
Disagree	2	93	20.2
Strongly disagree	1	11	2.4
	TOTAL	460	100.0

Mean = 3.3

There was a reasonable amount of agreement that local people do not want to spend money on solutions. However, the mean score and frequencies in the table indicate that, on average, participants tended to neither agree nor disagree. There were no significant differences between samples.

(9) the Herbert River catchment covers a large area

Response	Rating	N (461)	Percent
Strongly agree	5	142	30.8
Agree	4	272	59.0
Neither agree nor disagree	3	19	4.1
Disagree	2	24	5.2
Strongly disagree	1	4	.9
	TOTAL	461	100.0
Mean = 4.1			

As can be seen, there was very high agreement that the catchment covers a large area. Indeed, more than 60 percent of participants agreed and nearly 90 percent agreed or strongly agreed with this statement. There were no significant differences between samples.

(10) it's hard to get around the catchment (eg. from top to bottom)

Response	Rating	N (456)	Percent
Strongly agree	5	111	24.3
Agree	4	219	48.0
Neither agree nor disagree	3	79	17.3
Disagree	2	41	9.0
Strongly disagree	1	6	1.3
	TOTAL	456	100.0
Mean = 3.8			

The table indicates general acknowledgement of the difficulty of moving around the catchment (mean 3.8). No significant differences were evident among samples.

(11) people in the Herbert have a wide variety of opinions

Response	Rating	N (464)	Percent
strongly agree	5	79	17.0
agree	4	274	59.1
neither agree nor disagree	3	77	16.6
disagree	2	30	6.5
strongly disagree	1	4	.9
	TOTAL	464	100.0
Mean = 3.8			

The mean score and frequencies display general agreement that a wide variety of opinions exist in the Herbert (mean 3.8). There were no significant differences between samples.

An interesting comparison exists between the high level of agreement for this statement and the finding that conflict with other local people tended to be rated as a low impact. The two items

were not related. Therefore, while the existence of numerous opinions may impede land and water management in the Herbert, this may not, or has yet to, generate high levels of conflict among local people. From this, it might be suggested that, as a whole, the catchment community is likely to be resilient.

(12) local people don't trust government programs

Response	Rating	N (462)	Percent
strongly agree	5	111	24.0
agree	4	208	45.0
neither agree nor disagree	3	113	24.5
disagree	2	29	6.3
strongly disagree	1	1	.2
	TOTAL	462	100.0

Mean = 3.9

As above, the tendency was to agree with this statement (mean 3.9). There were no significant differences between samples. Across the board, level of trust in government therefore appears to be a key issue facing ICM in the Herbert.

(13) local people aren't that interested in community-type activities

Response	Rating	N (459)	Percent
strongly agree	5	24	5.2
agree	4	104	22.7
neither agree nor disagree	3	138	30.1
disagree	2	169	36.8
strongly disagree	1	24	5.2
	TOTAL	459	100.0

Mean = 2.9

While approximately 37 percent of the sample disagreed, this statement averaged out as one in which the whole sample neither agreed nor disagreed (mean 2.9). While no significant differences existed among the four samples, when comparing urban areas, Herberton residents were more likely to agree than those in Ingham (means 3.1 and 2.4 respectively).

(14) the government doesn't want to spend money on solutions

Response	Rating	N (463)	Percent
Strongly agree	5	100	21.6
Agree	4	174	37.6
Neither agree nor disagree	3	133	28.7
Disagree	2	52	11.2
Strongly disagree	1	4	.9
	TOTAL	463	100.0

Mean = 3.7

The mean score (3.7) and frequencies (more than 59 percent agreed or strongly agreed) indicate widespread agreement that the government does not want to spend money on solutions. There were no significant differences between samples.

4.6.5 Summary

In summary, from highest to lowest, the seven highest impediments to managing land and water in the Herbert were considered to be:

- the catchment's large area;
- a lack of easy solutions;
- the cost of solutions;
- low trust of government programs;
- the difficulty in moving around the catchment;
- the wide variety of opinions held by local people;
- insufficient understanding of relevant problems.

Also noteworthy, the three lowest potential impediments (all with mean scores below 3) included the statements "there are few benefits and many costs", "local people aren't that interested in community-type activities", and "there aren't any problems that need urgent action". In particular, participants tended to disagree most often with this final statement.

4.7 Knowledge of Government Strategies

Before we contacted you about this study, which of the following government strategies had you heard about?

		Property Management Planning (PMP)		Landcare		Integrated Catchment Management (ICM)	
Response	**Rating**	**N(475)**	**Percent**	**N(475)**	**Percent**	**N(475)**	**Percent**
Yes	1	123	25.9	406	85.5	178	37.5
No	2	352	74.1	69	14.5	297	62.5
TOTAL		475	100.0	475	100.0	475	100.0

The table shows that Landcare was by far the most familiar strategy to participants in the study. In brief, those who had not heard about Landcare were more likely to be in the urban samples, particularly the lower urban sample. Those who had heard about ICM and PMP were most likely to come from the lower rural sample (60 and 55 percent respectively).

Which strategy did you know most about?

Response	**Rating**	**N (453)**	**Percent**
PMP	1	12	2.6
Landcare	2	333	73.5
ICM	3	47	10.4
don't know of any	4	61	13.5
	TOTAL	453	100.0

As shown, the bulk of the sample (73.5 percent) knew most about Landcare.

Interestingly, 11 of the 12 people who knew most about PMP, and 42 of the 47 who knew most about ICM, resided in the lower catchment. Thus, the clear majority of people in the upper catchment (82.6 percent) knew most about Landcare.

Looking at differences between the rural and urban samples, for the latter, only 2 people, and 8 people knew most about PMP and ICM respectively. Of those who had not heard of any of the strategies, 40 of the 61 people were from the urban sample.

When thinking of the government strategy you know most about:

(1) how useful has this strategy been to you personally?

Response	Rating	N (380)	Percent
very useful	5	20	5.3
quite	4	36	9.5
moderately	3	102	26.8
not very	2	122	32.1
not at all useful	1	100	26.3
	TOTAL	380	100.0

Mean = 2.4

Only those who had heard of at least one of the strategies were asked to respond to this question. Notably, nearly 60 percent of the participants responded that the strategy had been not at all useful or not very useful. Looking at the results for PMP, Landcare and ICM separately, the mean responses were 3.0 (only 12 responses), 2.3 and 2.4 respectively (generally, moderately to not very useful).

For ICM, this figure may not be overly concerning given the fact that ICM in the Herbert is at an early stage of development. For Landcare, the lack of usefulness may be more of a concern given that it is a more established, localised and "hands on" approach than ICM. As noted below, however, very few of the sample were members of Landcare groups and this likely explains the figures in the above table.

(2) how effective has the strategy been in dealing with land and water issues in the Herbert?

Response	Rating	N (374)	Percent
Very effective	5	6	1.6
Fairly effective	4	100	26.7
Neither effective nor ineffective	3	130	34.8
Fairly ineffective	2	108	28.9
Very ineffective	1	30	8.0
	TOTAL	374	100.0

Mean = 2.9

Looking at the results for PMP, Landcare and ICM separately, the mean responses were 3.3 (only 12 responses), 2.8 and 2.8 respectively. Interestingly, when comparing the strategy's personal usefulness with their effectiveness generally, the mean scores were more positive and all increased significantly.

(3) how did you come to know of the strategy?

This was an open-ended question allowing up to two responses (for each strategy). Percentages show, for those providing at least one response (334), how many people gave a particular response. Some of the more prominent sources of knowledge about the three strategies are noted in the following table.

Sources of knowledge	N	Percent
Newspapers	79	23.7
Television / television advertisements	72	21.6
Media (in general)	44	13.2
Word of mouth	40	12.0
Meetings (in general)	31	9.3
Canegrowers meetings	22	6.6
Radio / radio talk shows	22	6.6
Reading	17	5.1
Advertisements (in general)	12	3.6
Canegrowers magazine	12	3.6
Local pamphlets	9	2.7
Personal experience	8	2.4
Landcare	6	1.8

In total, 429 responses were provided, of which 352 (more than 82 percent) appear in the table.

Notably, 67 percent of the responses could be classified as media sources (ie. a combination of the newspaper, television, media and radio responses).

Of those who knew most about PMP, the most common response was personal experience (4). For ICM, 15 people stated their sources to be meetings, while 7 people were more specific in stating canegrowers meetings. Other ways of knowing about ICM included newspapers (6), drainage boards (3), word of mouth (3), and the Canegrowers Magazine (2).

With approximately three quarters of this sample, Landcare accounted for the bulk of the responses. Most common were newspapers (72 of 79 in total), television (69 of 72), media (42 of 44), word of mouth (34 of 40), radio (22 of 22), and reading (15 of 17).

Have you heard of a group called the Herbert River Catchment Coordinating Committee?

Response	Rating	N (425)	Percent
Yes	1	93	21.9
Vaguely	2	86	20.2
No	3	246	57.9
	TOTAL	425	100.0

Interestingly, of those who had definitely heard about the Herbert River Catchment Coordinating Committee (HRCCC), 68 were from the lower rural sample (41 percent of this sample). Only 8 and 4 people had definitely heard about the HRCCC in the upper catchment rural and urban samples (14 and 5 percent of these samples) respectively. Thirteen people (10 percent) of the lower urban sample had heard of the HRCCC.

From lowest to highest, those who responded "Yes" or "Vaguely" comprised 17, 31, 34, and 65 percent of the upper urban, lower urban, upper rural and lower rural samples respectively. This result could have been expected, given that ICM may have more of a presence in the lower catchment and a greater focus on rural (rather than urban) resource management issues.

Of further interest, it is noteworthy that 179 people had heard of the HRCCC and 178 people had heard about ICM, with both figures being in the order of 40 percent. More than three quarters of those who had heard about ICM had heard of the HRCCC, while more than 21 percent of those who had not hear about ICM had at least vaguely heard about the HRCCC.

If YES or VAGUELY, what do you think the main purpose of this group is?

This was an open-ended question allowing up to two responses. Of these, a variety of responses were given. Some of the more prominent purposes of the HRCCC are summarised in the following table. The figures in the percent column are in relation to the total number of participants who provided at least one response (161).

Note that categories were formed to maintain detail and ease of presentation and, therefore, may not be mutually exclusive.

Purpose of HRCCC	**N**	**Percent**
Improve drainage systems (including in newly developed areas)	34	21.1
Preserve waterways (including land quality and river banks)	23	14.3
Conserve and manage water	21	13.0
Care for the catchment area	14	8.7
Coordinate river use	12	7.4
Control / mitigate flooding in the lower catchment (including a suggestion to dredge the Herbert River)	10	6.2
Raise awareness / inform the public of existing problems	8	5.0
Coordinate groups to discuss problems (such as drainage)	8	5.0
Calculate regular flood areas	7	4.3
Maintain flow in the Herbert River and creeks / keep it clean	7	4.3
Not sure / it has never been fully publicised locally	7	4.3
Form strategies to assist the community (eg. to help with drainage disputes)	6	3.7
Combine all drainage boards into one body (eg. to cut costs and improve effectiveness)	6	3.7
Dam the river	3	1.9
Monitor fertiliser runoff	3	1.9

In total, 196 responses were provided, of which 169 (more than 86 percent) appear in the table.

As can be seen, a variety of purposes were put forward. Most of the responses related primarily to water issues and many thought the purpose was fairly hands-on; for example, to improve drainage, control flooding, calculate flood areas, maintain river flow, and dam the river. Others, such as caring for the catchment area, raising awareness and forming strategies were more general.

4.8 Responsibility and Control, Views on Government, and Awareness and Intentions

In the next three sections, participants were asked to rate how much they agreed or disagreed with the following statements. The statements were organised into the three general areas of responsibility and control, views on government, and awareness and intentions. In brief, the perceived ability of residents to control land and water management issues, the assigned responsibility for dealing with such issues, views on government (including levels of trust and perceived competence), and levels of awareness and intentions (including preparedness to become involved in relevant activities) were all considered potential influences on the implementation of ICM.

In the tables below, means are only pertinent for issues considered applicable (which participants rated between 1 and 5). Thus, those who considered any issue not applicable were not included within analysis of that issue.

4.8.1 Responsibility and Control

There are things I can do personally to help improve the environment

Response	Rating	N (459)	Percent
strongly agree	5	77	16.8
agree	4	250	54.5
neither agree nor disagree	3	85	18.5
disagree	2	24	5.2
strongly disagree	1	7	1.5
not applicable		16	3.4
	TOTAL	459	100.0

Mean = 3.8

The mean score (3.8) and frequencies display widespread agreement with this statement. There were no significant differences between samples.

I don't usually have the finances available to plan more than a year ahead

Response	Rating	N (457)	Percent
Strongly agree	5	95	20.8
agree	4	197	43.1
neither agree nor disagree	3	68	14.9
disagree	2	59	12.9
strongly disagree	1	8	1.8
not applicable		30	6.6
	TOTAL	457	100.0

Mean = 3.7

The clear majority (nearly 64 percent) of the sample chose to agree or strongly agree with this statement. Therefore, the mean score (3.7) shows that lack of finances may be a hindrance to the establishment of more long-term planning time frames.

There was also a significant relationship between this item and levels of agreement that locals people lack the money to spend on solutions.

Concerning significant differences, while all four samples were likely to agree with the statement, compared with the two urban samples, those in the lower rural sample were less likely to agree (mean 3.5 compared with the upper urban mean of 4.1). Put another way, compared with the

lower rural sample, participants in the urban samples were more likely to agree they do not usually have the finances available to plan more than a year ahead. This was particularly evident for those living in Mount Garnet (mean 4.4).

While not significantly different, the mean score for the upper rural sample more closely matched those of the two urban samples.

Finally, of those who considered the statement as not applicable, 18 (60 percent) were from the lower urban sample.

The local community should take some responsibility for improving the environment

Response	**Rating**	**N (466)**	**Percent**
Strongly agree	5	113	24.2
agree	4	296	63.5
neither agree nor disagree	3	36	7.7
disagree	2	9	1.9
strongly disagree	1	8	1.7
not applicable		4	.9
TOTAL	466	100.0	

Mean = 4.1

The results in the table show that this was very much an "agree with" statement, with more than 87 percent of the sample choosing to agree or strongly agree. There were no significant differences between samples.

There are things local community groups can do to help improve the environment

Response	**Rating**	**N (458)**	**Percent**
strongly agree	5	78	17.0
agree	4	332	72.5
neither agree nor disagree	3	39	8.5
disagree	2	5	1.1
strongly disagree	1	2	.4
not applicable		2	.4
TOTAL		458	100.0

Mean = 4.0

As for the previous statement, there was widespread agreement that local community groups can undertake activities to help improve the environment. Nearly 90 percent of the sample agreed or strongly agreed with the statement, while only 7 people chose to disagree or strongly disagree (interestingly, of the latter, none were from the upper rural sample). Finally, there were no significant differences between samples.

Many environmental problems come from the way people manage their properties

Response	Rating	N (463)	Percent
strongly agree	5	101	21.8
agree	4	244	52.7
neither agree nor disagree	3	75	16.2
disagree	2	36	7.8
strongly disagree	1	5	1.1
not applicable		2	.4
	TOTAL	463	100.0

Mean = 3.9

Again, the mean score and frequencies in the table show widespread agreement. Indeed, nearly three quarters of the sample agreed or strongly agreed that many environmental problems come from the way people manage their properties.

Regarding any significant difference among the four samples, compared with upper rural and lower urban samples, the lower rural sample was less likely to agree with this statement (mean scores ranged from 3.7 to 4.1).

I can prevent any land and water problems from occurring on my property

Response	Rating	N (454)	Percent
strongly agree	5	47	10.4
agree	4	200	44.1
neither agree nor disagree	3	70	15.4
disagree	2	66	14.5
strongly disagree	1	22	4.8
not applicable		49	10.8
	TOTAL	454	100.0

Mean = 3.5

As expected, many participants did not consider this issue to apply to them. Of the 49 people who held this view, 43 were from the combined urban sample (88 percent) and, of these, 36 were from the lower urban sample (73 percent).

The table shows evidence of widespread agreement, and it is also noteworthy that less than 20 percent of the sample disagreed or strongly disagreed that land and water problems were preventable. The major difference between samples was between the upper and lower catchment sample. With means around 3.3, those in the lower catchment samples were less likely to agree with this statement. This distinction is likely to be related to differing environmental issues, the most prominent of which are incidences of periodic flooding, and some concerns regarding drainage.

Many participants also considered this issue as not applicable. Of the 42 people who held this view, 37 were from the combined urban sample (88 percent) and, of these, 30 were from the lower urban sample (71 percent). Much greater than any other sample, 23 percent of the lower urban sample regarded the issue as not applicable.

The mean score (2.9) resulted largely from a spread of ratings across the scale and, in particular, the frequencies revealed a division between those who agreed and disagreed.

I've complete control over what happens to the land and water on this property

Response	Rating	N (457)	Percent
Strongly agree	5	28	6.1
agree	4	144	31.5
neither agree nor disagree	3	68	14.9
disagree	2	129	28.2
strongly disagree	1	46	10.1
not applicable		42	9.2
	TOTAL	457	100.0
Mean = 2.9			

As they appear related, an interesting comparison exists between this statement and the statement, "I can prevent any land and water problems from occurring on my property". The latter provided a higher level of agreement (mean 3.5), while approximately twice as many participants chose to disagree or strongly disagree that they had complete control over land and water. A small number of participants who disagreed that they could prevent land and water problems from occurring agreed that they had complete control over land and water (although there was a strong tendency to disagree with both). On the other hand, 40 percent (70 people) of those who disagreed they had complete control agreed they could prevent problems from occurring.

Obviously prevention and complete control are similar although in many ways different notions. However, the relationship between the two statements was highly significant.

In terms of any significant differences between samples, compared with the lower rural sample, those in the lower urban sample were more likely to agree with this statement. This finding is notable when recalling that, for the issue regarding the prevention of land and water problems, the major difference between samples was between the upper and lower catchment. Indeed, in contrast, the difference between the combined rural and urban samples was also significant. In other words, those in urban areas generally felt they had more control over land and water on their properties.

This finding also indicates that the perceived ability to prevent and control land and water problems was lowest in the lower rural sample.

Laws should be changed to make landholders more responsible for the consequences of their activities

Response	Rating	N (456)	Percent
strongly agree	5	84	18.4
agree	4	179	39.3
neither agree nor disagree	3	116	25.4
disagree	2	50	11.0
strongly disagree	1	22	4.8
not applicable		5	1.1
	TOTAL	456	100.0
Mean = 3.6			

The mean score (3.6) and frequencies display a high level of agreement that laws should be changed to increase responsibility. Of the 72 people who disagreed or strongly disagreed, 45 (62

percent) were from the lower rural sample and 53 (74 percent) were from the combined rural sample.

In terms of significant differences between samples, compared with the two rural samples, those in the lower urban sample were more likely to agree with this statement (mean 4.0). Further, compared with the lower rural sample (which was the most ambivalent in responding to the statement), the upper urban sample was also more likely to agree (means 3.2 and 3.7 respectively). As such, the difference between the combined rural and urban samples was significant and, once again, the biggest difference was between the lower rural and lower urban samples.

It was also noted that the mean score for Ingham residents (3.6) was significantly lower than for the other four sample locations in the lower catchment (all other means were above 4.0 and for Halifax was 4.5)

It's too hard to think about land and water management issues for an area as big as the Herbert catchment

Response	Rating	N (462)	Percent
strongly agree	5	16	3.5
agree	4	47	10.2
neither agree nor disagree	3	70	15.2
disagree	2	223	48.3
strongly disagree	1	99	21.4
not applicable		7	1.5
	TOTAL	462	100.0
Mean = 2.2			

Interestingly, while the whole sample tended to agree that managing land and water in the Herbert may be difficult because of the catchment's large area, nearly 70 percent disagreed or strongly disagreed that thinking about relevant issues for an area this large is too hard. Thus, the general conclusion for the sample that might be drawn here is that while land and water management on a catchment basis is considered difficult, at the very least, conceptualising such issues is far from impossible.

Of further interest, there was one significant difference among the four samples. While all samples tended to disagree, compared with the lower rural sample, the upper rural sample was more likely to disagree (means 1.9 and 2.3 respectively).

While this difference is only in terms of degree, it is nonetheless an interesting finding given that the upper area of the Herbert occupies the largest part of the catchment.

4.8.2 Views on Government

Governments should work out better ways to fix land and water problems

Response	Rating	N (463)	Percent
Strongly agree	5	118	25.5
agree	4	243	52.5
neither agree nor disagree	3	76	16.4
disagree	2	16	3.5
strongly disagree	1	6	1.3
not applicable		4	.9
	TOTAL	463	100.0
Mean = 4.0			

The majority of the sample (78 percent) agreed or strongly agreed that governments should work out better ways to fix land and water problems. All four samples tended to agree with this statement and, as a result, no significant differences were evident.

I trust that public servants are working in my interest most of the time

Response	Rating	N (463)	Percent
Strongly agree	5	24	5.2
agree	4	159	34.3
neither agree nor disagree	3	125	27.0
disagree	2	88	19.0
strongly disagree	1	60	13.0
not applicable		7	1.5
	TOTAL	463	100.0
Mean = 3.0			

While there was some agreement with this statement, on average, the sample mean (3.0) was placed at the midpoint of the scale (neither agree nor disagree).

In terms of significant differences, compared with upper and lower rural samples, the upper urban sample was more likely to agree. Both rural samples returned mean scores below 3.

I've seen incompetent government activities in this part of the country

Response	Rating	N (455)	Percent
strongly agree	5	104	22.9
agree	4	207	45.5
neither agree nor disagree	3	89	19.6
disagree	2	30	6.6
strongly disagree	1	17	3.7
not applicable		8	1.8
	TOTAL	455	100.0
Mean = 3.8			

As with some previous issues, responses to this statement were markedly skewed to the top end of the scale. Nearly 70 percent of participants agreed or strongly agreed that they had witnessed government incompetence locally. Given ICM's need to establish a solid community profile, this strong level of agreement is clearly an important finding. There were no significant differences between samples.

Programs like Integrated Catchment Management interfere with people's rights to make their own decisions

Response	Rating	N (446)	Percent
strongly agree	5	17	3.8
agree	4	85	19.1
neither agree nor disagree	3	205	46.0
disagree	2	104	23.3
strongly disagree	1	22	4.9
not applicable		13	2.9
	TOTAL	446	100.0
Mean = 2.9			

A fairly even spread of ratings, and the fact that a large proportion of the sample (46 percent) chose to neither agree nor disagree acted to produce the mean score of 2.9. Hence, there was neither widespread agreement nor disagreement with this statement. Further, while those in the lower rural sample appeared most likely to agree, any differences between samples were not significant.

I am sure that our local views will be considered when planning for land and water management in this area

Response	Rating	N (461)	Percent
strongly agree	5	28	6.1
agree	4	152	33.0
neither agree nor disagree	3	144	31.2
disagree	2	101	21.9
strongly disagree	1	33	7.2
not applicable		3	.7
	TOTAL	461	100.0

Mean = 3.1

Ratings for this statement were reasonably spread, thus producing the mean score of 3.1 for the whole sample. There were no significant differences between samples.

I can recall at least one government action which has damaged my livelihood

Response	Rating	N (447)	Percent
Strongly agree	5	75	16.8
agree	4	117	26.2
neither agree nor disagree	3	100	22.4
disagree	2	69	15.4
strongly disagree	1	14	3.1
not applicable		72	16.1
	TOTAL	447	100.0

Mean = 3.5

Of the many who deemed this statement to be not applicable, 52 (72 percent) were from the urban sample.

The mean score (3.5) and frequencies in the table show that, compared with those who disagreed, more people agreed that they could recall a detrimental government action. Having the highest mean score (3.8), compared with the upper urban sample, the upper rural sample was more likely to agree with this statement.

4.8.3 Awareness and Intentions

Before discussing specific issues below, participants were asked three general questions concerning awareness and involvement in land and water issues in the Herbert. For these, note that the choice of responses differs from other statements in this category.

Generally speaking, what awareness do you think local people have about land and water issues in the Herbert?

Response	Rating	N (468)	Percent
very high awareness	5	63	13.5
high	4	123	26.3
moderate	3	164	35.0
low	2	95	20.3
very low awareness	1	23	4.9
TOTAL		468	100.0

Mean = 3.2

On average, the awareness of local people was considered moderate (mean 3.2). There was no significant difference among the four samples with mean scores ranging from 3.21 to 3.27 (to 2 decimal places).

How much do you think local people are prepared to become involved in land and water issues in the Herbert?

Response	Rating	N (467)	Percent
to a very high degree	5	32	6.9
high	4	104	22.3
moderate	3	199	42.6
low	2	116	24.8
very low degree	1	16	3.4
TOTAL	467	100.0	

Mean = 3.0

In all, preparedness to become involved in land and water issues was moderate (mean 3.0). No significant differences were evident among the four samples. However, while a comparison of the difference between ratings in the upper and lower catchments appeared slight, this was significant (means were 3.2 and 3.0 respectively). Essentially, compared with the lower catchment sample, those in the upper catchment were more likely to consider locals as prepared to become involved.

How much are you prepared to become involved in land and water issues in the Herbert?

Response	Rating	N (466)	Percent
to a very high degree	5	41	8.8
high	4	132	28.3
moderate	3	181	38.8
low	2	70	15.0
very low degree	1	42	9.0
TOTAL	466	100.0	

Mean = 3.1

Again, preparedness was moderate (mean 3.1). Of the four samples, the upper rural sample returned the highest mean score (3.4) which, when compared with the lower urban sample (mean 2.9), was significantly different. In addition, for the urban samples, residents in Mount Garnet were the most prepared (mean 3.6) compared with those in Ingham who were least prepared (mean 2.7).

The local environment is no worse off than it was when I first lived here

Response	Rating	N (459)	Percent
strongly agree	5	27	5.9
agree	4	129	28.1
neither agree nor disagree	3	81	17.6
disagree	2	151	32.9
strongly disagree	1	67	14.6
not applicable		4	.9
	TOTAL	459	100.0
Mean = 2.8			

As has occurred previously, for this statement the whole sample appeared somewhat divided between those who agreed and those who disagreed. Regarding any significant differences among the four samples, compared with the other 3 samples, the lower urban sample was more likely to disagree that the local environment is no worse off. In other words, this sample would be more likely to agree that the condition of the environment has deteriorated over time.

Interestingly, there appeared to be some relationship between this statement and levels of personal involvement in land and water management activities. More specifically, those who were more likely to become involved (eg. in local projects) were also less likely to agree that the condition of the local environment had not changed over time.

I would be prepared to assist in local projects such as riverbank stabilisation

Response	Rating	N (447)	Percent
strongly agree	5	32	7.2
agree	4	158	35.3
neither agree nor disagree	3	133	29.8
disagree	2	59	13.2
strongly disagree	1	9	2.0
not applicable		56	12.5
	TOTAL	447	100.0
Mean = 3.4			

The first result to note in the table is the large number of "not applicables", of which nearly 70 percent were from the urban samples.

The mean score (for those who considered the statement applicable) is less positive than the related statements which indicated widespread agreement that the local community should take some responsibility, and local community groups can undertake activities, for helping to improve the environment. However, it is situated on the positive side of the scale.

One significant difference existed among the four samples. Compared with the upper rural sample (who were most prepared), the lower urban sample was less prepared to assist in local projects (means ranged from 3.2 to 3.6). Significantly, within the lower urban sample, Ingham residents were the least prepared (mean 2.6), and notably less so than those living in Lucinda and Halifax (means both 3.7).

It is likely that I will become involved (or stay involved) with a Landcare or catchment group over the next year or two

Response	Rating	N (454)	Percent
strongly agree	5	15	3.3
agree	4	73	16.1
neither agree nor disagree	3	158	34.8
disagree	2	111	24.4
strongly disagree	1	26	5.7
not applicable		71	15.6
	TOTAL	454	100.0
Mean = 2.8			

Once again, many people considered this statement as not applicable. Of these nearly half were from the lower urban sample (and comprised 25 percent of that sample), and 20 percent were from the upper urban sample. 24 of the 71 people (34 percent) were from the rural samples and, of these, 18 were from the lower rural sample.

For the rest of the sample, the mean score is slightly below the mid point of the scale. The table also shows that more people chose to disagree than agree with the statement.

One significant difference existed among the four samples. As might be expected regarding rural-urban differences (and the perceived relevance of the statement), compared with the lower rural sample, those in the lower urban sample (particularly in Ingham) were less likely to become involved (mean scores ranged from 2.6 to 3.0).

It is likely that I will look into ways to improve the environmental condition of my property over the next year or two

Response	Rating	N (456)	Percent
strongly agree	5	47	10.3
agree	4	222	48.7
neither agree nor disagree	3	89	19.5
disagree	2	25	5.5
strongly disagree	1	11	2.4
not applicable		62	13.6
	TOTAL	456	100.0
Mean = 3.7			

As discussed a number times above, there were also many who considered this statement as not applicable. As expected, most of these participants (82 percent) were from the urban sample.

The mean score (3.7) and frequencies highlight the high level of agreement with this statement. Regarding differences among the four samples, while all samples tended to agree, compared with the other three samples, the lower urban sample was less likely to agree with this statement (mean 3.5, as compared with means between 3.7 and 3.8). This type of difference was expected given that the statement has more relevance to rural producers.

I could personally benefit from being involved in group activities to help manage land and water

Response	Rating	N (457)	Percent
strongly agree	5	18	3.9
agree	4	131	28.7
neither agree nor disagree	3	147	32.2
disagree	2	84	18.4
strongly disagree	1	18	3.9
not applicable		59	12.9
	TOTAL	457	100.0

Mean = 3.1

Participants who viewed this statement as not applicable included 45 (76 percent) from the urban sample. For the four samples, all mean scores centred around the mid point of the scale and were close to the sample mean (3.1). However, compared with the lower rural sample (mean 3.2), those in the lower urban sample were more likely to disagree with this statement (mean 2.9). Again, this finding was expected given the likely difference between rural and urban residents in the perceived relevance of the statement. As for a number of previous issues (including assessment of environmental change, likely involvement in planning and management, level of control), the fact that upper rural residents appeared more "rural" in their attitudes than lower urban residents is an interesting finding. In other words, for a number of statements, the lower urban sample appeared more likely to "stand out from the crowd".

Some people I know think that local groups are a good way to deal with many land and water management issues

Response	Rating	N (456)	Percent
strongly agree	5	29	6.4
agree	4	222	48.7
neither agree nor disagree	3	140	30.7
disagree	2	38	8.3
strongly disagree	1	9	2.0
not applicable		18	3.9
	TOTAL	456	100.0

Mean = 3.5

The mean score (3.5) and frequencies show a high level of agreement with this statement. For the four samples, all means scores were between 3.4 and 3.6 and, therefore, no significant differences were evident. This is noteworthy in that, given the nature of the statement, a difference between rural and urban samples may have been expected.

Section 5.7.1 discusses further investigation of items denoting intentions to participate in land and water management activities. A general measure named *Personal and Group Intentions* was formed and analyses were carried out to find out whether this measure was related to other items in the questionnaire.

4.9 Information Sources

Which of the following sources of information help you to keep informed about land and water management issues?

For this question, participants ticked as many boxes as were applicable. The figures in both percentage columns denote the proportion of people - compared with the whole sample - who use a particular source of information.

Information Source	Percent	Information Source	Percent
Neighbours	46.5	Telegraph Times	.2 (N=1)
A government agency	13.4	Herbert River Express	59.7
Industry groups	24.7	The Tablelander	27.3
Community groups	21.6	Tablelands Advertiser	23.9
Family members	34.2	Millstream Times	15.1
Friends/colleagues	53.9	Courier Mail	5.9
Personal experience	39.0	Magazines/journals	30.2
The local "grapevine"	48.4	Government newsletters	7.5
Public meetings	32.3	Country Hour (ABC radio)	28.3
The Australian newspaper	10.9	Landline (ABC television)	43.6
Cairns Post	16.8	None/I don't keep informed	2.5
Townsville Bulletin	30.6	Other	5.5

For the whole catchment, the ten most frequently used sources of information were - from highest to lowest - the Herbert River Express, friends/colleagues, the local "grapevine", neighbours, the television program "Landline", personal experience, family members, public meetings, the Townsville Bulletin, and magazines/journals. All of these sources were used by more than 30 percent of the sample.

Perhaps the most surprising findings were the fact that a local newspaper - the Herbert River Express - was used more frequently than more "traditional" sources of information such as friends/colleagues and personal experience. Second, also part of the media, "Landline" was a more often-used source than personal experience, family members and public meetings. Its use was as high as 53 percent in the upper catchment.

The primary position of the Herbert River Express is even more remarkable when noting that it is distributed principally in the lower catchment. For the lower catchment only, this paper was used by 84 percent of the sample.

Next, people who checked "a government agency", "industry groups", or "other" were asked to specify the particular source they had in mind.

Of the 15 specified government agencies, the Department of Primary Industries was noted for half the 68 entries (50 percent). CSIRO and Environment and Heritage were mentioned 3 times each and other agencies were noted on 2 or fewer occasions. These included Mines, Natural Resources, Lands, Water Resources, Forestry, the Irrigation and Water Supply Commission, and the National Wetlands Commission.

Of the 19 specified industry groups, Canegrowers was noted 75 times and formed the bulk of the 127 entries (59 percent). BSES (Bureau of Sugar Experimental Stations) was mentioned 19 (15 percent), the Cattleman's Union 7 (6 percent), and CSR and Drainage Boards 5 times (4 percent each). Other groups noted included the Queensland Commercial Fishing Organisation, Mining Companies, the Australian Cane Growers Association, and the Chamber of Commerce.

For other sources, local government, local government newsletters, universities, the Herbert River Improvement Trust, the Queensland Country Women's Association, the North Queensland Register, and radio and television in general were mentioned.

The above results were scrutinised to find any significant differences between samples.

First, obvious differences include use of various newspapers. As mentioned, the Herbert River Express is a lower catchment paper. In addition, the Townsville Bulletin was used virtually exclusively by lower catchment residents. 44 percent of the lower catchment sample used the Townsville Bulletin to keep informed about land and water management issues.

Similarly, the Tablelander, Tablelands Advertiser, and the Millstream Times are all distributed primarily in the upper catchment. For the upper catchment only, these papers were used as sources of information by 86, 75 and 49 percent respectively. The Cairns Post was also read almost exclusively in the upper catchment, with a readership of more than 50 percent. Interestingly, the Australian newspaper was also read by a larger proportion of people in this area (17 percent).

Briefly, a noticeable difference between the two catchment areas is found in the readership of the Townsville Bulletin (lower catchment) or the Cairns Post (upper catchment). Respectively, Townsville and Cairns are the closest major urban centres, and this is a clear example of the lack of integration between the two areas. Such separation might well produce many other differences than simply determining what newspaper is read.

There was no difference between samples regarding readership of the Courier Mail.

Other differences that may have been anticipated were those between the rural and urban samples. Compared with the urban sample, the rural sample was more likely to keep informed of land and water management issues by way of neighbours, industry groups, personal experience, public meetings, and government newsletters.

Additionally, magazines/journals were preferred by those in the rural sample, and particularly those in the lower rural sample (43 compared with 29 percent in the upper rural sample).

In contrast, the local "grapevine" was a preferred source of information in the upper catchment (59 compared with 44 percent). This was also the case for Landline (53 compared with 40 percent).

Significant differences between the lower rural and upper rural sample included the use of magazines/journals as mentioned, and (with the lower rural sample mentioned first) industry groups (52 compared with 5 percent), community groups (24 compared with 12 percent), and public meetings (46 compared with 25 percent).

Information sources that returned no differences between samples were family members, friends/colleagues, and the Country Hour.

Which two sources of information would you say were the most reliable for helping you to make decisions?

For the whole catchment, more than fifty separate sources were stated as the most reliable and, in all, 766 responses were provided. Comprising more than 90 percent of the total number of responses provided, the top twenty sources are presented in the following table. Note that the

figures in the percentage column show the proportion of people - compared with the whole sample (411) - who stated a certain source of information to be reliable.

Twenty most reliable information sources

Reliable Sources	**N**	**Percent**
Landline (ABC television)	88	21.4
Personal experience	82	20.0
Herbert River Express	74	18.0
Public meetings	51	12.4
The Country Hour (ABC Radio)	46	11.2
Canegrowers	44	10.7
Friends/colleagues	40	9.7
Neighbours	33	8.0
Industry Groups	31	7.5
Family members	28	6.8
The Tablelander	27	6.6
A government Agency	25	6.1
Magazines /Journals	24	5.8
The local "grapevine"	18	4.4
The Townsville Bulletin	17	4.1
Community groups	15	3.6
Newspapers (in general)	14	3.4
The Department of Primary Industries	13	3.2
The Cairns Post	12	2.9
BSES	12	2.9

A prominent and certainly unexpected finding, Landline was considered the most reliable source of information for helping participants to make decisions. This, in combination with the fact that Landline was fifth most used source of information highlights the potential influence this program has in conveying information to residents in the catchment.

It should also be noted that for the lower catchment sample only, Landline was the fourth most reliable source behind the Herbert River Express, public meetings, and personal experience. Therefore, in the upper catchment, Landline was considered by far to be the most reliable source (followed by personal experience, the Tablelander and the Country Hour).

Because of their reliability, these information sources, plus others noted in the table including Canegrowers and Industry groups, are clearly key areas for informing catchment residents about land and water management issues.

Further analysis was conducted to determine whether any differences existed between use of an information source and other items in the questionnaire. Numerous differences were evident and, once again, Landline figured prominently. The findings are as follows.

First, those used Landline as an information source were more likely to:
- agree there were things they could do to help improve the environment;
- agree they would become involved (or stay involved) with a Landcare or catchment group over the next year or two.

Those who kept informed of land and water management issues by talking to neighbours were more likely to have heard of ICM.

Participants used community groups were more likely to:
- have heard of PMP, and ICM;
- agree they would become involved (or stay involved) with a Landcare or catchment group;
- (as might be expected) agree they could personally benefit from being involved in group activities to help manage land and water.

Those used personal experience were more likely to:
- have heard of PMP, and ICM;
- agree they would become involved (or stay involved) with a Landcare or catchment group;
- agree that they would look into ways to improve the environmental condition of their property over the next year or two.

Those who used public meetings were more likely to:
- have heard of ICM;
- agree they would become involved (or stay involved) with a Landcare or catchment group;
- agree they could personally benefit from being involved in group activities to help manage land and water.

For the upper catchment only (no differences were found in the lower catchment), people who kept informed of land and water management issues by talking with family members were more likely to:
- have heard of Landcare;
- agree there were things they could do to help improve the environment.

People who kept informed by talking to friends/colleagues were more likely to have heard of Landcare.

Finally, for the lower catchment only, those who did not use the Herbert River Express as an information source were less likely to have heard of Landcare and ICM.

All significant differences noted above were evident even when looking at the rural sample only.

Does what you read in newspapers ever change your opinions about land and water management issues?

Response	Rating	N (447)	Percent
often	4	19	4.3
occasionally	3	254	56.8
seldom	2	137	30.6
never	1	37	8.3
	TOTAL	447	100.0
Mean = 2.6			

The mean score (2.6) indicates that, on average, the views of those in the sample change seldom to occasionally. There were no significant differences between the samples.

Does what you hear on the radio or see on TV ever change your opinions about land and water management issues?

Response	Rating	N (448)	Percent
often	4	49	10.9
occasionally	3	265	59.2
seldom	2	107	23.9
never	1	27	6.0
	TOTAL	448	100.0
Mean = 2.8			

For this question, the mean score (2.8) approached occasional opinion change. As the table shows, nearly 60 percent of the sample chose this response. Notably, the mean score was slightly, although significantly, higher than that for newspapers. However, it is noteworthy that the mean for the lower rural sample did not differ between the two questions.
Concerning other significant differences, compared with the lower rural sample, those in the upper rural sample were more likely to state that they occasionally changed their opinions when listening to radio or watching television. The greater watching of the television program Landline in the upper catchment may explain some of this difference.

How often do you discuss land and water management issues with your neighbours or others in this general area?

Response	Rating	N (453)	Percent
often	4	96	21.2
occasionally	3	213	47.0
seldom	2	121	26.7
never	1	23	5.1
	TOTAL	453	100.0
Mean = 2.8			

For this question, the mean score (2.8) approached occasional discussions with neighbours and other locals. As indicated, 47 percent of the sample chose this response.

As might be expected, compared with both urban samples (means 2.7), those in the lower rural sample were more likely to talk with their neighbours about land and water management issues (mean 3.0). While the mean score for the upper rural sample was also close to 3, there was no

significant difference (due to lower numbers in this sample). However, when combined, the difference between the rural and urban samples was significant.

4.10 Group Involvement

Are you a member of any regional, state or nationally-based groups or associations?
115 participants or exactly 25 percent of the whole sample (N=460) noted they were members of such groups. This level of membership ranged between (approximately) 17 percent for both urban samples, and 33 percent for the lower rural sample. Membership for the upper rural sample was 28 percent. From these figures, a test of the difference between rural and urban levels of membership was shown to be significant.

Are you a member of any local community groups or associations?
206 participants (44 percent of the whole sample, N=468) noted they were members of such groups. Included as members were 94 of the 115 people (or 82 percent) who indicated they were members of regional, state or nationally-based groups.

This level of membership ranged between (approximately) 50 percent for both rural samples, and 43 and 37 percent for the upper urban and lower urban samples respectively. From these figures, a test of the difference between rural and urban levels of membership was bordering on significant.

In total 236 participants (or nearly 50 percent of the whole sample) indicated membership in either local and/or regional/state/national groups.

Both of the above questions gave evidence of a higher level of group membership in rural landholders.

Analyses were conducted to determine whether any significant differences on items in the questionnaire existed between group members and non-members. For both members of regional/state/national and/or local groups a number of differences were evident. First, members were more likely to consider constraints to managing land and water in the Herbert to be the wide variety of opinions held by local people, and the difficulty in thinking about relevant issues for an area this size.

As might be expected, members were also more prepared to become involved in land and water issues, more prepared to assist in local projects such as riverbank stabilisation, more likely to become involved (or stay involved) in a Landcare or catchment group over the next year or two, and more likely to see personal benefits from involvement in group activities to manage land and water.

For regional/state/national groups only, members were less likely to agree that a constraint to managing land and water in the Herbert was that government strategies were a waste of time. They were, however, more likely to disagree with the statement "I trust that public servants are working in my interest most of the time".

For local groups only, members were more likely to agree that a constraint to managing land and water in the Herbert was that government does not to spend money on solutions.

Next, the questionnaire then asked those who were not members of any local community groups or associations were asked to state reasons for no involvement.

In all, 302 reasons were provided, with the ten most common appearing in the following table. These comprised more than 83 percent of the total number provided. The figures in the percentage column denote the proportion of a particular response, compared with the total number of people who provided at least one response (227).

Reasons for no involvement

Reason	**N**	**Percent**
Don't have the time / too busy / work commitments	151	66.5
Aged / too old	32	14.1
Not interested / apathetic	13	5.7
Poor health	10	4.4
No perceived need	10	4.4
Only recently arrived in the area	8	3.5
Dislike meetings / "not the type"	8	3.5
It is a "tight" community / not considered "local"	7	3.1
Too much travelling involved	7	3.1
Groups are all talk and not much action	7	3.1

Clearly, the bulk of the reasons given were related to lack of time, health and interest.

Next, those who were not members of any local community groups were asked whether they would ever consider joining a community group.

Of the sample of 237 (out of a possible 271), 21 percent stated "Yes", 32 percent "Don't Know" and 47 percent "No".

Those who responded "Yes" or "Don't Know" were asked to state their reasons for joining.

In all, 123 reasons were provided, with the nine most common appearing in the following table. These comprised more than 90 percent of the total number provided. The figures in the percentage column indicate the proportion of a particular response, compared with the number of people who gave at least one response (88).

Reasons for joining a community group

Reason	**N**	**Percent**
Interest in the topic/important focus	21	23.9
If I had a real chance to improve things (including betterment of the area)	20	22.7
Would depend on what the problem was	14	15.9
More time available	13	14.8
If I felt I had something to offer	12	13.6
If the issue affected me / my community	11	12.5

To gain personal fulfilment	8	9.1
To become better informed about an issue	6	6.8
Friendship and fellowship	6	6.8

Which of the following categories describe any of the groups you have some involvement with? This, and the following two questions, were answered only by those who were members of local and/or regional/state/national groups. As stated, this comprised 236 participants, of which 228 answered the question.

As shown in the following table, participants showed their involvement for a number of categories (or type of group), and ticked as many boxes as were applicable. The figures in both percentage columns indicate the proportion of people - compared with the whole sample of those involved in groups and who answered the question (228) - who were involved with a particular type of group.

Type of Group	Percent	Type of Group	Percent
Progress Association	10.1	Sporting Group	45.2
Rate Payers Association	5.7	Hobby/Craft Group	10.1
Professional Association	7.9	Community Action Group	10.1
Charity/Church/Welfare Group	28.9	Service Club (eg. Lions, Rotary)	18.9
Agriculture-related Organisation	28.5	Parents & Friends Association	25.0
Landcare, Conservation or similar Group	18.4	Other/s	19.3

The four separate samples were scrutinised to determine any differences in levels of involvement. Lower urban people were more likely to be involved with progress Associations and, as expected, the rural sample was more likely to be involved with an agriculture related organisation. However, within these figures, those in the lower rural sample were more likely to be involved than those in the upper sample.

Finally, compared with the other three samples, those in the lower rural sample were more likely to be involved with a parents and friends association.

Other groups written down by participants included ethnic/cultural, rural fire boards, a local ambulance committee, a traffic management committee, retired friends, political organisations, Masonic Lodge, Australian Volunteer Coast Guard, and the State Emergency Service.

Of the groups they were involved with, participants were next asked to designate the name of the group they considered as most important. For the 190 responses, and comprising almost 75 percent of this figure, most frequently mentioned were Sporting Groups (16.3 percent), Agriculture-related Organisations (14.7 percent), Charity/Church/Welfare Groups (12.6), Parents & Friends Groups (9.5 percent), Landcare, Conservation or similar Groups (8.4 percent), Service Clubs (6.8 percent), Progress Associations, and Hobby/Craft Groups (2.6 percent each).

Interestingly, approximately half of those who stated involvement with an Agriculture-related Organisation nominated this as the most important group. This was also the case for the "Landcare, Conservation or similar" category.

To complete this section of the questionnaire, participants were asked:

If you are involved in any groups in the "Landcare, Conservation or similar" category, please write down the name of the group that you are most involved with.
Of the 39 groups noted, over half (21) were Landcare groups. Other groups included Drainage Boards, Forestry, Hinchinbrook Citizens Association, Australian Conservation Foundation, Greenpeace, Queensland Commercial Fishing Organisation, Hinchinbrook Marine Resources Advisory Committee, Soil and Water Conservation Association of Australia, Herbert Cane Protection and Productivity Board, Warps Subdivision Working Group, and a local community rainforest reafforestation program.

4.10.1 Interest in Community Issues

Thinking of the local community where you live, please rate how much you agree or disagree with each of the following statements.
Participants used the following agree-disagree scale to respond to each statement. The statements and ordered mean scores appear in the table below.

1	2	3	4	5
strongly disagree	**disagree**	**neither agree nor disagree**	**agree**	**strongly agree**

Community issues

1.	Very few of my neighbours know me	2.0
2.	People in this community generally don't get along with each other	2.3
3.	I'm not very interested in local community issues	2.4
4.	The community is capable of getting things done without any outside help	2.6
5.	I don't really care what others in the community think of my actions	2.7
6.	I don't have the time to become involved in local community issues.	3.2
7.	I have almost no influence over what happens in this community	3.4
8.	I often think about local community issues	3.6
9.	It's very important to me to live in this particular community	3.7
10.	I want the same things from this community as other local people want	3.7
11.	I and many others in this community share similar values	3.8
12.	I feel quite comfortable in being a member of this local community	4.0
13.	I can recognise many of the people who live in this community	4.1
14.	I think this community is a good place to live	4.2
15.	I would like to remain living in this area for a long time	4.2

Considering mean scores of 4 or higher, most in the sample felt comfortable in being members of their local communities, could recognise many others, thought it was a good place to live, and would like to remain living in the Herbert for a long time.

As a rule of thumb, participants tended to disagree with negatively worded statements (ie. 1, 2, 3, 5) and agree with those worded positively. For the former, statements 6 and 7 are exceptions to

the rule, with mean scores lying on the agree side of the scale. For positively worded statements, only statement 4 stands out as lying on the disagree side of the scale.

In this regard, it was considered possible that statements 4 (community self-reliance) and 7 (personal influence) were possibly related. However, while many other statements were highly correlated, the relationship between these items was not significant.

Of the 15 statements, 7 revealed significant differences among the four samples. However, it should be noted that any differences were in terms of degree only and, as such, any conclusions need to be treated with caution. Noting that one sample was more interested in an issue than another does not imply that the latter was uninterested.

For statement 1, the lower rural sample was more likely to disagree agree than the upper urban sample. For statement 2, both lower catchment samples were more likely to disagree than the upper urban sample. For statement 4, the upper urban sample was more likely to disagree than the lower rural sample. For statement 5, the lower rural sample was more likely to disagree than the upper urban sample. For statement 9, the lower rural sample was more likely to agree than the three other samples. For statement 11, the lower rural sample was more likely to agree than the upper urban sample. Finally, for statement 15, the lower rural sample was more likely to agree than both urban samples.

It is notable that each of these results includes differences between the lower rural and upper urban samples. As a broad summary, compared mostly with the upper urban sample, the "community" as perceived by those within the lower rural sample appears more cooperative and self-reliant. Its members express more attachment to their area, are more concerned with how their actions are perceived by others, are likely to consider knowing more of their neighbours, and more likely to regard people in the community as sharing similar values.

4.10.2 Life Satisfaction

Please rate your level of satisfaction with the various aspects of your life at the moment. Participants used the following agree-disagree scale to respond to each statement. The statements and mean scores appear in the table below.

1	2	3	4	5
very dissatisfied	**moderately dissatisfied**	**neither satisfied nor dissatisfied**	**moderately satisfied**	**very satisfied**

Areas of Satisfaction	**Mean**
Your life in general	4.2
Your standard of living	4.1
Your personal health	4.1
The area where you live	4.3
The community in which you live	4.1
Existing community facilities and services	3.2

As can be seen, mean scores for the first five areas centred around moderate satisfaction. The exception was satisfaction with community facilities and services and, hence, this was the area that people were least satisfied with.

No significant differences existed among the four samples for the first four areas of satisfaction. For satisfaction with the community in which people live, the upper urban sample was less likely to be satisfied than the two lower catchment samples. Looking at particular areas, Herberton, Ravenshoe and Mount Garnet had the lowest mean scores. The difference between Mount Garnet (3.4) and Ingham (4.2) was the most prominent.

A similar difference among the four samples was also found for satisfaction with existing community facilities and services. While all tended to centre around "neither satisfied nor dissatisfied", the upper urban sample was more likely to be dissatisfied than the lower urban sample. This finding was highlighted earlier in responses to the question about key issues. In stating such issues, people in the upper catchment were more likely to note concerns such as lack of community services and access to those services, and also the poor quality of roads.

When thinking about your relationships with local people, how comfortable are you about living here?

This was the first of two final questions relating to community issues. Specifically, for these items, the degree of comfort people held with regard to their relationships with other local people was assessed.

Response	Rating	N (470)	Percent
very comfortable	5	227	48.3
quite	4	175	37.2
moderately	3	53	11.3
not very	2	11	2.3
not at all comfortable	1	4	.9
	TOTAL	470	100.0
Mean = 4.3			

Once again a matter of degree only, while all four samples centred around "quite comfortable", compared with both lower catchment samples, the upper urban sample had a lesser degree of comfort.

When thinking about how much interest local people have for your ideas and opinions, how comfortable are you about living here?

Response	Rating	N (454)	Percent
very comfortable	5	113	24.9
quite	4	177	39.0
moderately	3	125	27.5
not very	2	28	6.2
not at all comfortable	1	11	2.4
	TOTAL	454	100.0
Mean = 3.8			

Interestingly the only significant difference here was between the upper urban and the lower rural sample, with the latter indicating more comfort. However, all mean scores were between "moderately" and "quite" comfortable.

4.11 Demographic and Other Information

Age
Participants were aged between 17 (one person) and 91 years. The average age was 51.8 years. The mean ages for the four samples were very similar, ranging from 51.0 to 52.8 years.

Notably, with average ages of 55.7 and 56.8 respectively, the Lucinda and Taylors Beach samples appeared moderately older than other towns or the rural samples.

Gender
Of the 469 people who noted their gender, 293 were male (62.5 percent) and 176 female (37.5 percent). Notably, for the lower rural sample, more than 80 percent were male and, for the two urban samples around 47 percent were male (hence, more women than men answered the questionnaire in these samples). In the upper rural sample, 65 percent were male.

Country of Birth
Of the 462 people who noted their country of birth, 391 (84.6 percent) were born in Australia. Two other significant categories included 32 people born in "Europe" (6.9 percent) and 23 in "UK and Ireland" (5 percent).

Interestingly, only 65 percent of those in the upper urban sample were born in Australia. For this sample, and compared with the whole sample, other countries of birth included all of those born in New Zealand (5), and nearly half of those born in the UK and Ireland (11 of 23). Finally, none in the lower rural sample were born in the UK or Ireland, but included 14 of the 32 people born in Europe.

Marital Status
467 participants answered this question, of which 377 were married-defacto (80.7 percent), 35 widowed (7.5 percent), 34 never married/single (7.3 percent), and 21 divorced/separated (4.5 percent). The proportion of those married/defacto ranged from 88.3 percent (lower rural) to 70.6 percent (upper urban)

Do you have any family members living in the Herbert area other than those in your household?
331 of the 470 participants who answered this question (70.4 percent) responded positively.

Interestingly, for the upper urban and lower rural samples, this figure varied markedly between 44 and 87 percent respectively. At just over 52 percent, the upper rural sample was also a good deal lower than the average. Therefore, the conclusion drawn here is that, compared with the lower catchment, residents in the upper catchment are likely to have fewer familial ties beyond those in their household.

Main Occupation
Comprising more than 78 percent of the total number provided, the eleven most common occupations appear in the following table.

Occupation	N (463)	Percent
Cane Farmer	143	30.9
Home Duties	74	16.0
Retired	59	12.7
Grazier	22	4.8
Tradesman	20	4.3
School Teacher	11	2.4
General Farming (other than cane)	10	2.2
Nurse	8	1.7
Small Business	8	1.7
Retired Cane Farmer	4	.9
Community Worker	4	.9
Miner	3	.6

The reason that only three people stated their occupations as mining is related to the fact that, for those who hold mining leases, a large proportion will have other, "main" occupations.

How many years have you had this occupation?
There were 441 responses to this question. The range was from 1 to 72 years and the average length of time was 22 years.

Looking in particular at the dominant occupation provided, namely cane farming, the range was from 2 to 69 years and the average length of time was 29 years.

How long have you lived in the Herbert area?
Of the 467 responses to this question, the length of residence in the Herbert ranged from 1 to 89 years, with an average length of 34 years.

Looking again at the cane farming occupation only, the range was from 4 to 75 years and the average length of residence was 46 years.

For the four samples, there were also a number of differences between average length of residence. The range was from 18 years (upper urban) to 46 (lower rural). Again, the upper and lower samples differed significantly.

Is your property near to a river or creek which floods?
Of the 461 participants who answered this question 317 (68.8 percent) responded positively. 136 (29.3 percent) did not live, and 9 (2.0 percent) did not know whether they lived, near to a river or creek which floods.

As could be expected, 91 percent of the lower rural sample lived near to a river or creek which floods. However, this figure was as low as 47 percent for the lower urban sample. On closer inspection, this figure varied between 0 percent (Allingham) and 94 percent (Halifax). Within the

upper urban sample there was also variation between 29 percent (Mt Garnet) and 59 percent (both Herberton and Ravenshoe).

69 percent of the upper rural sample lived near to a river or creek which floods.

One interesting finding was that, compared with those who did not own or lease such property, those with property next to a river or creek which floods were less likely to agree that they had complete control over the land and water on their properties.

Thinking about where you live, what is the most important river or creek to you?
Comprising nearly 85 percent of the total number provided, the eleven most common rivers/creeks noted appear in the following table.

Important River / Creek	N (432)	Percent
Herbert River	192	44.4
Wild River	50	11.6
Millstream	30	6.9
Palm Creek	22	5.1
Stone River	21	4.9
Victoria Creek	15	3.5
Trebonne Creek	10	2.3
Cassady Creek	7	1.6
Vine Creek	7	1.6
Waterview Creek	6	1.4
Ripple Creek	5	1.2

How often do you use the river or creeks near where you live? (eg. for commercial, domestic or recreational purposes)

Response	Rating	N (469)	Percent
often	4	165	35.2
occasionally	3	136	29.0
seldom	2	89	19.0
never	1	79	16.8
TOTAL		469	100.0
Mean = 2.8			

While all means scores for the four samples were between 2.6 and 3.2 (centring around "occasionally"), the mean for the upper rural sample was the only one greater than 3. Therefore, people in this sample were the most likely to use the rivers or creeks near where they live (62 percent of this sample noted that they often use the river). In general, people in the upper catchment (rural and urban) were more likely to use rivers/creeks than those in the lower catchment.

For the lower urban sample, people in Halifax, Lucinda and Taylors Beach appeared to use rivers/creeks more regularly than those in Ingham and Allingham. The difference between

Ingham and Taylors Beach was significant (means were 3.2 and 2.3 respectively), with use by the latter sample being on par with that in the upper rural sample.

Of those who seldom or never use the rivers or creeks, respectively, 65 (73 percent) and 63 (80 percent) were from the lower catchment.

In addition, a number of significant differences were found between river use and other items in the questionnaire. Compared with those who never used the river, those who used the river often were:

- more likely to consider lower fish numbers as a personal impact;
- more likely to consider loss of access to recreation as a personal impact;
- more likely to have loss of confidence in government's ability to manage land and water resources;
- less likely to see programs such as ICM interfering with people's rights to make their own decisions;
- less likely to agree that the local environment had not deteriorated over time;
- more prepared to assist in local projects such as riverbank stabilisation;
- more likely to believe that many environmental problems come from the way people manage their properties;
- more likely to become involved (or stay involved) with a Landcare or catchment group in the next year or two;
- more likely to agree that there were personal benefits from being involved in group activities to help manage land and water.

How often do you go fishing for recreation?

Response	Rating	N (469)	Percent
often	4	77	16.4
occasionally	3	150	32.0
seldom	2	116	24.7
never	1	126	26.9
	TOTAL	469	100.0

Mean = 2.4

The mean score for this question shows that, for the whole sample, fishing for recreation was an activity tending to be carried out on a fairly infrequent basis. This figure, however, belies the fact that the mean scores of the four samples covered a wide range from 2.0 (upper rural) to 2.7 (lower urban). Generally, compared with the upper catchment samples, people in the lower catchment were likely to go fishing on a more regular basis.

Of the 77 participants who responded "often", 68 (88 percent) were from the lower catchment, and of the 150 who responded "occasionally", 111 (74 percent) were also from the lower catchment.

Within the lower urban sample, the likelihood of fishing more frequently was particularly evident for residents of Taylors Beach and Halifax (means 3.1 and 3.o respectively) Herberton provided the strongest difference (mean 1.9). However, it should also be noted that the mean score for Ingham was somewhat lower than that for Mount Garnet (means 2.3 and 2.5 respectively).

These findings correspond with the earlier item in which participants rated the degree of impact of lower fish numbers. For this item, Mount Garnet had the highest impact of the three upper urban samples, and had a similar mean score to that provided by Ingham.

Do you own or lease/rent a commercial rural, or rural property greater than 3 hectares (7.5 acres)?

Response	Rating	N (469)	Percent
yes -own	1	194	41.4
yes - lease/rent	2	25	5.3
yes – both	3	11	2.3
no	4	239	51.0
TOTAL		469	100.0

As the table indicates, 43.7 percent of the whole sample owned property greater than 3 hectares. Of those who owned such property, this figure was as high as 78 percent for the lower rural sample, followed by 60 percent for the upper rural sample. As expected, the rate of ownership of such property in the urban samples was low.

One unexpected result was that 13 participants in the upper rural sample did not own or lease/rent property above 3 hectares. On further investigation, the main occupations for these participants included home duties, tradesman, teacher and retired. One person also stated their occupation as mineral exploration.

Next, the original sample list was checked as a means to ensure that these properties were within the upper rural sample as had been specified. All were. 5 of the 13 properties were classified as mining-related and the remaining 8 as rural. Of the latter, it was confirmed that one participant owned stock, one resided on a rural residential block and one was a member of a Landcare group.

Which one of the following best describes your current use of this property?
Only those who owned or leased/rented rural property greater than 3 hectares were asked to complete this question. Results for the whole sample appear in the following table.

Current use of property

Use	Rating	N (228)	Percent
Cane farming	1	163	71.5
Grazing	2	41	18.0
Mining	3	3	1.3
Industrial	4	0	0
Other farming	5	12	5.3
Other	6	9	3.9
TOTAL		228	100.0

In brief, the majority of properties were used for cane faming. Most grazing activity occurred in the upper catchment (85 percent). The "other farming" category included goat and horse breeding, forestry, fruit growing, hay and maize production, potato farming, crayfish and rural residential subsistence. The "other" category included hobby farming and residential and minor stock use.

What is the size of your property?
For those who owned or leased/rented rural properties greater than 3 hectares, rounded to the nearest hectare, average property size was 6146 hectares in the upper catchment and 219 hectares in the lower catchment. To shed more light on property size, half the properties were 82 hectares or less. The average cane farm size was 145 hectares and grazing property, 6680 hectares.

Have you cleared any new land in the last twelve months?
30 people (12 percent of those owning property greater than 3 hectares) responded positively to this question. Of these, 24 (80 percent) were from the lower rural sample.

Those who had cleared new land were next asked to specify how much had been cleared. Results indicated a range from 1 to 162 hectares, with a mean score of 35 hectares and median of 18 hectares (ie. half the properties had cleared 18 hectares or less).

Would you be prepared to answer another shorter questionnaire if needed in a few months time?
284 participants, or 59.5 percent of the whole sample, were prepared to complete a further questionnaire. Surprisingly, compared with the lower catchment sample, more people were prepared to complete a further questionnaire in the upper catchment (73 percent as compared with 56 percent).

One interesting finding was that members of both local, and regional/state/national groups were more likely to agree to complete a further questionnaire. Of these, members involved with both Landcare, conservation or similar groups, and community action groups were more likely to agree.

5.0 SUMMARY AND CONCLUSIONS

This study aimed to understand landholders' existing attitudes, beliefs and behaviours relating to land and water management in the Herbert River catchment. The central aim was to provide an initial understanding of social factors with the potential to influence the implementation of ICM, and whether and how such factors vary according to where people live and what their interests are.

Some of the main conclusions provided by the research are noted as follows.

5.1 Issue Importance

Land degradation, water quantity problems, water quality problems and nature conservation issues were generally seen as highly important. The two latter issues yielded the highest and lowest means scores respectively. It was also observed that the lower urban sample was likely to place higher ratings of importance for these two issues.

Water quantity problems were largely viewed in terms of the lack - rather than abundance - of water and, as such, appeared to be of less importance in the lower catchment. Based on current perceptions, one difference between the two catchment areas appears to be that one does not have enough, and the other has too much water.

A clear finding was the difference in the ratings of importance to others and impacts on others. Essentially, one can consider an issue as important without being affected by it. More specifically, results showed that one's ratings of importance tended to be less for others than those felt personally. This occurred largely due to lower importance ratings being provided by the

rural samples. This makes intuitive sense given that the perception of "others" in the Herbert may include urban residents who may be less affected by problems such as land degradation.

It was interesting to note that where lower ratings (for others) were also provided by the urban sample, this was for issues more likely to be considered personally important (namely water quality and nature conservation issues). For water quality problems, the knowledge that such problems were isolated to certain areas (or less severe in other areas) of the catchment may have helped to lower importance ratings. Conceivably, "others" when thinking of nature conservation issues may have included rural producers and a perception that such people generally regard these issues as less important.

Possibly relating to this observation, a common finding in the literature is for people to underestimate others' feelings about the importance of prosocial behaviours (for example, the view that one's neighbours are less environmentally responsible).

5.2 Impacts

Regarding possible impacts of environmental and other pressures felt by people living in the Herbert, in particular, higher taxes and loss of confidence in the ability of government to manage natural resources were rated as high. Other impacts rated moderate to high included higher production costs, lower fish numbers and loss of environmental uses/benefits. Further, reduced farm productivity was a high impact for rural producers in the lower catchment. The low level of perceived conflict in the Herbert was also a noteworthy finding.

High impacts on others included higher taxes, higher production costs, loss of confidence in government, poor drinking water quality and loss of farm productivity.

As discussed, compared with impacts felt personally, impacts on others tended to be significantly higher. Also noted, compared with urban residents, the ratings for respondents in the two rural samples, and particularly the lower rural sample, were less liable to change (ie. more uniform). Therefore, the higher ratings for others generally came from participants in the urban samples, who were less likely to be personally affected by issues including higher production costs, loss of independence to make business decisions, and higher taxes.

As suggested, people in the lower urban sample appeared more "urban" than the upper urban sample in their views about certain issues. From this, it was suggested that the two upper catchment samples are more like-minded than their lower catchment counterparts.

This was evident, for example, for the impacts of loss of access to recreation, loss of environmental uses or benefits, and loss of scenery. As the lower urban sample was most likely to consider these impacts as high (and most likely to agree with other statements, including the need to change laws to increase landholder responsibility for actions undertaken), more "urban" may also equate with more "green". This particularly appeared to be the case for those living in Taylors Beach, whereas the views of those living in Ingham were not as conspicuous.

Interestingly, those in the lower urban sample were also generally less likely to become personally involved in land and water management activities (see below).

5.3 Tractability

For the broad issue of tractability, managing land and water in the Herbert was considered to be made most difficult by the catchment's large area, the fact that solutions are not easy, the expense required to put solutions in place, low trust of government programs, the difficulty of moving around the catchment, the wide variety of existing opinions, and insufficient understanding of problems.

In particular, and certainly from the point of view of perceived credibility, the low level of trust of government programs appears to be a key issue facing ICM in the Herbert.

On the upside of the scale, according to the bulk of those surveyed, the management of land and water would not be impeded by any lack of interest in community-type activities, the existence of more costs than benefits, or a lack of problems apparently requiring urgent action.

5.4 Awareness of Government Strategies

Of the three government strategies put forward, participants had heard most about Landcare (more than 85 percent) which, not surprisingly, was also the best-known strategy. Those who had heard about ICM (more than 37 percent), and knew most about ICM were most likely to be rural producers in the lower catchment.

Generally, knowledge of PMP, Landcare and ICM was greater in the rural samples. Knowledge about the strategies came most often from media sources while for ICM, meetings were also frequently mentioned.

As suggested above, while the widespread lack of perceived use-value and clear effectiveness of ICM and Landcare can be partially explained by low levels of membership in such groups (or, alternatively, may explain the low level of membership), this is still a finding that should warrant close attention.

Around three quarters of those who had definitely or vaguely heard of the Herbert River Catchment Coordinating Committee were rural producers in the lower catchment. Therefore, compared with this sample, all other samples were much less likely to have heard of the HRCCC.

5.5 Responsibility and Control

The first point of note was the widespread agreement by participants that there were things that they as individuals and as a community could do to help improve the environment, and that the local community should take some responsibility for doing this. Another potential spur to action was the high level of agreement that many environmental problems come from the way people manage their properties.

While there was agreement with these issues, any action may be hampered by an equally widespread perception of lack of finances to plan more than a year ahead (although less prevalent in the lower rural sample).

Next, many agreed they could prevent the occurrence of land and water problems on their properties. However, there was less agreement with this issue in the lower catchment (which was possibly related to flooding and drainage concerns being more prevalent).

Compared with the ability to prevent problems, less people agreed that they had complete control over the land and water on their properties. Interestingly, for prevention, distinctions were between the upper and lower catchment whereas for control, these were along rural-urban lines. As might be predicted, those in urban areas (and, therefore, with smaller properties and less direct use of their land) felt they had more control.

In brief, many agreed that laws should be changed to ensure landholders become more responsible for their actions. Once again, those in the lower urban sample (with the exception of Ingham) were more likely to agree and, compared with the lower rural sample, the upper urban sample was also more likely to agree. Lastly, the majority of the sample disagreed that thinking about land and water management for an area the size of the Herbert was too hard. One conclusion drawn from this was that, while managing land and water on a catchment basis was generally considered difficult, thinking about such issues was by no means viewed as impossible.

5.6 Views on Government

This component of the questionnaire highlighted widespread agreement that governments should work out better ways to fix land and water problems, and that incompetent government activities had been witnessed locally. Further, many people could recall a government action that had damaged their livelihood.

The upper urban sample was more likely to trust that public servants worked in their interests most of the time. In general, many others also agreed with this statement. However, as the direction of the mean score for this positively worded statement was less forceful than for the negatively worded statements mentioned above, some relationship between these issues and levels of trust was anticipated. In short, those who agreed they had witnessed incompetent government activities were less likely to trust that public servants worked in their interests.

Similar findings were evident for the statements, "I am sure that our local views will be considered when planning for land and water management in this area", and "Programs like Integrated Catchment Management interfere with people's rights to make their own decisions". Respectively, those who had witnessed government incompetence were less and more likely to agree with these statements.

5.7 Awareness and Intentions

In general awareness of, and preparedness (both personally and for others) to become involved in land and water management activities were viewed as moderate. Preparedness was generally rated as higher in the upper catchment.

In addition, many agreed they would be prepared to assist in local projects such as riverbank stabilisation. Once again this was more evident in the upper catchment.

Compared with this issue, less people thought it likely they would become involved or stay involved with a Landcare or catchment group over the next year or two. Similarly, less believed they could personally benefit from being involved in group activities. In addition, like all issues focussed on personal involvement, significant numbers responded that such issues were not applicable. Generally, the majority of these responses were from people in urban areas.

Many (close to 60 percent) agreed it was likely that they would look into ways to improve the environmental condition of their properties. Further, many agreed that they knew people who considered local groups to be a good way to deal with many land and water management issues.

Finally, again highlighting the distinction between other samples and the lower urban sample, the latter was more likely to disagree that the statement, "the local environment is no worse off than when I first lived here". For all samples, while more chose to disagree, there were also many who agreed. Some relationship also existed between this statement and the item, "how much are you prepared to become involved in land and water issues in the Herbert?". Those who were more likely to become involved were also less likely to agree that the condition of the local environment had not changed over time.

5.7.1 Influences on Involvement

Further analysis was carried out on the items denoting intentions to participate in land and water management activities. Of these, four items formed a reliable scale (0.8) and single intention component (or factor). These were then combined into a composite measure of behavioural intention by adding and dividing the ratings for each participant by four (the number of items). The items selected were:

- *How much are you prepared to become involved in land and water issues in the Herbert?;*
- *I would be prepared to assist in local projects such as riverbank stabilisation;*
- *It is likely that I will become involved (or stay involved) with a Landcare or catchment group over the next year or two;*
- *I can personally benefit from being involved in group activities to help manage land and water.*

The composite item concerns preparedness to become involved, both in a local and group context (specifically concerning land and water management), and relates group involvement to the achievement of personal benefits. A general name for this factor is *Personal and Group Intentions*.

Analyses were carried out to establish whether this intention measure was related to other items in the questionnaire. Using regression analyses, the capacity of other items to influence (predict) Personal and Group Intentions was then investigated.

For the whole sample (and in order of significance), Personal and Group Intentions were influenced by interest in local community issues, one's rating of the personal importance of land degradation, beliefs concerning the difficulty of thinking about an area the size of the Herbert, and the personal usefulness of the nominated government strategy (ie. the strategy known most about). Use of the river/creeks (note that one item within the intention factor related to riverbank stabilisation), the personal impact of higher production costs, and the personal importance of nature conservation issues also influenced intentions.

In summary, the likelihood of participating in land and water management activities appeared to be heightened by:

- a strong interest in local community issues;
- a belief that land degradation was personally important;
- a belief that thinking about land and water issues for an area as big as the Herbert was not too difficult;
- the opinion that government strategies (generally Landcare, and ICM) do have some personal use.

In addition, more frequent use of the river/creeks, concern about the personal impacts of higher production costs and the rating of nature conservation issues as important also related positively to Personal and Group Intentions.

It is noteworthy that, while trust of government programs was stated above as a key issue facing ICM in the Herbert, this was not related to Personal and Group Intentions. However, trust in public servants was to a small degree.

For the rural sample only (upper and lower catchment), influences on intentions were similar and also included the ability to prevent land and water problems from occurring at the property level.

For the urban sample, Personal and Group Intentions were best predicted by the personal importance of nature conservation issues, interest in community issues and the belief that many environmental problems come from the way people manage their properties. Loss of confidence in government's ability to manage land and water resources also influenced intentions.

5.8 Information Sources

The most frequently used sources of information included the Herbert River Express, friends/colleagues, the local "grapevine", neighbours, "Landline", personal experience, and family members.

One of the more notable findings was that the Herbert River Express was used more frequently than more "traditional" sources such as friends and personal experience. Second, "Landline" was used more frequently than personal experience, family members and public meetings. Its use was particularly high in the upper catchment.

Certainly an unexpected finding, Landline was considered the most reliable source. Clearly, Landline is an influential program in conveying information to catchment residents.

On this point, it was noted that the local "grapevine" was also a preferred source of information in the upper catchment, whereas sources including industry groups and public meetings were used more frequently in the lower catchment. This finding therefore suggests that ways to disseminate information about land and water management activities (including ICM) may need to be tailored to the two catchment areas.

The Herbert River Express, public meetings, personal experience, the Country Hour, and Canegrowers were also frequently noted as reliable sources.

Briefly, a clear example of the lack of integration between the upper and lower catchment areas was found in the readership of the Townsville Bulletin (lower catchment) and the Cairns Post (upper catchment).

Further analysis revealed a number of differences between the use of particular information sources and other questionnaire items. Many of these were related to the use of Landline, neighbours, community groups, personal experience and public meetings. For example, compared with non-use, use of these sources was related to more awareness of government strategies (PMP, Landcare, ICM), more agreement that things could be done personally to help improve the environment, and stronger intentions of becoming (or staying) involved in a Landcare or catchment group.

5.9 Group Involvement

One quarter of the whole sample were members of regional/state/national groups, while 44 percent were members of local groups. Many were members of each, and nearly 50 percent were members of either type of group. Rural producers, in particular, had high levels of group membership.

Compared with non-members, members were, for example, more likely to consider constraints to managing land and water to be the wide variety of opinions held by local people, and the difficulty in thinking about relevant issues for an area this size. Members were also more prepared to become involved in land and water issues and to assist in local projects such as riverbank stabilisation, and more likely to become (or stay) involved in a Landcare or catchment group and to see personal benefits accruing from involvement in group activities.

Some of the more prominent groups participants were involved with included sporting groups, Charity/church/welfare groups, agriculture related organisations, and Parents and Friends Associations. Groups considered most important also generally followed this order.

Lastly, approximately half of those who stated involvement with an Agriculture-related Organisation nominated this as the most important group. This was also the case for the "Landcare, Conservation or similar" category.

5.10 Interest in Community Issues

This component of the questionnaire indicated that most people were comfortable in being members of their local communities, thought it was a good place to live, could recognise many other local people, and would like to remain living in the Herbert for a long time.

Next, it was noted that any differences between samples on any of the items all included differences between the lower rural and upper urban samples. From this, it was broadly summarised that, compared mostly with the upper urban sample, the "community" as perceived by those within the lower rural sample appears more cooperative and self-reliant. However, as a word of caution, the differences appeared slight and any conclusions should not be drawn without further analysis.

For life satisfaction, all but one of the mean scores centred around moderate satisfaction. The exception was satisfaction with community facilities and services, with this being the area that people were least satisfied with. In particular, people in the upper urban sample was more likely to register dissatisfaction.

In a similar manner, for satisfaction with the community in which people live, people in the upper urban sample were less likely to be satisfied than those in the lower catchment.

The upper urban sample also responded less positively to the statements, "When thinking about your relationships with local people, how comfortable are you about living here?", and, "When thinking about how much interest local people have for your ideas and opinions, how comfortable are you about living here?".

5.11 Other Information

In brief, other findings included the following.

- Residents in the upper catchment had fewer familial ties beyond those in their household.
- People with property next to a river or creek which floods were less likely to agree that they had complete control over the land and water on their properties.
- Generally, people in the upper catchment were more likely to use rivers/creeks than those in the lower catchment.

Finally, compared with those who never used the river, those who used the river often provided significantly different ratings on a number of items. For example, the latter were:

- more likely to consider lower fish numbers and loss of access to recreation as personal impacts;
- more likely to have loss of confidence in government's ability to manage land and water resources;
- less likely to see programs such as ICM interfering with people's rights to make their own decisions.

Those who used the river often were also more prepared to be involved in land and water management activities and to see the benefits from such involvement.

6.0 IMPLICATIONS FOR ICM

Within the assessment of existing community behaviours and attitudes towards land and water management issues, a number of findings were considered to have implications for the progress of ICM in the Herbert River Catchment.

The first relevant finding was that the four principal issues (ie. land degradation, water quality problems, water quantity problems and nature conservation issues) were generally viewed as highly important. In brief, while some differences were evident between samples (eg. lower urban residents were more likely to rate the importance of water quality and nature conservation issues as high), the general importance of these issues to residents implies that ICM has the scope to plan and implement actions along a number of fronts. This could be done according to different areas of importance and, discussed below, where perceived impacts are seen to be high.

As was the case for issue importance, a number of influences on life in the Herbert were viewed as high impact, in particular, higher taxes and lost confidence in the ability of government to manage natural resources. Other notable impacts included higher production costs, lower fish numbers and loss of environmental uses/benefits.

Notably, the potentially wide scope for ICM was again emphasised by the fact that (a) several impacts were seen as high and (b) many impacts were seen as higher on others in the community than that experienced personally. That is, some issues were less important personally, but were still rated as having high impacts on others. These included the high cost of water, loss of farm productivity, and higher production costs.

On average, the awareness of land and water management issues held by local people was considered moderate. In conjunction with high ratings of personal impacts and those on others, this also demonstrates that ICM can have inroads into a number of important areas. As stated below, compared with "others", personal importance/impacts appeared more likely to influence intentions to participate in land and water management activities. However, knowledge that

certain impacts on others in the Herbert are generally seen as high (or low) can help to guide planning and action.

While awareness of land and water management issues held by local people was considered moderate, many agreed that problems are not well understood. Therefore, awareness of problems does not appear to be related to understanding.

Continuing with knowledge and awareness issues, Landcare was clearly the best-known government strategy, and knowledge of the three government strategies was generally higher in the rural samples. Those who had heard about ICM and the HRCCC and (of the three strategies) knew most about ICM were most likely to be rural producers in the lower catchment.

ICM in the Herbert is at an early stage of development. However, while noting that there appears to be a fair degree of awareness of relevant issues (at least as defined within the questionnaire), the widespread lack of knowledge and perceived effectiveness of ICM may require close attention. Further, target areas for increasing awareness of ICM include all urban settlements and the upper catchment generally.

Additionally, it is noteworthy that approximately 40 percent of the sample had heard of ICM and the HRCCC. Due to a lack of comparative results from other areas, it is difficult to say whether this level of awareness is excellent or mediocre (or somewhere in between).

In one study in the Blackwood Catchment in Western Australia (Butterworth & Carr, 1996), it is notable that similar questions returned 40 percent for ICM and 81 percent for the local coordinating group (BCCG).

A possible reason for this figure is that the BCCG has long had a reasonably solid public profile (eg. via local press) and, perhaps more significant, has had a "shop front" by way of a regional office in a prominent location in the catchment. A similar example closer to the Herbert, the Johnstone River Catchment Centre is located in the centre of Innisfail. This has helped ICM in the Johnstone to gain both a public profile and customer focus (Syme, Butterworth & Nancarrow, 1993).

From their findings, Butterworth and Carr (1996) suggested that the profile of ICM needed to be raised as the foundation underpinning the aims and activities of the BCCG. For example, within an information strategy, differences between ICM and Landcare as well as existing or needed coordination on areas of overlap could be highlighted.

For the issue of tractability, managing land and water was considered to be made most difficult by the large area and difficulty in moving around the catchment, the fact that solutions are not easy and expensive, low trust of government programs, the wide variety of existing opinions, and insufficient understanding of problems.

Results also showed that land and water management would not be obstructed by any lack of interest in community-type activities, the existence of more costs than benefits, or lack of problems requiring action. Within an ICM information strategy, for example, it may be advantageous to highlight factors such as the importance of land degradation and impacts associated with higher production costs, rather than emphasising the benefits of land and water management and the urgency of some problems.

Furthermore, the low level of perceived conflict in the Herbert contrasts with the view that the wide variety of existing opinions is a potential obstacle to managing land and water. This clearly has positive implications for ICM.

Another set of relevant findings for ICM included the analysis of behavioural intentions and subsequent formation of the combined measure "Personal and Group Intentions". In brief, those prepared to participate in land and water management activities were likely to:

- be interested in local community issues;
- believe that land degradation was personally important;
- believe that thinking about land and water issues for an area as big as the Herbert was not too difficult;
- hold that government strategies (generally Landcare, and ICM) do have some personal use.

More frequent use of the river/creeks, concern about the personal impacts of higher production costs and the rating of nature conservation issues as important also related positively to Personal and Group Intentions.

Assuming a causal relationship exists between the above influences and intentions, such influences could be the focus for arousing interest in ICM. Broadly, for example, the importance of land degradation throughout the catchment, the usefulness of ICM and Landcare, and the significance of catchment identity could all be promoted.

Regarding views on ability and responsibility to manage land and water, widespread agreement that actions could and should be undertaken as individuals and as a community provides another positive implication for ICM. However, noted above, any action may be restricted by an equally widespread perception of lack of finances to plan more than a year ahead and the related belief that locals do not have money available to spend on solutions (particularly in the upper catchment).

Many people also agreed that laws should be changed to ensure landholders become more responsible for their actions (although those in the lower rural sample were more ambivalent towards this statement). The majority also disagreed that thinking about relevant issues for the whole catchment was too hard. Consequently, it appeared that many may hold that managing land and water on a catchment basis may be a difficult, but certainly not futile exercise.

Views on government revealed a high level of agreement that governments should develop improved methods for addressing land and water problems, and that incompetent government activities within the catchment had been witnessed. Further, many stated they could recall a government action that had damaged their livelihood. People who agreed they had seen government incompetence were less likely to trust public servants and more likely to agree that programs like ICM interfere with the right of landholders to make their own decisions.

In particular, the low level of trust of government programs and public servants seem prominent issues facing ICM in the Herbert. Trust of public servants, for example, had a significant (although not highly predictive) relationship with the measure of intentions. In this instance, lower levels of trust of public servants were related to increased willingness to participate in land and water management activities.

One suggestion is proposed for dealing with the issue of low government credibility and trust. In conjunction with catchment residents, appropriate roles for public servants could be defined in

order to gain successful and ongoing relationships between the community and government in key areas.

These conclusions carry a number of implications for those selecting ICM planning and implementation processes. It is therefore proposed that a greater understanding of catchment management processes could be gained by investigating what these implications actually entail. As a result, there appears to be several avenues for future research by the study team. For example, comparisons could be made with property rights issues emerging from a study on institutional decision making for land and water allocation in the Shire of Gingin in Western Australia (McCreddin & Syme, 1996).

Finally, to mention two other findings that may have relevance for ICM, members of groups were more prepared to become involved in land and water management activities (including assisting in local projects), more likely to become (or stay) involved in a Landcare or catchment group, and more likely to assume there are personal benefits from involvement in group activities. Second, proximity to, and use of, the river/creeks provided some notable findings. For example, those with property next to a river or creek which floods agreed less that they had complete control over land and water, while those who used the river often were also more prepared to be involved in relevant activities and to see the benefits from such involvement.

Consequently, positive aspects and experiences related to group membership and involvement generally could also be used as promotional tools within an ICM information/communication strategy.

7.0 REFERENCES

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APPENDIX 1

Land and Water Management in the Herbert River Catchment Questionnaire

1. Using the scale below please rate your level of satisfaction with the various aspects of your life at the moment. *(please write your chosen number from the scale next to each item).*

Scale:

1	2	3	4	5
very dissatisfied	**moderately dissatisfied**	**neither satisfied nor dissatisfied**	**moderately satisfied**	**very satisfied**

Your life in general _____

Your standard of living _____

Your personal health _____

The area where you live _____

The community in which you live _____

Existing community facilities and services _____

2. What do you think are the major advantages of living in the Herbert?

_____

_____

_____

_____

3. Generally, what do you think are some of the key issues facing people in the Herbert?

_____

_____

_____

_____

4. In your opinion, how important are the following issues **(1) to you personally**, and **(2) to people in the Herbert generally**? *(using the following scale, please write your chosen number/s in the two boxes next to each issue).*

Scale:

1	2	3	4	5
very high importance	**high**	**moderate**	**low**	**very low importance**

	importance to you personally	importance to people in the Herbert
Land degradation		
Water quality problems		
Water quantity problems		
Nature conservation issues (eg. loss of wildlife habitat, management of state forests)		

5. Following are a list of issues which **some people** think have an impact on life in the Herbert. In **your opinion**, how much do each of the following impacts **(1) affect you personally**, and **(2) affect people in the Herbert generally**? *(using the following scale, please write your chosen number/s in the two boxes next to each impact).*

Scale:

1	2	3	4	5
very high degree	**high**	**moderate**	**low**	**very low degree**

OR **8** **not at all**

Possible Impacts	affects you personally	affects people in the Herbert
High cost of water		
Loss of farm productivity		
Higher production costs		
Poor drinking water quality		
Shortage of irrigation water		
Declining human health		
Loss of independence to make business decisions		
Emotional stress		
Conflicts with other local people		
Higher taxes		
Lower fish numbers		
Loss of access to recreation		
Loss of confidence in government's ability to manage land and water resources		
Loss of environmental uses or benefits (eg. wildlife habitat)		
Loss of scenery		

6. Generally speaking, what **awareness** do you think local people have about land and water issues in the Herbert? *(please circle one number only)*

1	2	3	4	5
very high awareness	**high**	**moderate**	**low**	**very low awareness**

7. How much do you think **local people** are prepared to become involved in land and water issues in the Herbert? *(circle one number only)*

1	2	3	4	5
to a very high degree	**high**	**moderate**	**low**	**very low degree**

8. How much are **you** prepared to become involved in land and water issues in the Herbert? *(circle <u>one</u> number only)*

1	2	3	4	5
to a very high degree	**high**	**moderate**	**low**	**very low degree**

9. Using the scale below please rate how much you agree or disagree with the following statements. *(please write your chosen number from the scale next to each statement).*

<u>Scale:</u>

1	2	3	4	5
strongly disagree	**disagree**	**neither agree nor disagree**	**agree**	**strongly agree**

Managing land and water in the Herbert is difficult because...

problems aren't well understood. _____

solutions aren't easy. _____

there aren't any problems that need urgent action. _____

local people lack the money to spend on solutions. _____

government strategies are a waste of time. _____

solutions are expensive. _____

there are few benefits and many costs. _____

local people don't want to spend money on solutions. _____

the Herbert River catchment covers a large area. _____

it's hard to get around the catchment (eg. from top to bottom). _____

people in the Herbert have a wide variety of opinions. _____

local people don't trust government programs. _____

local people aren't that interested in community-type activities. _____

the government doesn't want to spend money on solutions. _____

10. Before we contacted you about this study, which of the government strategies in the box below had you heard about and which one did you know most about?

STRATEGY	**HAD YOU HEARD OF THIS?** *(please tick as many boxes as apply)* ↓	**WHICH DID YOU KNOW MOST ABOUT?** *(tick <u>one</u> box only)* ↓
Property Management Planning or "PMP"	?	?
Landcare	?	?
Integrated Catchment Management or "ICM"	?	?

☞*If you haven't heard of any of these government strategies, please go to question* **12.**

11. When thinking of the government strategy you know most about:

A. how useful has this strategy been to you personally? *(please circle <u>one</u> number only)*

1	2	3	4	5
not at all useful	**not very**	**moderately**	**quite**	**very useful**

B. how effective has the strategy been in dealing with land and water issues in the Herbert? *(circle <u>one</u> number only)*

1	2	3	4	5
very effective	**fairly effective**	**neither effective nor ineffective**	**fairly ineffective**	**very ineffective**

C. how did you come to know of the strategy?

_____

_____

12. Have you heard of a group called the Herbert River Catchment Coordinating Committee?

YES .... 1 **VAGUELY .... 2** **NO .... 3** ☞*please go to question* **13.**

↓ ↓

If YES or VAGUELY, what do you think the main purpose of this group is?

_____

_____

13. Using the scale below please rate how much you agree or disagree with the following statements. *(write your chosen number from the scale next to each statement).*

<u>Scale:</u>

1	2	3	4	5	**<u>OR</u>**	8
strongly disagree	**disagree**	**neither agree nor disagree**	**agree**	**strongly agree**		**not applicable**

Governments should work out better ways to fix land and water problems. _____

There are things I can do personally to help improve the environment. _____

It's too hard to think about land and water management issues for an area as big as the Herbert catchment. _____

I don't usually have the finances available to plan more than a year ahead. _____

I trust that public servants are working in my interest most of the time. _____

I've seen incompetent government activities in this part of the country. _____

The local community should take some responsibility for improving the environment. _____

Programs like Integrated Catchment Management interfere with people's rights to make their own decisions. _____

There are things local community groups can do to help improve the environment. _____

I am sure that our local views will be considered when planning for land and water management in this area. _____

The local environment is no worse off than it was when I first lived here. _____

I would be prepared to assist in local projects such as riverbank stabilisation. _____

Many environmental problems come from the way people manage their properties. _____

I can prevent any land and water problems from occurring on my property. _____

It is likely that I will become involved (or stay involved) with a Landcare or catchment group over the next year or two. _____

I've complete control over what happens to the land and water on this property. _____

It is likely that I will look into ways to improve the environmental condition of my property over the next year or two. _____

I can recall at least one government action which has damaged my livelihood. _____

I could personally benefit from being involved in group activities to help manage land and water. _____

Laws should be changed to make landholders more responsible for the consequences of their activities. _____

Some people I know think that local groups are a good way to deal with many land and water management issues. _____

14. Which of the following sources of information help you to **keep informed** about land and water management issues? *(tick as many boxes as apply)*

Neighbours	☐	The Australian newspaper	☐
A government agency (please specify)	☐	Cairns Post	☐
_____		Townsville Bulletin	☐
_____		Telegraph Times	☐
Industry groups (please specify	☐	Herbert River Express	☐
_____		The Tablelander	☐
_____		Tablelands Advertiser	☐
Community Groups	☐	Millstream Times	☐
Family members	☐	Courier Mail	☐
Friends/colleagues	☐	Magazines/journals	☐
Personal experience	☐	Government newsletters	☐
The local "grapevine"	☐	The Country Hour (ABC radio)	☐
Public meetings	☐	Landline (ABC television)	☐
Other (please specify)	☐		
_____		None/I don't keep informed	☐
_____		☞ *please go to question* **19**.	

15. In the above box, which two sources of information would you say were the most **reliable** for helping you to make decisions?

- (1)
- (2)

16. Does what you read in newspapers ever change your opinions about land and water management issues? *(please circle <u>one</u> number only)*

1	2	3	4
often	**occasionally**	**seldom**	**never**

17. Does what you hear on the radio or see on TV ever change your opinions about land and water management issues? *(please circle <u>one</u> number only)*

1	2	3	4
often	**occasionally**	**seldom**	**never**

18. How often do you discuss land and water management issues with your neighbours or others in this general area? *(circle <u>one</u> number only)*

1	2	3	4
often	**occasionally**	**seldom**	**never**

19. When thinking about your **relationships with local people**, how comfortable are you about living here? *(circle <u>one</u> number only)*

1	2	3	4	5
not at all comfortable	**not very**	**moderately**	**quite**	**very comfortable**

20. When thinking about how much **interest local people have for your ideas and opinions**, how comfortable are you about living here? *(circle <u>one</u> number only)*

1	2	3	4	5
not at all comfortable	**not very**	**moderately**	**quite**	**very comfortable**

21. Are you a member of any regional, state or nationally-based groups or associations? *(please circle <u>one</u> number only)*

YES .... 1 **NO 2**

22. Are you a member of any local community groups or associations? *(circle <u>one</u> number only)*

YES .... 1 ☞ *please go to question* **25**.

or

NO 2

↓

23. Generally, what are some of your reasons for not being involved in any community groups?

_____

_____

_____

_____

24. Would you ever consider joining a community group? *(circle <u>one</u> number only)*

YES .... 1 **DON'T KNOW .... 2** **NO 3**

↓ ↓

For what reasons would you join? _____

_____

_____

_____

☞ *If you answered* **NO to question 21** *and* **NO to question 22**, *please go to question* **28**.

25. Which of the following categories describe *any* of the groups you have some involvement with? *(please tick as many boxes as apply)*

Progress Association	☐	Sporting Group	☐
Rate Payers Association	☐	Hobby/Craft Group	☐
Professional Association	☐	Community Action Group	☐
Charity/Church/Welfare Group	☐	Service Club (eg Lions, Rotary)	☐
Agriculture-related Organisation	☐	Parents & Friends Association	☐
Landcare, Conservation or similar Group	☐	Other/s (*please explain*)	☐
		_____	
		_____	

26. Of the groups you are involved with, please write down the name of the group that is **most important** to you.

- **Important group:** _____

27. If you are involved in any groups in the "Landcare, Conservation or similar" category, please write down the name of the group that you are **most involved** with. This may or may not be the same as the group that is the most important to you.

- **Landcare, Conservation or similar group:** _____

_____

28. Thinking of the local community where you live, please rate how much you agree or disagree with each of the following statements. *(using the scale below, write your chosen number from the scale next to each statement).*

Scale:

1	2	3	4	5
strongly disagree	**disagree**	**neither agree nor disagree**	**agree**	**strongly agree**

I'm not very interested in local community issues. _____

I feel quite comfortable in being a member of this local community. _____

The community is capable of getting things done without any outside help. _____

I would like to remain living in this area for a long time. _____

I have almost no influence over what happens in this community. _____

It's very important to me to live in this particular community. _____

People in this community generally don't get along with each other. _____

I don't really care what others in the community think of my actions. _____

Very few of my neighbours know me. _____

I often think about local community issues. _____

I want the same things from this community as other local people want. _____

I and many others in this community share similar values. _____

I think this community is a good place to live. _____

I can recognise many of the people who live in this community. _____

I. don't have the time to become involved in local community issues _____

OTHER INFORMATION

29. How old are you? _____ **years**

30. What is your gender? *(please circle a number)*

MALE .... 1 FEMALE 2

31. Which country were you born in? _____

32. What is your marital status? *(circle the most appropriate number)*

Married/Defacto	**.... 1**	Divorced/Separated	**.... 2**
Never Married/Single	**.... 3**	Widowed	**.... 4**

33. Do you have any family members living in the Herbert area other than those in your household? *(circle <u>one</u> number only)*

YES .... 1 NO 2

34. What is your main occupation? _____

35. How many years have you had this occupation? _____ **years**

36. How long have you lived in the Herbert area? _____ **years**

37. Is your property near to a river or creek which floods?

YES .... 1 **NO .... 2** **DON'T KNOW 3**

38. Thinking about where you live, what is the most important river or creek to you?

_____

39. How often do you use the river or creeks near where you live? (eg. for commercial, domestic or recreational purposes) *(please circle <u>one</u> number only)*

1	**2**	**3**	**4**
often	**occasionally**	**seldom**	**never**

40. How often do you go fishing for recreation? *(circle <u>one</u> number only)*

1	**2**	**3**	**4**
often	**occasionally**	**seldom**	**never**

41. Do you own or lease/rent a commercial rural, or rural property greater than 3 hectares (7.5 acres)? (*please circle <u>one</u> number only)*

YES **NO .... 3** ☞ *please go to question* **45.**

↓

OWN .... 1 or LEASE/RENT 2

42. Which one of the following best describes your current use of this property? *(circle <u>one</u> number only)*

Cane farming **.... 1** Grazing **.... 2** Mining **.... 3** Industrial **.... 4**

Other farming **.... 5** *(please specify)* _____

Other **.... 6** *(please specify)* _____

43. What is the size of your property? _____ **hectares** *<u>or</u>* _____ **acres**

44. Have you cleared any new land in the last twelve months?

YES .... 1 **NO .... 2** ☞ *please go to question* **45.**

↓

If YES, how much new land have you cleared? _____ **hectares** *<u>or</u>* _____ **acres**

45. Would you be prepared to answer another shorter questionnaire if needed in a few months time?

YES .... 1 **NO 2**

If YES, please write your name, postal address and phone number in the space provided.

Your Name:
Postal Address:
Phone number:

Thank you very much for your time.

Are there any comments you would like to add?

Chapter 3

Land and Water Management in the Herbert River Catchment: A Survey of Rural and Urban Residents

Summary Report to the Herbert River Catchment Coordinating Committee

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This study forms the community assessment component of CSIRO-led research evaluating the implementation of Integrated Catchment Management (ICM) in the Herbert River Catchment. The study is supported by the Land and Water Resources Research and Development Corporation (LWRRDC).

THE STUDY

This study examined landholders' behaviours and attitudes towards land and water management in the Herbert River Catchment. The aim was to provide an understanding of the sorts of issues that might affect the performance of Integrated Catchment Management (ICM) in the Herbert, and how these might vary according to where people live and what their interests are.

The basis of the study was a community survey, and this was designed as a questionnaire to be filled out by those agreeing to take part (see Appendix 1). Telephone calls were used to inform people about the study, and those willing to be involved were then mailed the survey.

The questionnaire contained items including landholders':

- level of importance, perceived impacts/effects, awareness and attitudes and attitudes towards various land and water management issues;
- perceived ability to control land and water management issues;
- tractability or "manageability" of potential issues;
- intentions to participate in relevant activities;
- awareness of government strategies;
- attitudes towards government's performance;
- use of information sources;
- group involvement.

The study area included the whole catchment. A range of landholders were contacted, including those in the upper and lower catchment; in rural and urban areas; and with different occupations including cane farming, grazing and mining.

In all, 800 telephone calls were made and 718 people agreed to take part. The number of returned and completed questionnaires was 477, providing an overall return rate of 66%.

A breakdown of the number of questionnaires returned and response rates appears in the following table.

Catchment	Type of Holding	Number Returned	Response Rate (%)	Towns surveyed	Number Returned	Response Rate (%)
UPPER	RURAL	59	64.1			
	URBAN	86	67.2	Herberton	38	76.0
				Mt Garnet	18	54.5
				Ravenshoe	30	66.7
LOWER	RURAL	191	67.7			
	URBAN	141	65.3	Allingham	28	60.1
				Ingham	45	61.6
				Halifax	17	54.8
				Lucinda	26	66.7
				Taylors Beach	24	88.9
TOTAL		**477**	**66.4**			

RESULTS

Some of the main conclusions of the research are discussed below. Most results are based on comparisons among four samples: *upper rural, lower rural, upper urban* and *lower urban*. When appropriate, these categories were also combined into more general *upper* and *lower*, and *rural* and *urban* samples.

Issue Importance

For the whole sample, land degradation, water quantity problems, water quality problems and nature conservation issues were generally seen as highly important. The last two issues produced the highest and lowest ratings (average or mean scores) respectively. The lower urban sample was likely to place higher ratings of importance for these two issues.

Water quantity problems were largely viewed in terms of the lack – rather than abundance – of water and, as such, appeared to be less important in the lower catchment. Based on current views, one difference between the two catchment areas might be that one does not have enough, and the other has too much water.

Results also showed that ratings of importance tended to be less for others than those felt personally. This occurred largely due to lower importance ratings being provided by the rural samples. This makes sense in that the perception of "others" in the Herbert may include urban residents who may be less affected by problems such as land degradation.

It was interesting that where lower importance ratings (for others) were also provided by the urban sample, this occurred when issues were more likely to be considered personally important (namely water quality and nature conservation issues). Also, for water quality problems, the knowledge that such problems were isolated to certain areas (or less severe in other areas) of the catchment may have helped to lower importance ratings.

Impacts

In terms of the effects of various issues on people personally, higher taxes and loss of confidence in the ability of government to manage natural resources were rated highly. Other impacts rated moderate to high included higher production costs, lower fish numbers and loss of environmental uses/benefits. For rural producers in the lower catchment, reduced farm productivity was a high impact.

High impacts on others included higher taxes, higher production costs, loss of confidence in government, poor drinking water quality and loss of farm productivity.

Compared with impacts felt personally, impacts on others tended to be significantly higher. Also, compared with urban residents, the ratings from people in the two rural samples, and particularly the lower rural sample, were less liable to change (when comparing self with others). Therefore, the higher ratings for others generally came from people in the urban samples, who were less likely to be personally affected by issues including higher production costs, loss of independence to make business decisions, and higher taxes.

As discussed in the full report, people in the lower urban sample appeared more "urban" than the upper urban sample in their views about certain issues. From this, it was suggested that the two upper catchment samples may be more like-minded than those in the lower catchment.

As examples, this was the case for the impacts of loss of: access to recreation, environmental uses or benefits, and scenery. As the lower urban sample was most likely to consier these impacts as high (and most likely to agree with other statements, including the need to change laws to increase landholders' responsibility for their actions), more "urban" may also stand for more "green". (Or – at least at this time – more concerned with such issues). This particularly seemed the case for those living in Taylors Beach, whereas the views of those living in Ingham were not as pronounced.

Interestingly, those in the lower urban sample were also generally less likely to become personally involved in land and water management activities (see below).

Tractability

For the issue of tractability (or manageability), managing land and water was thought to be made most difficult by the catchment's large areas, the fact that solutions are not easy, the expense required to put solutions in place, low trust of government programs, the difficulty of moving around the catchment, the wide variety of existing opinions, and insufficient understanding of problems.

Certainly from the point of view of perceived credibility, the low level of trust of government programs appears to be a key issue facing ICM in the Herbert.

On the upside of the scale, according to most, land and water management would not be impeded by any lack of interest in community-type activities, the existence of more costs than benefits, or a lack of problems apparently requiring urgent action.

Awareness of Government Strategies

Of the three government strategies put forward (ICM, Landcare and Property Management Planning), participants had heard most about Landcare (more than 85%) which, not surprisingly, was also the best-known strategy. Those who had heard about ICM (more than 37%), and knew most about ICM were most likely to be rural producers in the lower catchment.

Interestingly, 11 of the 12 people who knew most about PMP, and 42 of the 47 who knew most about ICM, resided in the lower catchment. Thus, the clear majority of people in the upper catchment (82.6%) knew most about Landcare.

Results appear in the following tables. Please note that the figure "**N**" in the tables shows the number of responses to a particular question. For any question, at least a few people chose not to respond.

		Property Management Planning (PMP		Landcare		Integrated Catchment Management (ICM)	
Response	**Rating**	**N(475)**	**Percent**	**N(475)**	**Percent**	**N(475)**	**Percent**
Heard about	1	123	25.9	406	85.5	178	37.5
Not heard about	2	352	74.1	69	14.5	297	62.5
TOTAL		475	100.0	475	100.0	475	100.0

Strategy known most about

Response	**Rating**	**N(453)**	**Percent**
PMP	1	12	2.6
Landcare	2	333	73.5
ICM	3	47	10.4
don't know of any	4	61	13.5
TOTAL		453	100.0

Usefulness of the strategy known most about

Response	**Rating**	**N(380)**	**Percent**
very useful	5	20	5.3
quite	4	36	9.5
moderately	3	102	26.8
not very	2	122	32.1
not at all useful	1	100	26.3
TOTAL		380	100.0
Mean = 2.4			

For this issue, nearly 60% of the participants responded that the strategy had been not at all useful or not very useful. Looking at the results for PMP, Landcare and ICM separately, the average ratings were 3.0 (only 12 responses), 2.3 and 2.4 respectively (generally, moderately to not very useful).

For ICM, this figure may not be too concerning since ICM in the Herbert is at a fairly early stage of development. For Landcare, the lack of usefulness may be more of a concern given that it is a more established, locally-based and "hands on" approach than ICM. As noted below, however, very few of the samples were members of Landcare groups and this likely explains the figures in the above table.

Response	Rating	N(380)	Percent
very effective	5	6	1.6
fairly effective	4	100	26.7
neither effective nor	3	130	34.8
ineffective	2	108	28.9
fairly ineffective	1	30	8.0
very ineffective			
		374	100.0
TOTAL			
Mean = 2.9			

Looking at the results for PMP, Landcare and ICM separately, the average ratings were 3.3 (only 12 responses), 2.8 and 2.8 respectively. Interestingly, when comparing the strategy's personal usefulness with their general effectiveness, the ratings all increased significantly.

While there were widespread views that ICM and Landcare lacked use-value and clear effectiveness, this might be partially explained by low membership numbers in such groups (or, alternatively, may explain the low level of membership). Nevertheless, it is a finding that should warrant close attention.

Sources of knowledge	N	Percent
Newspapers	79	23.7
Television/television advertisements	72	21.6
Media (in general)	44	13.2
Word of mouth	40	12.0
Meetings (in general)	31	9.3
Canegrowers meetings	22	6.6
Radio/radio talk shows	22	6.6
Reading	17	5.1
Advertisements (in general)	12	3.6
Canegrowers magazine	12	3.6
Local pamphlets	9	2.7
Personal experience	8	2.4
Landcare	6	1.8

67% of the responses could be classified as media sources (ie. a combination of the newspaper, television, media and radio responses).

With approximately three-quarters of this sample, Landcare accounted for the bulk of the responses. Most common were newspapers (72 of 79 in total), television (69 of 72), media (42 of 444), word of mouth (34 of 40), radio (22 of 22), and reading (15 of 17).

For ICM, 15 people stated their sources to be meetings, while 7 people were more specific in stating canegrowers meetings. Other sources included newspapers (6), drainage boards (3), word of mouth (3), and the Canegrowers Magazine (2).

The next question asked people whether they had heard of the Herbert River Catchment Coordinating Committee.

Response	Rating	N(425)	Percent
Yes	1	93	21.9
Vaguely	2	86	20.2
No	3	246	57.9
TOTAL		425	100.0

Interestingly, of those who had definitely heard about the HRCCC, 68 were from the lower rural sample (41% of this sample). Only 8 and 4 people had definitely heard about the HRCCC in the upper catchment rural and urban samples (14 and 5 % of these samples) respectively. Thirteen people (10%) of the lower urban sample had heard of the HRCCC.

Around three quarters of those who had definitely or vaguely heard of the Herbert River Catchment Coordinating Committee were rural producers in the lower catchment. Therefore, compared with this sample, all other samples were much less likely to have heard of the HRCCC.

From lowest to highest, those who responded "Yes" or "Vaguely" comprised 17, 31, 34, and 65% of the upper urban, lower urban, upper rural and lower rural samples respectively. This result could have been expected, given that ICM may have more of a presence in the lower catchment and a greater focus on rural (rather than urban) resource management issues.

Of further interest, it is noteworthy that 179 people had heard of the HRCCC and 178 people had heard about ICM, with both figures being in the order of 40%. More than three quarters of those who had heard about ICM had heard of the HRCCC, while more than 21% of those who had not heard about ICM had at least vaguely heard about the HRCCC.

Participants were then asked to state what they believed to be the main purpose of the HRCCC. Some of the more prominent purposes of the HRCCC are summarised in the following table. The figures in the percent column related to the total number of people who gave at least one response (161).

Purpose of HRCCC	N	Percent
Preserve waterways (including land quality and river banks)	23	14.3
Conserve and manage water	21	13.0
Care for the catchment area	14	8.7
Coordinate river use	12	7.4
Control/mitigate flooding in the lower catchment (including a suggestion to dredge the Herbert River)	10	6.2
Raise awareness/inform the public of existing problems	8	5.0
Coordinate groups to discuss problems (such as drainage)	8	5.0
Calculate regular flood areas	7	4.3
Maintain flow in the Herbert River and creeks/keep it clean	7	4.3
Not sure/it has never been fully publicised locally	7	4.3
Form strategies to assist the community (eg. to help with drainage disputes)	6	3.7
Combine all drainage boards into one body (eg. to cut costs and improve effectiveness)	6	3.7
Dam the river	3	1.9
Monitor fertiliser runoff	3	1.9

As can be seen, a variety of purposes were put forward. Most related mainly to water issues and many were fairly hands-on; for example, to improve drainage, control flooding, calculate flood areas, maintain river flow, and dam the river.

Responsibility and Control

For these questions, a clear finding was the widespread agreement by participants that (a) there were things that they as individuals and as a community could do to help improve the environment, and (b) the local community should take some responsibility for doing this. Another potential influence to action was the high level of agreement that many environmental problems come from the way people manage their properties.

While there was agreement with these issues, any action to improve the environment may be limited by an equally widespread view that finances are lacking to plan more than a year ahead (although less prevalent in the lower rural sample).

Next, many agreed they could prevent land and water problems on their properties. However, there was less agreement with this issue in the lower catchment (which was possibly related to flooding and drainage concerns being more widespread).

Compared with the ability to prevent problems, fewer people agreed that they had complete control over the land and water on their properties. Interestingly, for the issue of prevention, distinctions were between the upper and lower catchment (with those in the lower catchment believing they had less ability) whereas for control, these were along rural-urban lines. As might be predicted, those in urban areas (and, therefore, with smaller properties and less direct use of their land) felt they had more control.

In brief, many agreed that laws should be changed to ensure landholders become more responsible for their actions. Again, those in the lower urban sample (with the exception of Ingham) were more likely to agree and, compared with the lower rural sample, the upper urban sample was also more likely to agree. Lastly, most of the sample disagreed that thinking about land and water management for an area the size of the Herbert was too hard. One conclusion drawn from this was that, while managing land and water on a catchment basis was generally considered difficult, thinking about such issues was by no means viewed as impossible.

Views on Government

This part of the questionnaire showed a high level of agreement that governments should work out better ways to fix land and water problems, and that incompetent government activities had been seen locally. Many people also felt they could recall a government action that had damaged their livelihood.

The upper urban sample was more likely to trust that public servants worked in their interests most of the time, although, in general, many others also agreed public servants were trustworthy. Those who agreed they had seen government incompetence, however, were less likely to trust that public servants worked in their interests.

There were similar findings for the statements, *I am sure that our local views will be considered when planning for land and water management in this area*, and *Programs like Integrated Catchment Management interfere with people's rights to make their own decisions*. Those who noted they had seen government incompetence were less and more likely to agree with these statements respectively.

Awareness and Intentions

In general, awareness of, and willingness to become involved in land and water management activities were viewed as moderate. Willingness was generally rated as higher in the upper catchment.

Also, may agreed they would be prepared to assist in local projects such as riverbank stabilisation. Again, this was more evident in the upper catchment.

Compared with this issues, fewer people thought it likely they would become involved or stay involved with a Landcare or catchment group. Similarly, less believed they could personally benefit from being involved in group activities.

Like all issues concerning personal involvement, many people felt that such issues did not apply to them. Generally, the majority of these were from people living in urban areas.

Many (nearly 60%) agreed it was likely that they would look into ways to improve the environmental condition of their properties. Many (more than 50%) also agreed that they knew people who considered local groups to be a good way to deal with many land and water management issues.

To highlight again the distinction between other samples and the lower urban sample, the latter was more likely to disagree that the statement, *the local environment is no worse off than when I first lived here*. For all samples, while more chose to disagree, there were also many who agreed. There was also

some relationship between this statement and the item, *how much are you prepared to become involved in land and water issues in the Herbert?*. Those who were more likely to become involved were also more likely to disagree that the local environment had not deteriorated over time.

Influences on Involvement

Further scrutiny was made of the items relating to intentions to participate in land and water management activities. Of these, four items were combined into a single measure of intention. The items selected were:

- *How much are you prepared to become involved in land and water issues in the Herbert?*
- *I would be prepared to assist in local projects such as riverbank stabilisation;*
- *It is likely that I will become involved (or stay involved) with a Landcare or catchment group over the next year or two;*
- *I can personally benefit from being involved in group activities to help manage land and water.*

The combined measure concerns preparedness to become involved, both in a local and group context (specifically concerning land and water management), and relates group involvement to personal benefits. This measure was called *Personal and Group Intentions*.

Next, an attempt was made to find out whether this measure was related to other items in the questionnaire. In other words, other items were looked at to see if they could influence (predict) Personal and Group Intentions.

For the whole sample (and in order of significance), Personal and Group Intentions were influenced by interest in local community issues, the personal importance of land degradation, beliefs about the difficulty of thinking about an area the size of the Herbert, and the personal usefulness of the specified government strategy (ie. the strategy known most about). Use of the river/creeks, the personal effects of higher production costs, and the importance of nature conservation issues also influenced intentions.

In summary, the likelihood of participating in land and water management activities appeared to be influenced by:

- a strong interest in local community issues;
- a belief that land degradation was personally important;
- a belief that thinking about land and water issues for an area as big as the Herbert was not too difficult;
- the opinion that government strategies (generally Landcare, and ICM) do have some personal use.

Also, more frequent use of the river/creeks, concern about the personal effects of higher production costs and the rating of nature conservation issues as important, also related positively to Personal and Group Intentions.

It is important to note that, while trust of government programs was considered a key issue facing ICM in the Herbert, this was not related to Personal and Group Intentions. However, trust in public servants was to a small degree.

For the rural sample only (upper and lower catchment), influences on intentions were similar and also included the ability to prevent land and water problems from occurring at the property level.

For the urban sample, Personal and Group Intentions were best predicted by the personal importance of nature conservation issues, interest in community issues and the belief that many environmental problems come from the way people manage their properties. Loss of confidence in the ability of government to manage land and water resources was also influential.

Information Sources

Participants were asked, *Which of the following sources of information help you to keep informed about land and water management issues?*

In the following table, the figures in both percentage columns show the proportion of people – compared with the whole sample – who use a particular source of information.

Information Source	**Percent**	**Information Source**	**Percent**
Neighbours	46.5		.2 (N=1)
A government agency	13.4		59.7
Industry groups	24.7		27.3
Community groups	21.6		23.9
Family members	34.2		15.1
Friends/colleagues	53.9		5.9
Personal experience	39.0		30.2
The local "grapevine"	48.4		7.5
Public meeting	32.3		28.3
The Australian newspaper	10.9		43.6
Cairns Post	16.8		2.5
Townsville Bulletin	30.6		5.5

In brief, the most frequently used sources of information included the Herbert River Express, friends/colleagues, the local "grapevine", neighbours, "Landline", personal experience, and family members.

One of the more notable findings was that the Herbert River Express was used more frequently than more "traditional" sources such as friends and personal experience.

Second, "Landline" was used more frequently than personal experience, family members and public meetings. Its use was particularly high in the upper catchment.

Certainly an unexpected finding, "Landline" was considered the most reliable source. Clearly, "Landline" is an influential program in passing on information to catchment residents.

On this point, it was noted that the local "grapevine" was also a preferred source of information in the upper catchment, whereas sources including industry groups and public meetings were used more frequently in the lower catchment. This finding therefore suggests that ways to provide

information about land and water management activities (including ICM) may need to be tailored to the two catchment areas.

The Herbert River Express, public meetings, personal experience, the Country Hour, and Canegrowers were also frequently noted as reliable sources.

Briefly, a clear example of the lack of integration between the upper and lower catchment areas was found in the readership of the Townsville Bulletin (lower catchment) and the Cairns Post (upper catchment).

Further analysis revealed a number of differences between the use of particular information sources and other questionnaire items. Many of these were related to the use of Landline, neighbours, community groups, personal experience and public meetings. For example, compared with non-use, use of these sources was related to more awareness of government strategies (PMP, Landcare, ICM), more agreement that things could be done personally to help improve the environment, and stronger intentions of becoming (or staying) involved in a Landcare or catchment group.

Group Involvement

One quarter of the whole sample were members of regional/state/national groups, while 44% were members of local groups. Many were members of each, and nearly 50% were members of either type of group. Rural producers, in particular, had high levels of group membership.

Compared with non-members, members were, for example, more likely to consider constraints to managing land and water to be the wide variety of opinions held by local people, and the difficulty in thinking about relevant issues for an area this size. Members were also more prepared to become involved in land and water issues and to assist in local projects such as riverbank stabilisation, and more likely to become (or stay) involved in Landcare or catchment groups and to see the personal benefits of involvement in group activities.

Some of the more prominent groups included sporting groups, charity/church/welfare groups, agriculture related organisations, and Parents and Friends Associations.

Lastly, approximately half of those who stated involvement with an agriculture-related organisation nominated this as the most important group. This was also the case for the "Landcare, Conservation or similar" category.

Interest in Community Issues

This part of the questionnaire showed that most people were comfortable in being members of their local communities, thought it was a good place to live, could recognise many other local people, and would like to remain living in the Herbert for a long time.

Next, it was noted that any difference on the items all included differences between the lower rural and upper urban samples. From this, it was broadly summarised that, compared mostly with the upper urban sample, the "community" as perceived by those within the lower rural sample appears more cooperative and self-reliant. However, as a word of caution, the differences to appear slight.

For life satisfaction, all but one of the average ratings centred around moderate. The exception was satisfaction with community facilities and services, with this being the area that people were the least satisfied. In particular, people in the upper urban sample were more likely to register dissatisfaction.

Similarly, for satisfaction with the community in which people live, people in the upper urban sample were less likely to be satisfied than those in the lower catchment.

The upper urban sample also responded less positively to the statements, *When thinking about your relationships with local people, how comfortable are you about living here?*, and, *When thinking about how much interest local people have for your ideas and opinions, how comfortable are you about living here?*

Other Information

In brief, other findings included the following:
- Residents in the upper catchment had fewer familial ties beyond those in their household;
- People with property next to a river or creek which floods were less likely to agree that they had complete control over the land and water on their properties;
- Generally, people in the upper catchment were more likely to use rivers/creeks than those in the lower catchment.

Finally, compared with those who never used the river, those who used the river often gave different ratings on a number of items. For example, these people were:
- more likely to consider lower fish numbers and loss of access to recreation as personal impacts;
- more likely to have loss of confidence in government's ability to manage land and water resources;
- less likely to see programs such as ICM interfering with people's rights to make their own decisions.

Those who used the river often were also more prepared to be involved in land and water management activities and to see the benefits from such involvement.

Implications for ICM

A number of findings were considered to have implications for the progress of ICM in the Herbert.

The first relevant finding was that the four principal issues (ie. land degradation, water quality problems, water quantity problems and nature conservation issues) were generally viewed as highly important. In brief, while there were some differences between samples (eg. lower urban residents were more likely to rate the importance of water quality and nature conservation issues as high), the general importance of these issues to residents implies that ICM has the scope to plan and carry out actions along a number of fronts. This could be done according to different areas of importance and, discussed below, where perceived impacts are seen to be high.

As was the case for issue importance, a number of influences on life in the Herbert were viewed as having a high impact, in particular, higher taxes and lost confidence in the ability of government to manage natural resources. Other notable impacts included higher production costs, lower fish numbers and loss of environmental uses/benefits.

The potentially wide scope for ICM was emphasised by the fact that (a) several impacts were seen as high and (b) many impacts were seen as higher on others in the community than that experienced personally. That is, some issues were less important personally, but were still rated as having high impacts on others. These included the high cost of water, loss of farm productivity, and higher production costs.

On average, the awareness of land and water management issues held by local people was considered moderate. Along with high ratings of personal impacts and those on others, this also shows that ICM can have inroads into a number of important areas. As stated below, compared with "others", personal importance/impacts appeared more likely to influence intentions to participate in land and water management activities. However, knowledge that certain impacts on others in the Herbert are generally seen as high (or low) can help to guide planning and action.

While awareness of land and water management issues held by local people was considered moderate, many agreed that problems are not well understood. Therefore, awareness of problems does not appear to be related to understanding.

Continuing with knowledge and awareness issues, Landcare was clearly the best-known government strategy, and knowledge of the three government strategies was generally higher in the rural samples. Those who had heard about ICM and the HRCCC and (of the three strategies) knew most about ICM were most likely to be rural producers in the lower catchment.

ICM in the Herbert is at an early stage of development. However, while noting that there appears to be a fair degree of awareness of relevant issues (at least as defined within the questionnaire), the widespread lack of knowledge and perceived effectiveness of ICM may require close attention. Further, target areas for increasing awareness of ICM include all urban settlements and the upper catchment generally.

In addition, it is noteworthy that approximately 40% of the sample had heard of ICM and the HRCCC. Due to a lack of comparable results from other areas, it is difficult to say whether this level of awareness is excellent, mediocre, or somewhere in between.

In one study in the Blackwood Catchment in Western Australia (Butterworth & Carr, 1996), it is notable that similar questions returned 40% for ICM and 81% for the local coordinating group (BCCG).

A possible reason for this figure is that the BCCG has long had a solid public profile (eg. via local press) and, perhaps more significant, has had a "shop front" by way of a regional office in a prominent location in the catchment. A similar example closer to the Herbert, the Johnstone River Catchment Centre is located in the centre of Innisfail. This has helped ICM in the Johnstone to gain both a public profile and customer focus (Syme, Butterworth & Nancarrow, 1993).

From their findings, Butterworth and Carr (1996) suggested that the profile of ICM in the Blackwood needed to be raised as the basis of the aims and activities of the BCCG. For example, within an information strategy, differences between ICM and Landcare, as well as existing or needed coordination on areas of overlap, could be highlighted.

For the issues of tractability, managing land and water was considered to be made most difficult by the large area and difficulty in moving around the catchment, the fact that solutions are not easy and expensive, low trust of government programs, the wide variety of existing opinions, and insufficient understanding of problems.

Results also showed that land and water management would not be obstructed by any lack of interest in community-type activities, the existence of more costs than benefits, or lack of problems requiring action. Within an ICM information strategy, for example, it may be useful to highlight factors such as the importance of land degradation and impacts associated with higher production costs, rather than emphasising the benefits of land and water management and the urgency of some problems.

Next, the low level of perceived conflict in the Herbert (at least at the time of the survey) contrasts with the view that the wide variety of existing opinions is a potential obstacle to managing land and water. While this appears to have positive implications for ICM, it understood that "hot:" issues may occasionally occur in the Herbert and these may increase the potential for conflict. Therefore, further research would be needed to clarify the degree to which perceived conflict is stable or varies over time.

Another set of relevant findings for ICM included the analysis of people's intentions and formation of the measure *Personal and Group Intentions*. In brief, those prepared to participate in land and water management activities were likely to:

- be interested in local community issues;
- believe that land degradation was personally important;
- believe that thinking about land and water issues for an area as big as the Herbert was not too difficult;
- hold that government strategies (generally Landcare and ICM) do have some personal use.

More frequent use of the river/creeks, concern about the personal impacts of higher production costs and the rating of nature conservation issues as important also related to intentions to participate.

Assuming a "causal" relationship exists between the above influences and intentions, such influences could be the focus for arousing interest in ICM. Broadly, for example, the importance of land degradation throughout the catchment, the usefulness of ICM and Landcare, and the significance of catchment identity could all be promoted.

Regarding views on ability and responsibility to manage land and water, the widespread agreement that actions could and should be undertaken as individuals and as a community is another positive implication for ICM. However, any action may be restricted by an equally widespread perception of lack of finances to plan more than a year ahead and the related belief that locals do not have money available to spend on solutions (particularly in the upper catchment).

Many people also agreed that laws should be changed to ensure landholders become more responsible for their actions (although those in the lower rural sample had more mixed views towards this statement). The majority also disagreed that thinking about relevant issues for the whole catchment was too hard. As such, it appeared that many may think that managing land and water on a catchment basis may be a difficult, but certainly not futile exercise.

Views on government revealed a high level of agreement that governments should develop improved methods for addressing land and water problems, and that there had been incompetent government activities within the catchment. Further, many stated they could recall a government action that had damaged their livelihood. People who agreed they had seen government incompetence were less likely to trust public servants and more likely to agree that programs like ICM interfere with the right of landholders to make their own decisions.

In particular, the low level of trust of government programs and public servants seem prominent issues facing ICM in the Herbert. To this end, one suggestion is proposed for dealing with low government credibility and trust. In conjunction with catchment residents, appropriate roles for public servants could be defined as a way to gain successful and ongoing relationships between the community and government in key areas.

Finally, to mention tow other findings that may have relevance for ICM, members of groups were more prepared to become involved in land and water management activities (including assisting in local projects), more likely to become (or stay) involved in a Landcare or catchment group, and more likely to assume there are personal benefits from involvement in group activities. Second, proximity to, and use of, the river/creeks provided some notable findings. For example, those with property next to a river or creek which floods agreed less that they had complete control over land and water, while those who used the river often were also more prepared to be involved in relevant activities and to see the benefits from such involvement.

Consequently, positive aspects and experiences related to group membership and involvement generally could also be used as promotional tools within an ICM information/communication strategy.

References

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Chapter 4

Land and Water Management in the Herbert River Catchment:

A Summary of Community Views

CSIRO Land and Water Consultancy Report No. 99-39

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1.0 Introduction

This study follows a survey performed in 1996 (Butterworth, Syme and Nancarrow, 1997) examining landholders' attitudes, beliefs and behaviours relating to land and water management in the Herbert River Catchment in north Queensland. The two surveys form the community assessment component of research evaluating the implementation of Integrated Catchment Management (ICM) in the Herbert River Catchment.

The original survey (see Appendix 1) covered:

- levels of importance, perceived impacts, awareness and attitudes towards various land and water management issues;
- perceived ability to control land and water management issues;
- tractability or "manageability" of potential issues;
- intentions to participate in relevant activities;
- attitudes towards government's performance;
- use of information sources; and
- group involvement.

The 1998 survey (see Appendix 2) covered the above items and those listed below:

- importance of various activities for ICM;
- awareness and opinions of the Herbert River Catchment Coordinating Committee's (HRCCC's) activities;
- awareness of information resources for the catchment;
- perceptions of current and preferred monetary contributions to Landcare and ICM; and
- the relationship between local government and ICM.

Survey 1 respondents who agreed they would be involved in a similar survey in the future were contacted by telephone along with a random selection of additional landholders. The response rates are shown in the table below.

Catchment	Type of holding	Number returned	Response Rate (%)	Towns Surveyed	Number Returned	Response Rate (%)
Upper	Rural	47	47.0			
	Urban	70	55.1	Herberton	33	71.7
				Mt Garnet	18	60.0
				Ravenshoe	19	45.2
Lower	Rural	141	44.1			
	Urban	143	55.9	Allingham	38	71.7
				Ingham	40	42.6
				Halifax	19	55.9
				Lucinda	26	72.2
				Taylors Beach	20	74.1
TOTAL		401	49.9			

A comparison of the results for the upper and lower catchment is provided in the following table. The final section explains the implications of the results for ICM.

2.0 Comparison of Results for the Upper and Lower Catchment

	Upper Catchment	Lower Catchment
Response Rate		
Overall	51.5%	49.3%
Urban	Herberton 71.7% Mount Garnet 60.0% Ravenshoe 45.2%	Taylor's Beach 74.1% Lucinda 72.2% Allingham 71.7% Halifax 55.9% Ingham 42.6%
Rural	47.0%	44.1%
Repeat	65.7%	62.1%
New	40.0%	43.8%
Demographics		
Age	Median age 40 to 55 years.	Median age 40 to 55 years.
Gender	60% male and 40% female.	62% male and 38% female.
Main occupations	Retired, home duties, grazier.	Cane farmer, home duties, retired, education, or a trade.
Lived in Herbert	Average of 14.5 years. Average of 17.2 years.	Average of 24.4 years. Average of 38.2 years.
Rural Properties		
Rural properties over 3 hectares	53% did not own or lease/rent 37% owned 10% leased or rented	50% did not own or lease/rent 45% owned 4% leased or rented 2% owned & leased/rented
Average size	6258 hectares	202 hectares
Clearing	Very few who owned/leased/rented such properties had cleared in the last 12 months.	Very few who owned/leased/rented such properties had cleared in the last 12 months.
Farming	Mainly used for grazing. Other farming included maize, corn, avocadoes, navy beans, trees, vegetables, fruit, potatoes, goat and horse breeding, hay, hobby farming, grain, grapes, small crops and poultry.	Mainly used for cane farming. Other farming included grazing, trees, pharmaceutical drugs, and aquaculture.
Other uses	Mainly residential, wildlife, subdivision or idle.	Mainly residential, mixed grazing and cane, or subdivision.
Life Satisfaction	Moderate satisfaction with: life in general, standard of living, personal health, where they lived and their community. Lower satisfaction with community facilities or services.	Moderate satisfaction with: life in general, standard of living, personal health, where they lived and their community. Lower satisfaction with community facilities or services.

Main advantages of the Herbert River Catchment	Healthy environment, great climate, unspoiled natural environment, good quality drinking water.	Personal safety, close access to recreation, closeness to large centres, close knit community.
Key Issues	Unemployment, water quantity issues, lack of opportunities for young people.	Lack of diversity in industry, unemployment, lack of opportunities for young people, flooding, weather/changing weather patterns, fishing issues.
Importance of Issues High personal importance	Water quality problems, land degradation, water quantity problems, nature conservation, and loss of biodiversity.	Water quality problems, land degradation, vegetation on river banks, flooding, nature conservation, wetlands and loss of biodiversity.
Moderate to high personal importance	Vegetation on river banks, wetlands.	Water quantity problems.
High importance to the Herbert	Water quantity problems, water quality problems.	Flooding, water quality problems.
Moderate to high importance to the Herbert	Land degradation, flooding, vegetation on river banks, wetlands, loss of biodiversity, and nature conservation.	Land degradation, water quantity, vegetation on river banks, wetlands, loss of biodiversity, and nature conservation.
Impacts of Issues		
Overall	Where there was a difference between the upper and lower catchment, the upper catchment indicated lower impacts.	Where there was a difference between the upper and lower catchment, the lower catchment indicated higher impacts.
Personal impacts	Most issues had a moderate to high impact.	All issues had a moderate to high impact.
Highest impacts	1. Loss of confidence in government's ability to manage land and water resources. 2. Higher taxes (higher for rural). 3. Poor drinking water quality.	1. Higher taxes (higher for lower rural than other respondents). 2. Loss of confidence in government's ability to manage land and water resources. 3. Poor drinking water quality. lower fish numbers, 4. Loss of environmental uses. 5. Loss of farm productivity (higher for rural respondents). 6. Higher production costs (higher for lower rural than other respondents).
Lowest impacts	1. Loss of farm productivity. 2. Emotional stress.	Emotional stress.
Impacts on the Herbert	All of the issues were rated between moderate and high.	All of the issues were rated between moderate and very high.
Highest impacts	1. Higher production costs. 2. Higher taxes. 3. Loss of confidence in government's ability to manage land and water	1. Higher taxes, 2. Loss of farm productivity. 3. Higher production costs. 4. Poor water quality.

	resources. 4. Loss of productivity. 5. Lower fish numbers.	5. Loss of confidence in government's ability to manage land and water resources. 6. Lower fish numbers.
Lowest impacts	1. Emotional stress (higher for rural than urban respondents). 2. Loss of environmental uses. 3. Loss of access to recreation.	1. Emotional stress (higher for rural than urban respondents). 2. Loss of environmental uses.
Tractability		
Greatest impediments	1. Slow government strategies. 2. The catchment's size. 3. Slow reactions by government to new problems. 4. Cost of solutions. 5. Lack of easy solutions. 6. Low trust of government programs. 7. Insufficient understanding of relevant problems.	1. Slow government strategies. 2. The catchment's size. 3. Slow reactions by government to new problems. 4. Cost of solutions. 5. Lack of easy solutions. 6. Low trust of government programs. 7. Insufficient understanding of relevant problems.
Lowest impediments	1. There are few benefits and many costs. 2. Local people aren't that interested in community-type activities.	1. There are few benefits and many costs. 2. Local people aren't that interested in community-type activities.
Differences	Of the eleven impediments only *local people lack the money to spend on solutions* was rated differently in the upper and lower catchment – upper agreed more strongly.	Of the eleven impediments only *local people lack the money to spend on solutions* was rated differently in the upper and lower catchment – lower agreed less strongly.
Government Strategies		
Most familiar	93% had heard of Landcare 47% had heard of ICM 22% had heard of PMP Knowledge highest for Landcare.	89% had heard of Landcare 51% had heard of ICM 33% had heard of PMP More awareness in lower rural. Knowledge highest for Landcare.
Personal usefulness	Most familiar strategy rated as moderate to not very useful.	Most familiar strategy rated as moderate to not very useful.
Effectiveness in dealing with land and water issues	Landcare rated as fairly effective overall. ICM rated as fairly effective.	Landcare rated as fairly effective overall. ICM rated as fairly effective.
Sources of information	Heard of most familiar strategy mainly through newspapers, TV/TV advertisements, the media, or by word of mouth.	Heard of most familiar strategy mainly through newspapers, TV/TV advertisements, the media, or by word of mouth.
Other programs	One fifth were aware of other government funded programs on wider environmental matters.	One fifth were aware of other government funded programs on wider environmental matters.
Main comments	It lacked knowledge of the local situation, was poorly organised, dealt with reforestation, worked well, was not consulting locals.	It lacked knowledge of the local situation, was poorly organised, dealt with reforestation, worked well, was not consulting locals.

Activities for ICM		
Overall	All eleven activities were rated well over moderately important.	All eleven activities were rated well over moderately important.
Most important	1. Develop solutions for and better understanding of environmental problems in the Herbert catchment. 2. Raise the level of local awareness and knowledge of environmental management issues. 3. Encourage local government to take an active role in environmental management issues. 4. Encourage joint projects between community, industry and state and local government. 5. Encourage research.	1. Develop solutions for and better understanding of environmental problems in the Herbert catchment. 2. Raise the level of local awareness and knowledge of environmental management issues. 3. Encourage local government to take an active role in environmental management issues. 4. Encourage joint projects between community, industry and state and local government. 5. Encourage research.
Differences	Rural sample: upper catchment more strongly supported: 1. Encouraging coordinating of state government programs. 2. Separate ICM programs for the upper and lower catchments.	Rural sample: lower catchment less strongly supported: 1. Encouraging coordinating of state government programs. 2. Separate ICM programs for the upper and lower catchments.
The HRCCC		
ICM and HRCCC	21% of those who had not heard about ICM (earlier in the questionnaire) had at least vaguely heard of the HRCCC.	21% of those who had not heard about ICM (earlier in the questionnaire) had at least vaguely heard of the HRCCC.
Awareness	35.7% had heard of the HRCCC at least vaguely. Most rural respondents had heard of the HRCCC (less in the upper catchment).	48.1% had heard of the HRCCC at least vaguely. Most rural respondents had heard of the HRCCC (more in the lower catchment).
Perceived purposes	Most frequent responses: care for the catchment, conserve & manage water, preserve waterways, raise awareness/inform the public of existing programs. 10% were not sure or said that the purpose had not been fully publicised locally.	Most frequent responses: care for the catchment, conserve & manage water, preserve waterways, raise awareness/inform the public of existing programs. 10% were not sure or said that the purpose had not been fully publicised locally.
Effectiveness	Most of those who responded believed that the HRCCC had been effective in achieving its goals and purposes to some extent.	Most of those who responded believed that the HRCCC had been effective in achieving its goals and purposes to some extent.
Specific activities	Over one fifth were unaware of any of the specific activities of the HRCCC. (Low response rate may indicate an even higher percentage).	Over one fifth were unaware of any of the specific activities of the HRCCC. (Low response rate may indicate an even higher percentage).
Progress	Half responded that the HRCCC was progressing quickly enough, at least to some extent. The majority felt that they were heading in the right direction at least to some extent.	Half responded that the HRCCC was progressing quickly enough, at least to some extent. The majority felt that they were heading in the right direction at least to some extent.

Resources		
Herbert Resource Information Centre	2% had visited the HRIC.	28% had visited the HRIC.
Herbert River Catchment Atlas	30% had seen the Atlas.	33% had seen the Atlas.
HRCCC Catchment Management Strategy	6% had seen the Strategy.	10% had seen the Strategy.
Responsibility		
General agreement	Many environmental problems come from the way people manage their properties (upper rural higher than lower rural).	Many environmental problems come from the way people manage their properties (lower rural lower than upper rural).
Divided opinion regarding ICM	1. It should be paid for and run by the government. 2. It should remain a voluntary activity. 3. The government expects too much from local communities. 4. Laws should be changed to make landholders more responsible for consequences of their activities.	1. It should be paid for and run by the government. 2. It should remain a voluntary activity. 3. The government expects too much from local communities. 4. Laws should be changed to make landholders more responsible for consequences of their activities.
Control		
High agreement	There are things local community groups can do to help improve the environment (higher in the upper catchment).	There are things local community groups can do to help improve the environment (lower in the lower catchment).
General agreement	1. There are things I can do personally to help improve the environment. 2. I don't usually have the finances available to plan more than a year ahead.	1. There are things I can do personally to help improve the environment. 2. I don't usually have the finances available to plan more than a year ahead.
General disagreement	It is too hard to think about land and water management issues for an area as big as the Herbert catchment.	It is too hard to think about land and water management issues for an area as big as the Herbert catchment.
Government		
High agreement	Need better incentives for landholders to address environmental issues/problems.	Need better incentives for landholders to address environmental issues/problems.
General agreement	1. The government needs to give more resources to voluntary groups. 2. Different government agencies often give conflicting information on land and water management issues.	1. The government needs to give more resources to voluntary groups. 2. Different government agencies often give conflicting information on land and water management issues.
Split opinion	1. Programs like ICM interfere with people's rights to make their own decisions. 2. ICM programs should have legislative backing. 3. The government gives plenty of resources to voluntary groups.	1. Programs like ICM interfere with people's rights to make their own decisions. 2. ICM programs should have legislative backing. 3. The government gives plenty of resources to voluntary groups.

Awareness		
Local people	Moderate degree of awareness about land and water management issues (lower than lower catchment).	Moderate degree of awareness about land and water management issues (higher than upper catchment).
General agreement	There are problems that need urgent action (upper rural more than lower rural).	There are problems that need urgent action (lower rural less than upper rural).
Split opinion	Local environment is no worse off than when I first lived here.	Local environment is no worse off than when I first lived here.
Intentions		
Local people	Would be prepared to become involved in land and water issues to a moderate degree.	Would be prepared to become involved in land and water issues to a moderate degree.
Respondents	Prepared to be involved to a moderate/high degree.	Prepared to be involved to a moderate/high degree.
Split opinion	1. Preparedness to assist in local projects such as riverbank stabilisation (upper rural agreed more than lower rural). 2. Likelihood of becoming (or staying) involved with a Landcare or catchment group over the next year or two. 3. Personal benefits of being involved in group activities to help manage land and water.	1. Preparedness to assist in local projects such as riverbank stabilisation (lower rural agreed less than lower rural). 2. Likelihood of becoming (or staying) involved with a Landcare or catchment group over the next year or two. 3. Personal benefits of being involved in group activities to help manage land and water.
Involvement in Groups		
Local community groups	42% had been involved in local community groups or associations over the last 12 months.	28% had been involved in local community group or associations over the last 12 months.
Main groups	Landcare, conservation, etc, charity/church/welfare, agriculture related, service club, parents and friends, sporting group.	Landcare, conservation, etc, charity/church/welfare, agriculture related, service club, parents and friends, sporting group.
Landcare, conservation or similar groups	Few responses, however, most frequent were Landcare groups.	Few responses, however, most frequent were Landcare groups.
Local Community		
General agreement	1. It is a good place to live. 2. They recognise many of the people. 3. They feel quite comfortable there. 4. Interest in local issues. 5. They shared similar values with others. 6. It's important to live there (lower agreement in the upper catchment).	1. It is a good place to live. 2. They recognise many of the people. 3. They feel quite comfortable there. 4. Interest in local issues. 5. They shared similar values with others. 6. It's important to live there (higher agreement in the lower catchment).
Split opinion	1. Influence over what happens (less agreement in the upper catchment). 2. People in their community don't generally get along. 3. Often think about local community	1. Influence over what happens (more agreement in the lower catchment). 2. People in their community don't generally get along. 3. Often think about local community

	issues. 4. Having the time to become involved in local community issues.	issues. 4. Having the time to become involved in local community issues.
ICM and Local Government	90% believed that local government should have a role in ICM. The main reasons were: - knowledge of the local environment - more resources and information - responsible for building and maintaining infrastructure - within its region. 96% responded that local government planning should take ICM into account. The main reasons were: - benefit the community - responsible for building and maintaining infrastructure - knowledge of local environment - provide better management for the future.	88% believed that local government should have a role in ICM. The main reasons were: - knowledge of the local environment - more resources and information - representation of local people and views - better able to obtain funds. 93% responded that local government planning should take ICM into account. The main reasons were: - benefit the community - uniformity of approach - stop development in the wrong areas.
Funding		
Amounts being contributed by the different sections	Commonwealth gov $35.51** Queensland gov $32.57 Local government $14.79 Industry $4.91 ** Farmers $11.85 ** Significant difference between the upper and lower catchment.	Commonwealth gov $26.77 ** Queensland gov $28.29 Local government $19.35 Industry $11.89 ** Farmers $12.47 ** Significant difference between the upper and lower catchment.
Amounts that should be contributed by the different sections	Commonwealth gov $39.03 Queensland gov $29.82 Local government $12.11 ** Industry $10.23 Farmers $8.55 It was thought that industry should be contributing more than they were at the time.	Commonwealth gov $34.94 Queensland gov $26.26 Local government $16.94 ** Industry $11.53 Farmers $10.23 It was thought that the Commonwealth government should be contributing more than they were at the time.

3.0 Implications of the Findings for ICM

This section outlines consistent and important findings across Survey 2 and their implications for ICM.

There was very strong stability of opinions between 1996 and 1998.

- Prompted and unprompted responses displayed relatively few differences and differences that did exist were by a matter of degree.

For ICM, the stability of the results suggests that opinions and priorities do remain fairly stable over time, and that any changes in awareness or behaviour related to land and water management, are likely to take longer than two years to occur, given the resources available.

There was a fairly high degree of satisfaction with living in the Herbert.

- There was moderate satisfaction with life in general, standard of living, personal health, the area where respondents lived and the community in which they lived.
- Respondents generally agreed that it is a good place to live, they felt quite comfortable living there, recognised many of the people in their local community, shared similar values with others and felt it was important to live in that particular community.
- Respondents reported many advantages of the Herbert.

The finding that there was general satisfaction with many aspects of living in the Herbert River catchment suggests that most people would not support any changes that would threaten these aspects of their community.

The most important issues to respondents when not prompted were related to employment, in other words, life issues:

- unemployment;
- a lack of opportunities for young people; and
- a lack of diversity in industry.

Following these were issues related to land and water management and the environment:

- clearing of marginal land;
- flooding;
- drainage;
- water quantity issues;
- fishing issues;
- the impact of weather and changing weather conditions on primary industry; and
- environmental issues in general.

When prompted on land and water management issues, many respondents found them to be important:

- most issues were more important personally than to the Herbert in general;
- respondents generally agreed that there were problems that needed urgent action;
- however, opinion was divided on whether or not the environment had worsened since respondents first lived in the Herbert;
- high ratings of personal importance, and importance for the Herbert, of water quality problems, land degradation, water quantity problems and nature conservation;
- moderate to high ratings of importance of flooding, wetlands, vegetation on riverbanks and loss of biodiversity.

When asked about the personal impact, and the impact on the Herbert, of various issues:

- there were few differences over time;
- the personal impact of loss of farm productivity, poor drinking water quality and loss of environmental uses/benefits increased over time;
- for the Herbert, the impact of loss of farm productivity was seen to have increased since Survey 1 and the impact of lower fish numbers was perceived to have decreased;
- there was a high impact on respondents of poor drinking water quality and loss of environmental uses; and

- respondents perceived the largest impacts on the Herbert to be from loss of farm productivity and poor drinking water quality.

There was community awareness and interest in the Herbert issues, most respondents:
- were interested in local issues; and
- local awareness about land and water issues was considered to be moderate, as in Survey 1.

There is awareness of problems and the perception that land and water issues are important, both personally and on a catchment scale. This signifies general support for ICM to tackle land and water management on a number of fronts. However, land and water management issues were not uppermost in people's minds, which suggests that there needs to be awareness and acknowledgment by ICM that while people may support land and water management of various kinds, their first priorities lie with 'life issues'.

Opinions were divided about:
- the degree of influence respondents felt over what happened in their communities;
- whether or not people in their community generally got along; and
- whether or not respondents often thought about local community issues.

While there was community interest in issues for the Herbert, the influence people felt was not particularly high, it appeared that there may be some conflict and not all respondents often thought about local community issues. These factors may hinder community participation in ICM.

The community displayed a high sense of self-responsibility:
- many environmental problems come from the way people manage their properties;
- laws should be changed to make landholders more responsible for the consequences of their activities (more respondents agreed than disagreed, but generally divided).

While a high sense of self-responsibility in the community for dealing with land and water management issues is an advantage for ICM in gaining community participation, it will be very important for ICM to recognise this in working with the community and in the types of policies that are promoted.

There was a high sense of control over the community's ability to deal with land and water management, illustrated by agreement that:
- it was not too hard to think about land and water management issues for an area as big as the Herbert catchment;
- there were things they could do personally to help improve the environment; and
- there were things local community groups could do to help improve the environment.

A high sense of community control over dealing with land and water management issues is a very positive result for ICM.

The high sense of control may be hindered by a perceived lack of resources, for example:
- many didn't usually have the finances available to plan more than one year ahead;
- respondents tended to disagree that the government gives plenty of resources to voluntary groups;
- respondents reported a high personal impact of higher taxes;

- a high perceived impact on the Herbert of higher taxes, a loss of farm productivity, and higher production costs;
- many agreed the government needs to give more resources to voluntary groups; and
- support for government incentives for landholders to address environmental issues.

Many community members feel that individual landholders have a role to play in land and water management and see that there are ways they and their local communities can assist. To do this, they may need assistance from the government in terms of resources and government incentives.

In addition, there were perceived to be a number of impediments to effectively managing land and water in the catchment, the greatest impediments were seen to be:

- slow government strategies;
- slow reactions of government to new problems;
- the catchment's large area;
- the cost of solutions;
- a lack of easy solutions;
- low trust of government programs; and
- insufficient understanding of relevant problems.

It will be important for ICM to address these perceptions of impediments, perhaps by:

- encouraging timely responses from government;
- encouraging financial support for ICM;
- developing and promoting solutions;
- encouraging improved formal and informal communication between the government and the community; and
- improving understanding of land and water management problems.

While the catchment's large area was seen to be a difficulty, it was not considered to be insurmountable earlier in the survey.

Awareness of government strategies and resources was varied:

- Landcare was the most familiar strategy: most respondents had heard of Landcare and the majority knew more about it than ICM and Property Management Planning;
- one third had heard of PMP;
- half had heard of ICM;
- a higher proportion of cane farmers and graziers had heard of ICM than any of the other main occupations (home duties, trade, retired, education and general farming);
- a higher percentage of repeat respondents had heard of ICM than new respondents;
- those who had heard about ICM and (of the three strategies) knew most about ICM were most likely to be rural producers in the lower catchment, ie. cane farmer;
- only 2% of upper catchment respondents had visited the Herbert Resource Information Centre, compared with 28% from the lower catchment;
- approximately 30% had seen the Herbert River Catchment Atlas; and
- approximately 10% had seen the HRCCC Catchment Management Strategy.

Although the awareness levels of ICM are encouraging, they could be improved, particularly in urban areas and the upper catchment generally, which will be assisted by the efforts of the new upper catchment committee. The low percentage of upper catchment respondents who had visited the Herbert Resource Information Centre highlights a need for more information in the upper catchment.

The main sources of information regarding government strategies were:

- newspapers;
- television and television advertisements;
- the media in general; and
- general meetings or Canegrowers Association meetings (for ICM specifically).

Informing the community of broad scale government strategies will be most effective through newspapers, and if possible, television or the general media, whereas more localised information about ICM may be more effective through meetings.

Perceptions of government management of land and water were as follows:

- 60% of respondents felt that the most familiar government strategy was either not very useful or not at all useful to them personally.
- Comments on other government funded programs included that they lacked knowledge of the local situation, did not consult local people, did not use the best or most recent information, worked well or that it was a good idea.
- There was general agreement that different government departments often give conflicting information regarding land and water management issues.

The perceived personal usefulness of government strategies may need to be improved. It will be important for the government to respond to community perceptions regarding the importance of local knowledge, consulting local people, using the best quality information and giving consistent information to the community. Providing consistent feedback as to the positive outcomes of government programs would be useful.

Perceptions of the HRCC

- About 44% had heard of the HRCCC, at least vaguely (very similar to Survey 1).
- Its main purposes were perceived to be care for the catchment, conserving and managing water, preserving waterways, raising awareness and improving drainage.
- Very few people were aware of its specific activities.
- Most of those who had heard of the HRCCC felt that it had been effective to some extent in achieving its goals and purposes.
- About half thought that the group was progressing quickly enough.
- The majority thought they were generally heading in the right direction.
- 21% of those who had not heard about ICM had at least vaguely heard of the HRCCC.

Although the level of community awareness of the HRCCC was encouraging, it had not increased in the two years since Survey 1 was conducted. Awareness could be improved, particularly regarding the specific activities of the HRCCC. The majority of those who were aware of the committee supported its general direction and effectiveness and were fairly satisfied with the speed of its progress.

The main priorities for the direction of ICM were as follows:

- 90% of respondents felt that local government should have a role in ICM;
- 95% of respondents felt that local government planning should take ICM into account;
- encouraging joint projects between different parties;
- raising local awareness;
- developing solutions for, and better understanding of, environmental problems;
- encouraging research; and
- encouraging local government involvement.

Still highly important for ICM, but lowest in priority were:

- understanding specific on-ground projects;
- separate ICM programs for the upper and lower catchments;
- providing a continuing source of advice to local government on catchment issues; and
- encouraging discussion between community interest groups.

Continuing close involvement with local government, and reporting on this involvement to the community, will be very important for ICM in the future. In addition, key priorities for ICM are:

- encouraging joint projects;
- raising local awareness;
- gaining a better understanding of environmental problems;
- developing solutions for environmental problems;
- encouraging research; and
- communicating on this work to the community.

There were split opinions regarding community and government roles in ICM, for example, whether or not:

- ICM should remain a voluntary activity by community members;
- government expectations of the community in ICM were too high;
- the government should pay for and run ICM; and
- programs like ICM interfere with people's rights to make their own decisions.

In terms of funding contributions by government, industry and the community:

- the Commonwealth Government was perceived to be contributing more funding than the Queensland Government, Local Government, industry or farmers;
- upper catchment respondents thought that industry should be contributing more than they were, whereas lower catchment respondents thought that the Commonwealth Government should be contributing more than they were; and
- while industry was perceived to be contributing the least at the time of Survey 2, in general, respondents thought that farmers should contribute the least amount of funding of the five parties.

Overall, the differences between perceptions of current funding contributions and perceptions of how much government, industry and farmers should be contributing were quite small. This indicates that the overall system was perceived to be reasonably fair and indicates a preference for fairly even monetary contributions from various parties. In addition, various results show an overall preference for a partnership approach between government, industry and the community, rather than the responsibility going primarily either to the government or the community.

Involvement in groups

- there were divided opinions about whether or not respondents had the time to become involved in local community issues;
- 42% of upper catchment respondents and 28% of lower catchment respondents had been involved in local community groups or associations in the past years; and
- the main categories were Landcare, conservation, etc.; charity, church or welfare; agriculture related groups; and service clubs.

There were divided opinions regarding information to become involved:

- perceived preparedness of local people to become involved in land and water issues had decreased from Survey 1 (close to moderate in both);

- preparedness of respondents to become involved in land and water issues had increased since Survey 1 (again close to moderate in both) and was higher in rural respondents;
- preparedness to assist in local projects;
- likelihood of respondents becoming or staying involved with a Landcare or catchment management group over the next .year; and
- the degree of personal benefit to be gained from involvement in group activities to help manage land and water

Involvement in other local community groups and associations may prevent some people from becoming active in ICM groups due to their time commitments, particularly in the upper catchment. In addition, the split opinions regarding intentions to become or stay involved in land and water management indicate that there are some people who are unlikely to become involved in ICM. This does not mean that people will not be able to remain or become interested in ICM activities or carry out activities promoted by ICM. It does mean that the HRCCC should be careful to ensure maximised benefits for the time expended by the community on ICM related activities.

Finally, the questionnaire may have raised expectations in the community, and it will be important for the HRCCC to respond to the issues found to be important to respondents.

4.0 References

Butterworths, J.E., Syme, G.J. & Nancarrow, B.E. (1997). Land and water management in the Herbert catchment: A survey of rural and urban residents. CSIRO Land and Water Consultancy Report No. 97-2.

APPENDIX 1
1996 Questionnaire

CSIRO Australian Research Centre for Water in Society

LAND & WATER MANAGEMENT
ISSUES FOR THE HERBERT RIVER CATCHMENT
SURVEY QUESTIONNAIRE
July 1996

LOCATION:	Upper Catchment	…. 1	Lower Catchment	…. 2
LANDUSE:	Rural	…. 1		
	Urban			
	Herberton	…. 2	Allingham	…. 5
	Mt Garnet	…. 3	Ingham	…. 6
	Ravenshoe	…. 4	Halifax	…. 7
			Lucinda	…. 8
			Taylors Beach	…. 9

1. Using the scale below please rate your level of satisfaction with the various aspects of your life at the moment. *(please write your chosen number from the scale next to each item)*

Scale:

1	2	3	4	5
very dissatisfied	**moderately dissatisfied**	**neither satisfied nor dissatisfied**	**moderately satisfied**	**very satisfied**

Your life in general _____

Your standard of living _____

Your personal health _____

The area where you live _____

The community in which you live _____

Existing community facilities and services _____

2. What do you think are the major advantages of living in the Herbert?

_____

_____

_____

_____

3. Generally, what do you think are some of the key issues facing people in the Herbert?

_____

_____

_____

_____

4. How important are the following issues **(1) to you personally, and (2) to people in the Herbert generally**? *(using the following scale, please write your chosen number/s in the two boxes next to each issue)*

Scale:

1	2	3	4	5
very high importance	**high**	**moderate**	**low**	**very low importance**

	importance to you personally	**importance to people in the Herbert**
Land degradation		
Water quality problems		
Water quantity problems		
Nature conservation issues ..... (eg. loss of wildlife habitat, management of world heritage areas)		

5. Following are a list of issues which **some people** think have an impact on life in the Herbert. In **your opinion**, how much do each of the following impacts **(1) affect you personally**, and **(2) affect people in the Herbert generally**? *(using the following scale, please write your chosen number/s in the two boxes next to each impact)*

Scale:

1 very high degree — **2** high — **3** moderate — **4** low — **5** very low degree **OR** **8** not at all

Possible Impacts	affects you personally	affects people in the Herbert
High cost of water		
Loss of farm productivity		
Higher production costs		
Poor drinking water quality		
Shortage of irrigation water		
Declining human health		
Loss of independence to make business decisions		
Emotional stress		
Conflicts with other local people		
Higher taxes		
Lower fish numbers		
Loss of access to recreation		
Loss of confidence in government's ability to manage land and water resources		
Loss of environmental uses or benefits (eg. wildlife habitat)		
Loss of scenery		

6. Generally speaking, what **awareness** do you think local people have about land and water issues in the Herbert? *(please circle <u>one</u> number only)*

1 very high awareness — **2** high — **3** moderate — **4** low — **5** very low awareness

7. How much do you think **local people** are prepared to become involved in land and water issues in the Herbert? *(circle <u>one</u> number only)*

1 to a very high degree — **2** high — **3** moderate — **4** low — **5** very low degree

8. How much are **you** prepared to become involved in land and water issues in the Herbert? *(circle <u>one</u> number only)*

1	2	3	4	5
to a very high degree	**high**	**moderate**	**low**	**very low degree**

9. Using the scale below please rate how much you agree or disagree with the following statements. *(please write your chosen number from the scale next to each statement)*

<u>Scale:</u>

1	2	3	4	5
strongly disagree	**disagree**	**neither agree nor disagree**	**agree**	**strongly agree**

Managing land and water in the Herbert is difficult because...

problems aren't well understood _____

solutions aren't easy _____

there aren't any problems that need urgent action _____

local people lack the money to spend on solutions _____

government strategies are a waste of time _____

solutions are expensive _____

there are few benefits and many costs _____

local people don't want to spend money on solutions _____

the Herbert River catchment covers a large area _____

it's hard to get around the catchment (eg from top to bottom) _____

people in the Herbert have a wide variety of opinions _____

local people don't trust government programs _____

local people aren't that interested in community-type activities _____

the government doesn't want to spend money on solutions _____

10. Before we contacted you about this study, which of the government strategies in the box below had you heard about and which one did you know most about?

STRATEGY	**HAD YOU HEARD OF THIS?** *(please tick as many boxes as apply)* ↓	**WHICH DID YOU KNOW MOST ABOUT?** *(circle <u>one</u> number only)* ↓
Property Management Planning or "PMP"	☐	1
Landcare	☐	2
Integrated Catchment Management or "ICM"	☐	3

☞ *If you haven't heard of any of these government strategies, please go to question* **12.**

11. When thinking of the government strategy you know most about:
A. how useful has this strategy been to you personally? *(please circle <u>one</u> number only)*

1	2	3	4	5
not at all useful	**not very**	**moderately**	**quite**	**very useful**

B. how effective has the strategy been in dealing with land and water issues in the Herbert? *(circle <u>one</u> number only)*

1	2	3	4	5
very effective	**fairly effective**	**neither effective nor ineffective**	**fairly ineffective**	**very ineffective**

C. how did you come to know of the strategy?

_____

_____

_____

12. Have you heard of a group called the Herbert River Catchment Coordinating Committee?

YES …. 1 **VAGUELY …. 2** **NO …. 3** ☞ *please go to question* **13**

If YES or VAGUELY, what do you think the main purpose of this group is?

_____

_____

13. Using the scale below, please rate how much you agree or disagree with the following statements. (*Write your chosen number from the scale next to each statement).*

<u>Scale:</u>

1	2	3	4	5		
strongly disagree	**disagree**	**neither agree nor disagree**	**agree**	**strongly agree**	**<u>OR</u>**	**8 not applicable**

Governments should work out better ways to fix land and water problems	_____	_____
There are things I can do personally to help improve the environment	_____	_____
It's too hard to think about land and water management issues for an areas as big as the Herbert catchment	_____	_____
I don't usually have the finances available to plan more than a year ahead	_____	_____
I trust that public servants are working in my interest most of the time	_____	_____
I've seen incompetent government activities in this part of the courntry	_____	_____
The local community should take some responsibility for improving the environment	_____	_____
Programs like Integrated Catchment Management interfere with people's Rights to make their own decisions	_____	_____

There are things local community groups can do to help improve the environment	_____	_____
I am sure that our local views will be considered when planning for land and water management in this area	_____	_____
The local environment is no worse off than it was when I first lived here	_____	_____
I would be prepared to assist in local projects such as riverbank stabilisation	_____	_____
Many environmental problems come from the way people manage their properties	_____	_____
I can prevent any land and water problems from occurring on my property	_____	_____
It is likely that I will become involved (or stay involved) with a Landcare or catchment group over the next year or two	_____	_____
I've complete control over what happens to the land and water on this property	_____	_____
It is likely that I will look into ways to improve the environmental condition of my property over the next year or two	_____	_____
I can recall at least 1 government action which has damaged my livelihood	_____	_____
I could personally benefit from being involved in group activities to help manage land and water	_____	_____
Laws should be changed to make landholders more responsible for the consequences of their activities	_____	_____
Some people I know think that local groups are a good way to deal with many land and water management issues	_____	_____

14. Which of the following sources of information help you to **keep informed** about land and water management issues? (*tick as many boxes as apply*)

Neighbours	☐	The Australian newspaper	☐
A government agency (please specify)	☐	Cairns Post	☐
_____		Townsville Bulletin	☐
_____		Telegraph Times	☐
Industry groups (please specify)	☐	Herbert River Express	☐
_____	☐	The Tablelander	☐
_____	☐	Tablelands Advertiser	☐
Community groups	☐	Millstream Times	☐
Family members	☐	Courier Mail	☐
Friends/colleagues	☐	Magazines/journals	☐
Personal experience	☐	Government newsletters	☐
The local "grapevine"	☐	The Country Hour (ABC radio)	☐
Public meetings	☐	Landline (ABC television)	☐
Other (please specify)	☐		
_____		None/I don't keep informed	☐
_____		☞ please go to question **19**	

19. In the box above, which two sources of information would you say were the most **reliable** for helping you to make decisions?

1. _____

2. _____

16. Does what you read in newspapers ever change your opinions about land and water management issues? (*please circle <u>one</u> number only*)

1	2	3	4
often	**occasionally**	**seldom**	**never**

17. Does what you hear on the radio or see on TV ever change your opinions about land and water management issues? (*please circle <u>one</u> number only*)

1	2	3	4
often	**occasionally**	**seldom**	**never**

18. How often do you discuss land and water management issues with your neighbours or others in this general area? (*please circle <u>one</u> number only*)

1	2	3	4
often	**occasionally**	**seldom**	**never**

19. When thinking about your **relationships with local people**, how comfortable are you about living here? (*please circle <u>one</u> number only*)

1	2	3	4	5
not at all comfortable	**not very**	**moderately**	**quite**	**very comfortable**

20. When thinking about how much **interest local people have for your ideas and opinions**, how comfortable are you about living here? (*please circle <u>one</u> number only*)

1	2	3	4	5
not at all comfortable	**not very**	**moderately**	**quite**	**very comfortable**

21. Are you a member of any regional, state or nationally-based groups or associations? (*please circle <u>one</u> number only*)

YES …. 1 **NO …. 2**

22. Are you a member of any local community groups or associations? (*circle <u>one</u> number only*)

YES …. 1 ☞ *please go to question* **25**

or

NO …. 2
↓

23. Generally, what are some of your reasons for not being involved in any community groups?

_____

_____

_____

_____

24. Would you ever consider joining a community group? (*circle <u>one</u> number only*)

YES …. 1 **DON'T KNOW …. 2** **NO …. 2**

↓ ↓

For what reasons would you join? _____

_____

_____

_____

☞ If you answered **NO to question 21** and **NO to question 22**, please go to question **28**

25. Which of the following categories describe *any* of the groups you have some involvement with? (*please tick as many boxes as apply*)

Progress Assoc.	☐	Sporting Group	☐
Rate Payers Assoc.	☐	Hobby/Craft Group	☐
Professional Assoc.	☐	Community Action Group	☐
Charity/Church/Welfare Group	☐	Service Club (eg. Lions, Rotary)	☐
Agriculture-related Organisation	☐	Parents & Friends Assoc.	☐
Landcare, Conservation or similar group	☐	Other/s (*please explain*)	☐
		_____	
		_____	

26. Of the groups you are involved with, please write down the name of the group that is **most important** to you.

- **Important group**_____

27. If you are involved in any groups in the "Landcare, Conservation or similar" category, please write down the name of the group that you are **most involved** with. This may not be the same as the group that is the most important to you.

- **Landcare, Conservation or similar group:**_____

_____

28. Thinking of the local community where you live, please rate how much you agree or disagree with each of the following statements. *(using the scale below, write your chosen number from the scale next to each statement)*

Scale:

1	2	3	4	5
strongly disagree	**disagree**	**neither agree nor disagree**	**agree**	**strongly agree**

I'm not very interested in local community issues _____

I feel quite comfortable in being a member of this local community _____

The community is capable of getting things done without any outside help _____

I would like to remain living in this area for a long time _____

I have almost no influence over what happens in this community _____

It's very important to me to live in this particular community _____

People in this community generally don't get along with each other _____

I don't really care what others in the community think of my actions _____

Very few of my neighbours know me _____

I often think about local community issues _____

I and many others in this community share similar values _____

I think this community is a good place to live _____

I can recognise many of the people who live in this community _____

I don't have the time to become involved in local community issues _____

OTHER INFORMATION

29. How old are you? _____ **years**

30. What is your gender? *(please circle the number)*

MALE .... 1 **FEMALE 2**

31. Which country were you born in? _____

32. What is your marital status? (*circle the most appropriate number*)

Married/De facto	…. 1	Divorced/Separated	…. 2
Never Married/Single	…. 3	Widowed	…. 4

33. Do you have any family members living in the Herbert area other than those in your household? (*circle <u>one</u> number only*)

YES …. 1 **NO …. 2**

34. What is your main occupation? _____

35. How many years have you had this occupation? _____ **years**

36. How long have you lived in the Herbert area? _____ **years**

37. Is your property near to a river or creek which floods?

YES …. 1 NO …. 2 DON'T KNOW …. 3

38. Thinking about where you live, what is the most important river or creek to you?

_____

39. How often do you use the river or creek near where you live? (eg. for commercial, domestic or recreational purposes) (*please circle <u>one</u> number only*)

1	2	3	4
often	**occasionally**	**seldom**	**never**

40. How often do you go fishing for recreation? (*circle <u>one</u> number only*)

1	2	3	4
often	**occasionally**	**seldom**	**never**

41. Do you own or lease/rent a commercial rural, or rural property greater than 3 hectares (7.5 acres)? *(please circle <u>one</u> number only)*

YES **NO …. 3** ☞ *please go to question* **45**

↓

OWN .... 1 or LEASE/RENT 2

42. Which one of the following best describes your current use of this property? *(circle <u>one</u> number only)*

Cane farming **.... 1** Grazing **.... 2** Mining **.... 3** Industrial **.... 4**

Other farming **.... 5** *(please specify)*_____

Other **.... 6** *(please specify)*_____

43. What is the size of your property? _____ **hectares** *<u>or</u>* _____ **acres**

44. Have you cleared any new land in the last twelve months?

YES .... 1 NO .... 2 ☞ *please go to question* **45**

↓

If YES, how much new land have you cleared? _____ **hectares** *<u>or</u>* _____ **acres**

45. Would you be prepared to answer another shorter questionnaire if needed in a few months time?

YES .... 1 NO 2

If YES, please write your name, postal address and phone number in the space provided.

Your Name:

Postal Address:

Phone number:

Thank you very much for your time.

Are there any comments you would like to add?

APPENDIX 2
1998 Questionnaire

CSIRO Australian Research Centre for Water in Society

LAND & WATER MANAGEMENT
ISSUES FOR THE HERBERT RIVER CATCHMENT
SURVEY QUESTIONNAIRE
November 1998

LOCATION:	Upper Catchment	…. 1	Lower Catchment	…. 2
LANDUSE:	Rural	…. 1		
	Urban			
	Herberton	…. 2	Allingham	…. 5
	Mt Garnet	…. 3	Ingham	…. 6
	Ravenshoe	…. 4	Halifax	…. 7
			Lucinda	…. 8
			Taylors Beach	…. 9

1. Using the scale below please rate your level of satisfaction with the various aspects of your life at the moment. *(please write your chosen number from the scale next to each item)*

Scale:

1	2	3	4	5
very dissatisfied	**moderately dissatisfied**	**neither satisfied nor dissatisfied**	**moderately satisfied**	**very satisfied**

Your life in general _____

Your standard of living _____

Your personal health _____

The area where you live _____

The community in which you live _____

Existing community facilities and services _____

2. What do you think are the major advantages of living in the Herbert?

_____

_____

_____

_____

3. Generally, what do you think are some of the key issues facing people in the Herbert?

_____

_____

_____

_____

4. How important are the following issues **(1) to you personally, and (2) to people in the Herbert generally**? *(using the following scale, please write your chosen number/s in the two boxes next to each issue)*

Scale:

1	2	3	4	5
very high importance	**high**	**moderate**	**low**	**very low importance**

	importance to you personally	**importance to people in the Herbert**
Land degradation		
Water quality problems		
Water quantity problems		
Nature conservation issues ..... (eg. loss of wildlife habitat, management of world heritage areas)		

Flooding		
Wetlands.....		
Vegetation on river banks		
Loss of biodiversity (numbers of different species).....		

5. Following are a list of issues which **some people** think have an impact on life in the Herbert. In **your opinion**, how much do each of the following impacts **(1) affect you personally**, and **(2) affect people in the Herbert generally**? *(using the following scale, please write your chosen number/s in the two boxes next to each impact)*

Scale:

1 very high degree — **2** high — **3** moderate — **4** low — **5** very low degree **OR** **8** not at all

Possible Impacts	**affects you personally**	**affects people in the Herbert**
Loss of farm productivity.....		
Higher production costs.....		
Poor drinking water quality.....		
Emotional stress		
Higher taxes.....		
Lower fish numbers		
Loss of access to recreation		
Loss of confidence in government's ability to manage land and water resources		
Loss of environmental uses or benefits (eg. wildlife habitat)		

6. Generally speaking, what **awareness** do you think local people have about land and water issues in the Herbert? *(please circle <u>one</u> number only)*

1 very high awareness — **2** high — **3** moderate — **4** low — **5** very low awareness

7. How much do you think **local people** are prepared to become involved in land and water issues in the Herbert? *(circle <u>one</u> number only)*

1 to a very high degree — **2** high — **3** moderate — **4** low — **5** very low degree

8. How much are **you** prepared to become involved in land and water issues in the Herbert? *(circle <u>one</u> number only)*

1 to a very high degree — **2** high — **3** moderate — **4** low — **5** very low degree

9. Using the scale below please rate how much you agree or disagree with the following statements. *(please write your chosen number from the scale next to each statement)*

Scale:

1	2	3	4	5
strongly disagree	**disagree**	**neither agree nor disagree**	**agree**	**strongly agree**

Managing land and water in the Herbert is difficult because...

problems aren't well understood _____

solutions aren't easy _____

local people lack the money to spend on solutions _____

government strategies are too slow _____

solutions are expensive _____

there are few benefits and many costs _____

local people don't want to spend money on solutions _____

the Herbert River catchment covers a large area _____

local people don't trust government programs _____

local people aren't that interested in community-type activities _____

the government doesn't want to spend money on solutions _____

government departments and other agencies are too slow to react to new issues or problems _____

10. Before we contacted you about this study, which of the government strategies in the box below had you heard about and which one did you know most about?

STRATEGY	**HAD YOU HEARD OF THIS?** *(please tick as many boxes as apply)* ↓	**WHICH DID YOU KNOW MOST ABOUT?** *(circle one number only)* ↓
Property Management Planning or "PMP"	☐	1
Landcare	☐	2
Integrated Catchment Management or "ICM"	☐	3
		N/A

☞ *If you haven't heard of any of these government strategies, please go to question* **12.**

11. When thinking of the government strategy you know most about:
A. how useful has this strategy been to you personally? *(please circle one number only)*

1	2	3	4	5
not at all useful	**not very**	**moderately**	**quite**	**very useful**

B. how effective has the strategy been in dealing with land and water issues in the Herbert? *(circle <u>one</u> number only)*

1	2	3	4	5
very effective	**fairly effective**	**neither effective nor ineffective**	**fairly ineffective**	**very ineffective**

C. how did you come to know of the strategy?

_____

_____

_____

12. Are you aware of any other Government Funded programs on wider environmental matters in the Herbert catchment?

YES …. 1 ↓ **NO …. 2** ☞ *please go to question* **13**

If YES, please write down any comments you have on them.

_____

_____

_____

13. How important is it to you that the following activities are part of Integrated Catchment Management? *(Using the following scale, please write your chosen number next to each issue).* **Then…** please rank the three most important activities to you: 1 is most important.

<u>Scale:</u>

1	2	3	4	5
very high importance	**high**	**moderate**	**low**	**very low importance**

	Scale	Rank 1 to 3 ↓
Encourage community <u>action</u> at a catchment level.	____	____
Raise the level of local awareness and knowledge of environmental issues on the catchment.	____	____
Encourage Local Government to take an active role in environmental management issues.	____	____
Encourage coordination of state government programs.	____	____
Undertake specific on ground projects with other bodies.	____	____
Provide a continuing source of advice to local government on catchment issues.	____	____

Encourage research. _____ _____

Develop solutions for and better understanding of environmental problems in the Herbert catchment. _____ _____

Encourage discussion between community interest groups on environmental issues. _____ _____

Separate ICM programs for the Upper and Lower Herbert catchments. _____ _____

Encourage joint projects between community, industry and state and local government. _____ _____

14. Have you heard of a group called the Herbert River Catchment Coordinating Committee?

YES .... 1 **VAGUELY .... 2** **NO .... 3** ☞ *please go to question* **19**

If YES or VAGUELY, what do you think the main purpose of this group is?

_____

_____

15. Has the group been effective in achieving its goals and purpose?

YES …. 1 **TO SOME EXTENT …. 2** **NO …. 3**

16. Are there any specific things that you know they have done?

Please describe

_____

_____

_____

17. In your opinion, are they progressing quickly enough?

YES …. 1 **TO SOME EXTENT …. 2 NO …. 3**

18. In your opinion, are they heading in the right direction?

YES …. 1 **TO SOME EXTENT …. 2 NO …. 3**

19. Using the scale below please rate how much you agree or disagree with the following statements. *(write your chosen number from the scale next to each statement)*

Scale:

1	2	3	4	5	**OR** 8
strongly **disagree**	disagree	neither agree **nor disagree**	agree	strongly **agree**	not applicable

There are things I can do personally to help improve the environment. _____

It's too hard to think about land and water management issues for an area as big as the Herbert catchment. _____

I don't usually have the finances available to plan more than a year ahead. _____

The government needs to give more resources to voluntary groups. _____

Programs like Integrated Catchment Management interfere with people's rights to make their own decisions. _____

There are things local community groups can do to help improve the environment. _____

Catchment management should be paid for and run by the government. _____

The local environment is no worse off than it was when I first lived here. _____

ICM should remain a voluntary activity by community members. _____

I would be prepared to assist in local projects such as riverbank stabilisation. _____

Scale:

1	**2**	**3**	**4**	**5**	**OR**	**8**
strongly **disagree**	disagree	neither agree **nor disagree**	agree	strongly **agree**	not applicable	

Many environmental problems come from the way people manage their properties. _____

It is likely that I will become involved (or stay involved) with a Landcare or catchment group over the next year or two. _____

I could personally benefit from being involved in group activities to help manage land and water. _____

The government expects too much from local communities in catchment management. _____

Laws should be changed to make landholders more responsible for the consequences of their activities. _____

Different government agencies often give conflicting information on land and water management issues. _____

There should be better government incentives for landholders to address environmental issues/problems. _____

There aren't any environmental problems that need urgent action. _____

ICM programs should have legislative backing. _____

The government gives plenty of resources to voluntary groups. _____

20. Over the last 12 months, have you been involved in any local community groups or associations?

YES …. 1 **NO …. 2** ? *please go to question* **22**

If YES, which groups or associations were they?

_____

_____

_____

21. If you were involved in any Landcare, conservation or similar types of group, please write down the name of the group that you were **most involved** with.

_____

22. Thinking of the local community where you live, please rate how much you agree or disagree with each of the following statements. *(using the scale below, write your chosen number from the scale next to each statement)*

Scale:

1	2	3	4	5
strongly disagree	**disagree**	**neither agree nor disagree**	**agree**	**strongly agree**

I'm not very interested in local community issues. _____

I feel quite comfortable in being a member of this local community. _____

I have almost no influence over what happens in this community. _____

It's very important to me to live in this particular community. _____

People in this community generally don't get along with each other. _____

I often think about local community issues. _____

I and many others in this community share similar values. _____

I think this community is a good place to live. _____

I can recognise many of the people who live in this community. _____

I don't have the time to become involved in local community issues. _____

23. Should Local Government **have a role** in Integrated Catchment Management?

YES …. 1 **NO …. 2**

Please give reasons

_____

_____

_____

24. Should Local Government Planning sometimes **take into account** Integrated Catchment Management?

YES …. 1 **NO …. 2**

Please give reasons

_____

_____

_____

25. For every $100 spent on catchment management and landcare,

A. how much of it do you think **IS** being contributed by:
(please write the amount in the space provided)

The Commonwealth Government?		$_____
The Queensland Government?		$_____
Local Government on the Herbert Catchment?		$_____
Industry?		$_____
Individual farmers?		$_____
	TOTAL	**$ 100**

B. how much of it do you think **SHOULD** be contributed by:

The Commonwealth Government?		$_____
The Queensland Government?		$_____
Local Government on the Herbert Catchment?		$_____
Industry?		$_____
Individual farmers?		$_____
	TOTAL	**$ 100**

Please comment on why you have chosen the amounts for part B.

_____

_____

_____

26. Have you visited the Herbert Resource Information Centre in Ingham?

YES …. 1 **NO …. 2**

27. Have you seen the Herbert River Catchment Atlas?

YES …. 1 NO …. 2

28. Have you seen the Herbert River Catchment Coordinating Committee's Catchment Management Strategy?

YES …. 1 NO …. 2

OTHER INFORMATION

29. Show which category best describes your age. *(please circle one number only)*

Less than 24 years	**……..**	**1**
24 to 39 years	**……..**	**2**
40 to 55 years	**……..**	**3**
56 to 65 years	**……..**	**4**
66 to 75 years	**……..**	**5**
More than 75 years	**……..**	**6**

30. What is your gender? *(please circle the number)*

MALE .... 1 FEMALE 2

31. What is your main occupation? _____

32. How many years have you had this occupation? _____ **years**

33. How long have you lived in the Herbert area? _____ **years**

34. How often do you go fishing for recreation? *(circle <u>one</u> number only)*

1	2	3	4
often	**occasionally**	**seldom**	**never**

35. Do you own or lease/rent a commercial rural, or rural property greater than 3 hectares (7.5 acres)? *(please circle <u>one</u> number only)*

YES: OWN .... 1 or LEASE/RENT 2

NO .... 3 ☞ *if you have any further comments, please use the back page.*

36. Which one of the following <u>best</u> describes your <u>current</u> use of this property? *(circle <u>one</u> number only)*

Cane farming **.... 1** Grazing **.... 2** Mining **.... 3** Industrial **.... 4**

Other farming **.... 5** *(please specify)*_____

Other **.... 6** *(please specify)*_____

37. What is the size of your property? _____ **hectares** *or* _____ **acres**

38. Have you cleared any new land in the last twelve months?

YES .... 1 **NO 2**

If YES, how much new land have you cleared? _____ **hectares** *or* _____ **acres**

Thank you very much for your time. Please use the back page for any additional comments.

Chapter 5

Land and Water Management in the Herbert River Catchment:

A Longitudinal Study of Community Views

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Executive Summary:

Implications of the Findings for ICM

This section outlines consistent and important findings across Survey 2 and their implications for ICM.

There was very strong stability of opinions between 1996 and 1998.

- Prompted and unprompted responses displayed relatively few differences and differences that did exist were by a matter of degree.

For ICM, the stability of the results suggests that opinions and priorities do remain fairly stable over time and that any changes in awareness or behaviour related to land and water management are likely take longer than two years to occur given the resources available.

There was a fairly high degree of satisfaction with living in the Herbert.

- There was moderate satisfaction with life in general, standard of living, personal health, the area where respondents lived and the community in which they lived.
- Respondents generally agreed that it is a good place to live, they felt quite comfortable living there, recognised many of the people in their local community, shared similar values with others and felt it was important to live in that particular community.
- Respondents reported many advantages of the Herbert.

The finding that there was general satisfaction with many aspects of living in the Herbert River catchment suggests that most people would not support any changes that would threaten these aspects of their community.

The most important issues to respondents when not prompted were related to employment, in other words, life issues:

- unemployment;
- a lack of opportunities for young people; and
- a lack of diversity in industry.

Following these were issues related to land and water management and the environment:

- clearing of marginal land;
- flooding;
- drainage;
- water quantity issues;
- fishing issues;
- the impact of weather and changing weather conditions on primary industry; and
- environmental issues in general.

When prompted on land and water management issues, many respondents found them to be important:

- most issues were more important personally than to the Herbert in general;
- respondents generally agreed that there were problems that needed urgent action;
- however opinion was divided on whether or not the environment had worsened since respondents first lived in the Herbert;
- high ratings of personal importance, and importance for the Herbert, of water quality problems, land degradation, water quantity problems and nature conservation;
- moderate to high ratings of importance of flooding, wetlands, vegetation on riverbanks and loss of biodiversity.

When asked about the personal impact, and the impact on the Herbert, of various issues:

- there were few differences over time;
- the personal impact of loss of farm productivity, poor drinking water quality and loss of environmental uses/benefits increased over time;
- for the Herbert, the impact of loss of farm productivity was seen to have increased since Survey 1 and the impact of lower fish numbers was perceived to have decreased;
- there was a high impact on respondents of poor drinking water quality and loss of environmental uses; and
- respondents perceived the largest impacts on the Herbert to be from loss of farm productivity and poor drinking water quality.

There was community awareness and interest in Herbert issues, most respondents:

- were interested in local issues; and
- local awareness about land and water issues was considered to be moderate, as in Survey 1.

There is awareness of problems and the perception that land and water issues are important, both personally and on a catchment scale. This signifies general support for ICM to tackle land and water management on a number of fronts. However, land and water management issues were not uppermost in people's minds which suggests that there needs to be awareness and acknowledgment by ICM that while people may support land and water management of various kinds, their first priorities lie with 'life issues'.

Opinions were divided about:

- the degree of influence respondents felt over what happened in their communities;
- whether or not people in their community generally got along; and
- whether or not respondents often thought about local community issues.

While there was community interest in issues for the Herbert, the influence people felt was not particularly high, it appeared that there may be some conflict and not all respondents often thought about local community issues. These factors may hinder community participation in ICM.

The community displayed a high sense of self responsibility:

- many environmental problems come from the way people manage their properties;
- laws should be changed to make landholders more responsible for the consequences of their activities (more respondents agreed than disagreed but generally divided).

While a high sense of self responsibility in the community for dealing with land and water management issues is an advantage for ICM in gaining community participation, it will be very important for ICM to recognise this in working with the community and in the types of policies that are promoted.

There was a high sense of control over the community's ability to deal with land and water management, illustrated by agreement that:

- it was not too hard to think about land and water management issues for an area as big as the Herbert catchment;
- there were things they could do personally to help improve the environment; and
- there were things local community groups could do to help improve the environment.

A high sense of community control over dealing with land and water management issues is a very positive result for ICM.

The high sense of control may be hindered by a perceived lack of resources, for example:

- many didn't usually have the finances available to plan more than one year ahead;
- respondents tended to disagree that the government gives plenty of resources to voluntary groups;
- respondents reported a high personal impact of higher taxes;
- a high perceived impact on the Herbert of higher taxes, a loss of farm productivity, and higher production costs;
- many agreed the government needs to give more resources to voluntary groups; and
- support for government incentives for landholders to address environmental issues.

Many community members feel that individual landholders have a role to play in land and water management and see that there are ways they and their local communities can assist. To do this, they may need assistance from the government in terms of resources and government incentives.

In addition, there were perceived to be a number of impediments to effectively managing land and water in the catchment, the greatest impediments were seen to be:

- slow government strategies;
- slow reactions of government to new problems;
- the catchment's large area;
- the cost of solutions;
- a lack of easy solutions;
- low trust of government programs; and
- insufficient understanding of relevant problems.

It will be important for ICM to address these perceptions of impediments, perhaps by:

- encouraging timely responses from government;
- encouraging financial support for ICM;
- developing and promoting solutions;
- encouraging improved formal and informal communication between the government and the community; and
- improving understanding of land and water management problems.

While the catchment's large area was seen to be a difficulty, it was not considered to be insurmountable earlier in the survey.

Awareness of government strategies and resources was varied:

- Landcare was the most familiar strategy: most respondents had heard of Landcare and the majority knew more about it than ICM and Property Management Planning;
- one third had heard of PMP;
- half had heard of ICM;
- a higher proportion of cane farmers and graziers had heard of ICM than any of the other main occupations (home duties, trade, retired, education and general farming);
- a higher percentage of repeat respondents had heard of ICM than new respondents;
- those who had heard about ICM and (of the three strategies) knew most about ICM were most likely to be rural producers in the lower catchment, ie. cane farmers;
- only 2% of upper catchment respondents had visited the Herbert Resource Information Centre, compared with 28% from the lower catchment;
- approximately 30% had seen the Herbert River Catchment Atlas; and
- approximately 10% had seen the HRCCC Catchment Management Strategy.

Although the awareness levels of ICM are encouraging, they could be improved, particularly in urban areas and the upper catchment generally, which will be assisted by the efforts of the new upper catchment committee. The low percentage of upper catchment respondents who had visited the Herbert Resource Information Centre highlights a need for more information in the upper catchment.

The main sources of information regarding government strategies were:

- newspapers;
- television and television advertisements;
- the media in general; and
- general meetings or Canegrowers Association meetings (for ICM specifically).

Informing the community of broad scale government strategies will be most effective through newspapers and if possible television or the general media whereas more localised information about ICM may be more effective through meetings.

Perceptions of government management of land and water were as follows:

- 60% of respondents felt that the most familiar government strategy was either not very useful or not at all useful to them personally.
- Comments on other government funded programs included that they lacked knowledge of the local situation, did not consult local people, did not use the best or most recent information, worked well or that it was good idea.
- There was general agreement that different government departments often give conflicting information regarding land and water management issues.

The perceived personal usefulness of government strategies may need to be improved. It will be important for the government to respond to community perceptions regarding the importance of local knowledge, consulting local people, using the best quality information and giving consistent information to the community. Providing consistent feedback as to the positive outcomes of government programs would be useful.

Perceptions of the HRCCC

- About 44% had heard of the HRCCC at least vaguely (very similar to Survey 1).
- Its main purposes were perceived to be care for the catchment, conserving and managing water, preserving waterways, raising awareness and improving drainage.
- Very few people were aware of its specific activities.
- Most of those who had heard of the HRCCC felt that it had been effective to some extent in achieving its goals and purposes.

- About half thought that the group was progressing quickly enough.
- The majority thought they were generally heading in the right direction.
- 21% of those who had not heard about ICM had at least vaguely heard of the HRCCC.

Although the level of community awareness of the HRCCC was encouraging, it had not increased in the two years since Survey 1 was conducted. Awareness could be improved, particularly regarding the specific activities of the HRCCC. The majority of those who were aware of the committee supported its general direction and effectiveness and were fairly satisfied with the speed of its progress.

The main priorities for the direction of ICM were as follows:

- 90% of respondents felt that local government should have a role in ICM;
- 95% of respondents felt that local government planning should take ICM into account;
- encouraging joint projects between different parties;
- raising local awareness;
- developing solutions for, and better understanding of, environmental problems;
- encouraging research; and
- encouraging local government involvement.

Still highly important for ICM but lowest in priority were:

- undertaking specific on ground projects;
- separate ICM programs for the upper and lower catchments;
- providing a continuing source of advice to local government on catchment issues; and
- encouraging discussion between community interest groups.

Continuing close involvement with local government, and reporting on this involvement to the community, will be very important for ICM in the future. In addition, key priorities for ICM are:

- encouraging joint projects;
- raising local awareness;
- gaining a better understanding of environmental problems;
- developing solutions for environmental problems;
- encouraging research; and
- communicating on this work to the community.

There were split opinions regarding community and government roles in ICM, for example, whether or not:

- ICM should remain a voluntary activity by community members.
- government expectations of the community in ICM were too high;
- the government should pay for and run ICM; and
- programs like ICM interfere with people's rights to make their own decisions.

In terms of funding contributions by government, industry and the community:

- the Commonwealth Government was perceived to be contributing more funding than the Queensland government, local government, industry or farmers;
- upper catchment respondents thought that industry should be contributing more than they were whereas lower catchment respondents thought that the Commonwealth Government should be contributing more than they were; and
- while industry was perceived to be contributing the least at the time of Survey 2, in general, respondents thought that farmers should contribute the least amount of funding of the five parties.

Overall, the differences between perceptions of current funding contributions and perceptions of how much government, industry and farmers should be contributing were quite small. This indicates that the overall system was perceived to be reasonably fair and indicates a preference for fairly even monetary contributions from various parties. In addition, various results show an overall preference for a partnership approach between government, industry and the community rather the responsibility going primarily either to the government or the community.

Involvement in groups

- there were divided opinions about whether or not respondents had the time to become involved in local community issues;
- 42% of upper catchment respondents and 28% of lower catchment respondents had been involved in local community groups or associations in the past year; and

- the main categories were Landcare, conservation, etc; charity, church or welfare; agriculture related groups; and service clubs.

There were divided opinions regarding intentions to become involved:

- perceived preparedness of local people to become involved in land and water issues had decreased from Survey 1 (close to moderate in both);
- preparedness of respondents to become involved in land and water issues had increased since Survey 1 (again close to moderate in both) and was higher in rural respondents;
- preparedness to assist in local projects;
- likelihood of respondents becoming or staying involved with a Landcare or catchment management group over the next year; and
- the degree of personal benefit to be gained from involvement in group activities to help manage land and water.

Involvement in other local community groups and associations may prevent some people from becoming active in ICM groups due to their time commitments, particularly in the upper catchment. In addition, the split opinions regarding intentions to become or stay involved in land and water management indicate that there are some people who are unlikely to become involved in ICM. This does not mean that people will not be able to remain or become interested in ICM activities or carry out activities promoted by ICM. It does mean that the HRCCC should be careful to ensure maximised benefits for the time expended by the community on ICM related activities.

Finally, the questionnaire may have raised expectations in the community and it will be important for the HRCCC to respond to the issues found to be important to respondents.

1.0 INTRODUCTION

This study follows a survey performed in 1996 (Butterworth, Syme & Nancarrow, 1997) examining landholders' attitudes, beliefs and behaviours relating to land and water management in the Herbert River Catchment in north Queensland. Together, the two surveys form the community assessment component of research, led by CSIRO, evaluating the implementation of Integrated Catchment Management (ICM) in the Herbert River Catchment. The aims of the community assessment component were as follows.

1. *To examine, longitudinally, landholders' behaviours and attitudes towards land and water management in the Herbert River Catchment.*

As it was a longitudinal study, the second survey was conducted to assess variation in attitudes and behaviours over time. In addition, the two surveys will serve as a benchmark against which and attitude and behaviour change relating to the progress of ICM in the Herbert River Catchment in particular and in Queensland generally can be assessed.

2. *More specifically, to provide an understanding of social factors that might influence the implementation of ICM in the Herbert.*

The original impetus for the study evolved from ICM's focus on community involvement and an increasing emphasis on the need to evaluate effectiveness of this involvement. In other words, what does ICM deliver beyond isolated and "unintegrated" resource management activities, and, as a result, what changes occur? The results will provide key baselines for the assessment of factors that hinder or foster an effective ICM process in the Herbert.

3. *Relatedly, to provide an understanding of whether and how such factors vary according to where people live and what their interests are.*

The study focused on individuals in both rural and urban areas of the catchment and with a wide variety of occupations and interests.

2.0 STUDY AREA

With a catchment area of more than 10,000 square kilometres, the Herbert River rises in the Great Dividing Range west of Innisfail and flows south east to the sea to the south of Hinchinbrook Island. The upper catchment consists of tropical forest, a number of small active and inactive tin mines, and most of this area is devoted to grazing. In the more populated lower catchment, sugar cane production is the dominant land use on the lower river flats and coastal plain. Completely dividing the upper and lower areas, is the Wet Tropics World Heritage Area, which makes up approximately 15 percent of the catchment. The catchment contains the shires of Herberton and Hinchinbrook and the main settlements are Ingham, Herberton, Allingham, Ravenshoe, Halifax, Lucinda, Taylors Beach and Mount Garnet.

The upper and lower catchments are two distinctly different geographical areas. They also differ according to types of rural industry and the intensity of production, climatic and soil characteristics, and population size. As such, there are likely to be other distinctions, for example, along social, economic and recreational lines. Of course, this also applies for rural and urban areas.

3.0 METHODOLOGY

3.1 The Questionnaires

The original 1996 questionnaire (see Appendix 1) contained items concerning:

- levels of importance, perceived impacts, awareness and attitudes towards various land and water management issues;
- perceived ability of landholders to control land and water management issues;
- tractability or "manageability" of potential issues;
- intentions to participate in land and water management and other group activities, and perceived impediments to participation;
- awareness of government strategies (including Property Management Planning, Landcare, ICM), and the HRCCC;
- attitudes towards government's performance regarding land and water management issues;
- use of information sources, including the media;
- group involvement, interest in community issues, and life satisfaction;
- demographic information.

The 1998 questionnaire (see Appendix 2) contained all but the "use of information sources" item. Additional questions included:

- awareness of other government funded programs on wider environmental matters in the Herbert catchment;
- importance of various activities as part of ICM;
- effectiveness of the HRCCC in achieving its goals;
- awareness of HRCCC activities;
- opinions on the speed of their progress;
- opinions on the direction they are taking;
- whether local government should have a role in ICM;
- whether local government should take into account ICM;
- how much money is being contributed by the levels of government, industry and farmers to catchment management and landcare;
- how much money should be contributed by the levels of government, industry and farmers to catchment management and landcare;
- whether respondents had visited the Herbert Resource Information Centre in Ingham;
- whether respondents had seen the Herbert River Catchment Atlas; and
- whether respondents had seen the Herbert River Catchment Coordinating Committee's Catchment Management Strategy.

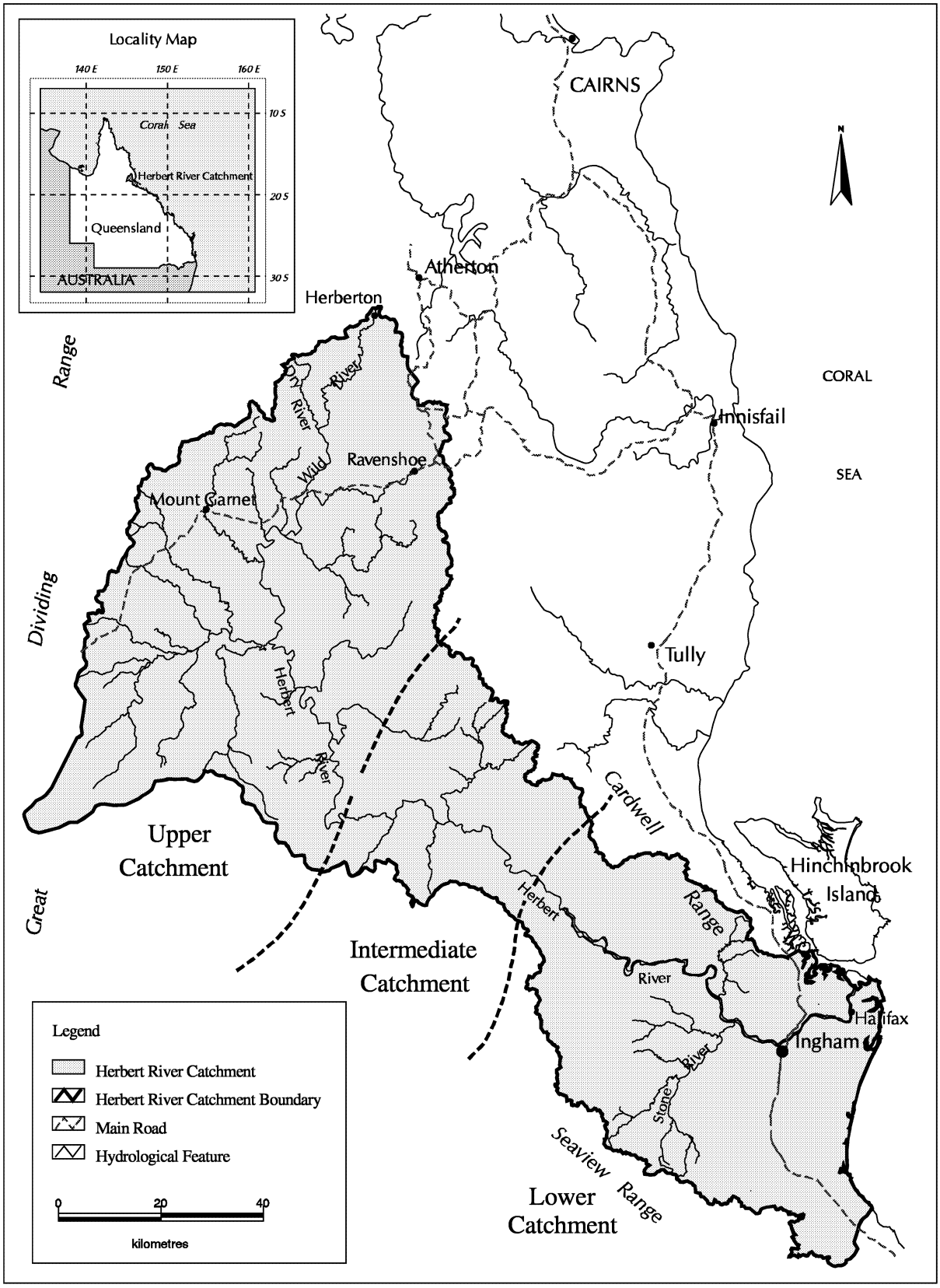


Figure 1. Herbert River Catchment.

3.2 The Sample

The same sampling procedure was used for Survey 2 (1998) and Survey 1 (1996). Due to the complexity of the catchment (eg. geographical and social) and the number of required comparisons (between different populations in the catchment and across time) the sample size for both surveys needed to be as large as feasible. Consequently, for logistic reasons, the surveys were designed as self-administered questionnaires and the mail-out method was selected as the means of administration. This method also provided better protection of anonymity and less intrusion on those who may not be familiar with ICM and other land and water management issues.

The sample was randomly selected and was proportionally sampled from ten locations in the catchment. In the upper catchment: rural areas and urban areas (Herberton, Mount Garnet and Ravenshoe) and in the lower catchment: rural areas and urban areas (Allingham, Ingham, Halifax, Lucinda, and Taylors Beach).

For both surveys, the sampling framework included telephone contacts as a component of the mail-out method. This was added to gauge willingness to participate, inform potential participants of the purpose of the study and increase the response rate (ie. the number of returned questionnaires). In Survey 1 reminder telephone calls were made to those people who had not returned the questionnaire by the specified due date. Reminder notes were used in Survey 2.

A range of landholders were contacted including those in the upper and lower catchment; in rural and urban areas; with different occupations including cane farming, grazing and mining; and with urban properties in eight settlements.

The maximum number of telephone contacts was set at 800. While this was also potentially the maximum sample size, a response rate of this size was unlikely given that some of those contacted would be unwilling to participate.

All Survey 1 respondents were asked whether they would be prepared to answer another questionnaire in the future. Those who replied yes, they would be involved again, were contacted first in Survey 2 (the 'repeat' sample). The samples for each location were then completed with randomly selected names from the list of residents obtained in Survey 1 (the 'new' sample). Due to the stability of the population in the intervening years, the same list was thought to be adequate for use in Survey 2.

To inform the general community that the repeat survey was being conducted, and why, and to give some brief information on the overall study, a short notice was placed in "The Herbert River Express" prior to the initial telephone calls (see Appendix 3 for the wording of the notice).

All of those people who agreed to participate were sent a copy of the questionnaire, a letter thanking them for their involvement and providing more details of the study, a map of the Herbert River Catchment, and a pamphlet explaining the study (see Appendix 4).

3.3 Returned Questionnaires

To provide a comparison of response rates for the two surveys, the two tables below show the number of people telephoned, the number who agreed to participate and the number of completed questionnaires returned.

1996 Survey

Catchment	Type of Holding	Calls	Sent	Returns	% of calls	Towns Surveyed	Returns	%
UPPER	Rural	100	92	59	59.0			
	Urban	125	128	86	68.8	Herberton Mt Garnet Ravenshoe	38 18 30	76.0 54.5 66.7
LOWER	Rural	320	282	191	59.7			
	Urban	255	216	141	55.3	Allingham Ingham Halifax Lucinda Taylors Beach	28 45 17 26 24	60.1 61.6 54.8 66.7 88.9
TOTAL		800	718	477	59.6			

59.6% response rate

1998 Survey

Catchment	Type of Holding	Calls	Sent	Returns	% of calls	Towns Surveyed	Returns	%
UPPER	Rural	100	76	47	47.0			
	Urban	127	119	70	55.1	Herberton Mt Garnet Ravenshoe	33 18 19	71.7 60.0 45.2
LOWER	Rural	320	263	141	44.1			
	Urban	256	245	143	55.9	Allingham Ingham Halifax Lucinda Taylors Beach	38 40 19 26 20	71.7 42.6 55.9 72.2 74.1
TOTAL		803	703	401	49.9			

49.9% response rate

Details of participation rates in the 1998 Survey

A total sample of 803 individuals were contacted by telephone and 703 agreed to participate. A total of 401 questionnaires were returned completed. Figures are shown for repeat respondents (rep) and new respondents (new).

Catchment	Type of Holding	Calls	Sent	Returns	% (of calls)	Towns Surveyed	Returns	%
UPPER	Rural	43 rep 57 new 100	37 rep 39 new 76	30 rep 17 new 47	69.8 29.8 47.0			
	Urban	59 rep 68 new 127	51 rep 68 new 119	37 rep 33 new 70	62.7 48.5 55.1	Herberton Mt Garnet Ravenshoe	18 rep 15 new 33 9 rep 9 new 18 10 rep 9 new 19	71.7 60.0 45.2
	Sub-total	227	195	117	51.5			
LOWER	Rural	100 rep 220 new 320	88 rep 175 new 263	56 rep 85 new 141	56.0 38.6 44.1			
	Urban	74 rep 182 new 256	61 rep 183 new 244 + 1 reply to ad in paper	52 rep 91 new 143	70.3 50.0 55.9	Allingham Ingham Halifax Lucinda Taylors Beach	11 rep 27 new 38 17 rep 23 new 40 6 rep 13 new 19 8 rep 18 new 26 10 rep 10 new 20	71.7 42.6 55.9 72.2 74.1
	Sub-totals	576	508	284	49.3			
TOTALS		276 rep 527 new 803	237 rep 466 new 703	175 rep 226 new 401	63.4 42.9 49.9			

Refusals

Those who declined to complete the questionnaire were asked if they would answer a few short questions (Appendix 5). Of the 43 who did, 18 stated that their main occupation was home duties and 10 that they were retired or pensioners. Two thirds were female and the average age was 56. Briefly, most (29) were not affected by any land or water management issues and those who were mainly mentioned rain/flooding and drinking water quality. Most (40) did not belong

to any local groups or associations. Most never went fishing for recreation and 58% had at least vaguely heard of the HRCCC.

4.0 PRESENTATION OF FINDINGS

Results of the data analysis are presented for each question in the survey and results for the whole sample are shown. Where there were significant differences between different groups, cross comparisons are shown (eg. between upper and lower catchment samples or between Survey 1 and Survey 2. The term, 'whole sample' represents the total number of completed and returned questionnaires (401). The number of people responding to a particular question (generally lower but close to 401) is always listed. In the tables that follow, "N" denotes the number of responses given for a particular question.

Most items in the questionnaire was examined for any statistically significant response differences between the upper and lower catchment samples or between the urban and rural samples; and any significant interactions between the two. Survey 1 results were however examined for statistically significant differences between the responses of the 'four samples', ie. the upper urban, upper rural, lower urban, and lower rural samples.

Responses to many questions, were rated on 5-point scales so for consistency, these have been re-coded in presenting the results. Unlike the questionnaire, for example, the scale of positive responses (such as very high or strongly agree) to negative responses (such as not at all useful or strongly disagree) is generally rated from 5 to 1 respectively.

Finally, respondents could provide up to two or three responses for open-ended questions so percentages will not add to 100. The number of people stating a particular response is shown along with a percentage comparing this with the overall number of respondents to that question. For these questions, categories were also formed to maintain both detail and ease of presentation. Therefore, some categories may not be mutually exclusive.

Extra comments made in the body of the questionnaire are included in the report. Additional comments were invited at the end of the questionnaire and these can found in Appendix 6. As such a large amount of input was gained from this exercise, a summary of the issues mentioned is also provided.

4.1 Statistical Tests

A number of statistical tests were used throughout the report. These included correlation analysis; appropriate analysis of variance for multiple group contrasts, paired samples t-tests and independent samples t-tests (to compare mean scores); reliability, regression and factor analysis; cross tabulations (for categorical data such as group membership); and, where appropriate, non-parametric tests.

4.2 Life Satisfaction

Please rate your level of satisfaction with the various aspects of your life at the moment. Participants were asked to use the following scale to respond to each statement. The statements and mean scores appear in the table below.

1	2	3	4	5
very dissatisfied	moderately dissatisfied	neither satisfied nor dissatisfied	moderately satisfied	very satisfied

Areas of Satisfaction	Survey 2 Mean	Survey 1 Mean
Your life in general	4.1	4.2
Your standard of living	4.0	4.1
Your personal health	4.0	4.1
The area where you live	4.2	4.3
The community in which you live	4.1	4.1
Existing community facilities and services	3.3	3.2

In Survey 2, mean ratings for the first five areas centred around moderate satisfaction but satisfaction was slightly lower with existing community facilities and services, close to neither satisfied nor dissatisfied.

Comparing the mean ratings of those people who were involved in both Surveys, their ratings of satisfaction with their life in general and with their standard of living were still close to moderately satisfied in Survey 2 but significantly lower in Survey 2.

A two way analysis of variance revealed that lower catchment respondents were more satisfied (mean = 3.4) with existing community facilities and services than upper catchment respondents (mean = 3.15). In Survey 1, lower urban respondents were more likely to be satisfied than upper urban respondents.

4.3 Advantages of Living in the Herbert River Catchment

The table lists prominent responses from Survey 1 and the percentage of respondents that offered each answer in Survey 2. There were four additional prominent responses for Survey 2. A total of 817 responses were stated by the sample and 778 of these (95 per cent) are noted in the table.

The main advantages experienced by respondents in Survey 2 were very similar to those mentioned in Survey 1. The area was said to offer a relaxed rural lifestyle, with a good climate, unspoiled, healthy and natural environment and excellent recreation opportunities. It was described as a small, safe, friendly, close knit community which is also close to large centres. Of the prominent responses, lower catchment respondents mentioned personal safety, close access to recreation, closeness to large centres and close knit community to a larger extent than upper catchment respondents. Upper catchment respondents mentioned healthy environment, best climate, unspoiled environment and good quality drinking water more frequently than lower catchment respondents.

What do you think are the major advantages of living in the Herbert?

Advantages	Survey 2 N = 372		Survey 1 N = 431	
	N	%	N	%
Lifestyle (stress free; country atmosphere)	121	32.5	138	32.1
Good climate	106	28.5	152	35.3
Close access to many recreation sites (eg. beaches; rainforest)	93	25.0	83	19.3
Small community / low population	58	15.6	56	13.0
Close to large centres (but also far enough away)	56	15.1	35	8.1
Good environment (unspoiled, natural, abundant wildlife)	53	14.2	54	12.5
Personal safety / security (eg. better for children; low crime)	52	14.0	57	13.2
Close knit community	50	13.4	10	2.3
Healthy environment (eg. less pollution)	42	11.3	63	14.6
Very quiet/peaceful	35	9.4	55	12.8
Quality of the people (eg. caring, friendly, easy going, helping)	33	8.9	71	16.5
Good quality drinking water	18	4.8	11	2.6
Good area for production (eg. sugar; soil; natural rainfall)	14	3.8	18	4.2
Good facilities	11	3.0	14	3.2
Farming *	9	2.4	-	-
Scenery *	8	2.2	-	-
Work *	7	1.9	-	-
Water available for irrigation **	6	1.6	-	-
It's home	4	1.1	14	3.2
Affordable land	2	0.5	7	1.6

* Not a prominent response in Survey 1 ** New category in Survey 2
NB: percentages do not add to 100 as up to three responses were allowed

4.4 Key Issues

Generally, what do you think are some of the key issues facing people in the Herbert?
The most frequent responses from Surveys 1 and 2 (1998) are listed in the table below.

Key issues	Survey 2 N = 359		Survey 1 N = 409	
	N	%	N	%
Unemployment (particularly long term)	97	27.0	169	41.3
Lack of diversity in industry/need for a new major industry (including overreliance on sugar industry; economic down turn)	90	25.1	59	14.4
Lack of opportunities for young people	67	18.7	31	7.6
Flooding in the lower catchment	57	15.9	23	5.6
Lack, and need for improvement, of community services/facilities	42	11.7	38	9.3
Weather, and changing weather patterns, affects primary industry *	28	7.8	-	-
Water quantity (eg availability; lack of storage; lack of groundwater)	27	7.5	39	9.5
Fishing issues (eg. Overfishing, habitat loss, swamp drainage)	27	7.5	25	6.1
Environmental issues (eg. Affect lifestyle and potential for jobs)	27	7.5	11	2.7
Clearing of marginal land/poor land management (including cane land expansion; tree clearing; "fauna versus farming'	24	6.7	60	14.7
Pollution (water and air)	21	5.8	24	5.9
Poor drinking water quality	15	4.2	201	4.9
Drainage (eg. Dissatisfaction with new proposals, run off too fast from new assignments)	15	4.2	13	3.2
High costs of living *	14	3.9	-	-
Lack of funds (eg. for creating jobs, from council) **	10	2.8	-	-
Poorly quality roads/poorly maintained roads	10	2.8	18	4.4
Tourism – lack of any tourism development	9	2.5	17	4.2
Cane prices	9	2.5	10	2.4
Weed degradation *	8	2.5	-	-
Ageing population *	8	2.2	-	-
Government interference in all aspects of life *	8	2.2	-	-
Lack of growth and progress **	8	2.2	-	-
Lack of entertainment	7	1.9	21	5.1
Conservationists/greenies ("ratbags")	6	1.7	10	2.4

* Not a prominent response in Survey 1 ** New category in Survey 2

A total of 762 responses were mentioned by the 359 respondents to this question. The most frequent responses are shown in the table and provide more than 83 per cent of the total number of responses. A comparison is made with the prominent responses in the 1996 Survey.

Unemployment was the most frequent response in both surveys but was mentioned by a lower percentage of respondents in Survey 2 (27.0%) than in Survey 1 (41.3%), reflecting an actual decrease in unemployment in that time period (Australian Bureau of Statistics, 1999). Related to this, a lack of opportunities for young people was mentioned more frequently in Survey 2 (18.7%) than Survey 1 (7.6%) and was mentioned more frequently by lower catchment respondents (57 of 67 responses).

While clearing of marginal land was the second most frequent response in Survey 1 (14.7%), in Survey 2 it appeared to be less important to respondents (6.7%). It was mainly of concern to lower catchment respondents (21 of 24 responses) in Survey 2.

Lack of diversity in industry was mentioned by a higher percentage of respondents in Survey 2 (25.1%) than in Survey 1 (14.4%) and was mentioned by lower catchment respondents in 73 of the 77 responses.

A higher percentage of respondents were concerned about flooding in Survey 2 (15.9%) than Survey 1 (5.6%) and this was predominantly a concern of lower catchment respondents (54 of the 57 responses). Drainage was mentioned by lower catchment respondents in 14 of the 15 responses.

Water quantity issues were mentioned by upper catchment respondents in 23 of the 27 cases. Fishing issues and weather conditions were only mentioned by lower catchment respondents and environmental issues were mentioned by lower catchment respondents in 21 of the 27 responses.

4.5 Issue Importance

This section asked for importance ratings of eight issues, both for respondents personally and for the people of the Herbert. Four issues were repeated from Survey 1 and four issues were added in Survey 2 to gain feedback from the community on their importance.

It was anticipated in Survey 1 that the two ratings (for self and others) may differ, and that knowledge of such differences would be important for establishing the importance of land and water management issues across the catchment.

How important are the following issues (1) to you personally, and (2) to people in the Herbert in general?

1. Land degradation (repeat)

		importance to you personally		importance to people in the Herbert	
Response	**Rating**	**N (385)**	**Percent**	**N (372)**	**Percent**
very high importance	5	193	50.1	139	37.4
high	4	106	27.5	102	27.4
moderate	3	65	16.9	91	24.5
low	2	14	3.6	36	9.7
very low importance	1	7	1.8	4	1.1
		TOTAL 385	100.0	TOTAL 372	100.0
		Mean = 4.2		Mean = 3.9	

Land degradation was generally seen as highly important for both self and others (the means were 4.2 and 3.9 respectively). It was seen to be significantly more important to respondents personally than they perceived it to be to others in the Herbert.

Overall, land degradation was found to be more important to respondents in Survey 2 than in Survey 1. It was significantly more important to respondents in Survey 2 than in Survey 1 (means 4.2 and 3.9) and it was perceived to be significantly more important to others in the Herbert in Survey 2 than in Survey 1 (means 3.9 and 3.7).

Similarly, those respondents who completed both Surveys found land degradation to be significantly more important in Survey 2 than Survey 1 (means 4.2 and 3.9) and also significantly more important to others in Survey 2 than Survey 1 (means 3.8 and 3.7).

2. Water quality problems (repeat)

		importance to you personally		importance to people in the Herbert	
Response	**Rating**	**N (394)**	**Percent**	**N (379)**	**Percent**
very high importance	5	232	58.9	192	50.7
high	4	93	23.6	101	26.6
moderate	3	41	10.4	62	16.4
low	2	23	5.8	21	5.5
very low importance	1	5	1.3	3	0.8
		TOTAL 394	100.0	TOTAL 379	100.0
		Mean = 4.3		Mean = 4.2	

Water quality problems were generally reported to be highly important to respondents and perceived to be highly important to others in the Herbert (means 4.3 and 4.2 respectively). Water quality problems were significantly more important to respondents personally than they perceived them to be to others in the Herbert.

Water quality was of higher importance to respondents in Survey 2 than to respondents in Survey 1 (4.3 and 4.2) and perceived to be more important to others in the Herbert in Survey 2 than in Survey 1 (means 4.2 and 4.0). It also increased significantly in importance to those respondents who participated in both Surveys, who rated water quality problems as significantly more important in Survey 2 (mean of 4.2 in Survey 1 and 4.4 in Survey 2).

3. Water quantity problems (repeat)

		importance to you personally		importance to people in the Herbert	
Response	**Rating**	**N (387)**	**Percent**	**N (374)**	**Percent**
very high importance	5	166	42.9	150	40.1
high	4	74	19.1	83	22.2
moderate	3	75	19.4	80	21.4
low	2	47	12.1	42	11.2
very low importance	1	25	6.5	19	5.1
		TOTAL 387	100.0	TOTAL 374	100.0
		Mean = 3.8		Mean = 3.8	

Water quantity problems were generally reported as having moderate to high importance by both respondents personally and to others (both means 3.8).

Different to the previous issues, water quantity problems were less important to Survey 2 respondents than Survey 1 respondents (means 3.8 and 4.0 respectively) and perceived to be less important to others in the Herbert in Survey 2 than Survey 1 (means 3.8 and 3.9 respectively).

In addition, water quantity problems decreased significantly in importance for repeat participants, rating it as highly important in Survey 1 and moderately to highly important in Survey 2 (4.0 and 3.8).

Using a two way analysis of variance, it was shown that there was a significant difference between the upper and lower catchments for the personal importance – more upper catchment

respondents found this issue to be important (means upper 4.2, lower 3.6). There was no significant difference between urban and rural respondents and no significant interaction between urban versus rural and upper catchment versus lower catchment.

Examining the perceptions of importance of water quantity to others in the Herbert in the same way, a similar effect was found. Water quantity was perceived to be more important to the Herbert by upper catchment respondents (4.35) than lower catchment respondents (3.6). There was no significant difference between urban and rural respondents and no significant interaction between upper versus lower catchment and urban versus rural respondents.

4. Nature conservation issues (repeat)

		importance to you personally		importance to people in the Herbert	
Response	**Rating**	**N (387)**	**Percent**	**N (370)**	**Percent**
very high importance	5	158	40.8	81	21.9
high	4	109	28.2	106	28.6
moderate	3	91	23.5	128	34.6
low	2	24	6.2	40	10.8
very low importance	1	5	1.3	15	4.1
		TOTAL 387	100.0	TOTAL 370	100.0
		Mean = 4.0		Mean = 3.5	

Nature conservation was of high importance to respondents personally and perceived to be of moderate to high importance by others in the Herbert. This was a significant difference.

Nature conservation was more important to Survey 2 respondents than to respondents in Survey 1 (4.0 and 3.7) and perceived to be more important to others in the Herbert in Survey 2 than it was in Survey 1 (3.5 and 3.3).

Those respondents who participated in both Surveys rated nature conservation as significantly more important in Survey 2 (mean 4.1) than Survey 1 (3.7).

Using a two way analysis of variance, it was shown that nature conservation was more important to urban respondents (4.2) than to rural respondents (3.8).

5. Flooding (new)

		importance to you personally		importance to people in the Herbert	
Response	**Rating**	**N (396)**	**Percent**	**N (376)**	**Percent**
very high importance	5	177	44.7	201	53.5
high	4	72	18.2	96	25.5
moderate	3	58	14.6	53	14.1
low	2	51	12.9	18	4.8
very low importance	1	38	9.6	8	2.1
		TOTAL396	100.0	TOTAL376	100.0
		Mean = 3.8		Mean = 4.2	

Flooding was of high importance to respondents and to others in the Herbert overall. It was, however, perceived to be significantly more important to other people in the Herbert than it was to respondents personally.

The results of a two way analysis of variance to examine the impact of catchment and urban versus rural were not surprising. Flooding was more important to lower catchment respondents

(mean 4.1) than to upper catchment respondents (2.8). In addition, it was found to be more important to rural respondents (4.0) than to urban respondents (3.5).

Again, a similar result was found for respondents' perceptions of the importance of flooding to others in the Herbert. Flooding was perceived to be more important to people in the Herbert by lower catchment respondents (4.4) than to upper catchment respondents (3.6).

6. Wetlands (new)

		importance to you personally		importance to people in the Herbert	
Response	**Rating**	**N (383)**	**Percent**	**N (369)**	**Percent**
very high importance	5	134	35.0	82	22.2
high	4	108	28.2	84	22.8
moderate	3	85	22.2	128	34.7
low	2	38	9.9	52	14.1
very low importance	1	18	4.7	23	6.2
		TOTAL 383	100.0	TOTAL369	100.0
		Mean = 3.8		Mean = 3.4	

Wetlands were of moderate to high importance to Survey 2 respondents who rated the importance as significantly higher to themselves than the importance to others in the Herbert.

Wetlands were more important, personally, to lower catchment respondents (4.0) than to upper catchment respondents (3.3) and more important to urban respondents (3.9) than to rural respondents (3.6).

7. Vegetation on river banks (new)

		importance to you personally		importance to people in the Herbert	
Response	**Rating**	**N (391)**	**Percent**	**N (372)**	**Percent**
very high importance	5	176	45.0	107	28.8
high	4	104	26.6	86	23.1
moderate	3	77	19.7	117	31.5
low	2	27	6.9	44	11.8
very low importance	1	7	1.8	18	4.8
		TOTAL391	100.0	TOTAL372	100.0
		Mean = 4.1		Mean = 3.6	

Vegetation on river banks was highly important to respondents and perceived to be significantly less important to others in the Herbert (means 4.1 and 3.6).

Vegetation on river banks was found to be more important to lower catchment respondents (4.2) than to upper catchment respondents (3.8) in a two way analysis of variance comparing respondents from the upper and lower catchments and urban and rural respondents.

8. Loss of biodiversity (new)

Response	Rating	importance to you personally N (387)	Percent	importance to people in the Herbert N (370)	Percent
very high importance	5	152	39.3	81	21.9
high	4	104	26.9	89	24.1
moderate	3	89	23.0	122	33.0
low	2	34	8.8	57	15.4
very low importance	1	8	2.1	21	5.7
		TOTAL 387	100.0	TOTAL370	100.0
		Mean = 3.9		Mean = 3.4	

Loss of biodiversity was of high importance to respondents and seen to be of moderate to high importance to others in the Herbert, which was a significant difference.

In a two way analysis of variance, urban respondents were found to have rated loss of biodiversity as more important than rural respondents.

Discussion

In summary, all eight issues were at least moderately important to respondents. Ranking the mean importance ratings (below), water quality was most important overall and land degradation was ranked second overall. Of interest is the finding that flooding was ranked equal first in its importance to people in the Herbert and ranked equal last in personal importance. This may be because while flooding doesn't affect a large proportion of people in the catchment, many were aware of its impact on those who do experience flooding.

Ranking of mean ratings	Importance to you personally	Importance to people in the Herbert
Land degradation	2	2
Water quality problems	1	1
Water quantity problems	6	3
Nature conservation issues	4	5
Flooding	6	1
Wetlands	6	6
Vegetation on river banks	3	4
Loss of biodiversity	5	6

Many of the issues were rated as more important personally than for the Herbert. Exceptions were flooding, as highlighted above, and water quantity, which was rated as equally important personally and for the Herbert.

Repeat issues

Land degradation, water quality and nature conservation were rated as more important personally, and to others in the Herbert, in Survey 2.

Respondents involved in both Surveys rated water quality and land degradation as more important in Survey 2, personally and for the Herbert, reflecting the overall samples. Nature conservation was only found to be more important personally in Survey 2 by repeat respondents and equally important in both surveys for others in the Herbert.

Water quantity problems decreased in importance from Survey 1 to Survey 2, both personally and for the Herbert in the overall comparison but only personally for those people who participated in both surveys.

For Survey 2, only a couple of differences were found between the upper and lower catchment or between rural and urban respondents for these repeat questions. Water quantity problems were rated as more important by upper catchment respondents, both personally and to others in the Herbert. Nature conservation was more important personally to urban respondents than to rural respondents.

New issues
Wetlands, vegetation on river banks and flooding were all found to be more important to respondents (personally) in the lower catchment. Flooding was also rated higher by lower catchment respondents in its importance to people in the Herbert.

In terms of personal importance, wetlands and loss of biodiversity were rated higher by urban respondents and flooding was rated higher by rural respondents.

4.6 Impacts of Issues

The seven issues with the highest personal impact in Survey 1 were used is Survey 2, ie. higher taxes, loss of confidence in government's ability to manage land and water resources, higher production costs, lower fish numbers, loss of environmental uses/benefits, loss of access to recreation and poor drinking water quality.

In addition, loss of farm productivity was also used in Survey 2 as it was among the seven issues reported to have the highest impact on people in the Herbert (loss of environmental uses/benefits was not among these seven issues). In addition, it was considered to be important to compare the impact of emotional stress on participants over time and this issue was therefore included in Survey 2.

In your opinion, how much do each of the following impacts (1) affect you personally, and (2) affect people in the Herbert generally?

1. Loss of farm productivity

		affects you personally		affects people in the Herbert	
Response	**Rating**	**N (392)**	**Percent**	**N (376)**	**Percent**
very high degree	5	145	37.0	184	48.9
high	4	66	16.8	122	32.4
moderate	3	63	16.1	49	13.0
low	2	49	12.5	11	2.9
very low degree	1	38	9.7	8	2.1
not at all	0	31	7.9	2	0.5
		TOTAL 392	100.0	TOTAL376	100.0
		Mean = 3.3		Mean = 4.2	

While 53.8% of the sample felt that loss of farm productivity affected them personally to at least a high degree, 81.3% felt that it affected people in the Herbert generally to at least a high degree. There was a significantly greater impact reported for people in the Herbert compared to the personal impact reported by respondents. This finding was the same as in Survey 1. Also similar to Survey 1, the majority of those not at all affected were from the urban sample (90%).

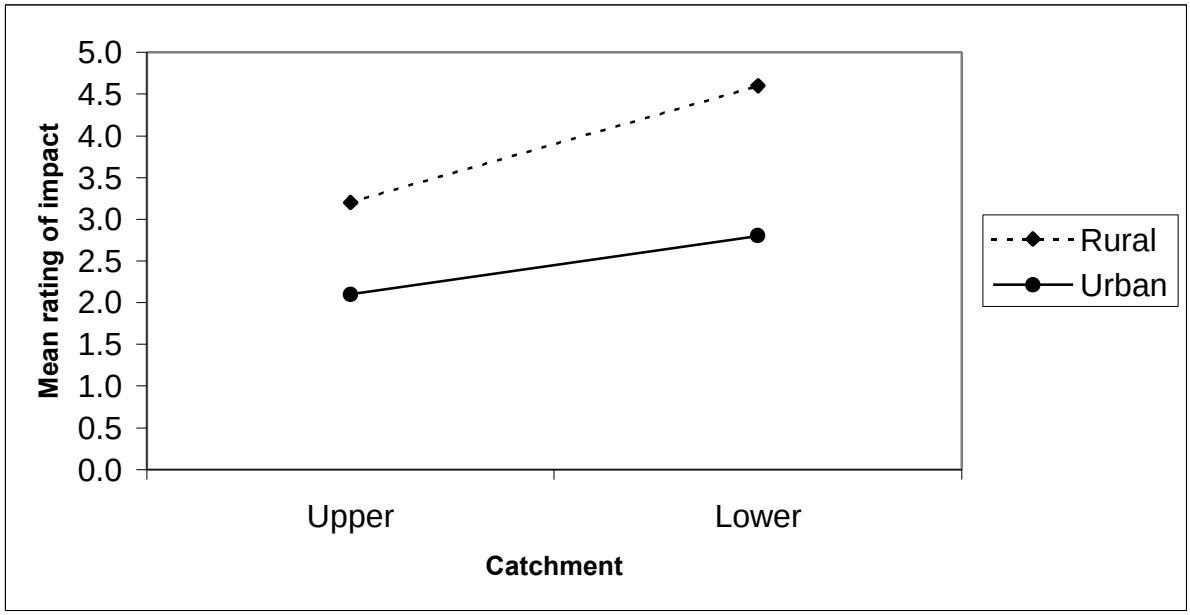
The impact of a loss of farm productivity had more effect on respondents in Survey 2 than in Survey 1 (3.3 and 2.9) and a higher perceived effect on others in Survey 2 (4.2 and 3.8). Similarly, for those respondents who completed both Surveys, the personal effect and the perceived effect

on others was higher in Survey 2 than Survey 1 (personal means 3.3 and 2.9; Herbert means 4.1 and 3.8).

A two way analysis of variance revealed a significant difference between upper and lower catchment respondents; between rural and urban respondents; and a significant interaction between the two, as shown above. It can be seen that loss of farm productivity impacted on lower rural respondents to the greatest degree, which was also found to be the case in Survey 1.

In terms of the impact on others, lower catchment respondents rated the impact on others higher than upper catchment respondents, similar to Survey 1 in which the lower urban sample was more likely than both rural samples to consider loss of farm productivity as having an effect on others.

To summarise these results, respondents perceived loss of farm productivity to have a strong impact on the Herbert Catchment and while still high, a significantly lower effect on them personally. The impact had become stronger in all ways since Survey 1, for those involved in both surveys and for the overall samples, and both personal impact and for the Herbert as a whole.



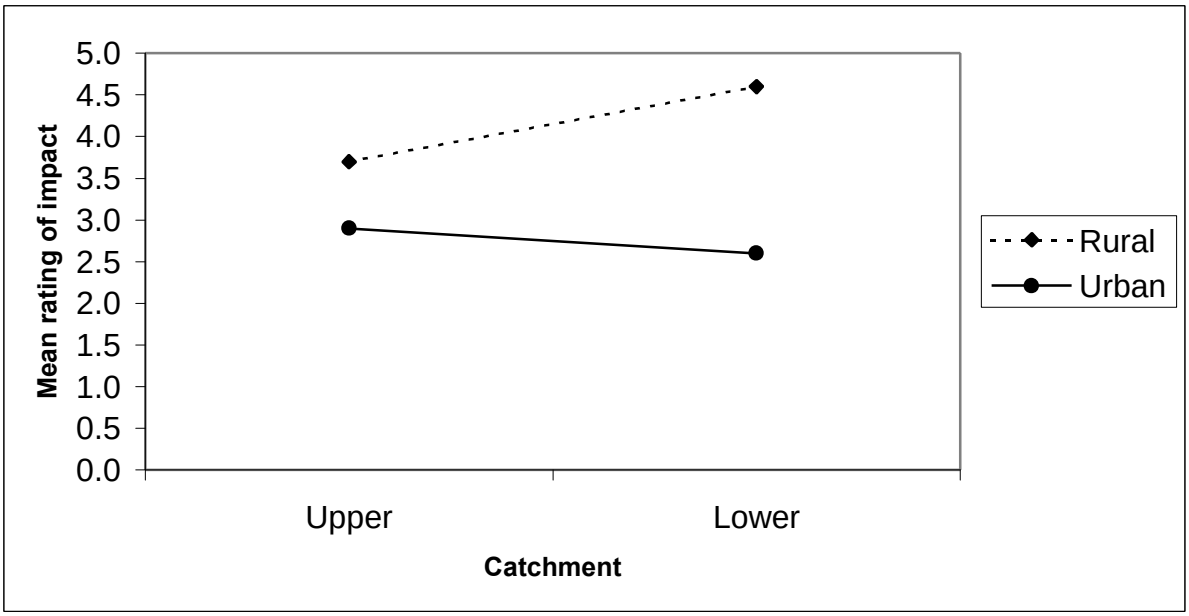
Not surprisingly, the impact was higher for rural respondents. It was also higher for lower catchment respondents. These trends suggest that the impact of a loss of farm productivity affected cane farmers more than other groups of people, as in Survey 1.

Lower catchment respondents felt it had a higher impact on others than upper catchment respondents, perhaps being aware of the higher impact that others in the lower catchment also felt from this issue.

2. Higher production costs

Response	Rating	affects you personally N (393)	Percent	affects people in the Herbert N (378)	Percent
very high degree	5	157	39.9	169	44.7
high	4	81	20.6	130	34.4
moderate	3	51	13.0	60	15.9
low	2	37	9.4	15	4.0
very low degree	1	39	9.9	3	0.8
not at all	0	28	7.1	1	0.3
		TOTAL393	100.0	TOTAL378	100.0
		Mean = 3.5		Mean = 4.2	

While 60.5% felt that higher production costs affected them personally to a high degree, 79.1% felt that it affected others in the Herbert to a high degree. The difference between the mean ratings of the effect on respondents compared to the perceived effect on other people in the Herbert was significant, repeating a finding from Survey 1. Similar to Survey 1, in Survey 2 all of those not at all affected were from the urban sample.



A two way analysis of variance was conducted to examine any differences between the upper and lower catchment and urban and rural respondents. It showed a significant main affect for urban versus rural respondents and a significant interaction between upper and lower catchment versus urban and rural residents for the personal impact. Higher production costs impacted on lower rural respondents to the highest degree.

The impact on people in the Herbert was rated higher by urban respondents (mean 4.3) than by rural respondents (mean 4.0). Both of these results were similar to the findings of Survey 1.
In summary, higher production costs was perceived to have a higher impact on the Herbert in general than respondents reported on themselves. There was consistency between the two Surveys. As in Survey 1, this issue affected rural respondents more than urban respondents. Urban and rural location versus upper and lower catchment interacted to influence the personal ratings. Lower rural respondents were affected the most and lower urban the least, suggesting, as in Survey 1, that cane farmers were affected more than other groups by higher production costs. The impact on the Herbert was rated higher by urban respondents than rural, illustrating an awareness of the impact this issue had on others in the catchment.

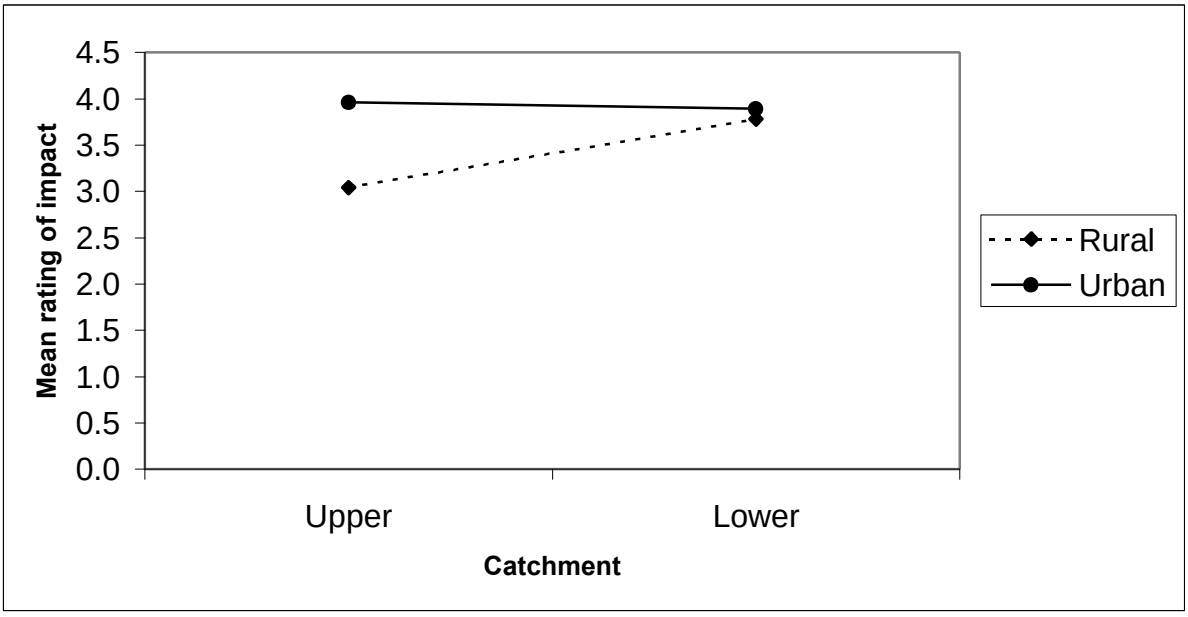
3. Poor drinking water quality

Response	Rating	affects you personally N (395)	Percent	affects people in the Herbert N (376)	Percent
very high degree	5	187	47.3	180	47.9
high	4	68	17.2	84	22.3
moderate	3	58	14.7	80	21.3
low	2	39	9.9	20	5.3
very low degree	1	26	6.6	11	2.9
not at all	0	17	4.3	1	0.3
		TOTAL395 Mean = 3.8	100.0	TOTAL376 Mean = 4.1	100.0

A large percentage (64.5%) felt that poor drinking water quality affected them to a high or very high degree and an even higher percentage (70.2%) felt that it affected others to a high or very high degree. This was a significant difference as it was in Survey 1.

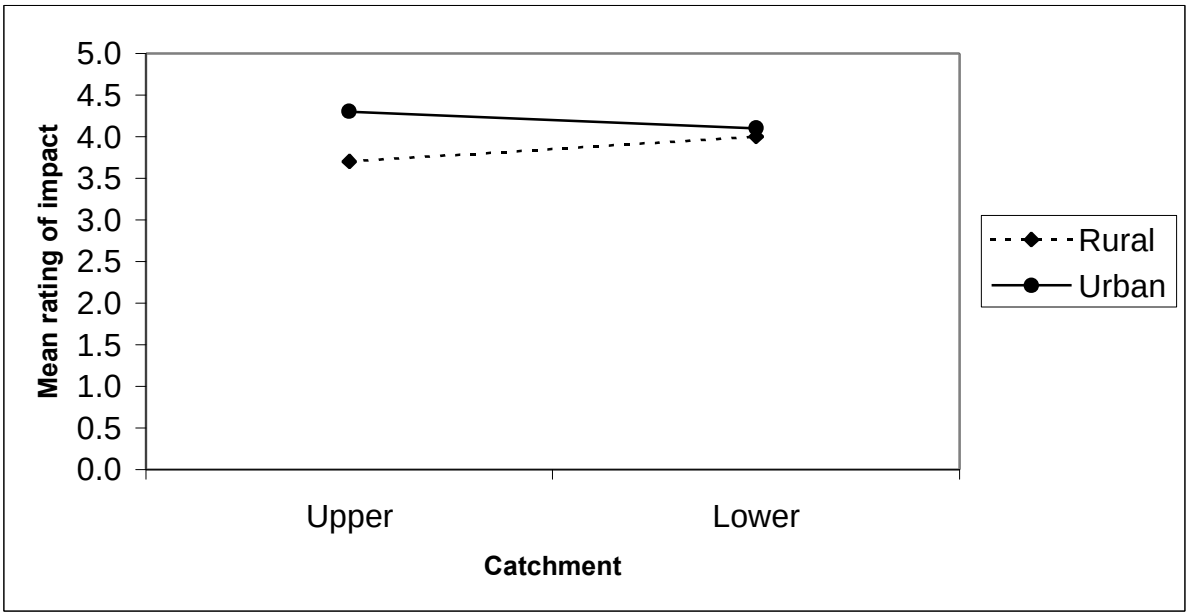
Poor drinking water quality had significantly more effect for respondents in Survey 2 than in Survey 1 (3.8 and 3.3) but there was no significant difference between the two Surveys for the perceived effect on others.

Very similar results were found for repeat participants: poor drinking water quality was reported to have a greater effect on respondents in Survey 2 than Survey 1 (3.7 and 3.3) but no significant difference for the perceived effect on others in the Herbert.



There was a significant difference between the upper and lower catchment; between the urban and rural respondents; and a significant interaction between the two. Lower catchment respondents rated the personal impact of poor drinking water quality higher than upper catchment respondents and urban respondents rated the personal impact higher than rural respondents. In Survey 1, however, lower urban respondents rated the impact significantly higher than the other samples. Upper rural respondents stood out as being least affected by poor drinking water quality, although still rated by them as moderate. As in Survey 1, poor drinking water quality was rated to have at least a moderate impact on all four samples of the catchment.

While there were no differences between the four samples in Survey 1, a number of differences were found between them in Survey 2. The impact on people in the Herbert of poor drinking water quality was rated significantly higher by urban respondents (mean 4.3) than by rural respondents (mean 3.7) when looking at upper catchment respondents. The figure above illustrates the significant interaction between upper and lower catchment versus and urban and rural location. The impact on people in the Herbert in general was rated highest by upper urban respondents and lowest by upper rural respondents.



Overall, poor drinking water quality had a high impact on people. Respondents reported a larger impact on people in the Herbert in general than the personal impact they felt. The impact on respondents was stronger in Survey 2 than Survey 1, both for the overall samples and for repeat respondents.

There was a significant interaction in examining urban and rural residents versus upper and lower catchments. For the upper catchment, urban respondents reported a higher personal impact than rural respondents. For those in rural areas, lower catchment respondents reported a higher personal impact than upper catchment respondents.

Upper rural respondents were affected the least by poor drinking water quality although they still reported a moderate impact.

Among upper catchment respondents, urban respondents reported a higher perceived impact on the Herbert in general than rural respondents.

4. Emotional stress

Response	Rating	affects you personally N (391)	Percent	affects people in the Herbert N (359)	Percent
very high degree	5	74	18.9	58	16.2
high	4	62	15.9	81	22.6
moderate	3	94	24.0	156	43.5
low	2	84	21.5	43	12.0
very low degree	1	53	13.6	16	4.5
not at all	0	24	6.1	5	1.4
		TOTAL391	100.0	TOTAL359	100.0
		Mean = 2.9		Mean = 3.3	

One fifth of respondents (19.7%) felt that emotional stress affected them personally to a very low degree or not at all. A higher percentage (34.8%) felt that emotional stress affected them personally to a high or very high degree.

A similar percentage (38.8%) felt that emotional stress affected other people in the Herbert to a high or very high degree, while the largest percentage (43.5%) felt that it affected other people to a moderate degree and only 5.9% felt that it affected others to a low degree or not at all. The mean scores were near the moderate mark, the same as in Survey 1.

There was a significant difference between the effect emotional stress had on respondents and the perceived effect it had on others in the Herbert, the same result as in Survey 1.

A two way analysis of variance examining upper and lower catchments and urban and rural locations revealed that there was a significant difference between urban and rural respondents: the impact of emotional stress was reported by urban respondents (mean 2.5) to be lower than for rural respondents (mean 3.3). Of those respondents who reported no impact at all, 70.8% were from the urban sample. A difference was also found between upper and lower catchments: upper catchment respondents reported a lower degree of impact on them (mean 2.3) than lower catchment respondents (mean 3.1). This reflects the results of Survey 1 in which lower rural respondents experienced more personal impact than upper catchment respondents.

The impact of emotional stress on people in the Herbert was rated significantly higher by lower catchment respondents (mean 3.4) than by upper catchment respondents (mean 3.1).

Thus, emotional stress was reported to have a moderate impact on respondents and on people in the Herbert but a significantly larger impact on the Herbert. These impacts had remained static from Survey 1. Emotional stress had a higher impact on rural respondents than urban and a lower impact on the upper catchment than the lower catchment.

It was perceived to have a larger impact on people in the Herbert by rural respondents than by urban respondents. Presumably, as emotional stress had a higher impact on rural respondents, they also perceived it to have a large impact on others.

5. Higher taxes

Response	Rating	affects you personally N (396)	Percent	affects people in the Herbert N (374)	Percent
very high degree	5	206	52.0	185	49.5
high	4	87	22.0	116	31.0
moderate	3	47	11.9	57	15.2
low	2	27	6.8	9	2.4
very low degree	1	18	4.5	6	1.6
not at all	0	11	2.8	1	0.3
		TOTAL396 Mean = 4.0	100.0	TOTAL374 Mean = 4.2	100.0

A large percentage of respondents reported that higher taxes had a high or very high degree of impact on them (74%) and an even larger percentage (80.5%) reported a high or very high degree of impact on other people in the Herbert. Higher taxes had the largest impact of all nine issues, in both Surveys. The mean scores were exactly the same for both surveys.

The issue of higher taxes was reported to affect respondents and others in the Herbert to a high degree but it was perceived to have a significantly higher effect on others in the Herbert, despite the similarity in the mean ratings.

A two way analysis of variance was conducted to examine any differences between the upper and lower catchment and rural and urban respondents. Lower catchment respondents reported a greater impact of higher taxes (mean 4.1) than upper catchment respondents (mean 3.7) and rural respondents reported a greater impact (mean 4.3) than urban respondents (mean 3.7). Of the eleven respondents who felt that higher taxes had no impact at all on people in the Herbert, ten were from the urban sample. Lower catchment respondents also reported a greater degree of impact on others of higher taxes (mean 4.3) than upper catchment respondents (mean 4.0). This was similar to Survey 1 in which lower rural respondents rated the impact of higher taxes significantly higher than the other three samples.

Higher taxes was reported to have a higher impact personally and on the Herbert, by lower catchment respondents than by upper catchment respondents and rural respondents reported a higher personal impact than urban respondents. These are similar results to Survey 1, in which the lower rural sample was more likely to feel personally affected by higher taxes compared with both upper catchment samples. However, there were no differences between samples for the effect on others.

6. Lower fish numbers

Response	Rating	affects you personally N (390)	Percent	affects people in the Herbert N (374)	Percent
very high degree	5	131	33.6	107	28.6
high	4	100	25.6	112	29.9
moderate	3	77	19.7	114	30.5
low	2	32	8.2	24	6.4
very low degree	1	28	7.2	15	4.0
not at all	0	22	5.6	2	0.5
		TOTAL390 Mean = 3.5	100.0	TOTAL 374 Mean = 3.7	100.0

The majority of respondents to this question rated the personal impact of lower fish numbers as high or very high (59.2%) and a similar percentage rated the impact in this way for people in the Herbert (58.5%).

Lower fish numbers was reported to have a moderate to high effect on both respondents and others in the Herbert but a significantly higher effect on other people in the Herbert, the same result as in Survey 1. In addition, comparing those people who participated in both Surveys, lower fish numbers was perceived to have decreased in its effect on people in the Herbert from Survey 1 to Survey 2 (means 3.7 and 3.5).

A two way analysis of variance conducted to examine differences between the upper and lower catchments and urban and rural locations showed that lower catchment respondents reported a significantly greater degree of impact of lower fish numbers (mean 3.8) than upper catchment respondents (mean 2.9), the same result as Survey 1, including very similar means. Urban respondents reported a significantly greater degree of impact (mean 3.7) than rural respondents (mean 3.4). Lower catchment respondents also reported a significantly greater degree of impact of lower fish numbers on people in the Herbert in general (mean 3.8) than upper catchment respondents (mean 3.5), the same as in Survey 1.
Overall, lower fish numbers had a moderate to high impact but a significantly higher impact on the Herbert than on respondents. Repeat respondents reported a decreased impact on the Herbert since Survey 1.

Lower fish numbers had a greater personal impact on lower catchment respondents, and they reported a greater impact on the Herbert, than upper catchment respondents. Urban respondents reported a greater personal impact than rural respondents. As in Survey 1, fishing appears to be more a recreational activity for those people living in the lower catchment, which is not at all surprising.

7. Loss of access to recreation

		affects you personally		affects people in the Herbert	
Response	**Rating**	**N (393)**	**Percent**	**N (373)**	**Percent**
very high degree	5	110	28.0	92	24.7
high	4	96	24.4	111	29.8
moderate	3	97	24.7	117	31.4
low	2	43	10.9	32	8.6
very low degree	1	28	7.1	16	4.3
not at all	0	19	4.8	5	1.3
		TOTAL 393	100.0	TOTAL 373	100.0
		Mean = 3.4		Mean = 3.6	

As in Survey 1, more than 50 per cent of the sample considered impacts experienced personally and by others to be high or very high and the mean scores (equal to Survey 1) were between moderate and high with a significantly higher impact on others in the Herbert.

The two way analysis of variance conducted to examine differences between the upper and lower catchment and urban and rural locations showed a significant difference between the upper and lower catchment. Lower catchment respondents rated the impact of the loss of access to recreation (mean 3.5) significantly higher than upper catchment respondents (mean 3.1).

No significant difference was found between the upper and lower catchment or between urban and rural respondents for the impact on people in the Herbert in general, whereas in Survey 1,

lower urban participants considered general Herbert impacts of a loss of recreation to be significantly higher than both upper catchment samples.

In summary, loss of access to recreation had a moderate to high impact overall but a higher impact was reported on the Herbert, repeating the results of Survey 1. The lower catchment was impacted more by a loss of access to recreation than the upper catchment.

The results of Survey 2 were very similar to the results of Survey 1. The majority of respondents rated the impact of loss of confidence in government's ability to manage land and water resources as high or higher, 68.4% for the personal impacts and 65.1% for the impact on others.

Loss of confidence in government's ability to manage land and water resources was reported to have a high effect on respondents and for others. Despite the similarity in the means, the personal impact was significantly higher than on others in the Herbert, the same as in Survey 1.

8. Loss of confidence in government's ability to manage land and water resources

		affects you personally		affects people in the Herbert	
Response	**Rating**	**N (395)**	**Percent**	**N (375)**	**Percent**
very high degree	5	154	39.0	130	34.7
high	4	118	29.4	114	30.4
moderate	3	93	23.2	97	25.9
low	2	17	4.3	26	6.9
very low degree	1	6	1.5	5	1.3
not at all	0	7	1.8	3	0.8
		TOTAL 395	100.0	TOTAL 375	100.0
		Mean = 4.0		Mean = 3.9	

The two way analysis of variance conducted to examine differences between the upper and lower catchment and urban and rural locations showed no significant differences or interaction, either for personal effect or effect on people in the Herbert in general. This was different to Survey 1 in which the lower urban sample rated the impact on the Herbert in general as higher than the lower rural sample.

In summary, loss of confidence in government's ability to manage land and water resources was rated as high overall and significantly higher on respondents themselves as opposed to the Herbert in general. No differences between the two Surveys were found nor any differences between catchments or between urban and rural respondents.

9. Loss of environmental uses or benefits (eg. wildlife habitat)

		affects you personally		affects people in the Herbert	
Response	**Rating**	**N (392)**	**Percent**	**N (372)**	**Percent**
very high degree	5	115	29.3	72	19.4
high	4	106	27.0	84	22.6
moderate	3	114	29.1	143	38.4
low	2	36	9.2	59	15.9
very low degree	1	11	2.8	11	3.0
not at all	0	10	2.6	3	0.8
		TOTAL 392	100.0	TOTAL 372	100.0
		Mean = 3.6		Mean = 3.4	

Loss of environmental uses or benefits was reported to have a moderate to high impact on respondents and others but a significantly higher effect on respondents, the same results as found in Survey 1.

Both the effect on respondents, and perceived effect on others, of a loss of environmental uses or benefits were reported to be significantly higher in Survey 2 than in Survey 1 (means 3.6 and 3.4; 3.4 and 3.2). Similarly, respondents who completed both Surveys reported an increase in the effect of a loss of environmental uses or benefits (Survey 1 Mean = 3.4; Survey 2 Mean = 3.7).

A two way analysis of variance was conducted to examine differences between the upper and lower catchment and urban and rural respondents. Lower catchment respondents were found to be impacted to a greater degree by loss of environmental uses or benefits (mean 3.7) than upper catchment respondents (mean 3.4). Urban respondents rated the impact higher (mean 3.8) than rural respondents (mean 3.5). These results are similar to the results of Survey 1 in which lower urban respondents rated the personal impact and impact on the Herbert as significantly higher than the upper rural sample. In Survey 2, however, no differences were found for the impact on people in the Herbert in general.

Overall, loss of environmental uses or benefits had a moderate to high impact and a higher personal impact. The personal impact had increased since Survey 1, both for the overall sample and for repeat respondents. Lower catchment respondents reported a higher impact than in the upper catchment and urban respondents more than rural respondents.

Discussion

Throughout this question, less participants responded to the section regarding the impact on people in the Herbert. This may be a result of more people feeling comfortable to respond about their own opinions than on behalf of others. In addition, fewer participants responded that there was no impact at all on people in the Herbert, presumably because fewer were willing to assume that there would be no-one who was affected by the issue.

Overall, comparing the mean responses for the entire sample, the four issues reported to have the highest impact on respondents were:

- higher taxes;
- loss of confidence in the government's ability to manage land and water resources;
- poor drinking water quality; and
- loss of environmental uses or benefits.

In Survey 1, the issues with the highest impact were (for repeat respondents only):

- loss of confidence in the government's ability to manage land and water resources;
- higher taxes;
- loss of farm productivity; and
- lower fish numbers.

In Survey 2, the four issues reported to have the highest impact on people in the Herbert were:

- higher taxes;
- loss of farm productivity;
- higher production costs; and
- poor drinking water quality.

In Survey 1, the four issues reported to have the highest impact were (for repeat respondents only):

- higher taxes;

- higher production costs;
- poor drinking water quality; and
- loss of confidence in the government's ability to manage land and water resources;

The stability of community opinions over the two years between the surveys was quite strong. However, there were some differences, listed below, between the two surveys.

- The impact of 'loss of farm productivity' increased, both in terms of the personal impact and the impact on the Herbert and for both the overall samples and for repeat respondents.
- The personal impact of 'poor drinking water quality' increased, both for the overall samples and for repeat respondents.
- In Survey 2, upper urban respondents rated the impact on the Herbert of 'poor drinking water quality' significantly higher than upper rural respondents whereas there was no difference between samples in Survey 1.
- In Survey 2, the impact of 'emotional stress' on the Herbert was rated higher by lower catchment respondents than upper catchment respondents but there was no difference between catchments in Survey 1.
- The impact of 'lower fish numbers' was rated significantly lower by repeat respondents for the Herbert in Survey 2 than in Survey 1.
- The personal impact of 'lower fish numbers' was rated higher by urban respondents than rural respondents in Survey 2 whereas there were no significant differences between them in Survey 1.
- 'Loss of access to recreation' was rated higher by lower catchment respondents than upper catchment respondents in terms of personal impact but there was no difference in Survey 1.
- The impact of 'loss of access to recreation' on the Herbert was rated higher by the lower urban sample than upper catchment respondents in Survey 1 but no difference was displayed between catchments or locations in Survey 2.
- While the impact of a 'loss of confidence in government's ability to manage land and water resources' on the Herbert was rated higher by the lower urban sample than the lower rural sample in Survey 1, there were no such differences in Survey 2.
- The only issue for which there agreement between the upper and lower catchment and rural and urban respondents was 'loss of confidence in government's ability to manage land and water resources'.
- 'Loss of environmental uses/benefits' increased in its impact, both personally and for the Herbert, both between the overall survey samples and for repeat respondents.
- The impact of 'loss of environmental uses/benefits' on the Herbert was rated higher by lower urban respondents than upper rural respondents in Survey 1 but no differences were displayed in Survey 2 between catchments or locations.

4.7 Awareness and Intentions

As in Survey 1, three general questions were asked concerning awareness and involvement in land and water issues in the Herbert.

Generally speaking, what awareness do you think local people have about land and water issues in the Herbert?

Response	Rating	N (392)	Percent
very high awareness	5	41	10.5
high	4	99	25.3
moderate	3	169	43.1
low	2	70	17.9
very low awareness	1	13	3.3
TOTAL		392	100.0
Mean = 3.1			

Awareness of local people about land and water issues in the Herbert was perceived to be moderate overall. Lower catchment respondents rated this item significantly higher than upper catchment respondents (means 3.3 and 3.0). There were no differences between the surveys.

How much do you think local people are prepared to become involved in land and water issues in the Herbert?

Response	Rating	N (394)	Percent
very high degree	5	15	3.8
high	4	72	18.3
moderate	3	195	49.5
low	2	94	23.9
very low degree	1	18	4.6
TOTAL		394	100.0
Mean = 2.9			

Respondents perceived that local people would be prepared to become involved in land and water issues in the Herbert to a moderate degree overall. The degree to which it was thought local people would become involved had significantly decreased from Survey 1 to Survey 2 (means 3.0 and 2.9) although the ratings were very close. Similarly, respondents who participated in both surveys gave a significantly lower response in Survey 2 than in Survey 1 (means 3.0 and 2.9).

How much are you prepared to become involved in land and water issues in the Herbert?

Response	Rating	N (389)	Percent
very high degree	5	40	10.3
high	4	118	30.3
moderate	3	154	39.6
low	2	50	12.9
very low degree	1	27	6.9
TOTAL		389	100.0
Mean = 3.3			

Respondents indicated that overall they would be prepared to become involved in land and water issues in the Herbert to a moderate/high degree. From Survey 1 to Survey 2 the degree to which respondents were prepared to become involved in land and water issues had increased significantly (means 3.1 and 3.2). In addition, from Survey 1 to Survey 2, repeat respondents were significantly more prepared to become involved (means 3.1 and 3.3).

In Survey 2, rural respondents rated this higher than urban respondents (means 3.4 and 3.1).

Discussion
Overall, local awareness about land and water issues was considered to be moderate, as it was in Survey 1.

Interestingly, while the perceived preparedness of local people to become involved in land and water issues had decreased from Survey 1, both overall and for repeat respondents, the actual preparedness of respondents themselves to become involved had increased both overall and for repeat respondents.

It would be useful to determine whether or not these two items are related, it may be that the decreased perception that local people were prepared to become involved contributed to the preparedness of respondents to become involved themselves.

4.8 Tractability

This section of the questionnaire was repeated from Survey 1. It examined how manageable (or practical) catchment management might be, given perceptions of possible impediments to effectively managing land and water in the catchment.

Participants were asked to rate how much they agreed or disagreed with the statements, each underlining a particular obstacle to managing land and water. Ten of the fourteen statements from Survey 1 were used in Survey 2 and two additional statements were used as they had become important issues since Survey 1 was conducted.

Managing land and water in the Herbert is difficult because…
1. problems aren't well understood (repeat)

Response	Rating	N (389)	Percent
strongly agree	5	66	17.0
agree	4	229	58.9
neither agree nor disagree	3	49	12.6
disagree	2	37	9.5
strongly disagree	1	8	2.1
TOTAL		389	100.0
Mean = 3.8			

The majority of respondents (75.9%) agreed or strongly agreed that managing land and water was difficult because problems were not well understood. This is a very similar result as Survey 1, in which the mean score was exactly the same. There were no significant differences between the four samples, as in Survey 1.

2. solutions aren't easy (repeat)

Response	Rating	N (392)	Percent
strongly agree	5	88	22.4
agree	4	224	57.1
neither agree nor disagree	3	35	8.9
disagree	2	36	9.2
strongly disagree	1	9	2.3
TOTAL		392	100.0
Mean = 3.9			

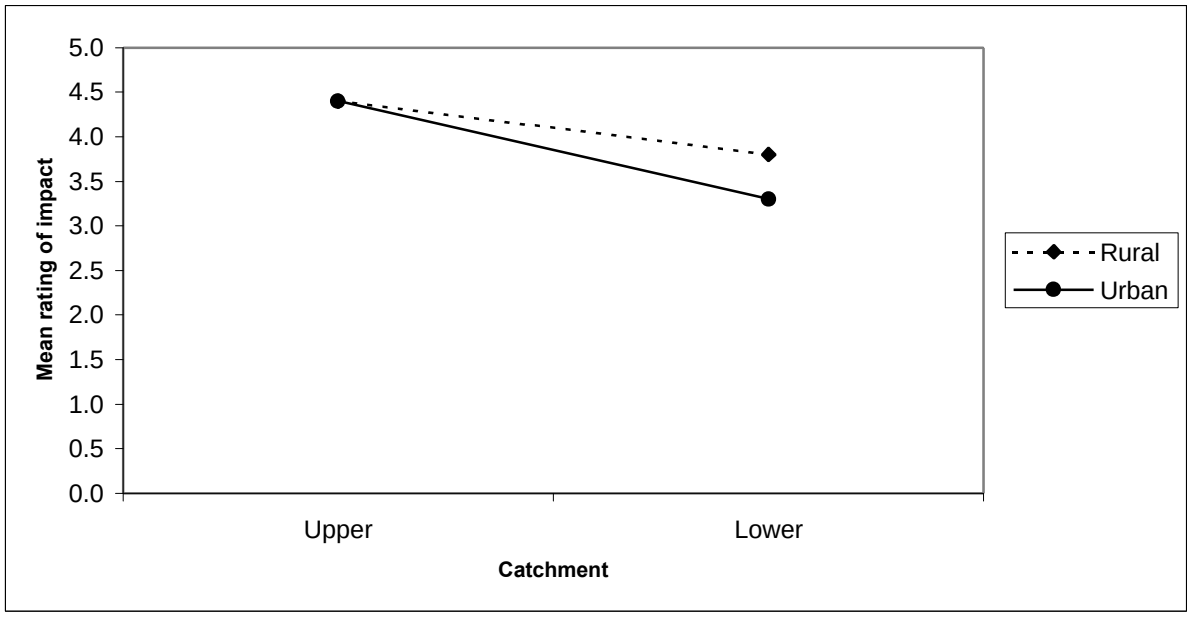
As in Survey 1, the majority of respondents agreed or strongly agreed (79.5%) that solutions were not easy, making land and water management difficult. There were no differences between any of the samples in Survey 2, whereas in Survey 1 lower catchment respondents were more likely to agree that solutions were not easy.

3. local people lack the money to spend on solutions (repeat)

Response	Rating	N (393)	Percent
strongly agree	5	121	30.8
agree	4	148	37.7
neither agree nor disagree	3	68	17.3
disagree	2	43	10.9
strongly disagree	1	13	3.3
TOTAL		393	100.0
Mean = 3.8			

Nearly 70% agreed or strongly agreed that local people lack the money to spend on solutions, making managing land and water difficult. There was a significant difference between the overall responses in Survey 1 and 2 with the mean being higher in Survey 2 than in Survey 1 (3.8 and 3.5). There was also a significant difference between the responses of those people who completed both Surveys, agreeing more strongly that local people lack the money to spend on solutions in the later Survey (Survey 1 mean = 3.5; Survey 2 mean = 4.0). This was the only significant difference for repeat respondents for this list of statements.

In addition, a two way analysis of variance showed that upper catchment respondents (mean 4.4) agreed more strongly than lower catchment respondents (mean 3.6), and rural respondents (mean 4.0) agreed more strongly than urban respondents (mean 3.7), that local people lack the money to spend on solutions. There was also an interaction between upper and lower catchment versus urban and rural location, as shown below. The Survey 1 results were similar: the lower urban sample was less likely to agree with the statement and the lower rural sample was less likely to agree with the statement than both upper catchment samples.



4. government strategies are too slow (new)

Response	Rating	N (391)	Percent
strongly agree	5	179	45.8
agree	4	152	38.9
neither agree nor disagree	3	50	12.8
disagree	2	7	1.8
strongly disagree	1	3	0.8
TOTAL		391	100.0
Mean = 4.3			

Most respondents (84.7%) agreed that government strategies are too slow. There were no differences between samples, either in Survey 1 or 2.

5. solutions are expensive (repeat)

Response	Rating	N (391)	Percent
strongly agree	5	143	36.6
agree	4	165	42.2
neither agree nor disagree	3	46	11.8
disagree	2	33	8.4
strongly disagree	1	4	1.0
TOTAL		391	100.0
Mean = 4.0			

The majority of respondents (78.8%) agreed or strongly agreed that solutions are expensive, making managing land and water difficult. The mean was significantly higher for Survey 2 than Survey 1 respondents overall (means 4.0 and 3.9). There were no differences between samples in Survey 1 or 2.

6. there are few benefits and many costs (repeat)

Response	Rating	N (392)	Percent
strongly agree	5	49	12.5
agree	4	113	28.8
neither agree nor disagree	3	84	21.4
disagree	2	102	26.0
strongly disagree	1	44	11.2
TOTAL		392	100.0
Mean = 3.0			

Opinions on this item were split, with 41.3% agreeing to some degree and 37.2% disagreeing to some degree. There was quite a high percentage who neither agreed nor disagreed with the statement (21.4%). The split of opinion was highlighted by the overall mean of 3.0, neither agree no disagree. While the overall means for Survey 1 and Survey 2 appeared similar, they were significantly different, with agreement higher in Survey 2 than in Survey 1 (3.0 and 2.9). There were no differences among the samples in either survey.

7. local people don't want to spend money on solutions (repeat)

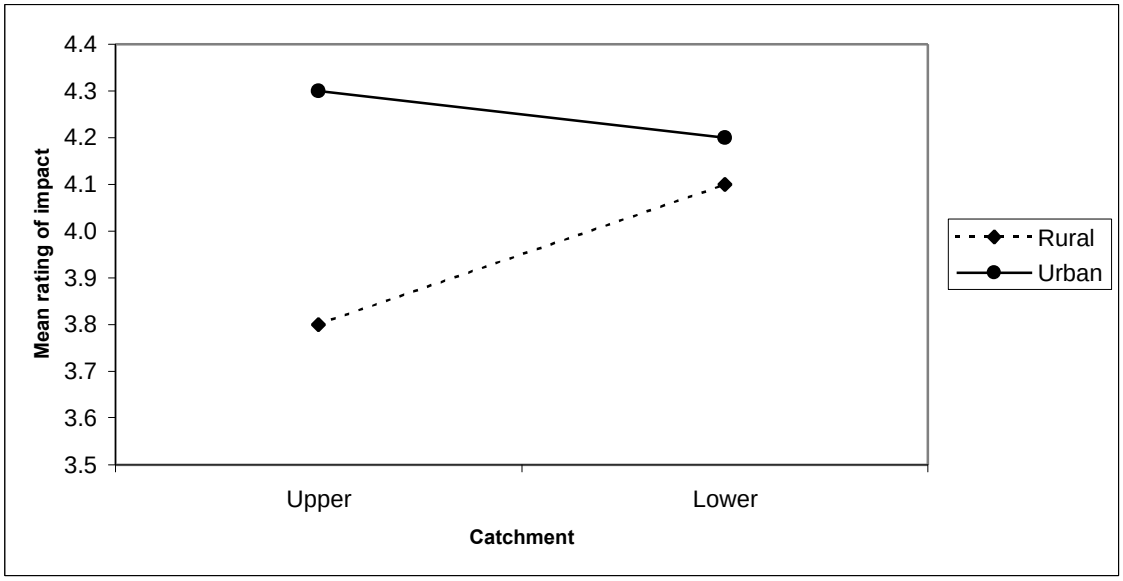
Response	Rating	N (392)	Percent
strongly agree	5	50	12.8
agree	4	150	38.3
neither agree nor disagree	3	102	26.0
disagree	2	81	20.7
strongly disagree	1	9	2.3
TOTAL		392	100.0
Mean = 3.4			

Half of the respondents agreed that local people don't want to spend money on solutions and a quarter neither agreed nor disagreed. The mean, however, as in Survey 1, indicated that on average, participants tended to neither agree nor disagree. There were no significant differences between the two Surveys and no differences between the samples in either survey.

8. the Herbert River Catchment covers a large area (repeat)

Response	Rating	N (388)	Percent
strongly agree	5	131	33.8
agree	4	207	53.4
neither agree nor disagree	3	27	7.0
disagree	2	16	4.1
strongly disagree	1	7	1.8
TOTAL		388	100.0
Mean = 4.1			

As in Survey 1, a very large percentage of respondents (87.2%) agreed or strongly agreed that land and water management are difficult because the Herbert River Catchment covers a large area. Rural respondents were more likely than urban respondents, in Survey 2, to agree that the large area of the Herbert River Catchment made land and water management difficult (means 4.0 and 3.7). There was also a two way interaction between catchment and location, as shown in the figure below. The direction of the difference between the two catchments was different depending on respondents' urban or rural location. There were no differences between samples in Survey 1.



9. local people don't trust government programs (repeat)

Response	Rating	N (393)	Percent
strongly agree	5	107	27.2
agree	4	155	39.4
neither agree nor disagree	3	99	25.2
disagree	2	23	5.9
strongly disagree	1	9	2.3
TOTAL		393	100.0
Mean = 3.8			

A much larger percentage of respondents agreed that local people don't trust government programs (66.6%) than disagreed (8.1%). In addition, approximately one quarter neither agreed nor disagreed. There were no differences between the two surveys nor between samples in either survey. Level of trust in government appears to be a key issue facing ICM in the Herbert.

A very low percentage strongly agreed or disagreed with the statement that local people aren't that interested in community-type activities. Responses were split between agreement, disagreement and neither. The mean of 2.9, as in Survey 1, highlights that, on average, the sample neither agreed nor disagreed that local people are not that interested in community-type activities. There were no differences between samples in either survey.

10. local people aren't that interested in community-type activities (repeat)

Response	Rating	N (392)	Percent
strongly agree	5	23	5.9
agree	4	106	27.0
neither agree nor disagree	3	112	28.6
disagree	2	130	33.2
strongly disagree	1	21	5.4
TOTAL		392	100.0
Mean = 2.9			

11. the government doesn't want to spend money on solutions (repeat)

Response	Rating	N (392)	Percent
strongly agree	5	79	20.2
agree	4	160	40.8
neither agree nor disagree	3	114	29.1
disagree	2	35	8.9
strongly disagree	1	4	1.0
TOTAL		392	100.0
Mean = 3.7			

A large percentage of respondents (61%) agreed that the government doesn't want to spend money on solutions making land and water management difficult. Nearly thirty per cent neither agreed nor disagreed. The mean score was the same as in Survey 1 and there were no differences between samples in either Survey 1 or Survey 2.

12. government departments and other agencies are too slow to react to new issues or problems (new)

Response	Rating	N (392)	Percent
strongly agree	5	144	36.7
agree	4	180	45.9
neither agree nor disagree	3	52	13.3
disagree	2	12	3.1
strongly disagree	1	4	1.0
TOTAL		392	100.0
Mean = 4.1			

Most respondents (82.6%) agreed that government departments and other agencies are too slow to react to new issues or problems and again there were no differences between samples.

Discussion

The greatest impediments to managing land and water in the Herbert were the same in both surveys, despite different orders and significant differences between some of the means. The highest impediments and their means, were:

Impediment	Survey 2	Survey 1
the catchment's large area	4.1	4.1
a lack of easy solutions	3.9	3.9
the cost of solutions	4.0	3.9
low trust of government programs	3.8	3.9
the difficulty of moving around the catchment	n/a	3.8
the wide variety of opinions held by local people	n/a	3.8
insufficient understanding of relevant problems	3.8	3.8
slow government strategies (new)	4.3	n/a
slow reactions by government to new problems (new)	4.1	n/a

It can be seen that the two additional items in Survey 2, *government strategies are too slow* and *government departments and other agencies are too slow to react to new issues or problems,* scored highest overall.

In Survey 1, the three lowest potential impediments (all with mean scores below 3) were *there are few benefits and many costs, local people aren't that interested* and *there aren't any problems that need urgent action.* In Survey 2, the latter item was not repeated but the other items were the lowest scoring items once again, with mean scores of 3 or less. They therefore constitute very little impediment to managing land and water in the Herbert. In other words, by implication, respondents did see there to be benefits of managing land and water in the Herbert and perceived local people to be interested in managing land and water.

There were very few differences between mean scores in comparing the two surveys, comparing catchments or comparing rural and urban samples. The only significant differences between the means of the two surveys were for the following three items: *local people lack the money to spend on solutions; solutions are expensive;* and *there are few benefits and many costs* were all agreed to more by respondents in Survey 2 than in Survey 1.

The only difference in Survey 2 between the four samples was that rural respondents agreed more than urban respondents that the catchment's large area was an impediment to managing land and water in the Herbert.

This may suggest that the issue of how manageable or practical catchment management might be are relatively stable across time and the location of residents in the Herbert Catchment.

4.9 Knowledge of Government Strategies

Before we contacted you about this study, which of the government strategies had you heard about …

		Property Management Planning (PMP)		Landcare		Integrated Catchment Management (ICM)	
Response	Rating	N	Percent	N	Percent	N	Percent
Survey 2							
Yes	1	118	29.9	357	90.2	196	49.5
No	2	277	70.1	39	9.8	200	50.5
	TOTAL	395	100.0	396	100.0	396	100.0
Survey 1							
Yes	1	123	25.9	406	85.5	178	37.5
No	2	352	74.1	69	14.5	297	62.5
	TOTAL	475	100.0	475	100.0	475	100.0

As for Survey 1, Landcare was the most familiar strategy to respondents. A slightly higher percentage had heard of all three strategies in Survey 2 than had in Survey 1. In Survey 2, approximately 90% had heard of Landcare, approximately 50% had heard of Integrated Catchment Management and 30% had heard of Property Management Planning. In Survey 2, a significantly higher percentage of repeat respondents had heard of ICM (58%) than new respondents (43%).

A higher percentage of respondents in the lower catchment had heard of Property Management Planning than in the upper catchment (33% and 22%). As in Survey 1, those who had heard about each of the strategies were more likely to come from the lower rural sample and less likely to come from the lower urban sample than to be expected.

… and which one did you know most about?

	Survey 2		Survey 1	
Response	**N(363)**	**Percent**	**N(453)**	**Percent**
PMP	14	3.9	12	2.6
Landcare	279	76.9	333	73.5
ICM	35	9.6	47	10.4
Don't know of any	35	9.6	61	13.5
TOTAL	363	100.0	453	100.0

The majority of respondents (76.9%) in Survey 2 knew most about Landcare and a very similar percentage in Survey 1 knew most about Landcare (73.5%).

When thinking of the government strategy you know most about:

1. how useful has this strategy been to you personally?

Response	Rating	N (322)	Percent
very useful	5	14	4.3
quite	4	30	9.3
moderately	3	91	28.3
not very	2	104	32.3
not at all useful	1	83	25.8
TOTAL		322	100.0
Mean = 2.3			

As in Survey 1, only those who had heard of at least one of the strategies were asked to respond to this question.

Again, as in Survey 1, nearly 60% of the participants responded that the government strategy had either been not at all useful or not very useful (58.1%). Upper catchment respondents reported the strategy they knew most about to be significantly less useful to them than was reported by lower catchment respondents (means 2.1 and 2.4 respectively). There was no significant difference between repeat respondents, or the overall samples, in Survey 1 and Survey 2. Looking at the results for PMP, Landcare and ICM separately, the mean scores were 2.6 (only 14 responses), 2.3, and 2.6, generally moderate to not very useful, similar to Survey 1.

2. how effective has the strategy been in dealing with land and water issues in the Herbert?

Response	Rating	N (310)	Percent
very effective	5	4	1.3
fairly effective	4	98	31.6
neither effective nor ineffective	3	97	31.3
fairly ineffective	2	81	26.1
very ineffective	1	30	9.7
TOTAL		310	100.0
Mean = 2.9			

Looking at the results for PMP, Landcare and ICM separately, the mean responses were 2.5 (only 13 responses), 2.9, and 2.9, similar to Survey 1 means, which were 3.3 (only 12 responses), 2.8, and 2.8.

3. how did you come to know of the strategy?

This was an open-ended question which allowed up to two responses. The table below shows the percentage of respondents for each different source of knowledge as a proportion of the number of respondents who gave at least one response (299). The most prominent responses are shown, with a total of 386 (or 92%) of the responses included.

Sources of knowledge	Survey 2 N = 299		Survey 1 N = 334	
	N	%	N	%
Newspapers	85	28.4	79	23.7
Television/television advertisements	58	19.4	72	21.6
Media (in general)	50	16.7	44	13.2
Word of mouth	34	11.4	40	12.0
Personal experience	29	9.7	8	2.4
Meetings (in general)	25	8.4	31	9.3
Canegrowers magazine	17	5.7	12	3.6
Radio/radio talk shows	13	4.3	22	6.6
Canegrowers meetings	11	3.7	22	6.6
Advertisements (in general)	10	3.3	12	3.6
Landcare	10	3.3	6	1.8
Reading	9	3.0	17	5.1
Local pamphlets	8	2.7	9	2.7
Publications **	8	2.7	-	-
Visual **	8	2.7	-	-
ICM delegate **	6	2.0	-	-
Department of Primary Industry **	5	1.7	-	-

** New category in Survey 2

A notable difference is that a higher percentage of respondents in Survey 2 had heard of the strategy they knew most about through personal experience than in Survey 1 (9.7% versus 2.4%).

While in Survey 1, 67% of the responses could be classified as media sources (ie. a combination of the newspaper, television, media and radio responses) only 49% percent of the responses were to do with the media in Survey 2.

Of those who knew most about PMP, the most common response was word of mouth (3 responses) as opposed to personal experience in Survey 1. For both surveys, the most frequent way for people to hear about ICM was through meetings, in Survey 2, 8 people stated their source to be meetings in general, while 5 were more specific in stating canegrowers meetings. Other ways for people to hear about ICM in Survey 2 were the newspapers (6), through their ICM delegate (6), and through the media in general (4).

Landcare accounted for 83% of the responses. The most common responses for Landcare were newspapers (71 of 79 in total), television/television advertisements (54 of 54 in total) media in general (45 of 49 in total), word of mouth (25 of 31), Canegrowers magazine (14 of 17), and personal experience (14 of 18).

Are you aware of any other Government Funded programs on wider environmental matters in the Herbert catchment?

This question was added in Survey 2 to gain some understanding of community awareness of other Government Funded programs on wider environmental matters in the Herbert catchment.

Response	N (369)	Percent
Yes	72	19.5
No	297	80.5
TOTAL	369	100.0

The majority of respondents (80.5%) to this question were not aware of any other Government Funded programs on wider environmental matters in the Herbert catchment.

Please write down any comments you have on them.
Sixty of those who were aware of other Government Funded programs on wider environmental matters gave 88 comments on those programs, 76 (86%) of which are listed below.

Comment	N (60)	Percent
Lack knowledge of the local situation	12	20.0
Poorly organised	10	16.7
Reforestation	9	15.0
Works well	7	11.7
Not consulting local people	6	10.0
Good idea	5	8.3
No benefit to the environment/no impact on environment	5	8.3
Not using best/most recent information	4	6.7
Need more funds	3	5.0
Token measures to suggest something is done	3	5.0
Government departments avoid difficult decisions	3	5.0
Blame others when problems arise	3	5.0
Fish kills in creeks	3	5.0
Lack of publicity	3	5.0

The most frequent comment on the program was that those conducting it did not have enough information on the local situation. Related to this were comments that the program was not using the best or most recent information or was not consulting local people. One sixth of the respondents felt that the program they knew most about was poorly organised. Positive comments included that the program works well (11.7%) or that it was a good idea (8.3%).

Discussion
Landcare was the most familiar government strategy to respondents: the majority of respondents stated that they had heard about Landcare. Half of the respondents had heard of ICM and nearly one third had heard of PMP. These were very similar results to Survey 1.

A greater proportion of respondents in the lower catchment had heard of PMP than in the upper catchment. Similar to Survey 1, those who had heard about the strategies were more likely to come from the lower rural sample.

In both surveys, the majority of respondents knew most about Landcare compared to the other two strategies.

As in Survey 1, nearly 60% of respondents felt that the government strategy they knew most about had either been not at all useful or not very useful to them personally. There was consistency across the surveys and the four samples. Mean ratings were *moderate* to *not very useful.*

Respondents felt that the strategy they knew most about was neither effective nor ineffective in dealing with land and water issues on average, which indicates either that respondents were unaware of the effectiveness of the strategy or were undecided.

When respondents were asked how they came to know of the strategy, newspapers were the most frequent source, followed by television/television advertisements and the media in general. The order of responses was very similar in both surveys considering the time span between surveys, slightly different samples, and open-ended nature of the question. However, a higher percentage of respondents reported hearing of the strategy through personal experience in Survey 2.

In both surveys, the most frequent way for respondents to hear about ICM was through meetings, in general or canegrowers meetings specifically.

Respondents were asked if they were aware of any other government funded programs on wider environmental matters in the Herbert catchment. One fifth of respondents to this question were aware of other programs. Rather than ask to specify the programs, the study concentrated on respondents' opinions of these programs. The main comment was that it *lacked knowledge of the local situation.* Related to this were the comments *not consulting local people* and *not using best or most recent information.* While most of the prominent comments were negative, amongst them were the comments *it works well* and *good idea.*.

4.10 Activities of Integrated Catchment Management

This question was added to Survey 2 to gain input from the community on the most important activities for ICM. Respondents were asked to rate how important each activity was and then to rank from one to three the most important of the list of 11 activities.

How important is it to you that the following activities are part of Integrated Catchment Management?

1. Encourage community action at a catchment level.

Response	Rating	N (367)	Percent
very high importance	5	103	28.1
high	4	161	43.9
moderate	3	84	22.9
low	2	15	4.1
very low importance	1	4	1.1
TOTAL		367	100.0
Mean = 3.9			

The majority of respondents gave this activity a rating of high or very high importance (72%) and the mean score was high.

2. Raise the level of local awareness and knowledge of environmental management issues.

Response	Rating	N (368)	Percent
very high importance	5	125	34.0
high	4	166	45.1
moderate	3	62	16.8
low	2	10	2.7
very low importance	1	5	1.4
TOTAL		368	100.0
Mean = 4.1			

The majority of respondents gave *raising the level of local awareness and knowledge of environmental issues* a rating of very high or high importance (79.1%) and the mean score was high.

3. Encourage Local Government to take an active role in environmental management issues.

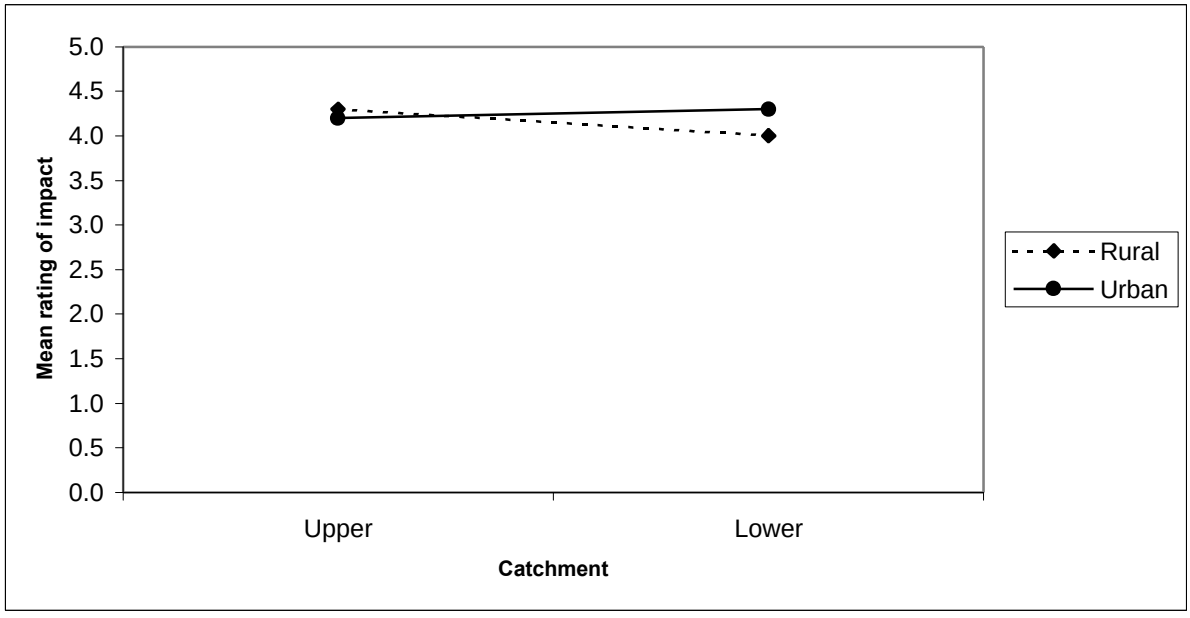
Response	Rating	N (368)	Percent
very high importance	5	161	43.8
high	4	143	38.9
moderate	3	49	13.3
low	2	6	1.6
very low importance	1	9	2.4
TOTAL		368	100.0
Mean = 4.2			

The overwhelming majority gave this activity a rating of very high or high importance (82.7%) and the mean was a little above high.

4. Encourage coordination of state government programs.

Response	Rating	N (371)	Percent
very high importance	5	148	39.9
high	4	155	41.8
moderate	3	52	14.0
low	2	14	3.8
very low importance	1	2	0.5
TOTAL		371	100.0
Mean = 4.2			

The majority (81.7%) rated this as high or very high. There was a significant two way interaction between upper and lower catchment versus urban and rural location, (below).



Within the rural sample, upper catchment respondents rated this activity significantly higher than lower catchment respondents (means 4.3 and 4.0) and within the lower catchment sample, urban respondents rated this activity significantly higher than rural respondents (means 4.3 and 4.0).

5. Undertake specific on ground projects with other bodies.

Response	Rating	N (362)	Percent
very high importance	5	87	24.0
high	4	173	47.8
moderate	3	83	22.9
low	2	14	3.9
very low importance	1	5	1.4
TOTAL		362	100.0
Mean = 3.9			

A large percentage of respondents to this question rated *undertaking specific on ground projects with other bodies* as very high or highly important (71.8%) and the mean was high.

6. Provide a continuing source of advice to local government on catchment issues.

Response	Rating	N (367)	Percent
very high importance	5	128	34.9
high	4	172	46.9
moderate	3	52	14.2
low	2	9	2.5
very low importance	1	6	1.6
TOTAL		367	100.0
Mean = 4.1			

Once again, the majority of respondents rated this activity as very high or highly important (81.8%) and the mean was high.

7. Encourage research.

Response	Rating	N (367)	Percent
very high importance	5	163	44.4
high	4	145	39.5
moderate	3	49	13.4
low	2	6	1.6
very low importance	1	4	1.1
TOTAL		367	100.0
Mean = 4.2			

The majority of respondents rated *encouraging research* as a highly important or very highly important activity (83.9%) and the mean response was high.

8. Develop solutions for and better understanding of environmental problems in the Herbert catchment.

Response	Rating	N (369)	Percent
very high importance	5	172	46.6
high	4	151	40.9
moderate	3	37	10.0
low	2	7	1.9
very low importance	1	2	0.5
TOTAL		369	100.0
Mean = 4.3			

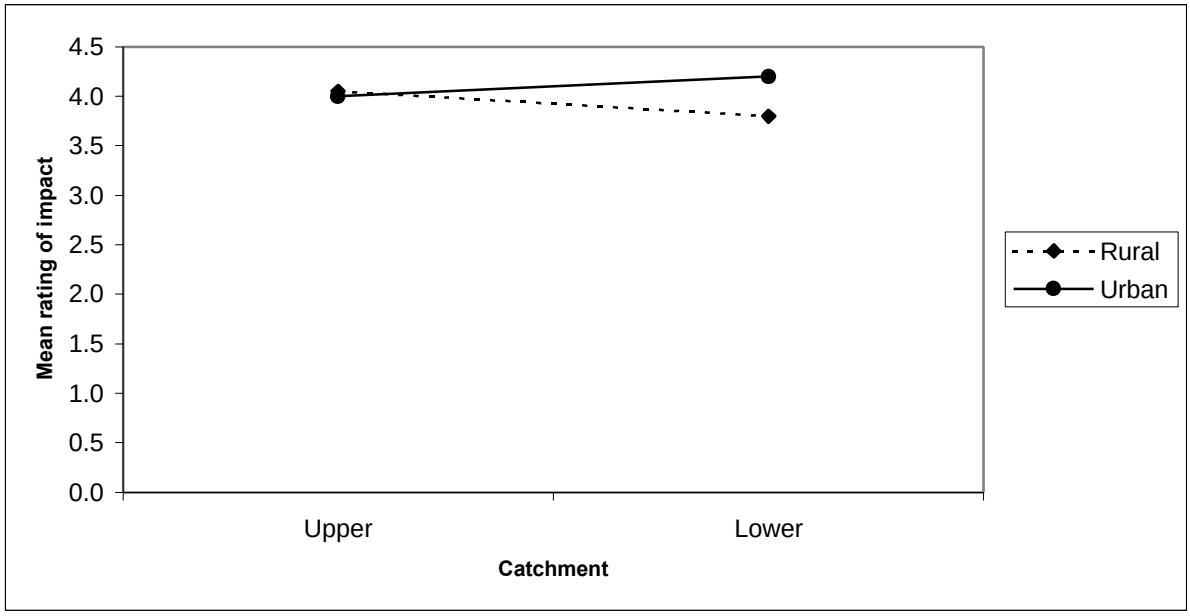
Most respondents rated this activity as very high or highly important (87.5%) and the mean was between high and very high.

9. Encourage discussion between community interest groups on environmental issues.

Response	Rating	N (366)	Percent
very high importance	5	109	29.8
high	4	165	45.1
moderate	3	73	19.9
low	2	14	3.8
very low importance	1	5	1.4
TOTAL		366	100.0
Mean = 4.0			

The majority of respondents rated *encouraging discussion between community interest groups on environmental issues* as very high or highly important (74.9%) and the mean response was high.

There was a significant two way interaction between the upper and lower catchment versus urban and rural location, as shown below. For the lower catchment sample, urban respondents rated this activity as more important than rural respondents (means 4.2 and 3.8).

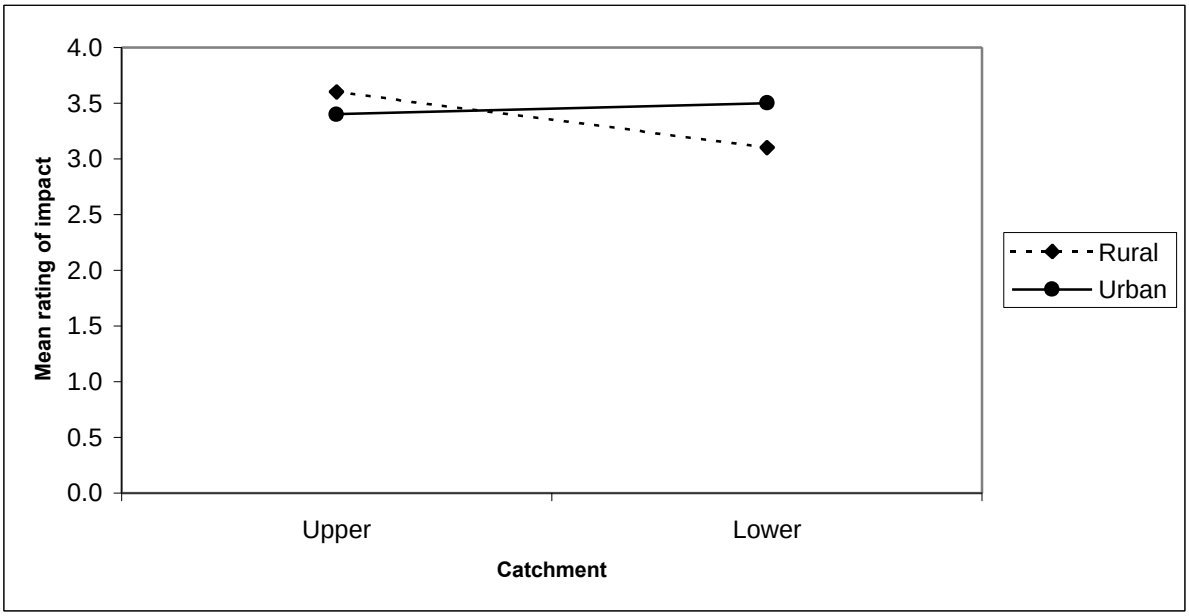


10. Separate ICM programs for the Upper and Lower Herbert catchments.

Response	Rating	N (351)	Percent
very high importance	5	68	19.4
high	4	100	28.5
moderate	3	91	25.9
low	2	58	16.5
very low importance	1	34	9.7
TOTAL		351	100.0
Mean = 3.3			

Nearly half of the sample rated this as important or highly important (47.9%). Approximately one quarter of the sample rated it as moderately important and another quarter as low or very low importance. The mean score of 3.3 was the lowest of the eleven possible activities for ICM.

There was a significant two way interaction as shown below. Within the lower catchment, urban respondents rated this activity as more important than rural respondents (means 3.5 and 3.0). Within the rural sample, upper catchment respondents rated this activity higher than lower catchment respondents (means 3.6 and 3.0).



11. Encourage joint projects between community, industry and state and local government.

Response	Rating	N (368)	Percent
very high importance	5	160	43.5
high	4	142	38.6
moderate	3	50	13.6
low	2	12	3.3
very low importance	1	4	1.1
TOTAL		368	100.0
Mean = 4.2			

A large percentage of respondents rated this activity as very high or highly important (82.1%) and the mean response was high.

And please rank the three most important activities to you: 1 is most important.
1. Encourage community action at a catchment level.

Ranking	N (244)	Percent
First	24	9.8
Second	23	9.4
Third	20	8.2
No rank	177	72.5
TOTAL	244	100.0

2. Raise the level of local awareness and knowledge of environmental management issues.

Ranking	N (244)	Percent
First	36	14.7
Second	31	12.7
Third	38	15.6
No rank	139	57.0
TOTAL	244	100.0

3. Encourage Local Government to take an active role in environmental management issues.

Ranking	N (241)	Percent
First	33	13.7
Second	31	12.9
Third	21	8.7
No rank	156	64.7
TOTAL	241	100.0

4. Encourage coordination of state government programs.

Ranking	N (244)	Percent
First	18	7.4
Second	24	9.8
Third	16	6.6
No rank	186	76.2
TOTAL	244	100.0

5. Undertake specific on ground projects with other bodies.

Ranking	N (241)	Percent
First	4	1.6
Second	12	5.0
Third	6	2.5
No rank	219	90.9
TOTAL	241	100.0

6. Provide a continuing source of advice to local government on catchment issues.

Ranking	N (243)	Percent
First	7	2.9
Second	8	3.3
Third	13	5.3
No rank	215	88.5
TOTAL	243	100.0

7. Encourage research.

Ranking	N (243)	Percent
First	32	13.2
Second	34	14.0
Third	25	10.3
No rank	152	62.5
TOTAL	243	100.0

8. Develop solutions for and better understanding of environmental problems in the Herbert catchment.

Ranking	N (243)	Percent
First	40	16.5
Second	43	17.7
Third	21	8.6
No rank	139	57.2
TOTAL	243	100.0

9. Encourage discussion between community interest groups on environmental issues.

Ranking	N (242)	Percent
First	5	2.1
Second	12	4.9
Third	17	7.0
No rank	208	86.0
TOTAL	242	100.0

10. Separate ICM programs for the Upper and Lower Herbert catchments.

Ranking	N (242)	Percent
First	12	4.9
Second	7	2.9
Third	6	2.5
No rank	217	89.7
TOTAL	242	100.0

11. Encourage joint projects between community, industry and state and local government.

Ranking	N (242)	Percent
First	33	13.6
Second	26	10.7
Third	49	20.3
No rank	134	55.4
TOTAL	242	100.0

The eleven activities were examined in terms of the percentage of respondents who gave each a ranking of first and the percentage of respondents who gave each a ranking in the top three. As there were slight differences in the overall ranking, both are shown in the table below.

In either list, however, the five most important activities for ICM were:

- encourage joint projects between community, industry and state and local government;
- raise the level of local awareness and knowledge of environmental management issues;
- develop solutions for and better understanding of environmental problems in the Herbert catchment;
- encourage research; and
- encourage Local Government to take an active role in environmental management issues.

Activity	**Ranking of percentages (1st)**	**Ranking of percentages (1st, 2nd or 3rd)**
Encourage joint projects between community, industry and state and local government.	1	4
Raise the level of local awareness and knowledge of environmental management issues.	2	2
Develop solutions for and better understanding of environmental problems in the Herbert catchment.	3	1
Encourage research.	4	5
Encourage Local Government to take an active role in environmental management issues.	5	3
Encourage community action at a catchment level.	6	6
Encourage coordination of state government programs.	7	7
Encourage discussion between community interest groups on environmental issues.	8	10
Provide a continuing source of advice to local government on catchment issues.	9	9
Separate ICM programs for the Upper and Lower Herbert catchments.	10	8
Undertake specific on ground projects with other bodies.	11	11

Discussion

Overall, most of the eleven activities were rated as very high or highly important. The only activity rated as moderately important was *separate ICM programs for the Upper and Lower catchments,* which, in addition, was not ranked in the top three activities by 90% of respondents to the question.

While most activities were important for ICM to undertake, by examining the importance of the activities to respondents in comparison to each other, it can be seen that the most important activities were related to developing solutions, raising awareness, and encouraging Local Government involvement, research and joint projects between different parties. The least

important activities, compared to others, were separate ICM programs for the upper and lower catchments, providing advice to local government, encouraging discussion, and undertaking specific on ground projects.

4.11 The Herbert River Catchment Coordinating Committee

Have you heard of a group called the Herbert River Catchment Coordinating Committee?

	Survey 2		Survey 1	
Response	**N (376)**	**Percent**	**N (425)**	**Percent**
Yes	90	23.9	93	21.9
Vaguely	77	20.5	86	20.2
No	209	55.6	246	57.9
TOTAL	376	100.0	425	100.0

In Survey 2, a little over half of the respondents had not heard of the Herbert River Catchment Coordinating Committee while a little less than half had heard of the group, either definitely (23.9%) or vaguely (20.5%). These were very similar results to Survey 1.

Of those who had definitely heard of the HRCCC, 58% were from the lower rural sample which was more than the proportion of lower rural respondents in the overall sample. Only 9% were from the upper urban sample, less than to be expected and 12% were from the upper rural sample, similar to the number expected. From the lower urban sample, less than would be expected (21%) had heard of the HRCCC.

From highest to lowest, those who responded "Yes" or "Vaguely" comprised 61%, 54%, 35%, and 23% of the lower rural, upper rural, lower urban and upper urban samples respectively, the same order as in Survey 1. As ICM often has more of a presence in the lower catchment and a greater focus in rural rather than urban areas, this result was to be expected.

In Survey 1, it was found that a very similar percentage had heard of ICM and the HRCCC. In Survey 2, the result was the same: while 49.5% of respondents to the appropriate question had heard of ICM, 44.4% had at least vaguely heard of the HRCCC. In Survey 1, more than three quarters of those who had heard of ICM had heard of the HRCCC at least vaguely and in Survey 2, this was slightly lower, 68%. In addition, in both surveys, 21% of those who had not heard about ICM had at least vaguely heard of the HRCCC.

If yes or vaguely, what do you think the main purpose of the group is?
Of the 167 participants who responded that they had heard of the HRCCC, vaguely or otherwise, 156 gave 200 responses to this question (two responses were permitted). The frequency of responses is shown below, compared to the most prominent responses from Survey 1. This represents 172 (or 86%) of the total number of responses.

Purpose of HRCCC	Survey 2 N = 156		Survey 1 N = 161	
	N	%	N	%
Care for the catchment area	28	17.9	14	8.7
Conserve and manage water	19	12.2	21	13.0
Not sure/it has never been fully publicised locally	18	11.5	7	4.3
Preserve waterways (including land quality and river banks)	15	9.6	23	14.3
Raise awareness/inform the public of existing problems	14	9.0	8	5.0
Improve drainage systems (including in newly developed areas)	12	7.7	34	21.1
Coordinate groups to discuss problems (such as drainage)	10	6.4	8	5.0
Ensure water availability, cost and quality *	7	4.5	-	-
Control/mitigate flooding in the lower catchment (including a suggestion to dredge the Herbert River)	6	3.8	10	6.2
Form strategies to assist the community (eg to help with drainage disputes)	6	3.8	6	3.7
Set guidelines for development to care for use of land and water*	6	3.8	-	-
Research into problems of the catchment area **	6	3.8	-	-
Coordinate river use	5	3.2	12	7.4
Best management practice catchment management program in partnership with the community *	5	3.2	-	-
Programs to prevent environmental problems **	4	2.6	-	-
Manage water supply in the best way, for all users	4	2.6	3	1.9
Discuss degradation *	4	2.6	-	-
Maintain flow in the Herbert River and creeks/keep it clean	1	0.6	7	4.3
Combine all drainage board into one body (eg to cut costs and improve effectiveness)	1	0.6	6	3.7
Monitor fertiliser runoff	1	0.6	3	1.9
Dam the river	0	0	3	1.9
Calculate regular flood areas	0	0	7	4.3

* Not a prominent response in Survey 1 ** New category in Survey 2

Noticeably more prominent in Survey 2 were the perceived purpose to *care for the catchment area* and the response *not sure/it has never been fully publicised locally.*

Additional responses in Survey 2 were *research into problems of the catchment area* and *programs to prevent environmental problems.* Some responses were mentioned by very few people in Survey 1 and were more prominent in Survey 2: *ensure water availability, cost and quality; set guidelines for development to care for use of land and water; best management practice catchment management program in partnership with community;* and *discuss degradation.* Less prominent responses in Survey 2 than in Survey 1 were *preserve waterways* and *improve drainage systems*.

Has the group been effective in achieving its goals and purpose?
This question, new to Survey 2, was asked of those 167 respondents who had heard of the HRCCC.

Response	N (148)	Percent
Yes	6	4.1
To some extent	110	74.3
No	32	21.6
TOTAL	148	100.0

The majority (74%) of the 148 respondents to this question indicated that they believed that the HRCCC was effective in achieving its goals and purposes to some extent.

Are there any specific things that you know they have done? Please describe.
This question was also new to Survey 2 and was asked to gain some understanding of the level of community awareness of HRCCC activities. Three responses were permitted to this question. Of those 167 respondents who had heard of the HRCCC, 89 answered this question (53.3%) and provided 122 responses, of which 89 (or 73%) are listed in the table.

Specific activities	N (89)	Percent
Unaware/don't know	20	22.5
Tree planting on riverbanks (eg to prevent destruction of river banks)	15	16.9
Survey water availability and quality	8	9.0
Work on the banks of the Herbert River	7	7.9
Erecting owl boxes and perches	7	7.9
Weed control	7	7.9
Formation of water drainage	6	6.7
Remove flood gates	4	4.5
Acid sulphate soils workshop	3	3.4
Work on the banks of the Annabranch River	3	3.4
Identify sites suitable for dams	3	3.4
Research into catchment area	3	3.4
Rock walling at Long Pocket	3	3.4

A large percentage responded that they were *unaware or didn't know* of any specific activities of the HRCCC. Considering the large percentage of those who had heard of the HRCCC and did not respond to this question, the percentage of respondents who were unaware of the specific activities of the HRCCC may be much larger. A large proportion mentioned *tree planting on riverbanks* and related to this were the responses: *work on the banks of the Herbert River* or *work on the banks of the Annabranch River*.

In your opinion, are they progressing quickly enough?
The 167 respondents who had heard of the HRCCC were asked whether the HRCCC was progressing quickly enough, a new question in Survey 2. Of those respondents, 147 answered this question (88%). The majority of responses were split between *no* (49%) and *to some extent* (46.3%) as shown in the table below.

Response	N (147)	Percent
Yes	7	4.8
To some extent	68	46.3
No	72	49.0
TOTAL	147	100.0

In your opinion, are they heading in the right direction?
Those who had heard of the HRCCC were also asked whether they were heading in the right direction, again a new question in Survey 2. A much larger percentage of respondents to this question believed that the HRCCC were heading in the right direction at least to some extent (approximately 90%).

Response	N (144)	Percent
Yes	42	29.2
To some extent	88	61.1
No	14	9.7
TOTAL	144	100.0

Discussion

Slightly less than half of the respondents had heard of the HRCCC, either definitely or vaguely, a very similar percentage to Survey 1. A higher proportion of people in the lower rural sample had heard of the HRCCC than from the other samples. As was to be expected, the order of the samples was the same as in Survey 1: lower rural, upper rural, lower urban and upper urban samples.

Those who had heard of the HRCCC were asked what they perceived to be the main purpose of the group. The most prominent responses were slightly different to Survey 1: *care for the catchment area*; *conserve and manage water*; and *not sure/it has never been fully publicised.* The first and third statement were more prominent in Survey 2. Less prominent in Survey 2 were: *preserve waterways* and *improve drainage systems.*

Survey 2 also asked those respondents who had heard of the HRCCC about the effectiveness, speed of progress, specific activities and direction of the HRCCC. The majority believed that the group had been effective in achieving its goals and purposes to some extent. Half felt that it was not progressing quickly enough and a little less than half felt that it was to some extent.

The most prominent response to the question about the HRCCC's perceived activities was *unaware/don't know.* The low response rate to the question may mean that the actual proportion may be much higher. There was, however, awareness of many different activities.

4.12 Responsibility and Control, Views on Government, Awareness and Intentions

Participants were asked to rate how much they agreed or disagreed with the following statements about responsibility and control, views on government, and awareness and intentions. 'Responsibility and control' includes the perceived ability of residents to control land and water management issues and the assigned responsibility for dealing with such issues. 'Views on government' includes levels of trust and perceived competence and 'awareness and intentions' includes levels of awareness and preparedness to become involved in relevant activities. These were all considered to be potential influences on the implementation of ICM. Those who considered any issues not applicable were presented but not included within mean scores and subsequent analyses.

4.12.1 Responsibility and Control

There are things I can do personally to help improve the environment. (Repeat)

Response	Rating	N (388)	Percent
strongly agree	5	72	18.6
agree	4	225	58.0
neither agree nor disagree	3	54	13.9
disagree	2	14	3.6
strongly disagree	1	7	1.8
not applicable		16	4.1
TOTAL		388	100.0
Mean = 3.9			

The majority (76.6%) of respondents agreed or strongly agreed with this statement. There was no difference between the surveys for those respondents involved in both surveys. For the overall samples, agreement was higher in Survey 2 than in Survey 1 (means 3.9 and 3.8). Comparing the urban and rural samples and upper and lower catchment samples, upper catchment respondents were more likely to agree than lower catchment respondents (means 4.1 and 3.9) whereas in Survey 1 there were no differences between samples.

It's too hard to think about land and water management issues for an area as big as the Herbert catchment. (Repeat)

Response	Rating	N (387)	Percent
strongly agree	5	5	1.3
agree	4	33	8.5
neither agree nor disagree	3	63	16.3
disagree	2	192	49.6
strongly disagree	1	84	21.7
not applicable		10	2.6
TOTAL		387	100.0
Mean = 2.2			

There was general disagreement with this statement: 71.3% disagreed or strongly disagreed and the mean score was very close to disagreement. There were no significant differences between the mean scores in both surveys, either for the overall samples or for those who participated in both surveys.

Rural respondents more likely to disagree that *it's too hard to think about land and water management issues for an area as big as the Herbert catchment* than rural respondents (means 2.1 and 2.2).

There were no differences between the upper and lower catchment whereas in Survey 1 there was one difference among the four samples. Compared with the lower rural sample, the upper rural sample was more likely to disagree with the statement. While the difference was only in terms of degree, it was nonetheless interesting given that the upper area of the Herbert occupies the largest part of the catchment.

As in Survey 1, most participants in Survey 2 also agreed that managing land and water in the Herbert is difficult because the Herbert catchment covers a large area (see Section 4.6). Once again it is of interest that despite this widespread opinion, there was general disagreement in both surveys that it is too hard to think about land and water management issues for an area as big as the Herbert catchment. Thus while land and water management in the Herbert may be difficult, it is definitely not viewed as impossible despite the size of the catchment.

I don't usually have the finances available to plan more than a year ahead. (Repeat)

Response	Rating	N (386)	Percent
strongly agree	5	91	23.6
agree	4	167	43.3
neither agree nor disagree	3	56	14.5
disagree	2	32	8.3
strongly disagree	1	9	2.3
not applicable		31	8.0
TOTAL		386	100.0
Mean = 3.8			

The majority of respondents (66.9%) agreed or strongly agreed with the statement *I don't usually have the finances available to plan more than a year ahead.* Repeat respondents more strongly agreed with this statement in Survey 2 than in Survey 1 (means 3.8 and 3.5) and overall, respondents more strongly agreed in Survey 2 than in Survey 1 (means 3.8 and 3.7).

There were no significant differences between the urban and rural samples or between the upper and lower catchment samples. This was different to Survey 1 in which those in the lower rural sample were less likely to agree compared with the two urban samples.

There are things local community groups can do to help improve the environment. (Repeat)

Response	Rating	N (388)	Percent
strongly agree	5	74	19.0
agree	4	273	70.2
neither agree nor disagree	3	29	7.5
disagree	2	6	1.5
strongly disagree	1	4	1.0
not applicable		3	0.8
TOTAL		388	100.0
Mean = 4.0			

The vast majority of respondents (89.2%) either agreed or strongly agreed that *there are things local community groups can do to help improve the environment,* a very similar result to Survey 1. Very few respondents disagreed or felt that it was not applicable.

There was consistency between the four samples as in Survey 1.

Catchment management should be paid for and run by the government. (New)

Response	Rating	N (388)	Percent
strongly agree	5	70	18.0
agree	4	138	35.6
neither agree nor disagree	3	123	31.7
disagree	2	46	11.9
strongly disagree	1	8	2.1
not applicable		3	0.8
TOTAL		388	100.0
Mean = 3.6			

A little over half (53.6%) of the respondents to this question agreed or strongly agreed that *catchment management should be paid for and run by the government*, a relatively large percentage neither agreed nor disagreed and very few respondents felt that this was not applicable.

There was consistency between the four samples.

ICM should remain a voluntary activity by community members. (New)

Response	Rating	N (388)	Percent
strongly agree	5	19	5.0
agree	4	90	23.7
neither agree nor disagree	3	128	33.8
disagree	2	104	27.4
strongly disagree	1	21	5.5
not applicable		17	4.5
TOTAL			100.0
Mean = 2.9			

Respondents were relatively indecisive about this issue, with 33.8% stating that they neither agreed nor disagreed and opinions were fairly evenly split between agreement (28.7%) and disagreement (32.9%).

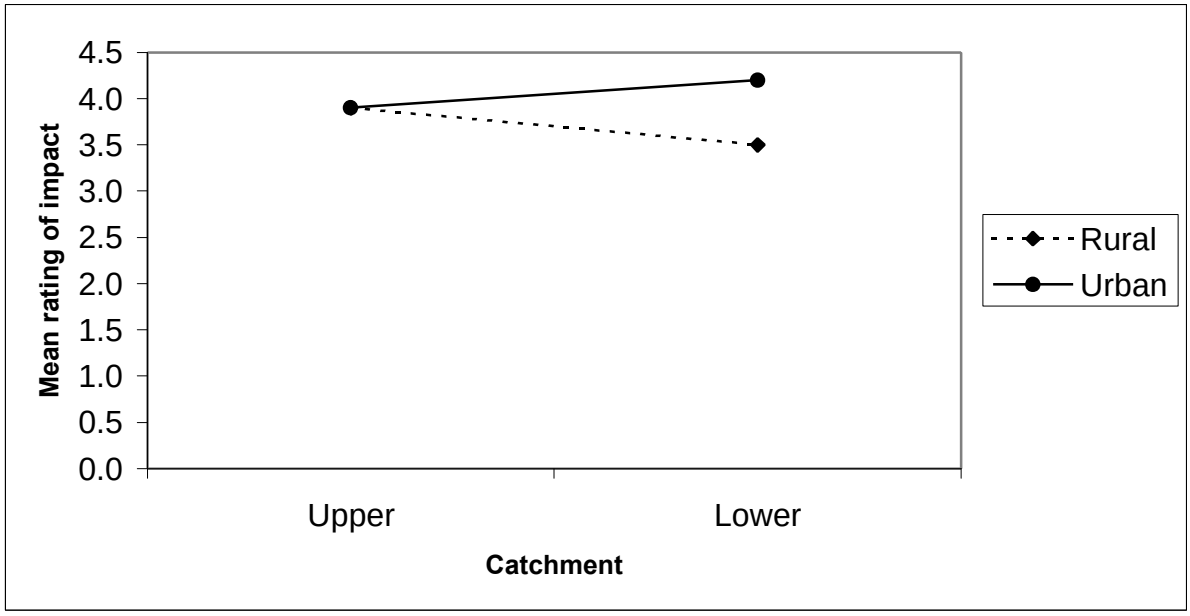
Rural respondents were more likely to agree with this statement than urban respondents (means 3.1 and 2.8).

Many environmental problems come from the way people manage their properties. (Repeat)

Response	Rating	N (388)	Percent
strongly agree	5	94	24.2
agree	4	193	49.7
neither agree nor disagree	3	65	16.8
disagree	2	24	6.2
strongly disagree	1	10	2.6
not applicable		2	0.5
TOTAL			100.0
Mean = 3.9			

A large percentage (73.9%) agreed or strongly agreed that *many environmental problems come from the way people manage their properties,* a very similar result to Survey 1. A low percentage disagreed or stated that it was not applicable.

There was consistency between the two surveys, both for repeat respondents and for the overall samples. In comparing the four samples, urban respondents more strongly agreed than rural respondents (means 4.1 and 3.6) and there was a significant two way interaction, as shown below.



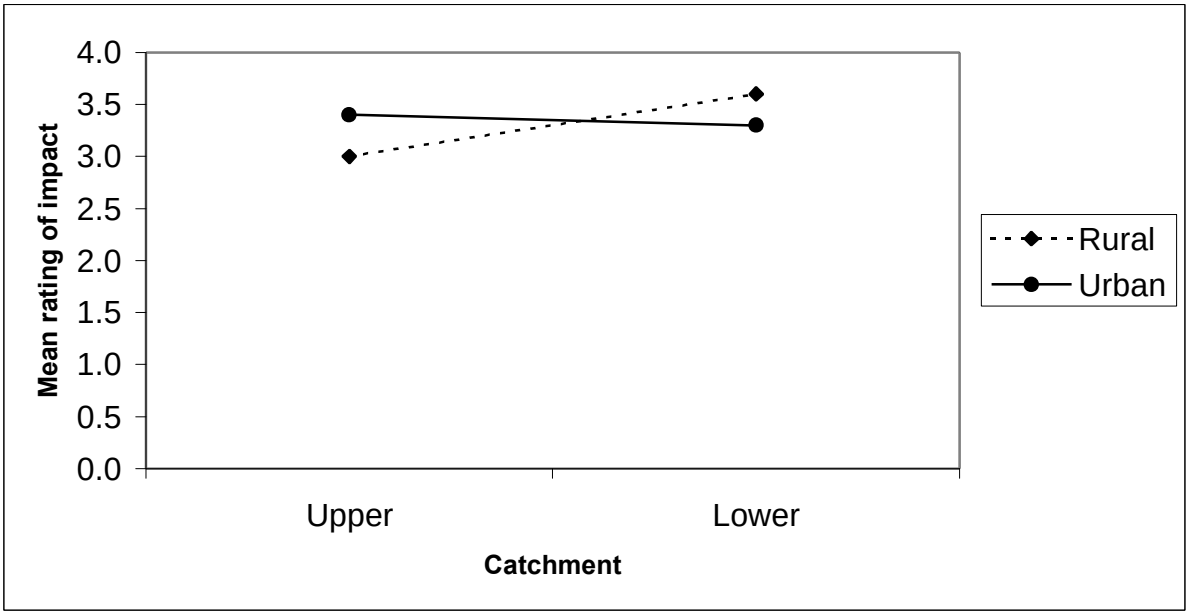
Within the lower catchment sample, urban respondents more strongly agreed with the statement than rural respondents. Within the rural sample, upper catchment respondents more strongly agreed than lower catchment respondents and within the urban sample, lower catchment respondents more strongly agreed than upper catchment respondents. These are very similar results to Survey 1 in which lower rural respondents were less likely to agree with the statement than upper rural and lower urban respondents.

The government expects too much from local communities in catchment management. (New)

Response	Rating	N (388)	Percent
strongly agree	5	39	10.1
agree	4	134	34.8
neither agree nor disagree	3	151	39.2
disagree	2	50	13.0
strongly disagree	1	6	1.6
not applicable		5	1.3
TOTAL			100.0
Mean = 3.4			

A larger percentage of respondents agreed or strongly agreed that *the government expects too much from local communities in catchment management* (44.9%) than disagreed or strongly disagreed (14.6%). A large percentage (39.2%), however, neither agreed nor disagreed with the statement. Very few felt that it was not applicable.

There was a significant difference between catchment samples: lower catchment respondents more strongly agreed than upper catchment respondents (means 3.5 and 3.2), and there was a significant two way interaction between upper and lower catchment versus urban and rural locations, as shown below.



Within the lower catchment sample, rural respondents more strongly agreed than urban respondents and within the rural sample, lower catchment respondents more strongly agreed than upper catchment respondents.

Laws should be changed to make landholders more responsible for the consequences of their activities. (Repeat)

Response	Rating	N (388)	Percent
strongly agree	5	86	22.1
agree	4	140	36.0
neither agree nor disagree	3	92	23.7
disagree	2	46	11.8
strongly disagree	1	23	5.9
not applicable		2	0.5
TOTAL			100.0
Mean = 3.6			

Many respondents (58.1%) agreed or strongly agreed that *laws should be changed to make landholders more responsible for the consequences of their activities*. A relatively large percentage (23.7%) neither agreed nor disagreed with this statement.

There was no significant difference between the ratings provided by respondents involved in both surveys or for the overall samples.

There was, however, a significant difference between urban and rural respondents: urban respondents were more likely to agree with the statement than rural respondents (means 4.0 and 3.2). In Survey 1, however, there were further differences. Lower urban respondents were more likely to agree than both rural samples and upper urban respondents were more likely to agree than lower rural respondents.

4.12.2 Views on Government

Programs like Integrated Catchment Management interfere with people's rights to make their own decisions. (Repeat)

Response	Rating	N (384)	Percent
strongly agree	5	19	4.9
agree	4	59	15.4
neither agree nor disagree	3	144	37.5
disagree	2	107	27.9
strongly disagree	1	39	10.2
not applicable		16	4.2
TOTAL		384	100.0
Mean = 2.8			

Nearly 40% neither agreed nor disagreed with this statement and the mean reflected this result. There was a great deal of consistency between the two surveys, for both repeat respondents and the overall samples, and consistency between the upper and lower catchment and urban and rural respondents. This was similar to Survey 1 in which there were no significant differences, despite a trend for those in the lower rural sample to be more likely to agree.

The government needs to give more resources to voluntary groups. (New)

Response	Rating	N (388)	Percent
strongly agree	5	83	21.4
agree	4	189	48.7
neither agree nor disagree	3	77	19.8
disagree	2	23	5.9
strongly disagree	1	11	2.8
not applicable		5	1.3
TOTAL		388	100.0
Mean = 3.8			

The majority of respondents (70.1%) agreed or strongly agreed that *the government needs to give more resources to voluntary groups* and very few disagreed or felt that it was not applicable.

No significant differences were found between the upper and lower catchment samples or between the urban and rural samples.

Different government agencies often give conflicting information on land and water management issues. (New)

Response	Rating	N (388)	Percent
strongly agree	5	75	19.4
agree	4	206	53.2
neither agree nor disagree	3	89	23.0
disagree	2	5	1.3
strongly disagree	1	1	0.3
not applicable		11	2.8
TOTAL			100.0
Mean = 3.9			

The majority (72.6%) of respondents agreed or strongly agreed that *different government agencies often give conflicting information on land and water management issues.* Nearly all of the remaining respondents neither agreed nor disagreed (23%).

There was consistency between the upper and lower catchment and urban and rural respondents.

There should be better government incentives for landholders to address environmental issues/problems. (New)

Response	Rating	N (388)	Percent
strongly agree	5	133	34.5
agree	4	197	51.0
neither agree nor disagree	3	34	8.8
disagree	2	14	3.6
strongly disagree	1	4	1.0
not applicable		4	1.0
TOTAL			100.0
Mean = 4.1			

The majority of respondents (85.5%) agreed or strongly agreed that *there should be better government incentives for landholders to address environmental issues/problems.*

A significant difference was found between the urban and rural samples, rural respondents more strongly with this statement than urban respondents (means 4.3 and 4.1).

ICM programs should have legislative backing. (New)

Response	Rating	N (388)	Percent
strongly agree	5	39	10.4
agree	4	152	40.4
neither agree nor disagree	3	142	37.8
disagree	2	24	6.4
strongly disagree	1	9	2.4
not applicable		10	2.7
TOTAL			100.0
Mean = 3.5			

While half of the respondents to this question agreed or strongly agreed that *ICM programs should have legislative backing*, nearly 40% neither agreed nor disagreed. Urban respondents were more likely to agree than rural respondents (means 3.7 and 3.4).

The government gives plenty of resources to voluntary groups. (New)

Response	Rating	N (388)	Percent
strongly agree	5	9	2.3
agree	4	28	7.3
neither agree nor disagree	3	154	40.0
disagree	2	144	37.4
strongly disagree	1	45	11.7
not applicable		5	1.3
TOTAL			100.0
Mean = 2.5			

The largest percentage of respondents (40%) neither agreed nor disagreed that *the government gives plenty of resources to voluntary groups.* The mean score was closer to disagreement than agreement and 37.4% disagreed with the statement. There were no differences between the upper and lower catchment or between the urban and rural respondents.

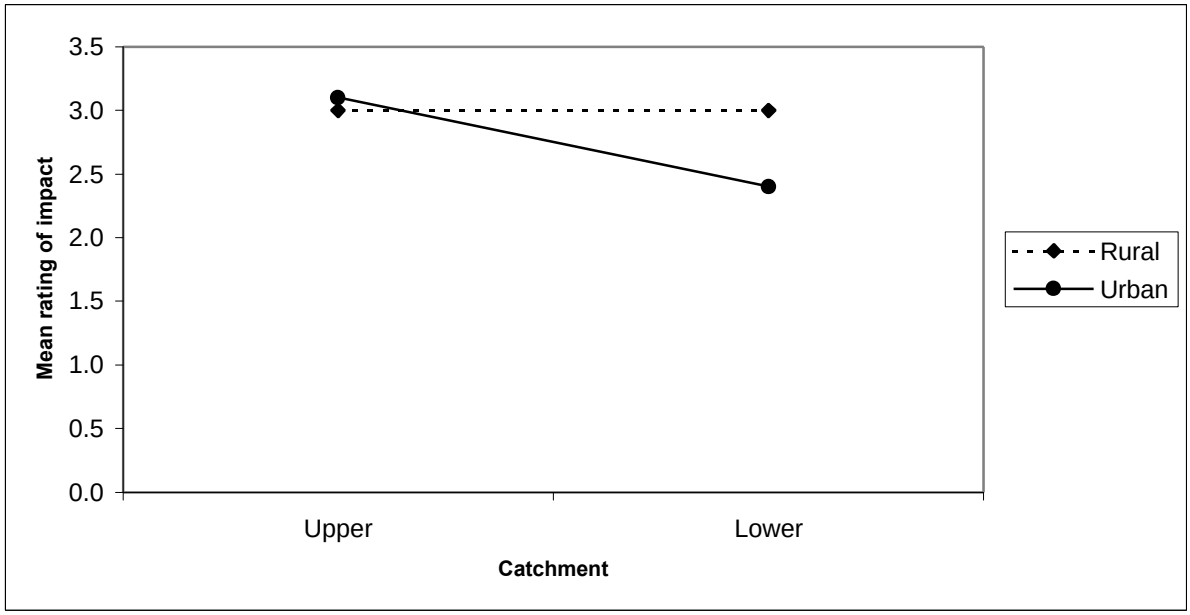
4.12.3 Awareness and Intentions

The local environment is no worse off than it was when I first lived here. (Repeat)

Response	Rating	N (388)	Percent
strongly agree	5	42	10.8
agree	4	92	23.6
neither agree nor disagree	3	70	17.9
disagree	2	113	29.0
strongly disagree	1	69	17.7
not applicable		4	1.0
TOTAL			100.0
Mean = 2.8			

There was a split opinion on this statement, as there was in Survey 1: while 34.4% agreed to some extent, 46.7% disagreed to some extent and only 17.9% neither agreed nor disagreed. Very few responded that this statement was not applicable. There were no significant differences between the two surveys.

Upper catchment respondents were significantly more likely to agree with this statement than lower catchment respondents (means 3.1 and 2.7). In addition, a two way interaction was found: within the lower catchment sample, urban respondents were less likely to agree than rural respondents and within the urban sample, lower catchment respondents were less like to agree than upper catchment respondents, as shown below. This is very similar to the Survey 1 results in which the lower urban sample were less likely to agree than the three other samples.

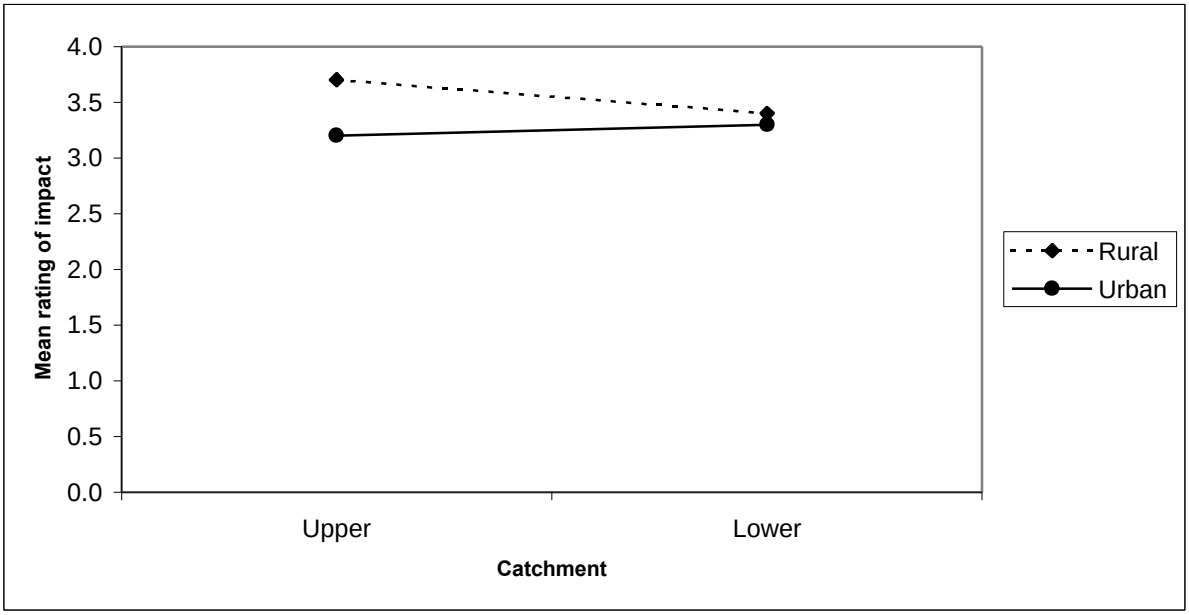


I would be prepared to assist in local projects such as riverbank stabilisation. (Repeat)

Response	Rating	N (388)	Percent
strongly agree	5	20	5.2
agree	4	142	36.9
neither agree nor disagree	3	100	26.0
disagree	2	45	11.7
strongly disagree	1	10	2.6
not applicable		68	17.7
TOTAL			100.0
Mean = 3.4			

While just over 40% agreed or strongly agreed that they would be prepared to assist in local projects, a relatively large percentage neither agreed nor disagreed (26%). Relative to other statements, a large percentage felt that this was not applicable to them. Interestingly, of those who felt that this statement was not applicable to them, 70.6% were from the urban sample (70% in Survey 1) while urban respondents made up 53.1% of the overall sample. There was consistency between the two surveys, both for repeat respondents and the overall sample.

Comparing catchment samples and location samples, rural respondents were more likely to agree than urban respondents (means 3.5 and 3.2) and a significant interaction was found, as shown below. Within the rural sample, upper catchment respondents were more likely to agree than lower catchment respondents and within the upper catchment sample, rural respondents were more likely to agree than urban respondents. In both surveys, upper rural respondents were most like to agree that they *would be prepared to assist in local projects such as riverbank stabilisation.* However, in Survey 1, they were only significantly more likely than the lower urban sample to agree.



It is likely that I will become involved (or stay involved) with a Landcare or catchment group over the next year or two. (Repeat)

Response	Rating	N (388)	Percent
strongly agree	5	16	4.2
agree	4	70	18.3
neither agree nor disagree	3	124	32.4
disagree	2	77	20.1
strongly disagree	1	21	5.5
not applicable		75	19.6
TOTAL			100.0
Mean = 2.9			

The most frequent response to this statement was neither agree nor disagree (32.4%), a little over one fifth of respondents agreed or strongly agreed and slightly more than one fifth of respondents disagreed or strongly disagreed with the statement. A relatively large percentage of respondents felt that this was not applicable to them. Of those who responded *not applicable*, 69.3% were from the urban sample (a similar percentage to Survey 1), higher than the 53.1% to be expected.

There was consistency between the two surveys, for both repeat respondents and the overall samples. Examining differences between the upper and lower catchment and urban and rural respondents revealed that rural respondents were more likely to agree with the statement than urban respondents (means 3.1 and 2.8). This was slightly different to the Survey 1 results in which lower rural respondents were more likely to agree than lower urban respondents.

I could personally benefit from being involved in group activities to help manage land and water. (Repeat)

Response	Rating	N (388)	Percent
strongly agree	5	19	4.9
agree	4	103	26.8
neither agree nor disagree	3	109	28.4
disagree	2	70	18.2
strongly disagree	1	19	4.9
not applicable		64	16.7
TOTAL			100.0
Mean = 3.1			

Nearly one third of respondents agreed or strongly agreed with this statement. A relatively large percentage neither agreed nor disagreed with the statement (28.4%) and a relatively large percentage felt that it was not applicable. Of those respondents who felt that the statement was not applicable, 73.4% came from the urban sample, higher than the percentage of urban respondents in the overall sample (53.1%), a similar result to Survey 1 (76%). Repeat respondents were less likely to agree in Survey 2 than in Survey 1 (means 3.2 and 3.3).

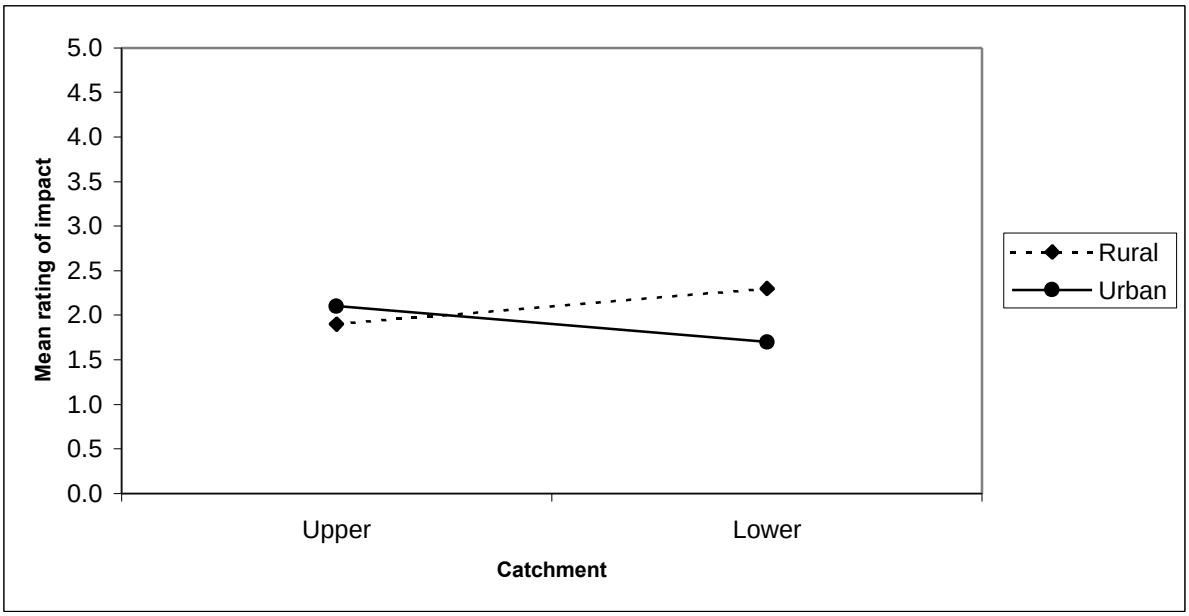
Rural respondents more strongly agreed than urban respondents (means 3.3 and 2.9), which was to be expected. This difference between rural and urban respondents existed in the lower catchment sample in Survey 1.

There aren't any environmental problems that need urgent action. (New)

Response	Rating	N (388)	Percent
strongly agree	5	13	3.4
agree	4	17	4.4
neither agree nor disagree	3	53	13.8
disagree	2	174	45.2
strongly disagree	1	125	32.5
not applicable		3	0.8
TOTAL			100.0
Mean = 2.0			

The mean rating for this statement was *disagree* and a large percentage (77.7%) disagreed or strongly disagreed with the statement *there aren't any environmental problems that need urgent action.* Less than 1% felt that this statement was not applicable.

A significant interaction was found, as shown in the figure below. Within the lower catchment sample, urban respondents more strongly disagreed than rural respondents. Within the rural sample, upper catchment respondents more strongly disagreed than lower catchment respondents and within the urban sample, lower catchment respondents more strongly disagreed than upper catchment respondents.



Discussion

The table below summarises the degree of agreement or disagreement with the statements.

Where greater than 80% of the sample agreed (strongly agreed or agreed) or disagreed (strongly disagreed or disagreed) with the statement, this is indicated by 'high agreement' or 'high disagreement'.

Where 60% to 80% of the sample agreed or disagreed with the statement, this is indicated by 'general agreement' or 'general disagreement'.

Where there was a spread of opinion from strongly agree to strongly disagree, this is indicated by 'split opinion'.

Responsibility and Control

Statement	Survey 2	Survey 1
There are things I can do personally to help improve the environment.	General agreement	General agreement
It's too hard to think about land and water management issues for an area as big as the Herbert catchment.	General disagreement	General disagreement
I don't usually have the finances available to plan more than a year ahead.	General agreement	General agreement
There are things local community groups can do to help improve the environment.	High agreement	High agreement
Catchment management should be paid for and run by the government.	Split opinion	n/a
ICM should remain a voluntary activity by community members.	Split opinionn/a	
Many environmental problems come from the way people manage their properties.	General agreement	General agreement
The government expects too much from local communities in catchment management.	Split opinionn/a	
Laws should be changed to make landholders more responsible for the consequences of their activities.	Split opinionSplit opinion	

In general, with respect to the perceived control residents had on land and water management, there was a great deal of agreement by all groups in both surveys, that there are things local community groups can do to help improve the environment. There was also general agreement by all respondents in both surveys, that there were things they could do personally to help improve the environment.

Most respondents in both surveys did not believe that it was too hard to think about land and water management issues for an area as big as the Herbert catchment, despite the general agreement earlier in the questionnaire that it did make land and water management more difficult. In Survey 2 rural respondents more strongly disagreed with this than urban respondents whereas in Survey 1 upper rural respondents more strongly disagreed than lower rural respondents.

Respondents believed that they and their community had control over land and water management issues in the Herbert catchment, despite the size. However, there was agreement by many respondents in both surveys that they did not have the finances available to plan more than a year ahead. This may make it difficult to plan for long term improvements.

Respondents generally agreed, in both surveys, that many environmental problems come from the way people manage their properties. There was a tendency in both surveys for urban respondents to agree more than rural respondents, although in Survey 1 only in the lower catchment.

When it came to changing laws to make landholders more responsible for the consequences of their activities, however, the sample of both surveys were divided. Although quite a large percentage agreed, quite a large percentage were undecided. Agreement was higher amongst urban respondents than rural respondents in Survey 2 and there was a tendency for this trend in Survey 1.

Three new statements were added in this section of Survey 2 relating to responsibility for dealing with land and water management issues. There was a split opinion on all three statements. Half of the respondents agreed that the government should pay for and run catchment management, however, one third neither agreed nor disagreed. Similarly nearly half of the sample agreed that the government expects too much from local communities in catchment management. There was less agreement that ICM should remain a voluntary activity with opinions being very divided. Rural respondents were more likely to agree than urban respondents.

In summary, respondents generally felt that they and the community could do things to help improve the environment despite the size of the Herbert catchment. Lack of finances may hinder the long term planning often required in environmental management.

While there was general agreement that many environmental problems come from the way people manage their properties, this did not follow through to widespread agreement that laws were needed to make landholders more responsible for the consequences of their activities.

In terms of the responsibility for catchment management, the answer was not very clear. While half of the respondents felt that the government should pay for and run catchment management and that the government expected too much from local communities in catchment management at the time, opinion was very divided on whether ICM should remain a voluntary activity by community members.

Views on Government

Statement	Survey 2	Survey 1
Programs like Integrated Catchment Management interfere with people's rights to make their own decisions.	Split opinion	Split opinion
The government needs to give more resources to voluntary groups.	General agreement	n/a
Different government agencies often give conflicting information on land and water management issues.	General agreement	n/a
There should be better government incentives for landholders to address environmental issues/problems.	High agreement	n/a
ICM programs should have legislative backing.	Split opinion.	n/a
The government gives plenty of resources to voluntary groups.	Split opinion	n/a

When it came to views on government, the table above shows that the highest agreement was with better incentives for landholders to address environmental issues/problems, rural more than urban respondents. While there was divided opinion on whether or not the government gives

plenty of resources to voluntary groups, the majority of respondents, across the samples, agreed that the government needs to give more resources to voluntary groups.

The majority of respondents, across the samples, agreed or strongly agreed that different government departments often give conflicting information on land and water management issues.

There was divided opinion about whether or not programs like Integrated Catchment Management interfere with people's rights to make their own decisions. This was consistent across the two surveys, location samples and catchment samples. While half of the respondents agreed that *ICM programs should have legislative backing,* nearly 40% neither agreed nor disagreed. Urban respondents agreed more than rural respondents.

In summary, respondents generally believed that better incentives were required for landholders to address environmental issues and while there was divided opinion about whether or not the government gave plenty of resources to voluntary groups, most agreed that more was needed. Government departments were perceived by most respondents to give conflicting information on land and water management issues.

The divided opinion about whether or not programs like ICM interfere with people's rights to make their own decisions and whether ICM programs should have legislative backing showed a range of opinions about the need for regulation.

Awareness and Intentions

Statement	Survey 2	Survey 1
The local environment is no worse off than it was when I first lived here.	Split opinion	Split opinion
I would be prepared to assist in local projects such as riverbank stabilisation.	Split opinion	Split opinion
It is likely that I will become involved (or stay involved) with a Landcare or catchment group over the next year or two.	Split opinion	Split opinion
I could personally benefit from being involved in group activities to help manage land and water.	Split opinion	Split opinion
There aren't any problems that need urgent action.	General disagreement	n/a

In terms of perceptions of environmental problems in the area, most respondents disagreed that there aren't any environmental problems that need urgent action (a new statement in Survey 2). There were some differences between the samples. Related to this, there was divided opinion in both surveys as to whether or not the local environment was no worse off than when people first lived there. Upper catchment respondents were more likely to feel that the local environment had stayed the same than in the lower catchment.

Opinions were fairly divided on the three statements about involvement, related to: preparedness to assist in local projects; becoming (or staying) involved in Landcare or a catchment group; or benefiting from being involved. There was a tendency in Survey 2 for rural respondents to agree more than urban respondents. For example, upper rural respondents were the most likely to agree that they would be prepared to assist in local projects; rural respondents agreed more than

urban that they would become involved (or stay involved) in Landcare or a catchment group and that they could personally benefit from being involved in group activities to help manage land and water.

A large percentage of the sample felt that the these were not applicable. As in Survey 1, around 70% of these were from the urban sample whereas overall urban respondents only made up around 53% of the sample.

4.13 Involvement

Over the last 12 months, have you been involved in any local community groups or associations?
While in Survey 1, 44% of the sample were currently involved in such groups, in Survey 121 (32%) of the 378 respondents to the question had been involved in local community groups or associations. The percentage was higher in the upper catchment (42%) than in the lower catchment (28%).

If yes, which groups or associations were they?
Those 121 participants who indicated that they had been involved in any local community groups or associations were asked in an open-ended question to list them. The following table provides a comparison with the categories used in Survey 1.

Community group/association	Survey 1 N (228)	Survey 1 Percent	Survey 2 N (121)	Survey 2 Percent
Progress Association	23	10.1	8	6.6
Rate Payers Association	13	5.7	4	3.3
Professional Association	18	7.9	2	1.6
Charity/Church/Welfare	66	28.9	15	12.4
Agriculture Related Organisation	65	28.5	15	12.4
Landcare, Conservation or similar	42	18.4	48	35.5
Sporting Group	103	45.2	11	9.1
Hobby/Craft Group	23	10.1	13	10.7
Community Action Group	23	10.1	0	0
Service Club	43	18.9	14	11.6
Parents and Friends	57	25.0	12	9.9
Other/s	44	19.3	61	50.4

If you were involved in any Landcare, conservation or similar types of groups, please write down the name of the group that you were most involved with.
Those 121 respondents who answered the previous question were asked to specify, if they had been involved in any Landcare, conservation or similar groups, which group they had been most involved with. Of the 37 responses made by participants, the main responses were Landcare groups (13), ICM (7); Waterwatch (3); Fishcare (2); and Trees for the Evelyn and Atherton Tableland (2). Other groups included the Australian Conservation Council, a tree planting program for future trees, town beautification, a progress association, rural women, Millstream redevelopment, Canegrowers, Herbert River Trust, and bushland rehabilitation.

Discussion
One third of those respondents had been involved in a local community group or association. The main categories were 'Landcare, Conservation or similar', 'Charity/Church/Welfare' and 'Agriculture Related Organisations'. As this was an open-ended question in Survey 2 a high percentage of responses fell into the 'Other' category, many only mentioned by very few respondents. Of the 37 respondents who indicated which Landcare, Conservation or similar group they were most involved with, the main responses were Landcare groups, ICM and Waterwatch.

4.14 The Local Community

Thinking of the local community where you live, please rate how much you agree or disagree with each of the following statements.
Results are presented below for each statement with a brief explanation of the degree of agreement or disagreement with each and significant differences between catchment samples or location samples. No significant two way interactions between catchment samples and locations samples were found. A comparison of the results from the two surveys is presented after the results for individual statements.

I'm not very interested in local issues.

Response	Rating	N (390)	Percent
strongly agree	5	6	1.5
agree	4	24	6.2
neither agree nor disagree	3	72	18.5
disagree	2	216	55.4
strongly disagree	1	72	18.5
TOTAL		390	100.0

Nearly three quarters of the sample (73.9%) disagreed or strongly disagreed that they weren't very interested in local issues and nearly one fifth neither agreed nor disagreed.

I feel quite comfortable in being a member of this local community.

Response	Rating	N (391)	Percent
strongly agree	5	65	16.6
agree	4	269	68.8
neither agree nor disagree	3	37	9.5
disagree	2	10	2.6
strongly disagree	1	10	2.6
TOTAL		391	100.0

The majority of respondents (85.4%) agreed with this statement, signifying that most respondents felt quite comfortable in being a member of their local community.

I have almost no influence over what happens in this community.

Response	Rating	N (389)	Percent
strongly agree	5	50	12.9
agree	4	169	43.4
neither agree nor disagree	3	85	21.9
disagree	2	71	18.3
strongly disagree	1	14	3.6
TOTAL		389	100.0

A little over half of the respondents (56.3%) agreed or strongly agreed that they have almost no influence over what happens in their community and a relatively large percentage neither agreed nor disagreed. Lower catchment respondents were more like to agree than upper catchment respondents (means 3.5 and 3.2) and urban respondents were more likely to agree than rural respondents (means 3.6 and 3.3).

It's very important to me to live in this particular community.

Response	Rating	N (389)	Percent
strongly agree	5	71	18.3
agree	4	170	43.7
neither agree nor disagree	3	119	30.6
disagree	2	21	5.4
strongly disagree	1	8	2.1
TOTAL		389	100.0

A large percentage of respondents (62%) agreed or strongly agreed that it was very important to them to live in their particular community and a relatively large percentage neither agreed nor disagreed. Lower catchment respondents were more likely to agree than upper catchment respondents (means 3.8 and 3.5).

People in this community generally don't get along with each other.

Response	Rating	N (390)	Percent
strongly agree	5	12	3.1
agree	4	42	10.8
neither agree nor disagree	3	87	22.3
disagree	2	194	49.7
strongly disagree	1	55	14.1
TOTAL		390	100.0

A large percentage (63.8%) disagreed with this statement, signifying that most respondents believed that people in their community generally do get along.

I often think about local community issues.

Response	Rating	N (389)	Percent
strongly agree	5	37	9.5
agree	4	222	57.1
neither agree nor disagree	3	100	25.7
disagree	2	28	7.2
strongly disagree	1	2	0.5
TOTAL		389	100.0

A large percentage (57.1%) agreed that they often did think about local community issues and one quarter of respondents neither agreed nor disagreed with the statement.

I and many others in this community share similar values.

Response	Rating	N (386)	Percent
strongly agree	5	41	10.6
agree	4	243	63.0
neither agree nor disagree	3	82	21.2
disagree	2	17	4.4
strongly disagree	1	3	0.8
TOTAL		386	100.0

The majority of respondents (73.6%) agreed or strongly agreed with this statement.

I think this community is a good place to live.

Response	Rating	N (392)	Percent
strongly agree	5	136	34.7
agree	4	229	58.4
neither agree nor disagree	3	20	5.1
disagree	2	7	1.8
strongly disagree	1	0	0.0
TOTAL		392	100.0

Most respondents (93.1%) felt that their community was a good place to live.

I can recognise many of the people who live in this community.

Response	Rating	N (392)	Percent
strongly agree	5	96	24.5
agree	4	267	68.1
neither agree nor disagree	3	22	5.6
disagree	2	6	1.5
strongly disagree	1	1	0.3
TOTAL		392	100.0

Most respondents (92.6%) could recognise many of the people living in their community.

I don't have the time to become involved in local community issues.

Response	Rating	N (388)	Percent
strongly agree	5	22	5.7
agree	4	116	29.9
neither agree nor disagree	3	147	37.9
disagree	2	87	22.4
strongly disagree	1	16	4.1
TOTAL		388	100.0

There were very divided opinions on this statement, while 35.6% agreed to some degree that they did not have the time to become involved in local community issues, 26.5% disagreed to some extent and 37.9% neither agreed nor disagreed.

Comparison of means in Survey 1 and Survey 2 (repeat respondents only)

Statement	Survey 2 Mean	Survey 1 Mean
I think this community is a good place to live. * 4.3	4.2	
I can recognise many of the people who live in this community.	4.1	4.1
I feel quite comfortable in being a member of this local community.	3.9	4.0
I and many others in this community share similar values.	3.8	3.8
It's very important to me to live in this particular community.	3.7	3.7
I often think about local community issues.	3.7	3.6
I have almost no influence over what happens in this community.	3.4	3.4
I don't have the time to become involved in local community issues.	3.1	3.2
People in this community generally don't get along with each other.	2.4	2.3
I'm not very interested in local community issues.2.2	2.4	

* denotes a significant difference ($p < .05$)

Discussion

There was greatest agreement by respondents about the feel of their community: that it was a good a place to live; they could recognise many of the people who lived there; they felt quite

comfortable living there; and people generally got along with each other. Most respondents felt they shared similar values with others in their community. Although it was very important to many respondents (more so in the lower catchment) to live in their particular community, a relatively large percentage neither agreed nor disagreed with this statement.

Opinions were more divided regarding involvement and influence in community issues. Over half the respondents agreed that they often thought about local community issues, related to the high degree of interest expressed in local community issues. In terms of involvement in local community issues, there was division over whether or not respondents had the time to be involved. A large percentage of respondents felt they had almost no influence over what happened in their community, more so in the lower catchment than the upper catchment and more so for urban respondents than for rural respondents.

4.15 Integrated Catchment Management and Local Government

Should Local Government have a role in Integrated Catchment Management?
Most (88.5%) of the 356 respondents who answered this question replied that Local Government should have a role in Integrated Catchment Management.

Please give reasons
The most prominent responses by participants are shown in the table below. In total, 394 answers were provided by 309 respondents of which 323 (82%) responses are shown. As the majority of respondents replied that Local Government should have a role in ICM, all of these reasons are related to why Local Government should have a role in ICM.

Reasons	N (309)	Percent
LG has knowledge of local environment	73	23.6
LG have more resources & information	38	12.3
A representation of local people, for views to be heard	30	9.7
In a better position to obtain funds for ICM	26	8.4
Within its region	25	8.1
Benefits all people and the environment	17	5.5
Uniformity of approach	15	4.9
More power to create changes and coordinate activities	15	4.9
Inform the community	13	4.2
Responsible for building and maintaining infrastructure	13	4.2
Affects/involves everyone in the community	11	3.6
Solve more problems	8	2.6
Pays rates to them	6	1.9
More supervision (eg. on the use of public monies)	6	1.9
Helps shire	6	1.9
Better management (eg. expertise)	6	1.9
Prevent conflict on land and water management issues	5	1.6
Affects Local Government planning	5	1.6
Share responsibility	5	1.6

The reasons respondents gave for the response that Local Government should not have a role in ICM were: too much inefficiency; ICM would be tied to politics; ICM is independent to Local Government; Government can not plan anything; different interests; Local Government activities conflict with measures needed for proper catchment management; and landowners are responsible for proper drainage.

Should Local Government Planning sometimes take into account Integrated Catchment Management?
Again, the majority of those who answered this question (93.8% of 336) believed that Local Government Planning should take into account ICM.

Please give reasons

The main reasons for participants' responses are shown in the table below. A total of 268 participants responded to the question, providing 307 responses. The table below lists 224 of those responses (73%).

Reasons	N (268)	Percent
Benefit or affect the community	34	12.7
Responsible for building and maintaining infrastructure *	20	7.5
Uniformity of approach *	18	6.7
Stop development in the wrong areas	18	6.7
LG have knowledge of local environment *	17	6.3
Provide better management for the future	16	6.0
Coordinate all activities	14	5.2
For local purposes/interests/issues	11	4.1
For management to be properly integrated	11	4.1
A representation of local people *	10	3.7
LG have more resources and funds for environmental issues	9	3.4
More planning is better/look at all issues of planning	8	3.0
Prevent conflict on land and water issues *	7	2.6
For greater control/to monitor local council work/watchdog	6	2.2
Affects ratepayers	5	1.9
A guide to verify plans to meet local conditions	5	1.9
Within its region *	5	1.9
Responsibility of LG	5	1.9
Should know what happens	5	1.9

* These categories were prominent reasons for Local Government to be involved in ICM.

Most of the respondents who believed that Local Government should not take ICM into account did not give reasons. The two reasons given were: Local Government is not capable of taking extra involvement; and too many inefficiencies would arise.

Discussion

The majority of respondents indicated that Local Government should have a role in ICM and that Local Government Planning should take into account ICM. The main reasons why Local Government should have a role in ICM were *Local Government has knowledge of local environment* and *Local Government have more resources and information.* There were no dominant reasons for why Local Government should not have a role in ICM.

The main reasons why respondents felt Local Government planning should take into account ICM were because it would *benefit or affect the community* and because they are *responsible for building and maintaining infrastructure.* Most respondents who did not think Local Government Planning should take ICM into account did not provide reasons. However, the two reasons given were *Local Government is not capable of taking extra involvement* and *too many inefficiencies would arise.*

4.16 Funding

For every $100 spent on catchment management and landcare,
A. how much of it do you think IS being contributed by:
B. how much of it do you think SHOULD be contributed by:

Parties	Perceptions of current contribution	Perceptions of what contributions should be
The Commonwealth Government	$29.08*	$34.39*
The Queensland Government	$29.84*	$27.03*
Local Government	$18.19	$15.82
Industry	$9.88*	$11.90*
Individual farmers	$12.41	$10.70

Means shown for 178 respondents who answered both sections. * Significant differences ($p<0.05$).

On average, the Commonwealth and Queensland Governments were thought to be contributing the largest amount of money to catchment management and landcare. Industry was seen to be contributing the least. Comparing the mean responses for those participants who completed both sections showed that respondents felt that the Commonwealth Government should be contributing significantly more than it was currently contributing, and still more than the other parties.

Comparing the upper and lower catchment and rural and urban respondents, the means were as follows. The underlining indicates significant differences between the perceptions of current contributions and perceptions of what the contributions should be in the future.

For a question of this nature, however, the differences were quite small. The overall system was therefore regarded as reasonably equitable by respondents.

Perceptions of current contributions

	Upper Catchment	Lower Catchment	Rural Respondents	Urban Respondents
Commonwealth government	$35.51*	$26.77*	$29.41	$29.09
Queensland government	$32.57	$28.29	$27.39	$31.98
Local government	$14.79	$19.35	$16.07	$20.35
Industry	$4.91*	$11.89*	$10.78	$8.87
Farmers	$11.85	$12.47*	$15.52*	$8.55*

* Significant differences between means ($p<0.05$).

Perceptions of what the contributions should be

	Upper Catchment	Lower Catchment	Rural Respondents	Urban Respondents
Commonwealth government	$39.03	$34.94	$38.75*	$33.34*
Queensland government	$29.82	$26.26	$29.35*	$25.10*
Local government	$12.11*	$16.94*	$14.69	$16.46
Industry	$10.23	$11.53	$9.65*	$12.74*
Farmers	$8.55	$10.23	$7.48*	$12.12*

* Significant difference between means ($p<0.05$).

Within the upper catchment, it was thought that industry should be contributing significantly more than they were at the time whereas in the lower catchment, respondents overall felt that the Commonwealth government should be contributing more.

Rural respondents on the whole felt that the Commonwealth government should be contributing more and farmers less. Urban respondents were quite different. They thought that the Queensland government should be contributing less and that industry and farmers should be contributing more than they were at the time.

A number of people chose not to answer the question, stating on their questionnaires that they did not know how much money was being contributed, that they found it difficult to answer or that they did not want to guess. Two respondents stated that they found the question to be pointless. In future, supplementary equity questions could be added to the questionnaire to….

Please comment on why you have chosen the amounts for part B.

Reasons	**N (228)**	**Percent**
Biggest share because they receive taxes	33	14.5
Unaware of how much is spent/guessing	23	10.1
Individuals have a responsibility	22	9.6
Least because already paid too much	22	9.6
Rewards gained/benefited/use water	21	9.2
Equal because share some responsibility	17	7.5
Government should contribute major share	15	6.6
To get all people to contribute/on behalf of all Australians	13	5.7
Biggest share because caused the environmental damage	11	4.8
Individual farmers should not have to pay/pay heavily	11	4.8
Equal contribution because equally interested	10	4.4
Looking after the environment/have environmental interests	9	3.9
Money should be put back	9	3.9
Levels of involvement	7	3.1
Authorities who make decisions should pay/pay for consequences of their actions	6	2.6
Local Government takes rates	6	2.6
Total community responsibility	6	2.6
Biggest share because have the most resources	6	2.6
Levels of interest	5	2.2
Biggest share because a national problem	5	2.2
Biggest share because owes it to the country	5	2.2

Overall, 228 participants responded to this question, providing 318 responses. The table shows the most prominent of these responses: 267 (84%) of the total number of responses.

The reasons have been broken down as listed below.

1. Reasons for assigning one party the biggest share were:
- they receive taxes;
- they have the most resources;
- they gain rewards or benefits;
- they caused the environmental damage;
- it is a national problem; or
- they owe it to the country.

2. Reason for assigning one party the lowest share:
- they have already paid too much.

3. Reasons for assigning an equal share to all parties:
- they share some responsibility;
- to get everyone to contribute/on behalf of all Australians;
- they are all equally interested; and
- it is a total community responsibility.

4. Reasons for various shares being assigned:
- levels of involvement;
- levels of interest.

5. Reasons for assigning, or not assigning, a share to particular groups:
- individuals have a responsibility;
- government should contribute a major share;
- individual farmers should not have to pay/pay heavily;
- authorities who make decisions should pay/pay for the consequences of their actions;
- local government takes rates;
- they are looking after the environment/have environmental interests; and
- money should be put back.

Discussion
while the Commonwealth Government was perceived to be contributing the most amount of money to catchment management and landcare, the results showed that respondents thought it should be contributing significantly more than it was at the time. Industry were perceived to be contributing the least amount of money and it was thought, on average, that this should increase slightly. Overall, it was thought that that the contributions of the Queensland Government, local government and individual farmers could all decrease slightly.

Reasons for the distributions of money related to access to factors such as: resources, degree of responsibility for problems, degree of interest in improvements, benefits from improvements, how much they have contributed in the past.

4.17 Resources

Have you visited the Herbert Resource Information Centre in Ingham?
The majority of respondents who answered this question (391) had not visited the Herbert Resource Information Centre in Ingham (79.8%) while 20.2% had visited the Centre.

Have you seen the Herbert River Catchment Atlas?
The majority of respondents who answered this question (390) had not seen the Herbert River Catchment Atlas (67.7%).

Have you seen the Herbert River Catchment Coordinating Committee's Catchment Management Strategy?
A very large percentage of those respondents who answered this question had not seen the Herbert River Catchment Coordinating Committee's Catchment Management Strategy (91.3%).

4.18 Demographics

Show which category best describes your age.

Age category	Frequency (N=397)	Percentage
Less than 24 years	1	0.3
24 to 39 years	71	17.9
40 to 55 years	157	39.5
56 to 65 years	95	23.9
66 to 75 years	58	14.6
More than 75 years	15	3.8
TOTAL	397	100.0

In Survey 1, the average age of respondents was 51.8 years. In Survey 2, the average age is, once again, in the 40 to 55 years category.

What is your gender?

The majority of the sample were male (61.6%) and 38.4% were female, very similar to Survey 1 in which 62.5% were male and 37.5% were female.

What is your main occupation?

Occupation	Survey 2 N = 392		Survey 1 N = 463	
	N	%	N	%
Cane farmer	111	28.2	143	30.9
Retired	61	15.5	59	12.7
Home duties	57	14.5	74	16.0
School teacher	22	5.6	11	2.4
Tradesman	18	4.6	20	4.3
Grazier	14	3.6	22	4.8
General farming (other than cane)	10	2.5	10	2.2
Mill worker	8	2.0	-	-
Nurse	6	1.5	8	1.7
Retired cane farmer	6	1.5	4	0.9
Office manager	5	1.3	-	-
Plant operator	4	1.0	-	-
Public servant	4	1.0	-	-
Small business	-	-	8	1.7
Community worker	-	-	1	0.3

The percentage of respondents in each occupation were extremely similar in both surveys.

How many years have you had this occupation?
There were 375 respondents to this question. The range was from one to seventy years and the average length of time was 23 years, almost identical to Survey 1 in which the range was from one to seventy-two years and the average length of time in their occupation was 22 years.

Looking at the dominant occupation, cane farming, the range was 1 to 55 years and the average was 29 years. In Survey 1 the range for cane farmers was from 2 to 69 years and the average was 29 years.

How long have you lived in this area?
Of the 394 respondents to this question, the length of residence ranged from 1 to 87 years with an average length of 34 years. This is again very similar to Survey 1 in which the range was from 1 to 89 years and the average length of residence in the area was 34 years.

Again looking at cane farmers, the range was from 8 to 76 years and the average length of residence was 47 years. In Survey 1, the range was from 4 to 75 years and the average length of residence was 46 years.

How often do you go fishing for recreation?

Response	Rating	N (398)	Percent
often	1	50	12.6
occasionally	2	167	42.0
seldom	3	88	22.1
never	4	93	23.4
TOTAL		398	100.0

As in Survey 1, fishing was an activity that tended to be carried out fairly infrequently.

Do you own or lease/rent a commercial rural, or rural property greater than 3 hectares (7.5 acres)?

		Survey 2		Survey 1	
Response	**Rating**	**N (391)**	**Percent**	**N (469)**	**Percent**
Yes - own	1	167	42.7	194	41.4
Yes – lease/rent	2	22	5.6	25	5.3
Yes - both	3	5	1.3	11	2.3
No	4	197	50.4	239	51.0
TOTAL		391	100.0	469	100.1

As shown in the table above, the results of Survey 1 and 2 were extremely similar. A little over 40% of respondents in both surveys owned a property greater than 3 hectares, approximately 5% leased or rented such a property and a very low percentage both owned and leased/rented a rural property of that size. Half of the respondents in both surveys did not own or lease/rent a rural property greater than 3 hectares.

Which one of the following best describes your current use of this property?

		Survey 2		Survey 1	
Use	**Rating**	**N (195)**	**Percent**	**N (228)**	**Percent**
Cane farming	1	131	67.2	163	71.5
Grazing	2	23	11.8	41	18.0
Mining	3	0	0	3	1.3
Industrial	4	0	0	0	0
Other farming	5	27	13.8	12	5.3
Other	6	14	7.2	9	3.9
TOTAL		195	100.0	228	100.1

As in Survey 1, the majority of properties were used for cane farming. Other farming had increased since Survey 1, but included similar types: maize, forestry, corn, avocadoes, navy beans, and vegetables. The 'other' categories included residential and hobby farming.

What is the size of your property?

For those 188 respondents who owned or leased/rented rural properties greater than 3 hectares, rounded to the nearest hectare, average property size in the lower catchment was 202 hectares (219 hectares in Survey 1) and in the upper catchment was 6258 hectares (6146 hectares in Survey 1).

Have you cleared any new land in the last twelve months?

Of the 158 respondents to this question who owned property greater than 3 hectares, only 8 had cleared any land in the last 12 months, or 4.8% (12% in Survey 1). These respondents were asked to specify the amount of land cleared. The range was from 1 hectare to 20 hectares, with an average of 7 hectares, compared to a range of 1 to 162 hectares and a mean of 18 hectares in Survey 1.

5.0 SUMMARY OF RESULTS

Response Rate

The response rate of 50% was less than the response rate in Survey 1 of 60%. This was not surprising as over-surveying was becoming an issue in the Herbert catchment (Bellamy, 1998). The response rates in the upper and lower catchment were very similar although higher in urban areas than rural areas (56% and 45%).

A higher percentage of repeat respondents (those who agreed in Survey 1 that they would participate again in the future) returned their questionnaires than new respondents (those people approached for the first time in Survey 2): 63% and 43% respectively.

Life Satisfaction
Generally, respondents reported moderate satisfaction with life in general, their standard of living, personal health, the area where they lived and the community in which they lived, very similar results to Survey 1. Satisfaction with existing community facilities and services was slightly lower, close to neither satisfied nor dissatisfied, as it was in Survey 1.

Ratings of satisfaction with life in general and the standard of living were still close to moderate in Survey 2 but significantly lower in Survey 2.

Lower catchment respondents were more satisfied with existing community facilities and services than upper catchment respondents.

Advantages of the Herbert River Catchment
Reported advantages experienced by respondents were very similar in both surveys despite being unprompted. Overall, the catchment offered a relaxed rural lifestyle, with a good climate, unspoiled, healthy and natural environment and good recreation opportunities. It was also described as a small, safe and friendly, close knit community which is also close to large centres.

Lower catchment respondents mentioned personal safety, closeness to large centres, ease of access to recreation, and the close knit community more than upper catchment respondents. Upper catchment respondents were more likely to mention the healthy environment, good climate, unspoiled environment and good quality drinking water.

Key Issues for the Herbert River Catchment
Unemployment was the key issue reported by respondents to an open-ended question, followed by lack of diversity in industry and a lack of opportunities for young people Unemployment was mentioned by a lower percentage of respondents in Survey 2 than in Survey 1, reflecting the actual decrease in unemployment during that time period (ABS, 1999). A lack of opportunities for young people was mentioned mainly by lower catchment respondents and was also mentioned more often in Survey 1 than in Survey 2.

Frequent responses related to land and water management included: clearing of marginal land; flooding; drainage; water quantity issues (ie. lack of water); fishing issues; the impact of weather and changing weather conditions on primary industry; and environmental issues.

Issue Importance
Ratings of personal importance, and importance for the Herbert in general, were gained for eight environmental issues. Land degradation, water quality problems, water quantity problems and nature conservation issues were repeated from Survey 2. Additional issues were flooding, wetlands, vegetation on riverbanks and loss of biodiversity. All of these issues were rated as at least moderately important by respondents on the whole. Water quality problems were most important and land degradation was ranked second overall.

Important to note is that flooding was ranked equal first in its importance to people in the Herbert and ranked equal last in its personal importance. This may be due to the fact that flooding does not affect a large proportion of people in the catchment, particularly in the upper catchment, but many people would be aware of its extreme impact on others.

Many of the issues were rated as more important personally than to people in the Herbert. As mentioned in Survey 1, this may be related to a finding in the literature that people often underestimate others' feelings about the importance of pro-social behaviours.

Overall, land degradation, water quality and nature conservation were rated as more important personally, and to others in the Herbert, in Survey 2. Repeat participants rated nature conservation higher in Survey 2 than in Survey 1 whereas water quantity problems were rated as less important in Survey 2.

Of the new issues, wetlands, vegetation on river banks and flooding were all found to be more important personally to respondents in the lower catchment. Flooding was also rated as more important for the Herbert by lower catchment respondents.

In terms of personal importance, wetlands and loss of biodiversity were rated higher by urban respondents and flooding was rated higher by rural respondents.

Impacts of issues
Ratings of the impact of various issues were gained, again both in terms of the personal impact on respondents and the perceived impact on the Herbert. The stability of community opinions over the two years between the surveys was quite strong.

The highest personal impact came from: higher taxes; poor drinking water quality; loss of environmental uses; and loss of confidence in government's ability to manage land and water resources. The impact of the latter issue signifies the importance of ICM and its community focus.

In Survey 1, however, the highest impact on respondents were from: loss of confidence in government's ability to manage land and water resources; higher taxes; loss of farm productivity; and lower fish numbers.

The highest impacts on people in the Herbert were perceived to be from: higher taxes; loss of farm productivity; higher production costs; and poor drinking water quality.

In Survey 1, the highest impact on the Herbert was from: higher taxes; higher production costs; poor drinking water quality; and loss of confidence in government ability to manage land and water resources.

Tractability
This section examined how manageable (or practical) catchment management might be, given perceptions of possible impediments to effectively managing land and water in the catchment. The greatest impediments to managing land and water in the Herbert were the same in both surveys:

- slow government strategies (only measured in Survey 2);
- slow reactions by government to new problems (only measured in Survey 2);
- the catchment's large area;
- the cost of solutions;
- a lack of easy solutions;
- low trust of government programs; and
- insufficient understanding of relevant problems.

Knowledge of government strategies
Landcare was the most familiar government strategy to respondents: the majority of respondents stated that they had heard about Landcare and the majority knew most about Landcare. Half the

respondents had heard of ICM and nearly one third had heard of PMP, very similar results to Survey 1. Also similar to Survey 1, those who had heard about the strategies were more likely to come from the lower rural sample (primarily canegrowers).

As in Survey 1, nearly 60% of respondents felt that the government strategy they knew most about had not been particularly useful to them personally. On average, respondents felt that it was neither effective nor ineffective in dealing with land and water issues, which may indicate either that respondents were unaware of the effectiveness of the strategy or were undecided.

When respondents were asked how they came to know of the strategy, newspapers were the most frequent source, followed by television/television advertisements and the media in general. The order of responses was very similar in both surveys considering the time span between surveys, slightly different samples, and open-ended nature of the question.

However, a higher percentage of respondents reported hearing of the strategy through personal experience in Survey 2, reflecting the finding of a study examining communication on ICM in the Herbert that many initial contacts were on a personal or mutual basis (McCreddin, Syme and Porter, 1999). In both surveys, the most frequent way for respondents to hear about ICM was through general meetings, or canegrowers' meetings specifically.

Respondents were asked if they were aware of any other government funded programs on wider environmental matters in the Herbert catchment. One fifth of respondents to this question were aware of other programs. Rather than ask to specify the programs, the study concentrated on respondents' opinions of these programs. While criticisms were evident, there was also some appreciation of programs, the main comments being that the program: lacked knowledge of the local situation; did not consult local people; did not use the best or most recent information; worked well; and was a good idea.

Activities of ICM

Survey 2 gained input from the community on their priorities for the activities of ICM. Overall, most of the eleven activities nominated in the questionnaire were rated as highly important. The only activity rated as moderately important was *separate ICM programs for the Upper and Lower catchments,* which, in addition, was not ranked in the top three activities by 90% of respondents to the question.

While most activities were seen to be important for ICM, the ranking of activities shows that the highest priorities were:

- encouraging joint projects between different parties;
- raising local awareness;
- developing solutions for and better understanding of environmental problems;
- encouraging research; and
- encouraging Local Government involvement.

Still highly important, but with the lowest ranking, starting with the lowest, were:

- undertaking specific on ground projects;
- separate ICM programs for the upper and lower catchments;
- providing a continuing source of advice to local government on catchment issues; and
- encouraging discussion between community interest groups.

The Herbert River Catchment Coordinating Committee

A little less than half the respondents had heard of the Herbert River Catchment Coordinating Committee, either definitely or vaguely. The percentage was higher in the rural sample than the

urban sample and higher in the lower catchment than the upper catchment. While a relatively large percentage were unsure of the purpose of the HRCCC or mentioned that it had never been fully publicised, the main perceived purposes were: care for the catchment area; conserve and manage water; preserve waterways; raise awareness; and improve drainage.

Similarly, a large percentage of respondents were unaware of specific activities of the HRCCC and combined with a low response rate to this question, there appears to be low awareness of the specific activities of the HRCCC. Those respondents who did respond mentioned activities such as:

- tree planting on riverbanks;
- surveys of water availability and quantity;
- work on the banks of the Herbert River;
- erecting owl boxes;
- weed control;
- formation of water drainage; and
- removal of flood gates.

Three quarters of those who had heard of the HRCCC felt that it had been effective to some extent in achieving its goals and purposes. Approximately half of those respondents who were aware of the HRCCC thought the group was progressing at an acceptable though moderate rate and generally heading in the right direction.

Resources

From the upper catchment, only 2% of respondents had visited the Herbert Resource Information Centre, compared to 28% from the lower catchment. Overall, approximately 30% of respondents had seen the Herbert River Catchment Atlas and approximately 10% had seen the HRCCC's Catchment Management Strategy.

Control

Feelings of control over land and water management issues were relatively high. Many respondents agreed that there were things they could do personally, or that local community groups could do, to help improve the environment and there was general disagreement that it was too hard to think about land and water management issues for an area as big as the Herbert catchment.

The agreement by many respondents that they don't usually have the finances available to plan more than a year ahead may place restrictions on these feelings of control.

Responsibility

Respondents generally agreed that many environmental problems come from the way people manage their properties and subsequently more respondents agreed than disagreed that laws should be changed to make landholders more responsible for the consequences of their activities.

There were split opinions regarding whether or not ICM should remain a voluntary activity, whether or not the government expects too much from local communities and whether or not the government should pay for and run ICM.

Views on Government

Although opinions were quite divided, similar to the views on government versus community responsibility, there was a tendency for respondents to disagree more than they agreed that ICM programs should have legislative backing. Most respondents believed that the government needed to give more resources to voluntary groups.

Related to the lack of personal resources and a need for more resources was the general agreement that there should be better government incentives for landholders to address environmental issues/problems.

It was thought that government agencies often give conflicting information on land and water management issues. Opinions were divided regarding whether or not programs like ICM interfered with people's rights to make their own decisions.

Awareness and Intentions

Overall, local awareness about land and water issues was considered to be moderate, as in Survey 1. While the perceived preparedness of local people to become involved in land and water issues had decreased from Survey 1 and was close to moderate, repeat respondents were more likely to become involved (slightly more than moderate). There was no difference between the two surveys when new respondents were compared with Survey 1. This suggests that participation in Survey 1 may have influenced the likelihood of becoming involved in land and water issues.

Respondents generally agreed that there were problems that needed urgent action (upper rural respondents agreed more than lower rural respondents). Respondents were divided on whether or not the local environment had worsened since they first lived there.

There were split opinions regarding respondents' preparedness to assist in local projects, likelihood of becoming or staying involved with a Landcare or catchment management group over the next year, and the degree of personal benefit to be gained from involvement in group activities to help manage land and water.

Involvement in Groups

In the upper catchment, 42% of respondents had been involved in local community groups or associations in the past year and 28% in the lower catchment. Overall, the percentage was less than in Survey 1 (32% and 44%). The primary categories overall were:

- Landcare, conservation and similar groups;
- charity, church or welfare groups;
- agriculture related groups; and
- service clubs.

There were relatively few responses when asked for the specific Landcare, conservation, or similar groups however most of these were Landcare groups.

Views of the Local Community

There was general agreement among respondents about the positive aspects relating to the feel of their local communities:

- it is a good place to live;
- they recognised many of the people;
- they felt quite comfortable there;
- they were interested in local issues;
- they shared similar values with others; and
- it was important to live there (more agreement in the lower catchment).

Opinions were divided, however, about issues relating to involvement, influence and conflict in their local community:

- the influence they felt over what happened (less agreement in the upper catchment);
- whether or not people in their community generally get along;
- whether or not they often thought about local community issues; and
- whether or not they had the time to become involved in local community issues.

ICM and Local Government

Approximately 90% of respondents felt that local government should have a role in ICM. The main reasons were:

- their knowledge of the local environment;
- they have more resources and information;
- they are responsible for building and maintaining infrastructure; and
- ICM is within their region.

Approximately 95% of respondents felt that local government planning should take ICM into account, mainly because:

- it would benefit the community;
- they are responsible for building and maintaining infrastructure;
- they have knowledge of the local environment; and
- it would provide better management for the future.

Funding

Respondents were asked how much they thought was being contributed, and how much should be contributed, for every $100 spent on ICM and landcare by five different parties.

Perceptions of current contributions (means)

	Upper Catchment	Lower Catchment	Rural Respondents	Urban Respondents
Commonwealth government	$35.51**	$26.77**	$29.41	$29.09
Queensland government	$32.57	$28.29	$27.39	$31.98
Local government	$14.79	$19.35	$16.07	$20.35
Industry	$4.91**	$11.89**	$10.78	$8.87
Farmers	$11.85	$12.47	$15.52**	$8.55**

** Significant differences between means.

Perceptions of what the contributions should be (means)

	Upper Catchment	Lower Catchment	Rural Respondents	Urban Respondents
Commonwealth government	$39.03	$34.94	$38.75**	$33.34**
Queensland government	$29.82	$26.26	$29.35**	$25.10**
Local government	$12.11**	$16.94**	$14.69	$16.46
Industry	$10.23	$11.53	$9.65**	$12.74**
Farmers	$8.55	$10.23	$7.48**	$12.12**

** Significant difference between means.

Within the upper catchment, it was thought that industry should be contributing significantly more than they were at the time. Lower catchment respondents overall felt that the Commonwealth government should be contributing more than they were at the time.

Within the rural respondents, it was thought that the Commonwealth government should be contributing more than they were at the time and farmers should be contributing less. Urban respondents felt that industry and farmers should be contributing more than they were at the time and the Queensland government should be contributing less.

Overall, while industry were perceived to be contributing the least at the time of Survey 2, respondents in general thought that farmers should contribute the least amount of the five parties.

However, as the differences were quite small for a question of this nature, by and large the system seemed reasonably equitable to respondents.

6.0 REFERENCES

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McCreddin, J.A., Syme, G.J., & Porter, N.B. (1999). Integrated Catchment Management communication study: The Herbert River catchment, Queensland. CSIRO Land and Water Consultancy Report No. 99-18. (Also this publication Vol. 6, Ch. 3, pp. 87-138).

APPENDIX 1

1996 Questionnaire

CSIRO **Australian Research Centre for Water in Society**

LAND & WATER MANAGEMENT
ISSUES FOR THE HERBERT RIVER CATCHMENT
SURVEY QUESTIONNAIRE
July 1996

LOCATION:	Upper Catchment	…. 1	Lower Catchment	…. 2
LANDUSE:	Rural	…. 1		
	Urban			
	Herberton	…. 2	Allingham	…. 5
	Mt Garnet	…. 3	Ingham	…. 6
	Ravenshoe	…. 4	Halifax	…. 7
			Lucinda	…. 8
			Taylors Beach	…. 9

1. Using the scale below please rate your level of satisfaction with the various aspects of your life at the moment. *(please write your chosen number from the scale next to each item)*

Scale:

1	2	3	4	5
very dissatisfied	**moderately dissatisfied**	**neither satisfied nor dissatisfied**	**moderately satisfied**	**very satisfied**

Your life in general _____

Your standard of living _____

Your personal health _____

The area where you live _____

The community in which you live _____

Existing community facilities and services _____

2. What do you think are the major advantages of living in the Herbert?

_____

_____

_____

_____

3. Generally, what do you think are some of the key issues facing people in the Herbert?

_____

_____

_____

_____

4. How important are the following issues **(1) to you personally, and (2) to people in the Herbert generally**? *(using the following scale, please write your chosen number/s in the two boxes next to each issue)*

Scale:

1	2	3	4	5
very high importance	**high**	**moderate**	**low**	**very low importance**

	importance to you personally	**importance to people in the Herbert**
Land degradation		
Water quality problems		
Water quantity problems		
Nature conservation issues ..... (eg. loss of wildlife habitat, management of world heritage areas)		

5. Following are a list of issues which **some people** think have an impact on life in the Herbert. In **your opinion**, how much do each of the following impacts **(1) affect you personally**, and **(2)**

affect people in the Herbert generally? *(using the following scale, please write your chosen number/s in the two boxes next to each impact)*

Scale:

1	2	3	4	5		
very high degree	**high**	**moderate**	**low**	**very low degree**	**OR**	**8 not at all**

Possible Impacts	**affects you personally**	**affects people in the Herbert**
High cost of water		
Loss of farm productivity		
Higher production costs		
Poor drinking water quality		
Shortage of irrigation water		
Declining human health		
Loss of independence to make business decisions		
Emotional stress		
Conflicts with other local people		
Higher taxes		
Lower fish numbers		
Loss of access to recreation		
Loss of confidence in government's ability to manage land and water resources		
Loss of environmental uses or benefits (eg. wildlife habitat)		
Loss of scenery		

6. Generally speaking, what **awareness** do you think local people have about land and water issues in the Herbert? *(please circle one number only)*

1	2	3	4	5
very high awareness	**high**	**moderate**	**low**	**very low awareness**

7. How much do you think **local people** are prepared to become involved in land and water issues in the Herbert? *(circle one number only)*

1	2	3	4	5
to a very high degree	**high**	**moderate**	**low**	**very low degree**

8. How much are **you** prepared to become involved in land and water issues in the Herbert? *(circle <u>one</u> number only)*

1	2	3	4	5
to a very high degree	**high**	**moderate**	**low**	**very low degree**

9. Using the scale below please rate how much you agree or disagree with the following statements. *(please write your chosen number from the scale next to each statement)*

<u>Scale:</u>

1	2	3	4	5
strongly disagree	**disagree**	**neither agree nor disagree**	**agree**	**strongly agree**

Managing land and water in the Herbert is difficult because...

problems aren't well understood _____

solutions aren't easy _____

there aren't any problems that need urgent action _____

local people lack the money to spend on solutions _____

government strategies are a waste of time _____

solutions are expensive _____

there are few benefits and many costs _____

local people don't want to spend money on solutions _____

the Herbert River catchment covers a large area _____

it's hard to get around the catchment (eg from top to bottom) _____

people in the Herbert have a wide variety of opinions _____

local people don't trust government programs _____

local people aren't that interested in community-type activities _____

the government doesn't want to spend money on solutions _____

10. Before we contacted you about this study, which of the government strategies in the box below had you heard about and which one did you know most about?

STRATEGY	**HAD YOU HEARD OF THIS?** *(please tick as many boxes as apply)* ↓	**WHICH DID YOU KNOW MOST ABOUT?** *(circle <u>one</u> number only)* ↓
Property Management Planning or "PMP"	☐	1
Landcare	☐	2
Integrated Catchment Management or "ICM"	☐	3

☞ *If you haven't heard of any of these government strategies, please go to question* **12.**

11. When thinking of the government strategy you know most about:
A. how useful has this strategy been to you personally? *(please circle <u>one</u> number only)*

1	2	3	4	5
not at all useful	**not very**	**moderately**	**quite**	**very useful**

B. how effective has the strategy been in dealing with land and water issues in the Herbert? *(circle <u>one</u> number only)*

1	2	3	4	5
very effective	**fairly effective**	**neither effective nor ineffective**	**fairly ineffective**	**very ineffective**

C. how did you come to know of the strategy?

_____

_____

_____

12. Have you heard of a group called the Herbert River Catchment Coordinating Committee?

YES …. 1 VAGUELY …. 2 NO …. 3 ☞ *please go to question* **13**

If YES or VAGUELY, what do you think the main purpose of this group is?

_____

_____

13. Using the scale below, please rate how much you agree or disagree with the following statements. (*Write your chosen number from the scale next to each statement).*

<u>Scale:</u>

1	2	3	4	5	**<u>OR</u>**	8
strongly disagree	**disagree**	**neither agree nor disagree**	**agree**	**strongly agree**		**not applicable**

Governments should work out better ways to fix land and water problems	_____	_____
There are things I can do personally to help improve the environment	_____	_____
It's too hard to think about land and water management issues for an areas as big as the Herbert catchment	_____	_____
I don't usually have the finances available to plan more than a year ahead	_____	_____
I trust that public servants are working in my interest most of the time	_____	_____
I've seen incompetent government activities in this part of the courntry	_____	_____
The local community should take some responsibility for improving the environment	_____	_____
Programs like Integrated Catchment Management interfere with people's Rights to make their own decisions	_____	_____
There are things local community groups can do to help improve the environment	_____	_____
I am sure that our local views will be considered when planning for land and water management in this area	_____	_____
The local environment is no worse off than it was when I first lived here	_____	_____

I would be prepared to assist in local projects such as riverbank stabilisation	_____	_____
Many environmental problems come from the way people manage their properties	_____	_____
I can prevent any land and water problems from occurring on my property	_____	_____
It is likely that I will become involved (or stay involved) with a Landcare or catchment group over the next year or two	_____	_____
I've complete control over what happens to the land and water on this property	_____	_____
It is likely that I will look into ways to improve the environmental condition of my property over the next year or two	_____	_____
I can recall at least 1 government action which has damaged my livelihood	_____	_____
I could personally benefit from being involved in group activities to help manage land and water	_____	_____
Laws should be changed to make landholders more responsible for the consequences of their activities	_____	_____
Some people I know think that local groups are a good way to deal with many land and water management issues	_____	_____

14. Which of the following sources of information help you to **keep informed** about land and water management issues? (*tick as many boxes as apply*)

Neighbours	☐	The Australian newspaper	☐
A government agency (please specify)	☐	Cairns Post	☐
_____		Townsville Bulletin	☐
_____		Telegraph Times	☐
Industry groups (please specify)	☐	Herbert River Express	☐
_____	☐	The Tablelander	☐
_____	☐	Tablelands Advertiser	☐
Community groups	☐	Millstream Times	☐
Family members	☐	Courier Mail	☐
Friends/colleagues	☐	Magazines/journals	☐
Personal experience	☐	Government newsletters	☐
The local "grapevine"	☐	The Country Hour (ABC radio)	☐
Public meetings	☐	Landline (ABC television)	☐
Other (please specify)	☐		
_____		None/I don't keep informed	☐
_____		☞ please go to question **19**	

19. In the box above, which two sources of information would you say were the most **reliable** for helping you to make decisions?

1. _____

2. _____

16. Does what you read in newspapers ever change your opinions about land and water management

issues? (*please circle <u>one</u> number only*)

1	2	3	4
often	**occasionally**	**seldom**	**never**

17. Does what you hear on the radio or see on TV ever change your opinions about land and water management issues? (*please circle <u>one</u> number only*)

1	2	3	4
often	**occasionally**	**seldom**	**never**

18. How often do you discuss land and water management issues with your neighbours or others in this general area? (*please circle <u>one</u> number only*)

1	2	3	4
often	**occasionally**	**seldom**	**never**

19. When thinking about your **relationships with local people**, how comfortable are you about living here? (*please circle <u>one</u> number only*)

1	2	3	4	5
not at all comfortable	**not very**	**moderately**	**quite**	**very comfortable**

20. When thinking about how much **interest local people have for your ideas and opinions**, how comfortable are you about living here? (*please circle <u>one</u> number only*)

1	2	3	4	5
not at all comfortable	**not very**	**moderately**	**quite**	**very comfortable**

21. Are you a member of any regional, state or nationally-based groups or associations? (*please circle <u>one</u> number only*)

YES …. 1 **NO …. 2**

22. Are you a member of any local community groups or associations? (*circle <u>one</u> number only*)

YES …. 1 ☞ *please go to question* **25**

or

NO …. 2
↓

23. Generally, what are some of your reasons for not being involved in any community groups?

_____

_____

_____

_____

24. Would you ever consider joining a community group? (*circle <u>one</u> number only*)

YES …. 1 **DON'T KNOW …. 2** **NO …. 2**

↓ ↓

For what reasons would you join? _____

_____

_____

_____

☞ If you answered **NO to question 21** and **NO to question 22**, please go to question **28**

25. Which of the following categories describe *any* of the groups you have some involvement with? (*please tick as many boxes as apply*)

Progress Assoc.	☐	Sporting Group	☐
Rate Payers Assoc.	☐	Hobby/Craft Group	☐
Professional Assoc.	☐	Community Action Group	☐
Charity/Church/Welfare Group	☐	Service Club (eg. Lions, Rotary)	☐
Agriculture-related Organisation	☐	Parents & Friends Assoc.	☐
Landcare, Conservation or similar group	☐	Other/s (*please explain*)	☐
		_____	
		_____	

26. Of the groups you are involved with, please write down the name of the group that is **most important** to you.

- **Important group**_____

27. If you are involved in any groups in the "Landcare, Conservation or similar" category, please write down the name of the group that you are **most involved** with. This may not be the same as the group that is the most important to you.

- **Landcare, Conservation or similar group:**_____

_____

28. Thinking of the local community where you live, please rate how much you agree or disagree with each of the following statements. *(using the scale below, write your chosen number from the scale next to each*

statement)

Scale:

1	2	3	4	5
strongly disagree	**disagree**	**neither agree nor disagree**	**agree**	**strongly agree**

I'm not very interested in local community issues _____

I feel quite comfortable in being a member of this local community _____

The community is capable of getting things done without any outside help _____

I would like to remain living in this area for a long time _____

I have almost no influence over what happens in this community _____

It's very important to me to live in this particular community _____

People in this community generally don't get along with each other _____

I don't really care what others in the community think of my actions _____

Very few of my neighbours know me _____

I often think about local community issues _____

I and many others in this community share similar values _____

I think this community is a good place to live _____

I can recognise many of the people who live in this community _____

I don't have the time to become involved in local community issues _____

OTHER INFORMATION

29. How old are you? _____ **years**

30. What is your gender? *(please circle the number)*

MALE .... 1 **FEMALE 2**

31. Which country were you born in? _____

32. What is your marital status? (*circle the most appropriate number*)

Married/De facto	…. 1	Divorced/Separated	…. 2
Never Married/Single	…. 3	Widowed	…. 4

33. Do you have any family members living in the Herbert area other than those in your household? (*circle <u>one</u> number only*)

YES …. 1 **NO …. 2**

34. What is your main occupation? _____

35. How many years have you had this occupation? _____ **years**

36. How long have you lived in the Herbert area? _____ **years**

37. Is your property near to a river or creek which floods?

YES …. 1 **NO …. 2** **DON'T KNOW …. 3**

38. Thinking about where you live, what is the most important river or creek to you?

_____

39. How often do you use the river or creek near where you live? (eg. for commercial, domestic or recreational purposes) (*please circle <u>one</u> number only*)

1	2	3	4
often	**occasionally**	**seldom**	**never**

40. How often do you go fishing for recreation? (*circle <u>one</u> number only*)

1	2	3	4
often	**occasionally**	**seldom**	**never**

41. Do you own or lease/rent a commercial rural, or rural property greater than 3 hectares (7.5 acres)? *(please circle <u>one</u> number only)*

YES ↓ **OWN .... 1 or LEASE/RENT .... 2** **NO …. 3** ☞ *please go to question* **45**

42. Which one of the following best describes your current use of this property? *(circle <u>one</u> number only)*

Cane farming **.... 1** Grazing **.... 2** Mining **.... 3** Industrial **.... 4**

Other farming **.... 5** *(please specify)*_____

Other **.... 6** *(please specify)*_____

43. What is the size of your property? _____ **hectares** *<u>or</u>* _____ **acres**

44. Have you cleared any new land in the last twelve months?

YES .... 1 ↓ **NO .... 2** ☞ *please go to question* **45**

If YES, how much new land have you cleared? _____ **hectares** *<u>or</u>* _____ **acres**

45. Would you be prepared to answer another shorter questionnaire if needed in a few months time?

YES .... 1 **NO 2**

If YES, please write your name, postal address and phone number in the space provided.

Your Name:

Postal Address:

Phone number:

Thank you very much for your time.

Are there any comments you would like to add?

APPENDIX 2

1998 Questionnaire

CSIRO Australian Research Centre for Water in Society

LAND & WATER MANAGEMENT
ISSUES FOR THE HERBERT RIVER CATCHMENT
SURVEY QUESTIONNAIRE
November 1998

LOCATION:	Upper Catchment	…. 1	Lower Catchment	…. 2
LANDUSE:	Rural	…. 1		
	Urban			
	Herberton	…. 2	Allingham	…. 5
	Mt Garnet	…. 3	Ingham	…. 6
	Ravenshoe	…. 4	Halifax	…. 7
			Lucinda	…. 8
			Taylors Beach	…. 9

1. Using the scale below please rate your level of satisfaction with the various aspects of your life at the moment. *(please write your chosen number from the scale next to each item)*

Scale:

1	2	3	4	5
very dissatisfied	**moderately dissatisfied**	**neither satisfied nor dissatisfied**	**moderately satisfied**	**very satisfied**

Your life in general _____

Your standard of living _____

Your personal health _____

The area where you live _____

The community in which you live _____

Existing community facilities and services _____

2. What do you think are the major advantages of living in the Herbert?

_____

_____

_____

_____

3. Generally, what do you think are some of the key issues facing people in the Herbert?

_____

_____

_____

_____

4. How important are the following issues **(1) to you personally, and (2) to people in the Herbert generally**? *(using the following scale, please write your chosen number/s in the two boxes next to each issue)*

Scale:

1	2	3	4	5
very high importance	**high**	**moderate**	**low**	**very low importance**

	importance to you personally	**importance to people in the Herbert**
Land degradation		
Water quality problems		
Water quantity problems		
Nature conservation issues ..... (eg. loss of wildlife habitat, management of world heritage areas)		
Flooding		

Wetlands.....		
Vegetation on river banks		
Loss of biodiversity (numbers of different species).....		

5. Following are a list of issues which **some people** think have an impact on life in the Herbert. In **your opinion**, how much do each of the following impacts **(1) affect you personally**, and **(2) affect people in the Herbert generally**? *(using the following scale, please write your chosen number/s in the two boxes next to each impact)*

Scale:

1 = **very high degree** **2** = **high** **3** = **moderate** **4** = **low** **5** = **very low degree** **OR** **8** = **not at all**

Possible Impacts	**affects you personally**	**affects people in the Herbert**
Loss of farm productivity		
Higher production costs.....		
Poor drinking water quality		
Emotional stress		
Higher taxes		
Lower fish numbers		
Loss of access to recreation.....		
Loss of confidence in government's ability to manage land and water resources		
Loss of environmental uses or benefits (eg. wildlife habitat).....		

6. Generally speaking, what **awareness** do you think local people have about land and water issues in the Herbert? *(please circle <u>one</u> number only)*

1 **very high awareness** — **2** **high** — **3** **moderate** — **4** **low** — **5** **very low awareness**

7. How much do you think **local people** are prepared to become involved in land and water issues in the Herbert? *(circle <u>one</u> number only)*

1 **to a very high degree** — **2** **high** — **3** **moderate** — **4** **low** — **5** **very low degree**

8. How much are **you** prepared to become involved in land and water issues in the Herbert? *(circle <u>one</u> number only)*

1 **to a very high degree** — **2** **high** — **3** **moderate** — **4** **low** — **5** **very low degree**

9. Using the scale below please rate how much you agree or disagree with the following statements. *(please write your chosen number from the scale next to each statement)*

Scale:

1 — **2** — **3** — **4** — **5**

strongly disagree	disagree	neither agree nor disagree	agree	strongly agree

Managing land and water in the Herbert is difficult because...

problems aren't well understood _____

solutions aren't easy _____

local people lack the money to spend on solutions _____

government strategies are too slow _____

solutions are expensive _____

there are few benefits and many costs _____

local people don't want to spend money on solutions _____

the Herbert River catchment covers a large area _____

local people don't trust government programs _____

local people aren't that interested in community-type activities _____

the government doesn't want to spend money on solutions _____

government departments and other agencies are too slow to react to new issues or problems _____

10. Before we contacted you about this study, which of the government strategies in the box below had you heard about and which one did you know most about?

STRATEGY	**HAD YOU HEARD OF THIS?** *(please tick as many boxes as apply)* ↓	**WHICH DID YOU KNOW MOST ABOUT?** *(circle one number only)* ↓
Property Management Planning or "PMP"	☐	1
Landcare	☐	2
Integrated Catchment Management or "ICM"	☐	3
		N/A

☞ *If you haven't heard of any of these government strategies, please go to question* **12.**

11. When thinking of the government strategy you know most about:
A. how useful has this strategy been to you personally? *(please circle one number only)*

1 not at all useful	2 not very	3 moderately	4 quite	5 very useful

B. how effective has the strategy been in dealing with land and water issues in the Herbert? *(circle one number only)*

1 very effective	2 fairly effective	3 neither effective nor	4 fairly ineffective	5 very ineffective

ineffective

C. how did you come to know of the strategy?

_____

_____

_____

12. Are you aware of any other Government Funded programs on wider environmental matters in the Herbert catchment?

YES …. 1 ↓ **NO …. 2** ☞ *please go to question* **13**

If YES, please write down any comments you have on them.

_____

_____

_____

13. How important is it to you that the following activities are part of Integrated Catchment Management? *(Using the following scale, please write your chosen number next to each issue).* **Then…** please rank the three most important activities to you: 1 is most important.

Scale:

1	**2**	**3**	**4**	**5**
very high importance	**high**	**moderate**	**low**	**very low importance**

	Scale	Rank 1 to 3 ↓
Encourage community action at a catchment level.	_____	_____
Raise the level of local awareness and knowledge of environmental issues on the catchment.	_____	_____
Encourage Local Government to take an active role in environmental management issues.	_____	_____
Encourage coordination of state government programs.	_____	_____
Undertake specific on ground projects with other bodies.	_____	_____
Provide a continuing source of advice to local government on catchment issues.	_____	_____
Encourage research.	_____	_____
Develop solutions for and better understanding of environmental problems in the Herbert catchment.	_____	_____
Encourage discussion between community interest groups		

on environmental issues. _____ _____

Separate ICM programs for the Upper and Lower Herbert catchments. _____ _____

Encourage joint projects between community, industry and state and local government. _____ _____

14. Have you heard of a group called the Herbert River Catchment Coordinating Committee?

YES .... 1 **VAGUELY .... 2** **NO .... 3** ☞ *please go to question* **19**

If YES or VAGUELY, what do you think the main purpose of this group is?

_____

_____

15. Has the group been effective in achieving its goals and purpose?

YES …. 1 **TO SOME EXTENT …. 2** **NO …. 3**

16. Are there any specific things that you know they have done?

Please describe

_____

_____

_____

17. In your opinion, are they progressing quickly enough?

YES …. 1 **TO SOME EXTENT …. 2 NO …. 3**

18. In your opinion, are they heading in the right direction?

YES …. 1 **TO SOME EXTENT …. 2 NO …. 3**

19. Using the scale below please rate how much you agree or disagree with the following statements. *(write your chosen number from the scale next to each statement)*

Scale:

1	**2**	**3**	**4**	**5**	**OR**	**8**
strongly **disagree**	disagree	neither agree **nor disagree**	agree	strongly **agree**	not applicable	

There are things I can do personally to help improve the environment. _____

It's too hard to think about land and water management issues for an area as big as the Herbert catchment. _____

I don't usually have the finances available to plan more than a year ahead. _____

The government needs to give more resources to voluntary groups. _____

Programs like Integrated Catchment Management interfere with people's rights to make their own decisions. _____

There are things local community groups can do to help improve the environment. _____

Catchment management should be paid for and run by the government. _____

The local environment is no worse off than it was when I first lived here. _____

ICM should remain a voluntary activity by community members. _____

I would be prepared to assist in local projects such as riverbank stabilisation. _____

Scale:

1	**2**	**3**	**4**	**5**	**OR**	**8**
strongly **disagree**	disagree	neither agree **nor disagree**	agree	strongly **agree**	not applicable	

Many environmental problems come from the way people manage their properties. _____

It is likely that I will become involved (or stay involved) with a Landcare or catchment group over the next year or two. _____

I could personally benefit from being involved in group activities to help manage land and water. _____

The government expects too much from local communities in catchment management. _____

Laws should be changed to make landholders more responsible for the consequences of their activities. _____

Different government agencies often give conflicting information on land and water management issues. _____

There should be better government incentives for landholders to address environmental issues/problems. _____

There aren't any environmental problems that need urgent action. _____

ICM programs should have legislative backing. _____

The government gives plenty of resources to voluntary groups. _____

20. Over the last 12 months, have you been involved in any local community groups or associations?

YES …. 1 **NO …. 2** ? *please go to question* **22**

If YES, which groups or associations were they?

_____

_____

_____

21. If you were involved in any Landcare, conservation or similar types of group, please write down the name of the group that you were **most involved** with.

_____

_____

22. Thinking of the local community where you live, please rate how much you agree or disagree with each of the following statements. *(using the scale below, write your chosen number from the scale next to each statement)*

Scale:

1	2	3	4	5
strongly disagree	**disagree**	**neither agree nor disagree**	**agree**	**strongly agree**

I'm not very interested in local community issues. _____

I feel quite comfortable in being a member of this local community. _____

I have almost no influence over what happens in this community. _____

It's very important to me to live in this particular community. _____

People in this community generally don't get along with each other. _____

I often think about local community issues. _____

I and many others in this community share similar values. _____

I think this community is a good place to live. _____

I can recognise many of the people who live in this community. _____

I don't have the time to become involved in local community issues. _____

23. Should Local Government **have a role** in Integrated Catchment Management?

YES …. 1 **NO …. 2**

Please give reasons

_____

_____

_____

24. Should Local Government Planning sometimes **take into account** Integrated Catchment Management?

YES …. 1 **NO …. 2**

Please give reasons

_____

_____

_____

25. For every $100 spent on catchment management and landcare,

A. how much of it do you think **IS** being contributed by:
(please write the amount in the space provided)

The Commonwealth Government?		$_____
The Queensland Government?		$_____
Local Government on the Herbert Catchment?		$_____
Industry?		$_____
Individual farmers?		$_____
	TOTAL	**$ 100**

B. how much of it do you think **SHOULD** be contributed by:

The Commonwealth Government?		$_____
The Queensland Government?		$_____
Local Government on the Herbert Catchment?		$_____
Industry?		$_____
Individual farmers?		$_____
	TOTAL	**$ 100**

Please comment on why you have chosen the amounts for part B.

_____

_____

26. Have you visited the Herbert Resource Information Centre in Ingham?

YES …. 1 NO …. 2

27. Have you seen the Herbert River Catchment Atlas?

YES …. 1 NO …. 2

28. Have you seen the Herbert River Catchment Coordinating Committee's Catchment Management Strategy?

YES …. 1 NO …. 2

OTHER INFORMATION

29. Show which category best describes your age. *(please circle one number only)*

Less than 24 years	**…….**	**1**
24 to 39 years	**…….**	**2**
40 to 55 years	**…….**	**3**
56 to 65 years	**…….**	**4**
66 to 75 years	**…….**	**5**
More than 75 years	**…….**	**6**

30. What is your gender? *(please circle the number)*

MALE .... 1 FEMALE 2

31. What is your main occupation? _____

32. How many years have you had this occupation? _____ **years**

33. How long have you lived in the Herbert area? _____ **years**

34. How often do you go fishing for recreation? *(circle <u>one</u> number only)*

1	2	3	4
often	**occasionally**	**seldom**	**never**

35. Do you own or lease/rent a commercial rural, or rural property greater than 3 hectares (7.5 acres)? *(please circle <u>one</u> number only)*

YES: OWN .... 1 or LEASE/RENT 2

NO .... 3 ☞ *if you have any further comments, please use the back page.*

36. Which one of the following <u>best</u> describes your <u>current</u> use of this property? *(circle <u>one</u> number only)*

Cane farming **.... 1** Grazing **.... 2** Mining **.... 3** Industrial **.... 4**

Other farming **.... 5** *(please specify)*_____

Other **.... 6** *(please specify)*_____

37. What is the size of your property? _____ **hectares** *or* _____ **acres**

38. Have you cleared any new land in the last twelve months?

YES .... 1 **NO 2**

If YES, how much new land have you cleared? _____ **hectares** *or* _____ **acres**

Thank you very much for your time. Please use the back page for any additional comments.

APPENDIX 3

Newspaper Notice

Herbert River Catchment Management

CSIRO

CSIRO will be contacting people in the Herbert River Catchment early in November to ask if they will be involved in a survey about their views on land and water management.

This is a follow-up to a survey conducted in 1996. About 800 people were contacted and over 700 agreed to take part with a high percentage then responding. The results were very helpful in guiding understanding of community concerns. CSIRO would like a similar number involved once again.

Many respondents at that time agreed to participate in the future and we again invite their response. This survey will provide an invaluable opportunity to see how things have changed over the past two years and why.

With so many people putting time, effort and money into managing land and water it is very important that we find out what works and what doesn't work.

Community input will help CSIRO to develop more effective methods for catchment management.

For further information contact Jenny Bellamy on (07) 3214 2345.

APPENDIX 4
Information Pamphlet

A STUDY OF INTEGRATED CATCHMENT MANAGEMENT (ICM)

A five-year study in the Herbert River catchment is in its final year. The aim has been to develop methods that lead to more effective catchment management in Australia by trying to better understand just how ICM works.

- ❖ What difference does ICM make to the way people manage their land and water?
- ❖ What arrangements and procedures are necessary to help people with ICM?
- ❖ What sorts of things affect the progress of ICM?
  Are these economic, technical, institutional, or social?

Who is involved?

✓	Industry	eg. sugar, fishing, beef, horticulture, tourism
✓	Community groups	eg. Landcare, ICM, conservation
✓	Researchers	CSIRO, James Cook University, The University of Queensland
✓	Government	State and Local

Why is the study important?

Integrated management of land and water is a very challenging task and one that is of national importance. While many ICM programs are up and running, we don't really know *what works well*.

With so many people putting in so much time, effort and money, we really need to find these things out. This is the first time such a comprehensive and long-term investigation has been undertaken in Australia.

We need your help!

The study team cannot do this alone. For this project to be a success, we are dependent on local community support.

FOR FURTHER INFORMATION, PLEASE CONTACT:

Jenny Bellamy
CSIRO Tropical Agriculture
306 Carmody Rd
ST LUCIA QLD 4067
ph: (07) 3214 2345
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MANAGING LAND & WATER IN THE TROPICS

Appendix 5
Refusal Survey Form

REFUSALS INFORMATION

Questions:

1. What is your main occupation? (*ask for specifics eg. potato farmer*) _____

_____

2. Are you personally affected by any land or water management issues (eg quality or quantity)? (*circle <u>one</u> number*)

YES …. 1 NO …. 2 DON'T KNOW …. 3

What issues are you affected by? _____

_____

_____

3. Do you belong to any local groups or associations? (*circle <u>one</u> number*)

YES .... 1 NO .... 2 ☞ *go to question 4*

What groups do you belong to? _____

_____

_____

4. Have you heard of a group called the Herbert River Catchment Coordinating Committee? (*circle <u>one</u> number*)

YES …. 1 VAGUELY …. 2 NO …. 3

5. How often do you go fishing for recreation? (*read out the options and circle <u>one</u> number*)

1	2	3	4
often	**occasionally**	**seldom**	**never**

6. What is your age? _____ **years**

Thank you very much for your time

To be filled in by interviewer (after the phone call):

- Property List (eg. lower catchment urban) _____
- Phone number _____
- Surname and First Name (or initials) _____
- Address _____
- Gender (*circle or number*) **MALE …. 1 FEMALE …. 2**

APPENDIX 6
Individual Comments

Individual Comments

➔ I would like to introduce myself. Number 195 not a problem, and 'Link' to the people of the district. Thanks for personally signing the cover note, it makes me feel more genuinely involved even though it's a survey as such, and there are no 'correct' answers to the questions. The method of questioning was difficult because of its broadness.

I am not a farmer or grazier of this district, but would like to share some of my feelings about how land and water management doesn't appear to be working. Through my and other landowners (cane farming) friends eyes the big picture does not exist. This is part of the reason why I have not participated in Landcare. 'Tis only a token gesture when plantings are only ? between the creek bank up the slope to the cane headland. Marginal reforestation!

It is time these greedy, tunnel visioned farmers relinquished several headlands to create a living environment abutting a chocked watercourse. A new environment, not short lived weedicide or arrogant approaches are needed to be created immediately if there is any hope.

This addendum did not mean to sound long winded, but with so many issues and people involved I felt I had to voice my opinion. I have worked on and off through my life in the local sugar industry, especially the field sector and have observed the depravation of the environment first hand. It is not healthy, and most people take for granted the water continues to flow to the sea carrying all the pollution which is then not their problem.

People of this district have a very arrogant mindset: "every microbe of pollutant that goes into these waterways will be neutralized when it reaches the great water dump".

The people's ideas need neutralizing.

Anyway, my pen could continue to flow in anger but that doesn't solve the woes of the world, and besides I'm shitty because some company just woodchipped my soap box.

Would like to conclude with a passage that I'd like to share with you. No optimism here just the truth.

'Cree Indian Prophecy'

'Only after the last tree has been cut down,
Only after the last river has been poisoned,
Only after the last fish has been caught
Only then will you find that money cannot be eaten.'

➔ I have partly answered the questions because I feel they are worded to suit you. I am not happy about government putting money towards it because our taxes are too high. I feel you may be trying to stop us from farming in a profitable way as farming is getting harder each year. I feel you may be trying in the future to stop us from farming by taking land from us. We should be able to make a living and support our families.

➔ I have completed the questionnaire the best I can, and find that I need more knowledge than I currently have to do it justice!!

However, I quite enjoyed the challenge, for challenge it was, and it took much longer than the 20 minutes you promised me!

Love to do it again for you in the future – just phone me in advance as usual?

➔ I feel this is a very important issue and shall be trying to gain more knowledge. The map shall be very handy.

➔ Some of the answers to questions aren't always able to be so black and white according to scales.

➔ Dear Madam, I feel I am not what you are looking for to answer your questions so please don't send me any more questionnaires as I will not participate.

➔ There does not seem to be any controls for scrub pulling, in some places instead of leaving islands of timber, the lot is pulled, the greater percent of scrub being pulled is not for farming but for grazing of cattle.

I am against any type of Bradford Scheme or turning water inland, if inland waterways are managed better and land not overstocked then the land would do well.

Have you taken into account the impact of feral animals in catchment areas? Toads, etc. When the toads hit Kakadu in the Northern Territory I think they will do far more damage than any uranium mine.

I do not agree with mining uranium, but groups seem more worried about mines in areas than other causes. I don't think any mine anywhere in the north has ever done anywhere as much damage to the environment as graziers have.

➔ Getting too old to care much about things in general, health not good at present.

➔ Please bear in mind that I am 77 years of age and live alone these past eight years. I own my own home and still drive a car. When I can no longer drive, I will have to leave here for alternative accommodation (not a happy prospect). This is just to alert you to the fact that my answers will be somewhat biased.

➔ I spent much of my time away working. Our nearest neighbour in Silver Valley is 5km away and I do not know them. I pay HSC rates and do not even get a graded road. Where I live on the Dry(?) River there is only intermittent water flow and I keep no animals of any kind nor do I grow anything but endemic native vegetation.

➔ Please bear with me for not answering some questions – as I mentioned when asked if I would partake of this questionnaire that I had just buried my wife of some 48 years and that I was also suffering quite a severe illness myself – however I have done my best in most sections of this survey. Thank you.

➔ Some of the questions I find a little hard to decide about but generally speaking this is as close as I could get.

➔ My son helped me fill in this as I do not know very much about the area as I am a newcomer and an aged pensioner. Thank you.

➔ As I don't live in the Herbert River Catchment Area I found a lot of the questions I shouldn't have been answering but anyway I hope you got some use out of my survey.

➔ I would like to have access to any information that is compiled as in my position as a teacher I feel that it is important to give students a knowledge of their local area and how it is being managed. (Gave contact details for the Catchment Coordinator of HRCCC).

➔ While I deeply respect and hold concerns for the natural environment I feel the most important issue within Integrated Catchment Management is flood mitigation and that was not mentioned in any detail on this questionnaire.

➔ General: I don't really know how much is spent by individual governments. I do know, if we don't do something soon, we will be in big trouble as far as landcare and water management goes. Not for me, but for future generations. In 20-30 years, these things will be critical, especially the water management.

➔ The general community is generally concerned about the environment but not many wish to become involved, although the situation is changing.

➔ 9 metre high dam will be sanctioned by government department for Spring Creek which is a small permanent creek. 80 acres of rainforest also allowed to be cleared for cattle by landholder. Landholders use these methods to decrease tax on successful businesses. Many issues like tax dodges and negative gearing need to be addressed. The land is the foundation of everything we have including our health and wealth, most seem to forget this.

➔ The state and federal government has many initiatives going on in the Hinchinbrook area at the present time. Most of the funding is reliant on local government and industry. A small community only has so much money and time. Some initiatives the government has promised money to but it hasn't been forthcoming and projects have stagnated and people have been left in limbo.

The main problem facing the Hinchinbrook area is the accessible wilderness areas. Every government department wants a say in what happens – many have opposing views. As a result local initiatives cannot get off the ground or are stalled until the cost becomes prohibitive.

➔ It would be good to find out why Hinchinbrook Shire Council allows rubbish to be dumped in wetlands – mangroves, such as that on the main road into Lucinda!.. So much for the Local Landcare Group and Catchment Management.

➔ I am very concerned that the hot (thermal) springs are neglected and polluted and no department including the council take responsibility for its management. It should be recognised as an important natural phenomenon and included in the catchment considerations.
➔ Too many cane assignments have been given in wetlands and marginal country.

➔ I may not be able to help with time and money but I do care about what we are doing to our land and environment.

My main problem here in Herbert is poor water quality and water restrictions. Council's never seem to have enough money put away for next year's budget. My town lacks community pull together. Nobody will move to a town like this if our Council won't even support our local kindergarten. Please note even our small town is plagued with crime of all sorts – young people bored – crime and pregnancy. Ex jail mates – drugs. Murders etc. People come and go but the land hopefully will always be there.

➔ Just a few comments on some issues, my opinion is:

Wetlands, mangroves and river banks on private land should be exempt from rates and not used. The rest of the public should fit the bill. The public in general benefit from all of this. Landholders not wishing to agree should have the land resumed.

You can't blame the landholder for wanting a return from this land to pay for his rates but the cost to the environment from this practice is too great.

Waterways are all chocked up with grass because all the trees along the banks have been cleared, allowing the sun in. Water temperature rises, making it unfit for some species of fish.

I am no 'greenie' but what is going on in the sugar industry with development is a disgrace.

➔ As an individual NOT actively involved in any specific community activity relating to environmental management issues, I feel my opinions regarding the Herbert River area are reasonably objective. I feel, also, that there is a rapidly growing awareness of the issues which will affect the future viability of our community. Cane farmers, particularly the younger ones, are strongly in favour of working towards solutions. It's extremely important to me to monitor my own property for signs of degradation and I wish to see other individuals/local groups doing likewise.

➔ The Herbert assignment committee has allowed cane assignment to be given to individuals to grow cane in totally unsuitable areas such as swamp on wetlands which are being continually drained in some cases with flood lifter pumps and this has led to further problems with water quality and clearing of riparian vegetation on creek banks. A very common practice is to excavate the creek to build up the banks to enable cane to be planted right up to the drain, creek is no longer appropriate.

➔ My husband has a trawler, we rely on the quality of water coming from the river for our livelihood.

➔ All waterways should be deepened and cleaned so that fish etc can live without being entangled in all foreign grasses and weeds that have been introduced for cattle over past years.

Instead of present policy of don't touch sit back and watch the problem grow, blame general farming for problems.

➔ Newspaper article enclosed from the Herbert River Express November 7th 1998

"Fish kill epidemic continues"

The third major fish kill in the Herbert River district this year was discovered in Lagoon Creek, east of Ingham yesterday.

Several hundred dead barramundi and boney brim were found in a section of Lagoon Creek in the Mount Cordelia area by a local farmer.

Many of the dead fish, mostly juveniles, were banked together on the water's edge in a 10m stretch of the creek.

It is the latest in a series of significant kills in North Queensland and follows fish deaths in local waterways Cattle Creek and Palm Creek.

Officers from the Ingham and Townsville Department of Environment and Heritage inspected the site yesterday.

Cane farmers Allan Regazzoli discovered the dead fish during a routine tour of his Cook's Land property.

"I could smell the fish, but I didn't know what the smell was until I rode around to the creek", he said.

In the wake of the Cattle Creek kill in October, a forum will soon be held in Ingham or Townsville to investigate the reasons for a spate of kills in the region.

The latest one co-incided with heavy rainfalls in the Herbert River district.

North Queensland Conservation Council coordinator Jeremy Tager has spoken out over the fish kills, saying a report in to the state of fish habitat areas in Queensland was a "damming indictment of government incompetence and industry vandalism".

Mr Tager said the release of the Fisheries Habitat Review by the Federal Government painted a picture of declining habitat areas in the Herbert River district due to intensive farming.

"It's about time these practices were stopped," Mr Tager said.

"The release of this report by the Commonwealth Government and the recent comments from Queensland Environment Minister Rod Welford regarding cane practices gives cause for hope that finally something will be done".

Mr Welford this week called for the sugarcane industry to clean up land use practices to prevent further fish kills.

Canegrowers general manager Ian Ballantyne said growers were dedicated to more sustainable farm practices and had been cleared of blame for a recent fish kill in Mackay.

➔ The Herbert River is nothing short of a poisonous drain. My guess the arsenic content is very high, old mangrove area drained and swamps in to river has killed all shell fish and small crabs in river except the last quarter mile to mouth of river.

There are no small crabs (Red claw, Black and purple types) no oysters, no barnacles, no shell fish in sand bars or yabbies in river till you get to channel almost on island side of channel all the above are plentiful.

There are Barra, jacks and cod in the river which are predators, all other types are few and far apart. The river has few bottom feeders it is rare to catch catfish, mullet etc.

➔ In the last year I have noticed some changes. Farmers have been prosecuted for disturbing mangroves. There has been some education about disturbing waterways and creeks and fish kills have been brought to public notice. Each is trying to absolve oneself, some are saying that this is caused by stockpiles of mill mud and some are saying that this is a natural occurrence that has happened for centuries.

Sampling by people from government agencies will probably find that the cause comes from the thousands of tonnes of fertilisers and poisons that are used to grow the cane crop and are spread

on the land each year. At times, I have seen dozens of chemical containers, at the Taylors Beach dump, used for cane production laying openly and these are labelled and marked 'poison'.

When the first rains come these chemicals, applied to farmland, probably wash into creeks and river poisoning the food cycle/chain. Fish kills.

We need government involvement and control in what is sold to these people and they should be educated in the use of poisons. The older generation mostly are illiterate.

Farmers drive past my home on their way to work with 8 or 10 x 20 litre containers of different chemicals and we the townsfolk suffer from wind drift.

On the positive side I have noticed changes in my workplace towards environmental issues and directions have come from higher authority about discharges to waterways and pollution and also changes in local council policy towards waste management and wetlands and wildlife.

➔ Cane farming, contrary to what the cane farmers say, has a big impact on the land. Ploughing fields up to river banks, filling in drain off areas. All contribute to flooding and erosion.

After a big fall of rain the water in the local small waterways is badly contaminated. For instance, Gentle Annie Creek, there the water is almost red, stinks and deposits a coating of slime on the banks. All this kills fish, and packs into carry out to sea and the Barrier Reef. It also kills grass and growth on the banks that help hold the creeks bank together.

➔ In my opinion until get a body to more strictly control the clearing of riverine vegetation and remaining areas of timber in one area we will be like so many third world countries – stuffed! Greed which permeates from the farming community right through to the top government departments is slowly but surely turning this great land of ours into an environmental desert.

➔ I apologise for my late reply to this questionnaire. The past season has been somewhat of a maverick year due to excess rain. There are many problems facing the Herbert River. Stream degradation is occurring throughout the district and addressing these problems should be put in motion as early as possible.

I feel that all sectors of the community and government departments should coordinate a strategy to try to solve the enormous drainage problems that exist in the Herbert District.

➔ It disappoints me to see how in this local area, in the past five years, that large tracts of land which was covered in scrub and bushland are now cleared and planted to sugar cane. Much of this area acted as a soil binding agent, which now that it is cleared is causing massive amounts of soil erosion, which eventually finds its way to the waterways and ultimately our ocean and coral reefs. Along with the loss of scrub I have noticed a dramatic decline in the numbers of wallabies and kangaroos along certain sections of the railway line, between Ingham and Bambaroo. There is also a large amount of laser levelling of cane land which fills in natural drains and waterways again causing soil erosion when the wet season comes and the run off water makes a new path across the land.

➔ I have lived in Ingham since 1965 and was in the 65 flood. I purchased a house in a flood area as I was advised this size of flood occurred only every 20 years – I have hardly missed a year since. These floods appear to be getting more regular and in some areas bigger. I live on the up side of the QGR rail line. Every flood the railway lifts the amount of ballast under the line but never increased the size of culverts on any additional drainage under it. It has now reached the proportion of a dam.

In the early years after the 1967 flood I was forced to lift my house out of flood height and proceeded to petition QGR, the local council and Federal members to do something about the rail line. I was amazed that most locals would not sign a petition – because of personal interests and was advised to give it up by one politician because the cane farmers on the down side of the line didn't want the flood water to come any faster and it would put more flood water over their cane.

In some of your questions you refer to local community. There are local non-cane farmers and local cane farmers – with two totally different aspects on life and attitudes and I don't think you will ever get both factions to agree.

I would be quite happy to live in Ingham if I didn't have the threat of a flood (some times two) every year. If it keeps on like this I will eventually move out. This situation has been caused, I feel, by the filling of all the swamps and drains in the area to grow cane where cane should never be grown.

➔ At this moment we have mill mud which is full of chemicals being dumped anywhere and everywhere because the mill can not cope with so much, but this will eventually wash into our waterways and seep into our local drinking water. Truck loads of mud have been going all day and night all throughout our area. This can not be good so what do we do?

The farmers are laser levelling their land therefore stopping the natural flow of waterway.

➔ I was born in Ingham 1925 and I have farmed in the Herbert all my life. My older brother and I have been keen fishermen all our lives, we used to fish all the way up to Abergowrie, one could fill a bag of fish in a couple of hours.

The tin dredges up top ruined the Herbert River, completely, and also waters from Lucinda and nearby, as the run off goes more out to sea than up the channels. On a trip to the reef, we actually travelled three quarters of the way to North Palm on yellow water before finding blue sea water and it was a sudden drop off from yellow water to blue.

Where were the Greenies, etc, then? We top dressed our bowling green with sand from the river and the clay content ruined our Green.

➔ I consider cane farmers due to lack of control have planted cane much too close to waterways in some cases and have seen cane growing in mangrove swamps. Though it would be costly I feel that all streams should be bonded with flow directed to settling ponds. There should be a minimum distance that separate cultivated area from streams.

The Taylors Beach Progress Association which did start out with good intention has fallen under the influence of a few disruptive people who have been successful in splitting this community apart. I have dissociated from this group. I consider my personal integrity affronted by some of their activities.

➔ 1. I feel there should be greater monitoring of pollution (air and water) at both sugar mills. 2. Filling in of swamp land which affects breeding habitat of fresh water fish. 3. The disposal of toxic waste from industrial sites. 4. Foreshore clearance. 5. Loss of habitat for native animals.

There should be greater education of the public about the land and water (programs, care and destruction) – not by sending out brochures but by television. Television has greater impact.

Yes my husband is a fisherman and yes I am a greenie (whatever that is supposed to mean – a lover of nature) but we both believe in management where industry, tourism and nature can be together. The natural beauty of this area is the main attraction to tourists and the local economy is heavily dependent on the sugar industry.

Management of land and water by the individual/industry and farmers may take a bit more of their time but is worth it in the long term.

➔ A barrage of education of sustainable agriculture and is your neighbour doing the right thing, penalties for those who don't. A farm plan should be part of having a cane assignment, if alterations are made without approval to drainage etc cancellation should be proceeded with.

All this is too much to put on paper by myself but it is all important.

➔ General: This district needs a strong, efficient, fair water management body that is game to tackle all issues. So this district can prosper with unusual vagrancies in the weather.

Drainage Boards run by farmers with government representation are a farce.

➔ The Herbert is a great area. We have enjoyed camping and fishing trips to may different locations along the river. After our wet season the river changes, there's a lot of change. The bed becoming silted, there are many noxious weeds along the banks, but it's still a beautiful river through the dry seasons of which we have had a few, the river has stopped running and is a string of large holes. Although I would not like to see rain forest or rare species of animals flooded, I see a strong argument for some sort of dam. At the moment, the river has a strong flow, all out to sea. There's a lot of potential for farming and industry but without water the country has to rely on seasonal rain which is too big a risk.

➔ Unless farmers are stopped from clearing scrub, filling in waterways, and unsafe chemicals being used with little or no training is the fastest way to kill this beautiful picture that we call home.

The proof that farmers have already destroyed the Herbert is overwhelming, where in the years when my grandfather was young, large boats were used to carry the sugar from as far up the river as Ingham and Hawkins Creek, now you can't drive a punt up the same river without running aground on silt banks caused by erosion of soils from farming areas.

Creeks that were the nurseries of the Barra have been either filled in or redirected they have silted up and turned sour… fish kills are becoming more and more common.

One can only hope it's not all too late.

It is sad that a local sporting shooters club can not get the land the build a rifle range in this district because of so called lead pollution and scrub destruction, when farmers go out of their way to clear land with the government blessing to plant sugar bush.

Money talks loudest.

➔ For 50 odd years I followed the pastoral and farming business. I cut down more than my share of trees and degraded many acres.

In my extended reading on the subject of greenhouse problems I have realised that this behaviour must stop. Sustainable progress with care – yes. Individuals will not voluntarily comply especially if pecuniary interests are at stake.

It is imperative that the three levels of government be shocked into line and be held fully responsible for leading. We are all in this boat together therefore we should all contribute.

The greatest problem in these environmental matters is apathy and ignorance. It is almost like a wall.

The education of our school students should have been started 25 years ago. If it is not too late that is where we should be also concentrating our effort now.

We rely on your youth, vigour and good sense to see the program proceeds.

➔ Over the years all levels of government have made funds available for mitigation and drainage of the district. However the community have been very suspicious of any worked carried out in the river and low lying areas – for fear of being personally affected. Unfortunately very little money has been spent – much to the disappointment of "ICM" and "Rivertrust".

To define benefited areas is almost an impossible task in this community – Hence it hinders major programs to be constructed.

➔ We had a very peaceful existence in this community for thirty years. My husband is an engineer and we lived in Macknade by the flooded Herbert for many years. The Herbert has levee banks along the Macknade side to protect the mill and environs. We still had flood waters to contend with. We now live at Taylors Beach and have a modest retired cottage. The new people at Taylors Beach (mostly from Southern states) we call "Mexicans" are all intent on changing everything, without any thought to the fact that it is only a paradise because we have kept it so. They blame the Government for everything. Enough said. Ta

➔ I'm of the opinion that there are too many government departments with their finger in the pie. Less Government nominees should result in better, faster results. Basic requirements for positions should be (put your money where your mouth is) and that <u>should</u> lead to a better result all round.

My experience has shown that the university trained expert has just about lost all common sense and practical solutions.

➔ Up until the instalment of flood gates on the Herbert River the Halifax area was slightly affected by flood water by major floods only as often as approximately ten yearly. Our elderly neighbours were here for the 1927, 1967 floods and have told us of the heights of the flood water. Since the flood gates we get more water and it rises very fast. Yes it keeps the water out of the township of Ingham nicely but pushes a large volume down to the Lower Herbert end. The promise of levee banks is still a non-event. We have managed to create a levee bank on the river behind our group of homes in Halifax and have seen how well they work. If the Lower Herbert was cleaned out by using dredging to deepen the water river (it is filled up by sand) and using the levee bank system we feel this could ease the volume of flood water in our district.

We would like to hear a much better flood warning system in this area. Trying to get river heights is useless. Most times our phones go down and we <u>can't</u> ring the council number. Radio stations only care what's going on in Townsville and should be forecasting at least as many times as local news is announced.

When it floods our upstairs sink and bathtub have floodwater pushed up into them (we have a high home) we also can't use our toilet. Luckily we undo the bung (plug) in our bathroom pipe to let bath water out, but have had to cut the drainpipe to be able to use the sink. This is why we are a bit more concerned than the everyday person as they don't realise these things.

➔ There is not much 'cultivational' land on the Wild River from its head at Herberton to the junction with the Millstream on Woodleith Station making the start of the Herbert River. From then on there are extensive flats that could be irrigated farms above the junction of Cameron Creek. This would have been a twenty mile long dam right up to the junction of Rudds Creek. Purpose to serve the Herbert River power station which was aborted by the J Peterson Queensland government. Instead the money was spent on coal power station at Collinsville to burn MIM coal. The water from this dam would be better used if sent over the range (Bradfields scheme), to grow such crops as rice, etc. The power eventually will have to be generated from the sun's rays, and coal left for the production of chemicals for future generations. Time Magazine's (22-7-94), account of the plight of the solar powered aeroplane to a height of 400m, stunted for 15 minutes and then landed safely, powered by a 21 square metres of solar panels generation 12KW of power demonstrates the future power source where giant power stations will be built in deserts generating sufficient power by day for day power plus enough Hydrogen from water to be burnt back to the same water for night power.

All vegetation can be grown and mature vegetation can be harvested for man's use, and make way for regrowth instead of being left to die and rot. Big squeals about the felling of trees but nothing said about the mining by a Yank company of our Phosphate deposits in central Queensland for export of phosphate fertiliser. This mineral is very scarce and should be reserved for Australian use. Politicians only think of the dollar in their pocket and the next election and the greenies are too dumb.

➔ Dear Sirs, Mesdames,

I've answered so many of these reports over the years, and still the water goes to waste in this Upper Herbert area. It's a sad state of affairs in a continent the driest in the world and least conservation of water.

Rats and possums etc all gravitate to the dams that farmers etc some how manage to put in to conserve water. In the times of drought (and this Upper Herbert gets those most each year), flood, and disastrous fires. (I've known people to light these deliberately). Little animals get to the nearest water and one time I saw the leaves from drought stricken trees floating on a rather polluted pond on an almost dry river burn on top of the water. I got in and put it out, or it would have gone for miles in a WILDFIRE. UGH! That water stank, but that was about all there was in the Blunder or the Wild River at the time. Of the Herbert had not much more that year. WE NEED THAT WAROORA DAM, for the future, to conserve water and the animals, that can't take drought better than man can.

Yes, I'm old, but have done a lot of living and been very much part of the community in lots of ways. Politics, business, civic, etc. Slowing down now though, but hate to see resources being wasted as they are at the present time.

Inspection tool place first forty eight years ago, with pegs way out in the paddocks, and still it's more and more investigations, and wasted public money as our taxes rise and rise to keep people on the investigation jobs, that any man on the land could talk about easily IF THEY WERE LET. INVESTIGATORS ignore any knowledge the man on the land may have and go their own way without listening to a lifetime of experience. So wrong ideas and impressions get

bruited around and ignorance gets accepted as fact when often the facts are quite another matter. WE NEED AND WANT THAT WAROORA DAM ON THE HERBERT RIVER CATCHMENT AREA, ACROSS THE BLUNDER. This country could be a food growing belt for so many people in the cities and overseas.

➔ The day of the small business is fading fast, they are too vulnerable to every sort of corporate predator. "Divided we fall". It is a natural process which should be taken into account to provide a "soft landing" instead of making the victims of change disposable environmental pollutants. Some of these old pioneering coots still remember Gallipoli in connection with "developing" this country.

Let us accept the one world reality and the efficiency of Big business and exchange ideas and knowledge and level <u>that</u> playing field before we carve up the neighbours resources in the present way.

It would be best for government to research actual environment pressure sources and accept responsibility because <u>that is their job.</u> Giving some top administrators jobs on properties for a full year would be a rich source of information at the most effective level. Policies of all persuasions are most effective with a real basis. The "coal face" workers are expected to be environmentally responsible and on the Internet in futures trading picking the international weather. Our politicians are swearing allegiance to a feudalistic Imperium which observes the letter of the Law of Moses and denies responsibility for the spirit of the Law. Try a day in court, before resorting to adding to legislation. It qualifies more realistically as the "Dead Heart" of Australia than Ayres Rock. The actual freedom of this country's people allows me to say these things, which I appreciate No. 5. By contrast the Indonesian Military are provoking violence and sedition as an excuse for suppression and murder. Australia has a touch of the same disease. Competition policies etc are being used to isolate and separate, forcing large scale business to use Kerry Packer's techniques in defending themselves, at the expense of Australia. That is what seems to be the driver of land degradation to me, world wide. What is needed is true democracy which includes. Although we are legally expected to vote, party selection committees are not democracy and neither is allegiance to the Queen <u>before</u> God or Country. A secure job biases your thinking and distracts your attention, bring back the swaggies as an environmental research tool. I'm nearly serious.

➔ Being a sugar-cane growing district, crop returns are vital. CSR and other big companies such as Coles and Woolworths do NOT leave much finance to benefit Shire. There are too many bureaucrats pushing their own barrow. Shire Council, Canegrower organisations, CSR, millers and community groups contain too many people who only think for themselves. Government ministers (ARE NOT AWARE) of the nitty gritty position that many people who have over 80 years of family work etc to show, are being exploited by bureaucracy is serious exploit. All ministers should be seeking advice of rank and file people who are the backbone of the Herbert. Ministers should bypass elected people and speak to the rank and file person who is the main contributor.

➔ Statement three: "local people lack the money to spend on solutions", rates as 3, neither agree nor disagree:

Local people are a mixture of pensioners, workers and cane farmers and graziers.

The first two groups do not have money to spend on solutions.

Farmers, on the other hand, are mostly extremely affluent – some millionaires – do have money to spend on solutions to problems which they have caused – user pays!!

➔ Creeks rising from heavy rainfall ad requiring the re-location of private water pumps, to avoid inundation – mainly due to siltation of creek beds which do not have an ongoing maintenance by any water authority – I personally need to engage the services of a back-hoe operator at my expense, to clean my creek of silt and water-grass every three years.

➔ Sadly community know very little about Strategies because you have people (so called elected people) who keep most information behind closed doors.

➔ Considerable environmental impact studies were done for the Tully-Millstream Hydro-electric scheme which I believe showed that this quite large scheme would not have as much environmental impact as what most people thought.

➔ The Government is very wise in having nothing to do with the Millstream-Tully power scheme. This proposed white elephant starts with a dam on the Millstream a few miles below Ravenshoe – water channelled for miles to another dam on Blunder Creek through a tunnel 10 miles or so to another dam on Mitcheter Creek. This dam has to be high enough to gravitate water upstream to the Koomboomba Dam then an inclined tunnel down to a new power station in the Tully Gorge. The water from the Blunder dam has to be pumped to the Mitcheter dam.

➔ Hinchinbrook Channel – Money is the root of all evil.

Related to the question on awareness of the HRCCC:
➔ We don't know, because if you take a local problem, they do not want to know of it. They say they are looking at the broader picture.

Related to the question about specific HRCCC activities:
➔ Were effective in planting Palm Creek but only until funds ran out – rather prematurely. Lots of effort and good work but hardly started when they had to stop!

➔ Have read that they are active but have not seen any information on their actions or recommendations.

Related to the question about Local Government planning taking ICM into account:
➔ In answering question 24, I would say there was no input by the Mareeba or Atherton Council in the Mareeba, Dimbulah irrigation scheme, likewise with the Tully Falls, Koombooloomba Hydro-Electric Scheme. I would say there was no consultation with the Herberton Shire Council.

Related to the question about funding of ICM:
➔ The government want$ and need$ primary industry but take little responsibility in the utilisation and care of the same industry – by the same token, they are not totally responsible for the geographical placing of the industry – so costs should be shared fairly evenly.

➔ I have no idea. This is a complex matter: Industry/farmers should pay a levy on productivity/profit. The others to pay a pro rata % stipulated by a variety of factors.

Related to the question about seeing the Catchment Management Strategy:
➔ Have tried to get hold of it but so far it has been unavailable to me and the club I belong to although we have had speakers on the topic. (A copy of the Catchment Management Strategy was sent to this respondent).

Summary of Individual Comments

Participants were invited to include any additional comments at the end of the survey. Of the 401 surveys returned, 53 included extra comments and many covered a number of issues. The main areas were: feedback on the survey (11 comments); apologies (9 comments); the environment (48 comments); government (21 comments); and local issues (27 comments).

Feedback
Feedback on the survey included: this is an important issue; questions were difficult; thanks for personally signing the cover letter; I enjoyed participating; not happy that the government funded this questionnaire; would like to use the results for educational purposes; shall try to gain more knowledge from now on; and I don't want to take part again.

Apologies
A number of people apologised for not filling out questions or for the quality of their answers. The reasons given were due to age (4 respondents); not home a lot; illness; family problems; new to the area; some questions don't apply to me; and it was hard to make decisions on some questions.

Environmental Issues
Environmental issues were commented upon most frequently, these were related to land and water issues (41 comments); land use problems (4 comments); and damage caused by animals and the loss of habitat for local species.

Of the land and water issues mentioned, water quality and clearing of land were the most frequent (10 and 7 respondents respectively). Wetland issues were raised by 5 respondents; flood issues by 4 respondents and stream degradation and erosion by 3 respondents.

Other issues raised were water restrictions and monitoring; a new water scheme; the lack of ongoing maintenance of creek beds; filling in swampland; hot springs; need for a new dam; problems with Spring Creek dam; potential and current problems with land and water management; the Millstream-Tully power scheme; and the comment was made that "land is the foundation of our lives".

Land use issues were also commented upon in some individual comments, such as damage to the area by the use of chemicals; disposal of toxic waste in the area; damage to the area by graziers which was perceived to be greater than damage by mining; and mud problems caused by the mill.

Government
There were 21 comments regarding government issues, such as financial issues (8 comments), government interference (5 comments), community needs (3 comments) and other issues.

Financial issues dominated this area: financial dependence of the community upon the government; lack of money in councils; concentration by government and politicians on

money and elections; greed of the community and government; wastage of tax money by conducting investigations; sharing of costs by all involved in the area; and the fact that little of the funds made available for floods were actually spent in the area.

Government interference and stalling of progress were other issues raised by a number of people: "the government is trying to stop farming and take away land"; "there is too much government

interference"; "the community know little about strategies as you have people who keep most information behind doors"; "there are too many stalled projects"; and "government department conflict sometimes results in projects not going through".

There were also comments on what the community needs from the government – the need for government involvement and control of the use of chemicals in the area and a strong management body.

Other comments concerned activities in the Hinchinbrook area; drainage boards; lack of government consultation of the community; and the lack of commonsense.

Local issues
Comments concerning local issues can be further categorised under community and financial issues (8 comments each), suggestions for the area (8 comments) and other issues.

Community issues raised were the lack of community pull-together; that the community cares but takes no action; the rapidly growing awareness and change in community attitudes; variety of different opinions lack of agreement; everyone blaming everyone else; lack of a big picture vision; and negative attitudes.

Financial issues included: the perception that "money talks loudest"; the cost to the environment due to desired profit; community paying for the wetlands; lack of funding doesn't mean that people don't care; too many tax dodgers; rates not being spent on a graded road; some locals have more money than others to spend on solutions; and big businesses taking over individual businesses.

Suggestions for the area were that individuals should monitor their own environment; we should blame farming; the whole community should coordinate a strategy; greater education of environmental issues is needed; use television; have penalties for those who do the wrong thing; and the necessity of farm plans.

Other comments made were about the Taylors Beach Progress Association; that it is hard to obtain the Catchment Management Strategy; new people coming which changes everything; the HRCCC; the question of future power sources; that it is not too late to fix problems; and that it is a really nice area.

Those who included extra comments covered a wide range of issues of concern to them. While some issues were raised more frequently than others, these were all very important to respondents and therefore no priorities can be assigned to the issues.

EVALUATION OF INTEGRATED CATCHMENT MANAGEMENT IN A WET TROPICAL ENVIRONMENT: COLLECTED PAPERS OF LWRRDC R&D PROJECT CTC7

Compiled by Jennifer A. Bellamy

VOLUME 6

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Chapter 1

Economic Evaluation of ICM Organisations: A Case Study of the Herbert River ICM Organisation

An Interim Report

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1.0 INTRODUCTION

1.1 Evaluation of Integrated Catchment Management in a Wet Tropical Environment

In 1994, the Land and Water Resources Research Development Corporation (LWRRDC) funded research staff at CSIRO Tropical Agriculture (in Brisbane and Townsville), CSIRO Land and Water (in Perth) and the University of Queensland, Department of Geographical Sciences and Planning, to undertake research on Integrated Catchment Management (ICM) processes. The research is a longitudinal study, conducted over five years, focussing on the implementation of ICM in the Herbert River catchment in North Queensland as a case study. The objectives of the research are:

1. To monitor and document the process of implementation of ICM in the Herbert River catchment and identify the social, economic and institutional factors which facilitate or hinder this process.
2. Evaluate key impacts of the implementation of the ICM process in terms of attitude and behaviour changes in the community and changes in the severity or tractability of the resource use conflicts for the catchment.
3. Assess the specific technical and related information needs that are relevant to an effective ICM implementation process in a wet tropical environment.
4. Develop a framework and related methods for evaluating the process of ICM implementation that will facilitate the development of more effective catchment management programs in Australia.

The temporal complexities of catchment management require a longitudinal study. A longitudinal study facilitates an evaluation of processes and the impact of the implementation of these processes over a period of time. A study of this nature is essential if the issues of catchment management are to be understood and appropriate lessons learned. The project acknowledges that, by its nature, a study of ICM requires a multidisciplinary approach. For example, ICM needs to take into account social, economic, institutional and environmental considerations, all of which operate under conditions of uncertainty. Moreover, indicators of progress are not easily defined and difficult to measure. Research in this area has raised more issues than it has resolved.

In responding to the complexities and multidisciplinary nature of ICM, this research has adopted a multidisciplinary approach to an evaluation and draws on areas of expertise including natural resource sciences, social science, land-use planning, economics and media analysis.

An economic evaluation of the ICM organisation in the Herbert River Catchment requires an approach which is expected to provide information to decision-makers about the efficiency of investment. An appropriate approach is expected to provide consistent and reliable evaluations of this organisation and other organisations of this nature.

This study will establish the information that an economic evaluation would be able to provide to decision-makers. It will also identify a number of assumptions that will need to be made to undertake an economic evaluation of ICM and the limitations associated with a study of this nature.

In relation to the overall evaluation of ICM, it is expected that the economic evaluation will provide information that will:

- assist in the identification of factors that foster or constrain an ICM organisation from achieving stated objectives;
- identify potential impacts of ICM;
- assist in assessing the technical needs for effective ICM.

- assist in identifying appropriate indicators to support future evaluations measuring performance and efficiency of ICM organisations.

This is the first report on the economic evaluation of ICM.

1.2 Grounds for this Study

Natural resources in river catchments in Australia are coming under increasing pressure from industrial, urban and agricultural development. Development and redevelopment of land and water resources is directed towards earning the highest financial return from investment. Short-term gain is sometimes placed ahead of long-term ecological sustainability. The condition of Australia's agricultural resource base is cause for particular concern. The Prime Minister's Science and Engineering Council (1995) registered its concern that "the maintenance of productivity and competitiveness has been bought at the price of the condition of the land itself" (p.1). Economics is the study of making choices when resources are scarce, that is, when there are competing and sometimes conflicting uses for resources. The economic problem to be addressed by authorities (which includes community organisations) managing river catchments is how the land and water resources within a catchment are to be managed to best satisfy the criteria for ecological sustainable development (ESD).

Prior to the 1970s resource management would have been interpreted as satisfying the material needs of society, namely food and shelter. In the 1990s resource management encompasses the concept of ESD. ESD recommends the development and management of natural resources to "ensure that it meets the needs of the present without compromising the ability of future generations to meet their own needs (WCED, 1987, p.8). In addition, "the ecological dimensions of policy [need to] be considered at the same time as the economic, trade, energy, agricultural, and other dimensions" (WCED, 1987, p.10).

A number of state governments in Australia have adopted integrated approaches to natural resource management, particularly with regard to the development and management of land and water resources. To assist in the identification and implementation of resource management a number of state governments have established integrated catchment management (ICM) organisations. These organisations are, at least partly, funded by public sector investment. Decision-making in Australia, with regard to public sector investment in a project or program requires an economic evaluation to provide information about the efficiency of resource allocation and investment, such an evaluation includes consideration to the quality of the environment.[1]

Accountability of public expenditure is an increasingly important requirement of agencies that have been allocated public funding and/or have applied for public funding for the provision of a program or a public good. In this regard, the Australian National Audit Office (ANAO) (1997) is particularly critical of the lack of progress of organisations, such as DPIE and Environment Australia which manage funding for programs which aim to encourage ESD principles, towards measuring program outcomes, particularly in relation to performance and financial accountability. This requirement of ICM organisations in Queensland is acknowledged by Rowland and Begbie (1997), from the Department of Natural Resources (DNR), who identify the need for accountability and performance as an area requiring attention. Since 1995, the Liberal party government in Australia has substantially increased funding to natural resource management through the National Heritage Trust (NHT). Curtis and Lockwood (1998) have expressed concern that government has also invested increased sums of public money in natural resource management through NHT on the basis that regional catchment plans are of sufficient quality to ensure investment returns which would satisfy the Department of Treasury (Curtis and

1 Where a program is defined as an aggregation of individual projects (AACM, 1997).

Lockwood, 1998, p.15).

They continue to claim that formal assessments indicating how limited resources should be allocated or of the benefits associated with investment already made, have not been undertaken. (p.15).

The NHT uses cost-sharing principles that enable community and private benefits from specific works to be identified. Applications for funding require that the relative proportion of public and private benefits flowing from projects is demonstrated. In Victoria catchment management committees operate under business plans, employing staff and purchasing services to implement catchment strategies. In short, ICM organisations are developing into well-defined and well organised community structures with greater financial resources for which they are required to be accountable.

For many programs or projects, an element of private investment is required for successful implementation. The level of private investment is necessary information for decision-makers. Firstly, it is an important consideration for establishing the cost sharing arrangements for funding of projects. Secondly, if programs or projects which necessitate private investment are to be undertaken by individuals then information needs to be provided to individuals which indicates the possible return from their investment. In relation to the increasing need for performance and financial accountability, an economic evaluation is required of ICM organisations in Queensland, more specifically, of ICM organisations representing and implementing their interpretation of the Queensland strategy in their own catchments.[2]

1.3 Objectives of this Report

The objective of this report is to identify and describe an appropriate methodology for conducting an economic evaluation of ICM organisations, using the Herbert River Catchment Coordinating Committee (HRCCC) as a case study. The remainder of this paper is organised to complete a number of tasks. Firstly, a review of previous studies which provide economic evaluations of natural resource management programs is undertaken to identify the approach of previous evaluations and to highlight issues which would need to be addressed in this study. The second task reviews a number of economic techniques or tools which might be applied to evaluate programs to establish an appropriate evaluation technique for this study. The choice of technique will largely be determined by the information it can provide to the decision-maker; the data requirements, and; by the ability of the technique to provide consistent and valid outcomes. A number of the problems associated with the application of an appropriate technique to evaluate projects or programs concerning environmental issues are discussed and a methodology described which could go some way towards addressing these problems.

2.0 PREVIOUS APPROACHES TO ECONOMIC EVALUATIONS OF NATURAL RESOURCE MANAGEMENT PROGRAMS

A review of the literature describing economic assessments of programs in Australia that have the objective of managing natural resources suggests that an economic evaluation, where the social costs of undertaking investment in a natural resource management program are compared to the social benefits, has not been undertaken routinely. Curtis, Robertson and Race (1998) suggest that the lack of published studies could be a reflection of evaluator concerns for confidentiality

2 The distinction between ICM and Landcare is made at this point to prevent subsequent confusion. Stallman (1994) distinguishes between them, defining ICM as involving "the community and government working together through various forums to develop and implement strategies for the better management of catchments" (p.28). Landcare, on the other hand, is defined as relating to " groups of local people forming landcare groups or associations. Landcare is the body working to solve those local issues at a local level" (p.28).

and of the potential for the findings to be controversial. Regardless of the reason however, lack of published evaluations has reduced the possibility of transfer of information between project managers about how studies of this nature could be approached and how problems encountered through the studies might be addressed.

Assessments have been undertaken of projects or programs involving consideration to ecological or environmental issues which concentrate on assessing the impact of the project on the financial viability of individual farm units (Greiner, 1994; 1997). Although studies of this nature make an important contribution towards increasing the understanding about the ability of individual farm units to invest in resource management on their own properties, they do not provide information about the net social benefits of public investment in resource management programs.

Identification of appropriate methods to value the environment, for example, Common, Blamey and Norton (1993); Sinden, (1994); Morrison *et al*., (1996) dominate the literature about economic evaluation of the environment. Although these studies are important because they assist in establishing consistent and reliable methods to quantify non-marketed environmental goods and services, how information about the *value* of an environmental good is to be used in an *evaluation* is not necessarily made clear. Cameron (1997) describes a contingent valuation (CV) approach to valuing the water quality in the Hawkesbury-Nepean catchment. Although Cameron does not conduct an economic evaluation of the ICM organisation in the catchment using the information acquired through the CV, he does suggest that such information would be valuable in a CBA or to establish catchment community priorities for resource management. Interestingly, Cameron argues that the information about the value of an environmental good, such as water quality, is not necessarily useful to ICM organisations. He contends that "if it were to be introduced into ICM in a widespread way, there would be pressure from participants to modify the use of CV into a more qualitative and educative role" (p.164). These sentiments are not shared by Curtis and Lockwood (1998) who claim that extended CBAs incorporating "comprehensive valuation studies can … enable explicit representation of all stakeholders" (p.20) and facilitate improved evaluation of investment of public funds. It is very possibly the process of actively involving the catchment community in the decision-making process, by soliciting their opinion, that Curtis and Lockwood find appealing about CV rather than the estimates of willingness to pay.

General appraisals or assessments of ICM programs frequently concentrate on assessing the process rather than the outcomes from the implementation of the process. For example, a study appraising the Lockyer Valley ICM organisation in Queensland (Stone and Assoc., 1995), reviewed and assessed the process rather than the extent to which the organisation had achieved its stated objectives. No attempt was made to evaluate the performance of the organisation in economic terms. Indeed, lack of information about an appropriate set of performance indicators was cited as the reason why this had not, and could not, be undertaken.

Lack of economic analysis of catchment management programs has been identified by AACM (1995) in their report assessing the strengths and weaknesses of current catchment management policies and programs.

> In the activities reviewed there was no use of resource economic analysis to identify priorities and allocate costs and benefits between public and private sectors. Social costs and benefits were rarely identified and almost never used to justify public investment. Very few of the investments in activities reviewed were based on financial analysis of the costs and benefits associated with natural resource management. None of the investments were based on analysis of the economic costs and benefits of resource management. (AACM, 1995, p.6)

As a result therefore, the report concludes that no government agency or community group could justify the investment in their projects in terms of national (economic) benefits.

An evaluation of the National Dryland Salinity Program (VCG Australia, 1997) includes a CBA of the predicted costs and benefits of the program over a period of 60 years. However, the assumptions underlying the identification, measurement and valuation of costs and benefits are not made explicit. In addition, apart from valuing the avoided costs of lost production, no other benefits were identified or discussed. In brief, the CBA is in the form of a financial evaluation where only the financial transactions associated with the implementation of the program are evaluated. For example, downstream impacts on the biological diversity of the river environs are not considered, neither are the financial outlays and economic costs to individuals in the catchment community.

More recently, the Land and Water Resource Research Development Corporation (LWRRDC) commissioned a series of studies which firstly, established guidelines for the selection of appropriate techniques for evaluation of LWRRCD funded research and development projects (AACM, 1997) and second, evaluated a number of projects (ACIL, 1997; Sloane Cook, 1997; Harrison and Tisdell, 1997). Evaluations had the objective of "identifying actual and potential outputs and benefits of projects and where possible to quantify the benefits accruing to users of natural resources and to the Australian Community in general" (ACIL, 1997, p.x). These studies go a considerable way towards addressing the need for economic analysis of research projects. One of the acknowledged limitations of a large proportion of these evaluations is the quantification of non-market benefits.

An evaluation of a project entitled "Developing methods for assessing the effectiveness of whole catchment management" (ACIL, 1997) is of particular interest to the current study. Essentially, the evaluation is of an evaluation project. The purpose of the project is described as facilitating evaluation of whole catchment management (WCM) which will provide recommendations for ongoing evaluations of WCM nationally. Assessment of the project stresses the option value of the information gathered which is estimated to result in a 1 per cent improvement in the control of one specific natural resource problem (dryland salinity). The evaluation of the project is reliant on the assumptions about the potential of WCM to change the salinity situation which relies also on assumptions about the ability of WCM to change the behaviour of land managers. This evaluation acknowledges that identification of *potential* benefits is not a problem, the real problem lies in *realisation* of the benefits. A number of the issues raised in this evaluation, in particular attributing any improved condition in natural resources to a specific project or program and determining the extent to which potential project or program benefits will be realised, will need to be addressed for the current study.

Enters (1998) reviews a number of projects dealing with soil erosion, drawing attention to the issues surrounding economic assessment, including methods of valuation, the time horizon of studies and the choice of discount rate, and drawing some conclusions about how these issues could be addressed. He takes the approach that "strong arguments for soil conservation need to be based on thorough economic assessments of the on- and off-site impacts of soil erosion…to provide the necessary input to environmental decision making" (p.v). In so saying, he contends that CBA is an appropriate technique for evaluations of this nature because it has the capacity to incorporate all of the information about a project and because it provides valuable information to decision-makers. Enters stresses the importance of stating the assumptions underlying a CBA and in particular for identifying, measuring and valuing costs and benefits.

In summary, economic evaluations of projects or programs which have the objective of improving the quality or condition of natural resources have not been undertaken on a routine basis. A review of published economic evaluations indicates that many are in the nature of a financial analysis where the financial returns to the implementing or funding agency are estimated rather than the returns to society as a whole. Problems encountered by analysts undertaking

economic evaluations include measuring environmental improvements and valuing environmental benefits. The next section reviews a number of economic evaluation techniques which are capable of providing valuable information to decision-makers about the economic impact of projects or programs or about the net social benefits of projects or programs.

3.0 ECONOMIC EVALUATION TECHNIQUES

Although there are a number of economic evaluation techniques or models available to project analysts which provide information to assist in decision-making, the choice of technique will ultimately come down to the nature of the information required from the analysis, the data requirements and the robustness of the assumptions underlying the technique.

3.1 Economic Evaluation Approaches

Input-output techniques which measure the economic impact or a project or program on industry sectors in a regional or state economy are appropriate in situations which do not require information about the efficiency of the investment. Input-output techniques estimate the direct and indirect effects on industry sectors of an initial investment in the economy through market transactions (assuming a linear relationship between economic variables). The results from an analysis are conventionally provided in terms of a number of economic indicators, including: employment, gross output, gross income or value-added. Only market transactions are included using this type of impact assessment. The impact of investment on the quality of the environment is not directly measured. Conventionally, qualifying assumptions are made to suggest that environmental impacts require additional work needs to be undertaken. For example, Robinson *et al.* (1994) provides a regional impact assessment of options to expand irrigation infrastructure in the Burdekin River Irrigation Area (BRIA). An important assumption stated up-front in the report was that environmental impacts were not included in the evaluation.

Although there is scope for input-output models to be developed that could provide this information, the data requirements would be substantial and difficult to collect. In addition, the assumption of linearity between economic variables may not reflect the "real world" situation, particularly for environmental impacts.

An advance on input-output analysis is the more complex computer generalised equilibrium model (CGE), for example the ORANI model (Dixon, 1982; IAC, 1987). These models, like the previously discussed input-output models, rely on powerful assumptions about the relationship between variables in the model and suffer from the same uncertainties underlying all models which attempt to reflect the real world. Data requirements for these models are substantial. A CGE model has been developed to measure the impact on industry of taxes to reduce greenhouse gas emissions (McDougall, 1993; Hinchy and Hanslow, 1996). Conventionally, these models are used to measure the impact of a policy change on industry rather than the impact on the environment of a change in resource use or management.

Another evaluation technique which is increasing its scope of applications is a Multiple Objective (or criteria) Decision Support System (MODSS). Although economic considerations are not necessarily central to the MODSS approach to decision-making it does have the capacity to incorporate economic criteria within the evaluation and decision-making process. It is regarded as worthy of consideration to evaluate a project or program which has multiple outcomes, some of which might be of an economic nature. It is particularly appropriate in situations where some outcomes are difficult to value in monetary terms and could be in conflict with other criteria. Examples of MODSS approaches to decision-making are described by Shaw *et al.* (1998); Robinson *et al.*, (1998) and Bellamy *et al.*, (1997). Closely related to MODSS approaches are Lexicographic Goal Programming and Weighted Goal Programming techniques which are

mathematical approaches, using linear programming techniques, to identify a solution when there are multiple criteria to be met (for example McGregor and Dent, 1993).

Although MODSS techniques facilitate the incorporation of qualitative information about project outcomes (including environmental impacts) which is valuable information, they also require subjective assessment of the criteria for project evaluation, the assigning of weights to the criteria and frequently a subjective score for the performance of project options. Reduction in the degree of subjectivity requires detailed information and research which take resources and time to gather. A MODSS provides valuable information to assist decision-making when a choice between projects or programs is required. It does not specifically address environmental impacts or provide estimates of economic returns from the implementation of a project, in addition the scores assigned to the expected performance of project options could be uncertain.

Investment Decision Analysis (IDA) which incorporates probability estimation of outcome into decision-making is an extension of CBA. The real value of this technique is in the results from the simulation of outcomes or actions. The choice of action or alternative is made on the basis of information which reduces the risk associated with a decision. Increasingly, IDA is carried out as a useful adjunct to a CBA and is described as a risk analysis (see for example Brown *et al.,* 1994). For the simulations to be meaningful and reliable considerable data are required. Although this approach addresses the uncertainty surrounding decision-making, on its own, it has limited usefulness.

3.2 Economic Cost-Benefit Analysis

An economic CBA is employed mainly by governments to determine whether or not particular projects or policies will improve a community's welfare and should therefore be supported. A CBA is regarded as a way of systematically organising information to present arguments about whether or not a project or policy should proceed. An economic CBA provides more than an accounting statement or balance sheet of financial transactions associated with a project or program. It provides a consistent and valid procedure for comparing alternative courses of action by reference to the net social benefits they produce (Dept. Finance, 1992).

The term 'net social benefits" refers to the difference between social benefits and social costs. Benefits and costs are "social" as distinct from private or individual in the sense that they are measured irrespective of the people to whom they accrue. In the case of many public sector projects, and particularly those for which there is an environmental component, market prices are not available. In these cases estimates of costs and benefits are made using non-market valuation techniques.

CBA can also play a role in measuring the effectiveness of a project or program. These evaluations look at whether a project or program, which still has some time to mature, is achieving its stated objectives and whether the objectives themselves are still relevant. The project or program outcome that is measured using a CBA is the value that consumers in a competitive market place on goods and services, or would place on goods and services if a competitive market existed. A CBA should address the question "do the expected program outcomes justify the commitment of the proposed level of resources?"

Cost effectiveness analysis (CEA) which is closely related to CBA provides another approach to an economic evaluation of a project or program. This technique is particularly applicable when it is easier to identify benefits than to value them. An evaluation using a CEA offers a priority ranking of projects on the basis of comparative "cost per unit of effectiveness". The analytical requirements of a CEA mean that the chosen measure of effectiveness adequately captures the predominant impact of the project alternatives under consideration. CEA is therefore not

regarded as appropriate when the outcomes of a project and the alternatives to the project have multiple outcomes. The difficulties inherent in identifying and valuing the outcomes from an ICM organisation, such as the HRCCC, might suggest that a CEA would be appropriate. However, data about the possible costs of alternatives to an ICM organisation, including regulations and economic policy instruments are not readily available. In addition, not only are the outcomes from an organisation, such as ICM, which provides a service to the community, not easily measured, but there is not a common indicator of effectiveness of these organisations. Specifically, ICM organisations commonly undertake multiple activities with multiple and sometimes poorly defined outcomes. This discussion is continued in relation to the identification of appropriate sustainability indicators.

CBA provides valuable information to decision-makers. This includes:

- A definition of the scope and objectives of a project or program and alternative options, including policy options, which might be available to government to meet the same objectives.
- Identification and valuation of costs and benefits associated with the implementation of a project, particularly when these costs and benefits are in the nature of externalities and are not marketed. Estimating an economic value for non-market costs and benefits raises policy issues about the appropriateness of non-market valuation techniques to estimate a willingness to pay (WTP) or a willingness to accept compensation (WTA).
- Information about the uncertainty associated with a project or program. By providing decision-makers with information about the nature of the uncertainty and estimating the impact of uncertainty on project worth, a number of policy issues can be highlighted. For example, the speed of implementation of a project or program is likely to impact on project returns. CBA can demonstrate to decision-makers the additional benefits of funding a project early, or, conversely delaying an investment decision until further information can be made available.
- CBA can identify appropriate policies to improve the performance of a project or program. For example, it can identify pricing structures or areas where a subsidy or tax might improve the ability of a project or program to meet its overall objectives.
- CBA can provide information about the distribution of the costs and benefits associated with a project or program. This is important information which is particularly appropriate where cost-sharing decisions are required. Information about the distribution of costs and benefits provided through a CBA may provide information which enables statements to be made about cost-sharing policies but not about equity. Equity implies value judgements about "fairness" which introduces moral judgements about what is fair and these value judgements are beyond the scope of a CBA. The Department of Finance (1991) suggests that CBA should provide decision-makers with information about the distribution of costs and benefits and leave any value judgements about fairness to policy-makers.

An economic evaluation is not merely an accounting statement of a project or program. It provides a source of valuable information to decision-makers about the project or program under review. The limitations associated with CBA are discussed in more detail below. The choice of approach to a natural resource management evaluation and the methodology underlying the application of the evaluation technique will be determined by the information the decision-maker requires and by the data availability surrounding the project or program under review. It is important to stress however, that a consistent approach to evaluation is required if decision-making is to be regarded as reliable and valid.

3.3 Appropriateness of CBA as a Tool to Evaluate ICM

Resource economists traditionally have used CBA to establish the efficiency of investment in a project or program. Laut and Taplin (1989) are sceptical of the appropriateness of CBA to

examine the economic success of catchment management techniques. They claim that it is more appropriate for pre-development proposals than for post-development evaluation. The lack of suitable performance criteria, particularly sustainability indicators, the likely cost of monitoring market surrogates and the lengthy time-scales are cited as mitigating against the successful adoption of CBA as an evaluation technique.

Criticisms of CBA, particularly in its application where environmental issues are involved, include:

(i) Ecosystems are complex and the information about the impact of development is uncertain and could lead to irreversible damage to the ecosystem. How is a change to the ecosystem to be measured? What are the indicators of change? How are the changes to be valued? Does the possibility of damage to the ecosystem mean that an investment decision is delayed until the necessary information is available? This course of action could result in present generations being made worse off to accommodate future generations.

(ii) The valuation of non-market goods and services such as native flora and fauna as well as the landscape poses a problem. Problems which need to be addressed include the method used to estimate values and the reliance that can be placed on estimates. Questions have been raised about the morality of placing money values on the environment.

(iii) The discounting of future costs and benefits raises a number of questions about the appropriate rate. Does discounting violate the rights of future generations? If we do not discount would we be encouraging exploitation of natural resources? How do we set a discount rate that will safeguard the ability of future generations to meet their needs?

All of these problems need to be addressed before an economic evaluation of an ICM organisation can be undertaken. Specifically, what are the appropriate indicators of improved environmental quality? How is an improvement in the ecological sustainability of resource use in the catchment going to be measured? How is an estimate to be made of the value of the improved quality of the environment? What is an appropriate discount rate for future costs and benefits? What is the time frame for the evaluation?

Sustainability Indicators

The Standing Committee on Agriculture (1991) endorsed a definition of sustainable agriculture from which sustainability indicators could be inferred. Sustainable agriculture is defined as the use of farming practices and systems which maintain or enhance:

- The economic viability of agricultural production
- The natural resource base
- Other ecosystems which are influenced by agricultural activities.

The identification of measurable attributes of the ecological sustainability of the economy of a nation, region, catchment or farm unit is explored by Walker and Reuter (1996). They define indicators as "key attributes that give an impression of major trends and condition, and are based on the key components of the whole agro-ecosystem" (p.7). It is proposed that ecological sustainability indicators are "precise and accurate in describing a particular function of the environment and will serve to signal desirable or undesirable changes" (p.7).

More recently, the State of the Environment Advisory Council (SEAC) (1997) and the Australian Local Government Association (ALGA) (1997) have adopted the pressure-state-response model developed by the Organisation for Economic Cooperation and Development (OECD) to propose a set of indicators that reflect priority issues in regional policies, plans and strategies. The pressure-state-response model is based on indicators which represent key elements of more complex systems. It is a model developed to assess or evaluate natural resource management. Pressure indicators are selected as representing human activities that affect the environment;

response indicators represent the human response to a perceived environmental problem; and state indicators register changes in the environment which reflect the impact or pressures and/or the effectiveness of the response. The report by the ALGA has identified data sources of selected indicators and identified gaps in the currently available data. One of the findings from the report states that "there is currently a dearth of reliable baseline data" and that establishment of quantifiable benchmarks or indicators for evaluation of resource management is an important requirement (p.10).

Preparation of the State of the Environment (SoE) reporting (SEAC, 1997) has involved the development of a set of indicators that can be used to assess the condition of natural resources. It is anticipated that these indicators will provide "a good foundation for future development" (p.ES-6).

Since 1991 the Australian Bureau of Statistics (ABS) has made progress towards establishing a set of indicators of the ecological sustainability for agriculture in Australia. Using the report from the Standing Committee on Agriculture and Resource Management (SCARM) (1993), the ABS has produced a report providing data about a set of key indicators which "embody a particular aspect of agriculture, with the attributes being numerical descriptions of individual parameters" (ABS, 1996, p.5). The SCARM (1993) indicators include:

- long-term real net farm income
- land-water quality to sustain production
- managerial skills
- off-site environmental impacts.

More recently (SCARM, 1998), the indicators have been revised to include socio-economic impacts.

These proposed indicators of sustainability embody a number of individual parameters of attributes. For example, long-term real net income could embody parameters such as net farm income, productivity, terms of trade and number and size of agricultural establishments. Compiled over time, it is suggested by SCARM that these parameters could reveal information about the economic and ecological viability of the agricultural sector. Unfortunately, no suggestions are offered about how changes in these indicators, if detected, are to be valued. The SCARM (1998) indicators and descriptive attributes are shown in Table 1.

Table 1. SCARM Indicators of Sustainable Agriculture

Key Indicators	Descriptive Attributes				
Long-term Real net Farm income	Real net farm Income	Total Factor productivity	Farmers' terms of trade	Average real net farm income	Debt servicing ratio
Natural Resource Condition	Nutrient balance: P and K	Soil condition: acidity and sodicity	Rangeland vegetation condition	Agricultural plant species diversity	Water utilisation by vegetation
Managerial Skills	Farmer education level	Extent of participation in Landcare and training	Implementation of sustainable practices		
Off-site Environmental Impacts	Chemical residues in products	Salinity in streams	Dust storm index	Impact of agriculture on native vegetation	
Socio-economic Impacts	Age structure of agricultural workforce	Access to key services			

Source: SCARM ,1998, p.7.

The choice of indicators of sustainability is highly dependent upon subjective assessment of what constitutes ecologically sustainable agriculture and what is unsustainable. SCARM (1998) claims that "these indicators are not comprehensive, but have been chosen for their ability to record the sustainability of agriculture. The attributes used to measure each indicator are those for which reliable and consistent data are available" (p.3).

To measure an improvement in the ecological sustainability of agriculture as a result of the activities of ICM would require a number of indicators of ecological sustainability in a catchment to be established at the outset of implementation of the ICM organisation. Identification of appropriate indicators would need to accommodate spatial and temporal considerations. Measuring the achievements of an ICM organisation is not simply a case of identifying particular attributes for sustainability indicators and measuring a change over time. Evaluation of an ICM organisation using measurable change in sustainability indicators would require the identification of particular issues and for indicators to be identified which would best measure the effectiveness of ICM activities towards addressing the issues. For example, an issue such as river bank erosion would require an ICM organisation to undertake a number of activities, such as encouraging wider riparian zones and stabilisation of the river bank. The outcome of these activities could be improved and/or increased stability in agricultural production along river banks as well as improved water quality. An appropriate indicator in this situation would be the area under riparian vegetation, water quality indicators such as turbidity, as well as improved on-farm production. Attributing or apportioning any change in these indicators to the endeavours of an ICM organisation would be problematic because ICM does not work in isolation from other resource management agencies or organisations.

Although, in the case of the Herbert River catchment, there is considerable information currently available about the condition of the natural resources in the catchment, see for example, Department of Natural Resources (1996) and Johnson and Murray (1997), this information has not been collected as a time series which would demonstrate a change in the condition of the natural resources. As a result, therefore, any change in the condition of natural resources in the catchment would be estimated on an *ad hoc* basis.

Choice of indicator however does not need to be based on specific scientific, economic or social data but rather on what is important for a particular catchment. In relation to the choice of appropriate indicators, Brown (1998) recommends that

> a good indicator is visually arresting, politically significant, and scientifically valid for the use to which it is to be put. It must carry meaning at the individual as well as the social level. Most of all it must fit within a framework familiar to scientist, politician, administrator and conservationist alike. For indicators to speak to decision-makers at local, national or global scales, they must be sensitive to matters of time and social priorities, of place and scales, and in a framework that links social, economic and environmental data.
> (Brown, 1998, p.272)

Performance Indicators

Establishing a common set of performance indicators or criteria to measure the performance of ICM organisations is difficult because the levels of performance of each catchment vary in accordance with the inherent natural resources of catchments, the problems a resource management strategy is required to address as well as the resources available to the catchment organisation (including social, institutional and financial resources).

The ANAO and the Department of Finance (1996) guide for the Australian Public Service suggests monitoring and evaluation of performance of programs or work units. Accountability of agencies relies on performance information which is considered to be a critical tool to assist in

management of programs. Performance is defined as "the carrying out or achievement of a particular purpose, task or function" (ANAO and Dept. of Finance, 1996, p.3). It is suggested that the identification of appropriate performance indicators be developed within a framework which includes the objectives and strategies of the project or program. In addition, early identification of performance indicators is recommended to facilitate on-going monitoring and evaluation of programs.

The Industry Commission (IC) (1997) describes two performance indicators to measure the efficiency and effectiveness of an organisation providing a service to the community.

1. Efficiency describes how well organisations use their resources in producing services – that is, the relationship between the actual and optimal combination of inputs used to produce a given bundle of outputs. This would normally be measured by means of CBA where the opportunity cost of producing the services was estimated.
2. Effectiveness is the degree to which a system achieves its program and policy objectives. It normally encompasses a number of different, desired aspects of a service linked to program outcome objectives. These outcomes can be classified in terms of:
    - Appropriateness;
    - Accessibility; and
    - Quality

Performance refers to the carrying out or achievement of a particular purpose, task or function. For a program organisation, the key components of the program "include the resources used (inputs) what is done (processes) what is produced (outputs) and what impacts are achieved (outcomes)" (ANAO and Dept of Finance, 1996, p.3). Performance information addresses the relationships between these components.

Performance indicators, however, need to be used with care. Evaluation of programs has a tendency to concentrate on performance indicators that are quantifiable which could result in important outcomes of a qualifying nature being overlooked. This situation could arise in relation to an evaluation of ICM. In particular, ICM is defined as a process specifically designed to enhance the participation and cooperation of the community in natural resource management decision-making and implementation. However, the degree to which an ICM organisation successfully meets this objective might be measured only in terms which suggest that the performance of the organisation is indicated by the extent to which it has put projects in place rather than by the extent to which the community are involved in the decision-making. It is for this reason that it is stressed that an economic evaluation, and in particular a CBA, measures the efficiency of the investment in the organisation, it does not measure directly the performance of the organisation in terms of quality of service delivery or the level of involvement of the catchment community in decision-making. An economic evaluation can evaluate only measurable outcomes from the process, it does not evaluate the process itself. Evaluation of the process of ICM, in terms of social, institutional and technical outcomes, is dealt with in other reports resulting from this research project (see Bellamy *et al.,* In Press)

Performance indicators, in particular measurable indicators, have not been identified specifically for ICM organisations. In 1995, a report on the Lockyer Valley ICM (Stone and Assoc., 1995, p.64) recommended that "Performance Indicators be established for all Catchment Coordinating Committees".

Valuing the Costs and Benefits of Environmental Improvement

CBA requires an economic value to be estimated for all costs and benefits associated with a project or program under review. The concept of economic value is broadly defined as associated with anything from which an individual gains satisfaction, and, for which the individual is willing to give up scarce resources. Economic value is comprised of both use as well as non-use benefits.

Use benefits are those explicitly accruing from the physical use of something. For example, production from farming an area of land or recreational fishing from a river or stream. Non-use values refer to the benefits individuals may obtain from a resource without directly consuming or acquiring a service from them. For example, the knowledge that a national park exists, such as Kakadu, attributes an existence value to the park, whilst retaining the option or opportunity to use a resource in the future is an option value. Non-use values encompass existence values, option values and bequest values.

Biodiversity, one of the objectives of ESD policies, is valued because "it satisfies human wants or is biologically important in supporting other species that do" (Harris, 1996, p.159). Valuation poses problems because the basis for valuing natural environmental resources is weak. Specifically, people may be unaware that they may depend upon certain biological resources even where information exists.

Because there are both technical and ethical limitations associated with estimating a monetary value for environmental resources, the Commonwealth of Australia (1995) suggests that monetary valuations should be regarded as bounding values – as orders of magnitude rather than as a precise value.

The net value or net benefit of environmental quality is calculated as:

Net value = benefit – cost

This is equivalent to the willingness to pay or accept compensation less the opportunity cost.

Methods to estimate the willingness to pay/accept and the opportunity cost will vary with the market situation. In competitive markets, the market price is regarded as a direct value for willingness to pay/accept and for estimates of opportunity cost. However, where markets don't exist, or are imperfect, then other data, such as the willingness to pay in surrogate markets, are used. Competitive markets rarely exist for environmental goods and services.

Valuation techniques can be categorised as using observable market data or non-observable market data. Techniques using observable market data derive values from comparisons of costs and revenues in existing markets or from surrogate or related markets. These techniques include Travel Cost and Hedonic pricing. Techniques using non-observable data derive values by survey techniques where markets are simulated and respondents are asked to state their preferences. Examples of these techniques include Contingent Valuation (CV), Conjoint Analysis and Choice Modelling.[3]

Market value approaches include deriving values for environmental goods and services by estimating the effect the change in the quality of the environment could have on productivity or on income. Other approaches include estimating a value for replacing or preserving an environmental asset. All of these approaches use observable revenues and costs and interpret the behaviour of the individual in the market. Attributing the effect of a change in the environment on productivity or income however is difficult because we need to know how much of the change in productivity or income is directly due to a change in the environment. Values for replacement or preservation of an environmental asset could be underestimated because the costs of replacement/preservation would likely be minimal values of benefits expected to be earned.

3 Examples of these studies include the RAC (1990) CV of the Kakadu Conservation Zone in the Northern Territory; Beggs *et al.,* (1981) Conjoint Analysis of electric cars and Morrison et al., (1998) Choice Modelling of an ephemeral wetland in North – West New South Wales.

The use of surrogate or related markets to derive a market value uses actual prices and actual costs from actual market transactions. The surrogate or related market is directly or causally related to the environmental good or service of interest. Typical of these techniques is the travel cost technique used to value recreational benefits of the environment (for example, Willis and Garrod, 1991).

Simulated market approaches are contingent on the successful simulation of a hypothetical market for an environmental good or service. These techniques use survey techniques to directly solicit the stated preferences or willingness to pay or accept bids for the environmental good or service in question. Survey questionnaires are of a specific format. They seek to inform before soliciting a response and collect information from respondents about their socio-economic circumstances to provide a check for consistency of response. Morrison *et al.,* (1996) provide a comprehensive review of these techniques.

It is worthwhile noting a paper by Diamond and Hausman (1994) in which CV estimates of willingness to pay were discussed in relation to their usefulness in CBAs and for estimates of environmental damage where non-use values for environmental goods is required. Their conclusions are somewhat forceful, stating that "current contingent valuation methods should not be used for damage assessment or for benefit cost analysis" (p.63). A problem with adopting CV estimates of willingness to pay to value environmental goods or services is that although project analysts state the assumptions and limitations underlying their estimates, these assumptions are frequently ignored by decision-makers. Decision-makers are notorious for reading only the executive summary of a report and looking for the "bottom-line", the NPV or benefit cost ratio. How the numbers have been arrived at is frequently overlooked.

Queensland Treasury (1992) acknowledges that, in circumstances where prices to directly value benefits are not available, an appropriate technique is the damage cost method. This method is described as attempting to assess the cost of preventing environmental damage or of restoring or replacing natural resources.

The Department of Finance (1991) suggests that one method to overcome a valuation problem when there are no market prices, is to use the opportunity cost concept. It is suggested that this can be used to establish the cost of an activity, thereby identifying a threshold value that beneficiaries must place on the outcome if the program is to be worthwhile. Analysts may then leave it to the political process to resolve whether or not the expected benefits equal or exceed the threshold value.

Another approach suggested by the Department of Finance for valuing publicly supplied services is to value the savings in costs made possible by the program – these could be cost savings as well as avoided cost savings.

The choice of valuation technique or techniques should include consideration towards:

- The suitability of the technique to value a specific environmental impact. This requires that there is knowledge about the nature of the environmental effect. For example, do we require a use value only to be estimated or are there also non-use values involved? This criterion might require a number of techniques to be utilised to capture the full environmental effect.
- The theoretical validity of the technique. This requires consideration towards the reliability of the technique. Are the assumptions about what the technique is valuing and how the technique is implemented valid? For example, if we use surrogate market information, is this market valid?
- The data requirements. This means simply that data is available to employ a specific technique.

To estimate a value for an improvement in the ecological sustainability of natural resources resulting from the activities of an ICM organisation requires values to be estimated for both use and non-use impacts. Specifically, activities such as increasing the areas of remnant rainforest or riparian vegetation along rivers and creeks have a use value in terms of recreational value, an avoided cost associated with avoiding the loss of productive farm land and/or damage or loss of crops, and a non-use value in terms of the biological diversity which might be preserved as a result of maintaining or increasing these areas. There is not an existing market for all of these benefits on which to base an estimated value. Pest and weed control using natural conservation measures provide another example of an activity which can be only partially valued. These activities have a marketable benefit in terms of increased production but a non-use value in terms of preservation of biodiversity.

Other activities undertaken by ICM organisations which have the objective of increasing the awareness of farmers to improve their land management practices, are not readily valued. An estimate of the opportunity cost of providing the service to the community may be the most appropriate approach in these circumstances.

Appropriate Discount Rate

Discounting, or at least choice of an appropriate discount rate, is an important issue for environmental management. A large volume of literature is available that debates the pros and cons of discounting mostly in relation to evaluation of projects for which there could be a significant environmental cost in the future. In these circumstances, a positive discount rate has the effect of reducing the impact of an environmental cost on project outcome. Where long-term environmental damage is acknowledged and estimates of cost included in an analysis, a positive discount rate has the effect of weighting these costs to be less important than the present benefits. The common argument against adopting a lower discount rate in these circumstances is that current generations need not be concerned about the loss or injury caused to future generations, from loss or damage to natural capital, because they will benefit from advances and developments in human-made capital which will enable them to maintain their standard of living.

For the evaluation of organisations, such as ICM, which provide a service to the community, the costs of establishing these organisations are generally incurred early in the life of the program and the benefits are earned later. In these circumstances, a positive discount rate has the effect of reducing the value of benefits. The argument supporting a positive discount rate in these circumstances is similar to that used in the previous case. Specifically, that monies spent on improving the well being of future generations when they will, regardless of such projects, inherit a larger capital stock than current generations, can not be regarded as an efficient use of public monies. The question which needs to be addressed is: what is an appropriate discount rate? Hanley and Spash (1993) contend that choice of discount rate depends on our view of intergenerational equity. Ultimately, the choice of discount rate is a political choice. Government, acting in the interests of society as a whole, and with consideration to intergeneration equity issues, takes responsibility for setting an appropriate discount rate. Queensland Treasury (1997) suggests the appropriate rate for projects of a non-commercial nature to be 6 per cent real with sensitivity testing at 4 per cent and 8 per cent. LWRRDC (1994) concur with this recommendation, suggesting that, because the issue of appropriate discount rates for natural resource projects has not been satisfactorily resolved, the approach recommended is to present the results from an analysis under a number of rates, ranging from 4 per cent to 10 per cent.

Appropriate Time Frame

Closely associated with the choice of an appropriate discount rate is the choice of a time frame over which the estimated costs and benefits associated with a project or program are to be evaluated. Where natural resource impacts are involved, as is the situation for an assessment of ICM organisations, the full effects of the specific project undertaken or of the improved

cooperation and communication process to influence the attitude of the catchment community towards natural resource management, may very likely show no measurable change for 10, 15 or more years into the future. Once a change has become apparent however, it is likely to continue to have a positive impact for some considerable time into the future. If a positive discount rate is applied to the predicted net benefit stream, benefits earned late in the life of a project (and in particular, beyond 20 years) will not impact significantly on the estimated project returns.

Variations in both the time frame and the discount rate can be accommodated in an economic evaluation of an ICM organisation by including them as a part of the sensitivity analysis. Specifically, the results from the analysis can be reported with the life of the organisation estimated at 15, 20, 25 and 30 years with the discount rate set at 4, 6, 8 and 10 per cent.

Despite the apparent problems associated with conducting a CBA of ICM organisations, these problems are not insurmountable. CBA has the capacity to provide valuable information about the extent to which ICM organisations, in this case the Herbert River Catchment Coordinating Committee (HRCCC), has to date been successful in achieving its objectives and the extent to which it is predicted it will meet its objectives in the future. In addition, information can be provided through the CBA about and the possible distribution of costs and benefits amongst the major stakeholder groups.

3.4 CBA Approach to an Evaluation of the HRCCC

After consideration to the previous discussion about economic evaluations of projects and programs that have the objective of improving community awareness about environmental problems by providing research information or undertake activities to improve the quality of natural resources, a CBA approach is considered to be appropriate to evaluate the HRCCC. The limitations of CBA for an evaluation of this nature are acknowledged; in particular establishing suitable indicators of environmental quality and valuing improvements in the condition of natural resources. However, it is expected that by stating the assumptions underlying the analysis the outcomes can provide meaningful information to decision-makers. It is expected that a CBA will provide valuable information about the extent to which the investment in establishing the organisation and implementing the stated strategy has been efficient as well as information about the distribution of the costs and benefits amongst major stakeholder groups.

The ICM organisation in the Herbert River catchment (the HRCCC) was established in the catchment in 1992 with the appointment of a steering committee. The organisation is in its infancy. Since its inception a draft catchment strategy has been produced and a number of activities undertaken with the assistance of funding from DNR, NLP, NHT state government agencies, local industry organisations as well as payment in kind from the people within the catchment community. Funding has not been confined to specific activities but has supported the appointment of a coordinator in the catchment. Funding is on-going and is expected to continue over the life of the organisation.

Many of the benefits which could be expected to result from the activities of the organisation including specific activities undertaken, as well as data collection projects, have been designed to increase community awareness and to establish the state of the natural resource base in the catchment. Realisation of the benefits from these activities involves a change in attitude on the part of the catchment community towards stewardship of the natural resources in the catchment. Any future benefits cannot realistically be expected to become apparent in the catchment until some time into the future.

To evaluate the HRCCC on its economic cost to date and its estimated benefits to date would be misleading because the activities of the organisation are on-going. For the purpose of this

economic evaluation, the estimated economic life of the HRCCC is assumed to be 20 years. The estimated future costs and those benefits which can be identified and valued are estimated over a period of 20 years from 1992 when the HRCCC was officially established as an ICM organisation. It is expected that an economic evaluation conducted over this period will provide a predictive estimate of the net economic worth of the organisation.

Bellamy and Johnson (1997) describe the HRCCC approach to implementation of ICM as being pragmatic and opportunistic motivated by a perceived need to raise the awareness of the organisation in the catchment and to "get runs on the board". This is view is consistent with that of Laut and Taplin (1989) who claim that ICM was in the past and would, in the future, become increasingly *issues-based*. However, it is the "runs on the board" which provide an opportunity to value the costs and benefits of the achievements of the organisation to date. Activities which have been undertaken by the HRCCC to date include:

- Fostering the construction of roosting boxes for owls. This activity had the objective of increasing community awareness that pest management, which would increase sugarcane production, could be achieved without adversely affecting nature conservation.
- Supporting on-farm tree planting of commercial hardwoods and rainforest species on cane fields where the field-design was inferior or access to the field was limited. Again, some financial gain for landholders was suggested.
- Undertaking, with the support of the cane farmer, the removal of exotic grasses from farms to clear drainage channels and improve farm productivity.
- Developing artificial wetlands on-farm to mitigate local drainage problems and improve the productivity of farms.
- Management of riparian vegetation which has, in the past, been cleared for agricultural purposes has been promoted to ensure that further degradation of water courses does not occur and that those areas that have been degraded are rehabilitated.
- Management of acid sulphate soils by increasing farmer awareness of the problems associated with disturbing these areas.
- Establishing revised guidelines for tree clearing and future subdivisions following the redevelopment of the Pomona wetlands.
- Establishing data-base on the condition of mining dams in the Upper Herbert which could adversely affect downstream water-users, natural drainage in the Lower Herbert and the biodiversity of aquatic habitats.
- Working in cooperation with the Herbert River Management Trust to manage the river at Long Pocket to prevent erosion which would put public infrastructure at risk
- Assistance in designing and construction of suitable drainage for a new 1,000 ha caneland development at Wharps Holding.

The costs associated with the establishment and administration of the organisation are mostly identifiable and can be valued in monetary terms (including an estimate of the opportunity cost of voluntary time incurred by committee members and the catchment community). In addition, the costs (to the HRCCC, landowners and the catchment community generally) of undertaking specific activities in the catchment are mostly identifiable, measurable and can be valued. The impact or benefits of the HRCCC, in terms of its effectiveness in facilitating a cooperative approach to sustainable development in the catchment, although measurable in terms of attendance at meetings and hearsay evidence of a change in attitude towards stewardship of the land resulting in changed management practices, is less obvious and does not lend itself readily to measurement and valuation. However, some benefits can be valued, in particular avoided costs and improved on-farm productivity.

The Outcome-Scenario Approach

Due to problems associated with both identifying outcomes *per se* (including an improvement in the condition of natural resources in the catchment) and outcomes which can be regarded as *solely*

attributable to the endeavours of the HRCCC as well as valuing these outcomes in monetary terms, an outcome-scenario approach is required. The evaluation is approached by estimating the present value of the costs associated with the organisation and its activities over a specified period and then presenting the returns from the investment under a number of outcome-scenarios.

The outcome-scenarios target two specific areas of uncertainty, namely:
- the apportionment of apparent benefits to the HRCCC; and,
- temporal issues, in particular how long it takes for the effect of a project to be realised.

The apportionment of apparent benefits to the HRCCC is largely determined by the assumptions underlying the identification of the "do nothing" scenario. Specifically, the "do nothing" scenario is the situation in the catchment with regards to natural resource management and the resultant condition of natural resources in the catchment which would have occurred in the absence of the HRCCC. Because this situation is not clear-cut, and because it is difficult also to identify and measure a change in the condition of natural resources directly resulting from the activities of the HRCCC, a number of scenarios apportioning apparent benefits to the HRCCC has been developed. The scenarios estimate the net return from investment so that 100 per cent, 75 per cent, 50 per cent and 25 per cent of quantifiable benefits are attributed to the HRCCC.

Temporal issues identified as important for the evaluation are primarily concerned with the time lag between when an activity is undertaken and when the benefits are realised. These issues can be accommodated in the CBA by developing a number of scenarios where estimated the benefits are delayed for 5, 10 or 15years. Another temporal issue that would be worthy of investigation through the CBA is that the benefits attributable to the endeavours of the HRCCC might have been forthcoming regardless of the HRCCC. The impact of the HRCCC might well be to bring improvements in the condition of natural resources forward by 5 or 10 years. Again, this situation can be analysed through a scenario analysis.

Sensitivity and Risk Analysis
It is acknowledged that an analysis which predicts future costs and benefits will result in uncertain outcomes. Conventionally, sensitivity and risk analysis are utilised to test the robustness of the results from the CBA. Sensitivity analysis is useful in measuring the effect on estimated outcome of a change in the value of specific uncertain variables in the model and presents the outcomes in terms of NPV or IRR. Sensitivity analysis is commonly employed to estimate the return to investment under a number of discount rates and when the life of a project or program is varied. Risk analysis is somewhat more versatile, allowing the analyst to vary a number of uncertain variables simultaneously and presenting the results in the form of a probability distribution of outcomes for specified confidence levels. Both forms of analysis will be utilised to test the robustness of the outcomes from the CBA of the HRCCC.

4.0 SUMMARY COMMENTS

This report has reviewed previous studies in the literature which have undertaken economic evaluations of projects or programs dealing with natural resource management. In addition, it has reviewed a number of evaluation techniques which might have been appropriate for this study. The objective of these reviews has been to determine what has been done in the past and to identify the problems which have been encountered previously. The findings from these reviews have contributed towards the identification of an appropriate approach towards conducting an economic evaluation of ICM.

The review of previous evaluations of natural resource management projects or programs shows that economic evaluations are not routinely undertaken. In addition, they have not necessarily

addressed the social costs and social benefits arising from the implementation of the project or program. In addition, measuring and valuing a change in the condition of natural resources has been flagged as requiring further work. No consistent methodology has been identified that is purported to address this problem.

The review of evaluation techniques that might be appropriate to undertake an economic evaluation of ICM organisations has determined that CBA offers a consistent framework for evaluation. CBA is capable of providing valuable information to decision-makers about the efficiency of investment in ICM organisations, the distribution of the costs and benefits arising from the activities undertaken by ICM organisations and the uncertainty underlying the evaluation.

A CBA approach has been outlined which addresses the problems associated with measuring and valuing improvements in the condition of natural resources, the choice of discount rate, the project life and the realisation of potential benefits. An outcome-scenario approach is aimed at providing information to the decision-maker under a number of alternative scenarios.

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Chapter 2

Economic Evaluation of the Herbert River Integrated Catchment Management Organisation

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EXECUTIVE SUMMARY

This report provides an economic evaluation of the Integrated Catchment Management (ICM) organisation in the Herbert River catchment, the Herbert River Catchment Coordinating Committee (HRCCC). Although it provides information specifically about the HRCCC, it is indicative of the type of information likely to result from an economic evaluation of organisations of this nature. In addition, it provides an indication of possible problems, including data availability and the limitations of valuation techniques that may be encountered when undertaking an economic evaluation.

The economic structure of the regional economy within which the HRCCC pursues its objectives could influence the type of activities undertaken by the organisation. As well, the financial viability of land and water users in the catchment, specifically farmers, could have at least some impact on the apparent effectiveness of the organisation in meeting its stated objectives.

The economy of the lower catchment is heavily dependent on the sugar industry and the economy of the upper catchment is dependent on the cattle industry. The economic impact of these industries on the regional economy of North Queensland shows that, together, these industries make a significant contribution (both direct and flow-on effects) to gross output and employment in the region. Specifically, in 1995 the contribution to regional output and employment of sugar production in the Herbert River District and the Cattle industry in the upper catchment have been estimated as:

- *Output*: the sugar industry of the lower Herbert River catchment contributed to over $354m of output in the regional economy, including $206m of output from sugar production and a further $148m in flow-on impacts from other industries in the region. The cattle industry in the upper Herbert River catchment contributed $16m in output to the regional economy, including $13m in output from Cattle production and a further $3m in flow-on impacts.
- *Regional employment*: the sugar industry of the lower Herbert River catchment provided employment for over 3,300 people in the Northern statistical division in 1995. Over 1,300 of these people are estimated to be employed directly in the production of sugar with a further 1,936 people employed in industries supporting the sugar industry. The cattle industry in the upper Herbert River catchment is estimated to provide employment for 170 people, which includes 120 people employed directly in cattle production and a further 49 in support industries.

This information suggests that the economic sustainability of these industries, particularly the sugar industry, is important to the regional economy. However, the financial viability of cane farmers in the future is not optimistic. Although the real prices of agriculture have increased steadily over the past 25 years, the rate of increase has not been as rapid as the increase in costs of inputs to production. The possibility of reduced financial viability could result in a reluctance, on the part of farmers, to engage in farm management practices which, though regarded as improving the state of the environment, would not directly improve the financial status of individual framers.

Cost-benefit analysis was adopted to evaluate the HRCCC because this approach has the capacity to provide information about the economic efficiency of investment in the HRCCC as well as the possible distribution of costs and possible benefits associated with the activities undertaken.

The objectives of the HRCCC are caste in general terms that encompass both its role as a coordinator between the catchment community and government agencies as well as its role as a monitor of catchment health. The HRCCC is constrained in undertaking these roles both

financially, in terms of funding to carry out specific activities, as well as institutionally, in terms of its legislative or statutory power to regulate resource management. The achievements of the HRCCC need to be considered in the light of the "without the HRCCC" scenario. This is identified as *ad hoc* programs and projects which are likely to take some time to implement. In short, *all* improvements to the condition of the natural resources in the catchment, cannot realistically be attributed solely to the endeavours of the HRCCC.

It would be expected that, regardless of whether the HRCCC were established in the catchment as a coordinating body, most of the activities undertaken by the HRCCC would have been taken-up by other community or industry support organisations or by government agencies at some time in the future. In addition, attributing outcomes solely to the endeavours of the HRCCC would be an exaggeration of the work of the HRCCC. Specifically, the HRCCC does not work in isolation from community organisations, such as the Native Wildlife organisation or from industry support organisations such as the Bureau of Sugar Experiment Stations (BSES). In brief, the HRCCC has accepted a coordinating role, taking on activities in response to research initiatives undertaken by other organisations.

The present value of the costs associated with the establishment and on-going administration of the HRCCC over a period of 20 years is estimated to be approximately $974,000. The HRCCC has undertaken a number of specific activities in the catchment to meet its stated objectives that offset these costs. These activities have been funded from both the public purse as well as from the catchment community. The findings are summarised in the table below.

It was found that these activities have the potential to significantly improve or preserve the condition of natural resources in the catchment. It was found also that, for the successful implementation of a number of these activities, notably management of riparian vegetation, management of acid sulfate soils and management of wetlands, private property owners would incur considerable financial expense. In addition, all of the potential benefits resulting from investment in these activities were not equitably distributed among farmers incurring the cost and that those who do not contribute to the cost could not realistically be excluded from enjoying the benefits. In an economic climate where the financial viability of farmers is generally deteriorating, the ability, and therefore the willingness, of farmers to invest in improved resource management is considerably reduced. Community-based organisations, which rely on the voluntary cooperation of individual resource managers, may need to take this into consideration to improve the effectiveness of their strategies.

In undertaking the evaluations, a number of simplifying assumptions were required. Assumptions included those concerning the causal relationship between the activities of the HRCCC and potential improvement in the condition of natural resources. Indicators measuring the condition of natural resources need to be identified and monitored in the future to enable substantiation of claims of natural resource improvement.

In conclusion, a number of problems associated with data availability were encountered during the course of this study. These problems include limited data availability to identify the "without project" scenario; on-going data collection to determine any improvements in the condition of the natural resources in the catchment and limited data to enable credible valuation of any deterioration in the condition of the environment as well as valuation of the benefits resulting from improvements in the condition of the environment. In brief, insufficient data was available to establish, measure and value causal relationships between the condition of the natural resources in the catchment and the activities of the ICM organisation.

Table 1. Summary of potential costs and benefits of HRCCC activities.

Issue	HRCCC Activity	Potential Costs of Activity	Potential Benefits
Management of vegetation in riparian areas	· Mapping of riparian vegetation · Raising community awareness of restoration and retention of riparian vegetation · Organising a Community Riparian Forum with guest speakers	*Individual landowners:* · Cost of revegetation/restoration of riparian areas varies with width required along watercourse and extent of revegetation (eg. 40m buffer corridor costs $120K/km) · Opportunity cost of land which varies with cane assignment/farm size (eg. a 4ha riparian area, with 40% normally under cane would incur a net income loss of $4,000 per annum. This would represent 4% per annum of the net income for a farm with 100ha assignment but 10% per annum net income loss for a farm with 40ha assignment)	*Individual landowners:* · Reduced rat damage to cane crop (eg. value of protection of 8ha area of riparian vegetation is $23K per annum) · Avoided cost of baiting control (where applicable) · Reduced damage to cane resulting from aquatic weed inundation · Improved drainage · Stabilisation of river bank leading to reduced risk of cane loss due to stream bank collapse and scouring *Catchment Community:* · Improved water quality downstream · Improved habitat for fish and crustacea leading to reduced fish kills · Improved natural habitat and source of nutrients for riverine plants and wildlife · Aesthetic benefits (eg. Native wildlife habitat)
Preservation of natural habitats	· Owl box program in support of an integrated approach to pest management	*Individual landowners* · Cost of building owl nesting box and hunting perches ($80/box) *Catchment Community:* · Cost of hire of cherry picker of $1500	*Individual landowners* · Reduced rat damage to cane (see above) *Catchment Community:* · Adoption of ecologically sensitive pest control · Aesthetic benefits
Management of drainage	· Lobbying for technical drainage expert extension officer · Fostering of Landcare group to resolve Wharps Sub-division drainage problems	*Catchment Community:* · Cost of drainage reparation works	*Individual landowners* · Reduction in loss of cane production due to poor drainage *Catchment Community:* · Reduction in adverse impacts of inappropriate drainage infrastructure on other land-owners and habitats · Reduced social conflicts and reduction in litigation and transaction costs associated with negotiation over drainage management

Issue	HRCCC Activity	Potential Costs of Activity	Potential Benefits
Management of wetlands	· Raising awareness of ecological importance of retaining natural wetlands on farm · Fostering the development of artificial wetlands on cane farms	*Individual landowners:* · Opportunity cost of land · Construction costs of wetland vary according to size and site of area to be constructed and availability of suitable areas for disposal of soil (eg. Cost of 0.3ha lagoon up to 3m deep range from $15K to $20K) *Catchment Community:* · Contribution to salary and on-costs for DNR extension officer	*Individual landowners:* · Improvement to on-farm drainage · Source of water in dry periods · Aesthetic attraction of habitat etc. *Catchment Community:* · Retention of significant natural habitats on the Herbert floodplain for fish and wildlife · Providing a retention basin for nutrients and sediments in wetland leading to improved water quality downstream · Improve recharge of groundwater · Aesthetic benefits
Management of acid sulfate soils	· Raising farmer awareness of potential problems of acid sulfate soils	*Individual landowners:* · Estimated opportunity cost of land (eg. decision not to convert grazing land to caneland) for area 'at risk' in catchment (approx. 787ha) is approx. $1,772K per annum. *Catchment Community:* · Costs of media releases and distribution of literature to "at risk" farmers	*Individual landowners:* · Avoided costs of loss of cane production (eg. 1% reduction in yield on current caneland in ASS prone areas is approx. $20K per annum) varies with size of area of potential impact *Catchment Community:* · Avoided costs (eg. Avoidance of fish kills and degradation of estuarine habitat)) varies with size of area of potential impact
Strategic river bank protection	· Joint project with Herbert River Improvement Trust at Long Pocket	*Catchment Community:* · Cost of works (eg. bank stablisation using vegetation and rock protection as well as land use changes)	*Individual landowners:* · Avoided costs of loss of cane production *Catchment Community:* · Protection of existing infrastructure (eg. cane railway link to mill and road bridge across river) · Prevention of river bank erosion upstream causing loss of riparian vegetation and adjacent productive cane land · Reduction in siltation downstream
Stabilising relict mining dams in the upper catchment	· Inventory of derelict tin dams in upper catchment to assess risk and prioritise work needed · Fostering of coordinated action between government agencies and landowners	*Individual landowners:* · In-kind contribution of time and earth moving equipment *Catchment Community:* · NLP Project grant of $21K p.a. for dam wall stabilisation	*Individual landowners:* · Improved water supply to property owners *Catchment Community:* · Improved water quality downstream · Avoidance of risk of dam failure

1.0 INTRODUCTION

In 1994, the Land and Water Resources Research Development Corporation (LWRRDC) funded research staff at CSIRO Tropical Agriculture (in Brisbane and Townsville), CSIRO Land and Water (in Perth) and the University of Queensland, Department of Geographical Sciences and Planning, to undertake research on Integrated Catchment Management (ICM) processes[1]. The research is a longitudinal study, conducted over five years, focussing on the implementation of ICM in the Herbert River catchment in North Queensland as a case study (Bellamy *et al* 1999; Bellamy and Johnson 1999). The objectives of the research are:

1. To monitor and document the process of implementation of ICM in the Herbert River catchment and identify the social, economic and institutional factors which facilitate or hinder this process.
2. Evaluate key impacts of the implementation of the ICM process in terms of attitude and behaviour changes in the community and changes in the severity or tractability of the resource use conflicts for the catchment.
3. Assess the specific technical and related information needs that are relevant to an effective ICM implementation process in a wet tropical environment.
4. Develop a framework and related methods for evaluating the process of ICM implementation that will facilitate the development of more effective catchment management programs in Australia.

As part of this research, the economic evaluation of the ICM organisation in the Herbert River Catchment has required an approach which provides information to decision-makers about the efficiency of public sector investment in these organisations and about the possible distribution of identified costs and benefits. Detailed discussion has been provided in a previous report, Robinson, Bellamy and McDonald (1998), establishing the appropriateness of cost-benefit analysis which is argued to provide a consistent and reliable evaluation of this organisation and other organisations of this nature.

This report provides an economic evaluation of the ICM organisation in the Herbert River catchment, the Herbert River Catchment Coordinating Committee (HRCCC). Although it provides information specifically about the HRCCC, it is indicative of the type of information likely to result from an economic evaluation of organisations of this nature. In addition, it provides an indication of possible problems that may be encountered when undertaking an economic evaluation. The information resulting from this economic evaluation contributes to the broader research on ICM in the Herbert River catchment in a number of ways:

- assists in the identification of factors that foster or constrain an ICM organisation from achieving stated objectives;
- identifies potential impacts of ICM; and
- assists in identifying appropriate indicators to support future evaluations measuring performance and efficiency of ICM organisations.

2.0 OUTLINE OF REPORT

Section 3 of this report describes the economic context for the ICM organisation in the Herbert River catchment. It is intended that this information will define the extent of agricultural land use in the catchment and the dependency of the economy of the region on agricultural related activities. This information could provide some basis for considering the extent to which farmers in the catchment have the financial ability to implement improved farm management practices.

Section 4 deals with the initial steps in the CBA process. Specifically, it describes the objectives of ICM and the constraints the HRCCC has encountered in meeting its objectives. In addition, the

[1] LWRRDC R&D Project CTC7: Evaluating integrated catchment management in a wet tropical environment.

"without" ICM scenario for the catchment is considered and alternatives to the HRCCC are discussed. Finally, this section identifies and estimates the components of cost associated with the establishment and on-going administration of the HRCCC.

Section 5 provides a detailed evaluation of a number of the activities undertaken by the HRCCC to implement its stated strategy. The final section makes a number of concluding comments about the evaluation of the HRCCC which are relevant for other organisations of a similar ilk. A number of issues are raised which will need to be addressed by the HRCCC to assist future economic evaluations.

3.0 THE ECONOMIC CONTEXT FOR THE HERBERT RIVER ICM ORGANISATION

For the most part, the Herbert River Catchment is encompassed by two statistical local areas (SLA), namely: the Hinchinbrook Shire (in the Northern statistical division) and the Herberton Shire (in the Far North statistical division). These SLAs are generally referred to as the "lower catchment" and the "upper catchment" respectively. See Figure 1.

The economic structure of the regional economy within which the HRCCC pursues its objectives could influence the type of activities undertaken by the organisation. As well, the economic structure of the regional economy could have at least some impact on the apparent effectiveness of the organisation in meeting its stated objectives. Information is therefore required about the economic structure of the economy of the region and of the sub-region, the Herbert River catchment.

This section firstly provides a broad overview of the economy of the two areas within the catchment, particularly with respect to land-use. Some historical data on employment is provided as a means of highlighting the different economic structure of these areas. Secondly, an economic modelling technique (input-output analysis) is employed to describe the relative contribution of major land-use industries in the catchment to the economy of the region and also to estimate the impact of these industries on the regional economy.

3.1 Overview of the Economy of the Hinchinbrook and Herberton Shires

The Hinchinbrook Shire encompasses a total area of 271,000,000ha. In 1991 it was estimated that there were 608 agricultural establishments occupying a total of 231,000,000ha (ABS, 1992). The Herberton Shire on the other hand encompasses a total area of 953,000,000ha, which is over three times the area of the lower catchment. There are significantly fewer agricultural establishments in the upper catchment (95) occupying a total area of 695,000,000ha (ABS, 1992).

Arable agricultural production in the catchment is dominated by the production of sugar cane in the lower catchment. Johnson and Murray (1997) list forestry, beef cattle and small crops including pineapples, melons and pumpkins as important industries. The major land-use in the lower catchment is sugar cane production, whereas in the upper catchment the major land use is indicated to be cattle production (ABS, 1992).

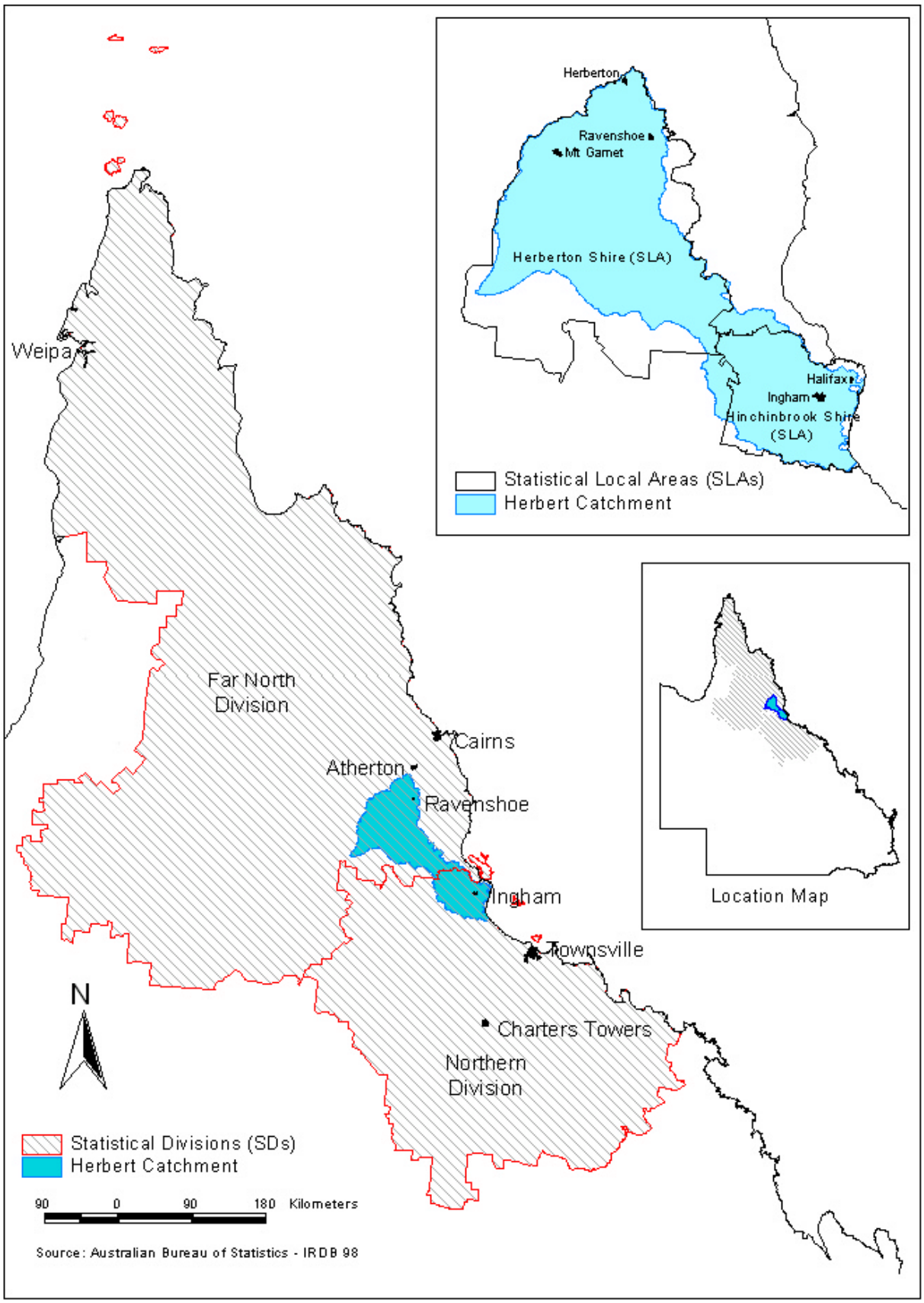

Figure 1. Location map showing the Herbert River catchment boundary and statistical division and statistical local area boundaries.

Table 3.1 provides some summary statistics about land use in the two SLAs.

Table 3.1 Land Use in the Hinchinbrook and Herberton Shires 1991/92

	Hinchinbrook Shire	Herberton Shire
Shire Area ('000 ha)	271,000	953,000
Area under agriculture ('000ha)	231,000	695,000
Number of establishments	608	95
Number of cattle	30,822	66,416
Area under crop (inc. cane) ('000ha)	110,000	17,000

Source: ABS Cat. No. 3235.3 (1992)

The 1996 Population Census (ABS, 1996) estimates the resident population of the Hinchinbrook Shire to be 15,495 people and the Herberton Shire to be 5,253 people. Agricultural establishments are not the sole source of employment in these sub-regional economies. Table 3.2 provides summary statistics about estimated employment at the 1991 population census and for the more recent 1996 population census for the two areas.

Table 3.2 Industry Employment in the Hinchinbrook and Herberton Shires 1991 and 1996 (No. persons)

	Hinchinbrook Shire		Herberton Shire	
Industry Sector*	1990/91	1995/96	1990/91	1995/96
Agriculture, Forestry, Fishing, Hunting	1291	1357	242	257
Mining	36	33	40	51
Manufacturing	703	872	79	146
Electricity, Water, Gas	40	79	12	7
Building Construction	202	273	108	91
Wholesale and Retail Trade	863	884	174	192
Transport and Communication	217	201	42	48
Finance, Property and Business Services	226	294	45	76
Public Admin and Defence	226	491	60	77
Community Services	685	1049	236	268
Recreation and Personal Services	245	392	64	120
Other				
TOTAL	5198	6185	1221	1410

Source: ABS, Cat. No. 2015.3 (1991); ABS, Cat. No.2015.3 (1996).
* ABS changed the industry classification from AISIC to ANZSIC between the 1991 Census and the more recent 1996 Census.

Table 3.2 shows that growth in employment is greater in the Hinchinbrook Shire (19 per cent) than in the Herberton Shire (15 per cent). A significant source of the employment growth in the Hinchinbrook Shire is from Community Services which grew by 364 persons (approximately 50 per cent). A significant contribution to the growth in employment in the Herberton Shire over the period was from the Manufacturing sector in which 67 additional people were employed (an increase of approximately 85 per cent).

3.2 Input-Output Approach

Input-Output (I-O) economic analysis offers an approach, which has the capacity to provide valuable information, about a regional or sub-regional economy. In particular, an I-O model of a regional economy provides information about the economic structure of the region in terms of a number of economic indicators such as employment, gross output and exports. In addition, and more importantly, the I-O model provides a detailed analysis of the nature and extent of the economic linkages between industries within the regional economy.

Previous studies which adopted an I-O approach to determine the economic impact or economic

significance of the sugar industry on a regional economy include McGoven *et al.,* (1988) and Robinson *et al.,* (1994). Limitations of the earlier work of McGoven *et al.*, which specifically estimated the impact of the sugar industry in the Herbert district to the economy of the Northern statistical division, include the lack of differentiation between the structure of the sugar industry in the Herbert district with that of the Burdekin district, and that the I-O transaction table used to model the industry was somewhat dated (1978/79). Although technological change in an economy is generally considered to be slow, the sugar industry in Queensland underwent considerable structural change in the early 1980s to improve its technological competitiveness in an increasingly competitive world market. The I-O transaction table adopted by McGoven *et al.* to estimate the impact of the sugar industry on the regional economy pre-dates these changes in the industry. The report by Robinson *et al.* is more recent, utilising an I-O transaction table of the regional economy for 1992. It provides a detailed account of the regional impact of a number of components or economic activities which contribute towards the sugar industry in the Burdekin district. However, the cost structure of the sugar industry in the Burdekin district is considerably different to that of the Herbert where sugar cane is largely grown without irrigation and where the average cane farm is smaller than in the Burdekin. In addition, the information required for this study about the impact of the sugar industry in the Herbert district on the regional economy, does not require the level of disaggregation provided in the Robinson *et al.* study.

This section describes the I-O methodology and provides information about the economic structure of the Northern statistical division and about the economic significance of major land-use industries in the Herbert River catchment on the economy of that region.

3.2.1 The Input-Output Model

The I-O model, in the form of a transactions table or matrix showing industry sector sales (rows) and purchases (columns), provides a detailed picture of the structure of an economy at a particular point of time. It thus provides the foundation for analysis of the contribution of individual sectors to economic indicators such as employment and gross output and of the intersectoral relationships within an economy. The input-output approach uses the intersectoral relationships of industries in the regional economy to assess the impact of an industry on the economy of a region in relation to both direct and flow-on effects. Impact analysis is concerned with measuring the impact or effect of a given stimulus on the economy, which could include specific industries, in this case, major land-users within the Herbert River catchment. The impact of these industries is measured in economic terms including gross output and employment generated in the region.

Industries of Interest.

In the case of the Herbert River catchment, two industries have been identified as the major land-use industries in the Herbert River catchment: the sugar industry in the lower catchment, and the beef cattle industry in the upper catchment.

The sugar industry in the lower catchment is defined, for this study, as including those economic activities which constitute the growing of sugar cane and the milling of the cane to produce raw sugar (94 net titre or 94nt). The growing of sugar cane is conventionally modelled in an I-O transaction table as a part of the sector "Other Agriculture" and the milling of the cane is included in "Food Manufacturing". For the purpose of this study, these two activities have been disaggregated from these sectors and are depicted as a single industry labelled, "HR Sugar". Data available from the Australian Sugar Year Book (1996) and from ABS (1996-97) publications has been used to confirm the structure of the Herbert District sugar industry in the region for inclusion in the existing transaction table.

The beef cattle industry in the upper catchment has been modelled as a separate industry, labelled "HR Cattle". This industry essentially involves extensive grazing with limited pasture

improvement.

Region of Impact
Rather than develop I-O transaction tables for both the Far North statistical division, in which the Herberton Shire or SLA is a sub-region (see Fig. 1), and the Northern statistical division, in which the Hinchinbrook Shire or SLA is a sub-division, only one I-O table has been constructed, that for the Northern statistical division (see Fig. 1). This course of action has been taken because the beef industry in the upper catchment (Herberton Shire) is comparable with the beef industry in parts of the Northern statistical division and the impacts and industry linkages are likely to be similar.

An input-output transaction table for the Northern statistical division, identified as the appropriate statistical division which incorporates the lower catchment, has been constructed by the Urban and Regional Economics Research Unit at the University of Queensland (Robinson *et al.*, 1994). This existing transaction table has been updated to reflect the structure of the regional economy in 1995 using currently available ABS data as well as survey data about specific industry sectors.

Indicators of Economic Impact
It is conventional in impact studies to use a 'standard' list of indicators of economic impact. These include:

- *gross output* levels, referring to the effects of the impacting agent on the output levels of firms and industries in the region,
- *employment* levels, or the effects of employment in the region in terms of full-time employment equivalents.

Table 3.3 shows the estimated contribution by HR Sugar and HR Cattle industries to gross output and employment in the regional economy of North Queensland in 1995.

Table 3.3 shows that the contribution by HR Cattle to output and employment in the regional economy of North Queensland in 1995 is estimated to be relatively small (0.2 per cent in both cases). In contrast to HR Cattle, HR Sugar is estimated to make a contribution to output and employment which is comparable to a number of manufacturing sectors in the regional economy, including Wood and Paper manufacturing, Machinery and Appliances and Non-metal manufacturing.

Table 3.3 Estimated Sectoral Contributions to Regional Output and Employment, Northern Statistical Division, 1995.

Sector	Output		Employment	
	Amount ($000's)	**%**	**Persons (no.)**	**%**
Animal Industries	100,540.5	1.5	452	0.6
HR Cattle	13,283.0	0.2	121	0.2
O'Agriculture	355,570.0	5.3	2,988	4.2
Forestry/Fishing	37,049.6	0.6	286	0.4
Coal/Petroleum Mining	140,056.0	2.1	522	0.7
O'Mining	417,437.0	6.2	1,226	1.7
Food Manufacture	521,287.0	7.8	2,826	4.0
HR Sugar	206,288.0	3.1	1,367	1.9
Wood/Paper Manufacture	92,571.0	1.4	917	1.3
Machinery/Appliances	67,947.0	1.0	635	0.9
Metals Manufacture	1,042,023.5	15.5	1,559	2.2
Non Metals Manufacture	51,293.0	0.8	415	0.6
O'Manufacture	46,068.2	0.7	418	0.6
Elect/Water/Gas	179,132.0	2.7	722	1.0
Building Construction	377,767.9	5.6	5,058	7.1
Trade	587,864.9	8.7	14,290	20.0
Transport/Communication	440,417.1	6.5	5,478	7.7
Finance	580,320.2	8.6	5,389	7.5
Pub Admin	494,730.8	7.4	8,303	11.6
Comm Services	689,081.3	10.2	13,133	18.4
Rec/Personal Services	283,222.6	4.2	5,393	7.5
TOTAL	**6,723,951**	**100.0**	**71,498**	**100.0**

Sectoral Distribution of Impacts

One of the strengths of the input-output approach is the ability to disaggregate the estimated impacts (both direct and flow-on effects) on the region of specific sectors in the region. For example, the total employment in the region generated by the sugar industry in the Herbert District can be disaggregated into the number of jobs generated directly by the industry, and those resulting from flow-on effects. Direct employment includes those persons employed in the growing and milling of sugar cane. The flow-on employment results from the industry support effects generated by the purchase, by the sugar industry, of goods and services from each of the sectors defined in the input-output table. Tables 3.4 and 3.5 show the industrial significance of HR Sugar in terms of output and employment effects respectively. Tables 3.6 and 3.7 show the industrial significance of the HR Cattle industry on output and employment in the regional economy.

Table 3.4 shows the industrial significance, in terms of output effects, of the Herbert District sugar industry in the regional economy of North Queensland in 1995. It shows that the initial or direct impact of the sugar industry on the regional economy is $206m with an additional $148m in flow-on effects. The total output effect on the regional economy is estimated to be $364m. The more significant flow-on effects are estimated to be on the Finance sector ($28m), Trade (which includes both retail and wholesale trade) ($24m) and Other Agriculture ($21m). Flow-on output from the Herbert River sugar industry is estimated to produce an additional 0.719 dollars from other industries (a total multiplier effect of 1.719).

Table 3.4 Output Effects of the Herbert Sugar Industry on the Economy of the Northern Statistical Division, 1995 ($000's)

Sector	Initial Effect	Flow-on Effect	%	Total Effect	Rank	%
Animal Industries	0.00	267.72	0.2	267.72	19	0.1
O'Agriculture	0.00	21,930.82	14.8	21,930.82	4	6.2
Forestry/Fishing	0.00	114.72	0.1	114.72	20	0.0
Coal/Petroleum Mining	0.00	276.76	0.2	276.76	18	0.1
O'Mining	0.00	430.50	0.3	430.50	17	0.1
Food Manufacture	0.00	1,965.39	1.3	1,965.39	13	0.6
HR Sugar	206,288	0.00	0.0	206,288.00	1	58.2
Wood/Paper Manufacture	0.00	837.29	0.6	837.29	15	0.2
Machinery/Appliances	0.00	7,822.07	5.3	7,822.07	8	2.2
Metals Manufacture	0.00	1,418.47	1.0	1,418.47	14	0.4
Non Metals Manufacture	0.00	499.52	0.3	499.52	16	0.1
O'Manufacture	0.00	4,237.40	2.9	4,237.40	10	1.2
Elect/Water/Gas	0.00	7,262.28	4.9	7,262.28	9	2.0
Building Construction	0.00	9,137.32	6.2	9,137.32	7	2.6
Trade	0.00	24,936.70	16.8	24,936.70	3	7.0
Transport/Communication	0.00	21,689.35	14.6	21,689.35	5	6.1
Finance	0.00	28,244.09	19.0	28,244.09	2	8.0
Pub Admin	0.00	3,549.25	2.4	3,549.25	11	1.0
Comm Services	0.00	10,339.66	7.0	10,339.66	6	2.9
Rec/Personal Services	0.00	3,411.59	2.3	3,411.59	12	1.0
TOTAL	206,288	148,370.91	100.0	354,658.91		100.0
Multiplier	**1.00**	**0.719**		**1.719**		

Table 3.5 Employment Effects of the Herbert Sugar Industry in the Economy of the Northern Statistical Division, 1995 (No. persons)

Sector	Initial Effect	Flow-on Effect	%	Total Effect	Rank	%
Animal Industries	0.00	1.40	0.1	1.40	17	0.0
O'Agriculture	0.00	184.29	9.5	184.29	6	5.6
Forestry/Fishing	0.00	.89	0.0	.89	20	0.0
Coal/Petroleum Mining	0.00	1.03	0.1	1.03	19	0.0
O'Mining	0.00	1.26	0.1	1.26	18	0.0
Food Manufacture	0.00	10.65	0.6	10.65	13	0.3
HR Sugar	1,367	0.00	0.0	1,367.00	1	41.4
Wood/Paper Manufacture	0.00	8.29	0.4	8.29	14	0.3
Machinery/Appliances	0.00	73.10	3.8	73.10	8	2.3
Metals Manufacture	0.00	2.12	0.1	2.12	16	0.1
Non Metals Manufacture	0.00	4.04	0.2	4.04	15	0.1
O'Manufacture	0.00	38.45	2.0	38.45	11	1.2
Elect/Water/Gas	0.00	29.27	1.5	29.27	12	0.9
Building Construction	0.00	122.34	6.3	122.34	7	3.7
Trade	0.00	606.17	31.3	606.17	2	18.3
Transport/Communication	0.00	269.78	13.9	269.78	3	8.2
Finance	0.00	262.28	13.5	262.28	4	7.9
Pub Admin	0.00	59.57	3.1	59.57	10	1.8
Comm Services	0.00	197.06	10.2	197.06	5	6.0
Rec/Personal Services	0.00	64.96	3.4	64.96	9	2.0
TOTAL	1,367	1,936.96	100.0	3,303.96		100.0
Multiplier	**1.00**	**1.417**		**2.417**		

Table 3.5 shows the industrial significance, in terms of employment, of the Herbert River sugar industry on the regional economy of North Queensland in 1995. Specifically, it is estimated that

1,367 people are employed directly in the industry and approximately 1,936 additional people are employed in the regional economy in industries supporting the sugar industry in the Herbert district. It is estimated that total employment generated in the region by the sugar industry is approximately 3,304 people. The employment multiplier (2.417) shows that, for every additional person employed in the industry, a further 1.417 people are employed in other industries in the regional economy.

Table 3.6 Output Effects of the Herbert Cattle Industry on the Economy of the Northern Statistical Division, 1995 ($000's)

Sector	Initial Effect	Flow-on Effect	%	Total Effect	Rank	%
Animal Industries	0.00	17.98	0.6	17.98	13	0.1
HR Cattle Industry	13,283	0.00	0.0	13,283	1	81.5
O'Agriculture	0.00	31.38	1.0	31.38	10	0.2
Forestry/Fishing	0.00	6.85	0.2	6.85	16	0.0
Coal/Petroleum Mining	0.00	2.98	0.1	2.98	18	0.0
O'Mining	0.00	1.28	0.0	1.28	20	0.0
Food Manufacture	0.00	131.88	4.4	131.88	7	0.8
Wood/Paper Manufacture	0.00	29.22	1.0	29.22	11	0.2
Machinery/Appliances	0.00	15.66	0.5	15.66	14	0.1
Metals Manufacture	0.00	6.75	0.2	6.75	17	0.0
Non Metals Manufacture	0.00	2.90	0.1	2.90	19	0.0
O'Manufacture	0.00	8.96	0.3	8.96	15	0.1
Elect/Water/Gas	0.00	83.42	2.8	83.42	8	0.5
Building Construction	0.00	20.28	0.7	20.28	12	0.1
Trade	0.00	786.19	26.0	786.19	2	4.8
Transport/Communication	0.00	136.31	4.5	136.31	6	0.8
Finance	0.00	685.50	22.7	685.50	4	4.2
Pub Admin	0.00	80.16	2.7	80.16	9	0.5
Comm Services	0.00	737.69	24.4	737.69	3	4.5
Rec/Personal Services	0.00	236.75	7.8	236.75	5	1.5
TOTAL	13,283	3,022.14	100.0	16,305.14		100.0
Multiplier	**1.00**	**0.23**		**1.23**		

Table 3.6 shows the industrial significance, in terms of output effects, of the Herbert River Cattle industry in the regional economy of North Queensland in 1995. It shows that the initial impact on the regional economy is estimated to be $13m with an additional $3m in flow-on effects. The contrasts significantly with the estimated impact of HR Sugar (Table 3.4) where both the initial and flow-on effects were substantial.

Table 3.7 shows the industrial significance, in terms of employment, of the Herbert River Cattle industry on the regional economy of North Queensland in 1995. Specifically, it is estimated that 121 people are employed directly in the industry and approximately 49 additional people are employed in the regional economy in industries supporting the cattle industry in the Herbert district. A large percentage of the flow-on employment is expected to be sourced from the trade sector (38.7 per cent).

Table 3.7 Employment Effects of the Herbert Cattle Industry on the Economy of the Northern Statistical Division, 1995 (No. persons)

Sector	Initial Effect	Flow-on Effect	%	Total Effect	Rank	%
Animal Industries	0.00	0.08	0.2	0.08	15	0.0
HR Cattle Industry	121.00	0.00	0.0	121.00	1	71.0
O'Agriculture	0.00	0.26	0.5	0.26	12	0.2
Forestry/Fishing	0.00	0.05	0.1	0.05	16	0.0
Coal/Petroleum Mining	0.00	0.01	0.0	0.01	18	0.0
O'Mining	0.00	0.00	0.0	0.00	20	0.0
Food Manufacture	0.00	0.71	1.4	0.71	8	0.4
Wood/Paper Manufacture	0.00	0.29	0.6	0.29	21	0.2
Machinery/Appliances	0.00	0.15	0.3	0.15	10	0.1
Metals Manufacture	0.00	0.01	0.0	0.01	13	0.0
Non Metals Manufacture	0.00	0.02	0.0	0.02	19	0.0
O'Manufacture	0.00	0.08	0.2	0.08	17	0.0
Elect/Water/Gas	0.00	0.34	0.7	0.34	14	0.2
Building Construction	0.00	0.27	0.6	0.27	9	0.2
Trade	0.00	19.11	38.7	19.11	11	11.2
Transport/Communication	0.00	1.70	3.4	1.70	2	1.0
Finance	0.00	6.37	12.9	6.37	6	3.7
Pub Admin	0.00	1.35	2.7	1.35	4	0.8
Comm Services	0.00	14.06	28.5	14.06	7	8.3
Rec/Personal Services	0.00	4.51	9.1	4.51	3	2.6
TOTAL	121.00	49.37	100.0	170.37	5	100.0
Multiplier	**1.00**	**0.41**		**1.41**		

3.3 Profitability of Farm Business

The previous section estimated the economic impact of the sugar and cattle industries, located in the Herbert River catchment, on the regional economy of North Queensland. Although this information demonstrates that, together, HR Sugar and HR Cattle contribute to the employment of nearly 3,500 people in the Northern statistical division and to over $370m of output, it does not indicate the financial viability of individual farm units in the region. The profitability of a farm business is a key determinant of the ability of that business to undertake farm management practices which are ecologically sustainable. This section considers the overall profitability of farm businesses in Australia and the profitability of the sugar industry in particular. The profitability of a farm business is dependent on a number of factors including: the quantity of output and the value of output. The quantity of output is dependent on the size and the productivity of the business whilst the value of output is dependent on the quality and the marketing of the product.

Wegener (1997) reports that Australian farmers' terms of trade, expressed as a ratio of an index of prices received by farmers to an index of prices paid by farmers for inputs, have declined steadily over the past 25 years. It is suggested that although the real prices for agriculture have increased steadily over the past 25 years, the rate of increase has not been as rapid as the increase in costs of inputs to production. Wegener continues to report that sugar farmers, in particular, have not experienced a significant change in real sugar prices.

In order to improve productivity, many farmers have increased variable inputs such as fertiliser but have experienced diminishing marginal returns. Wegener suggests that a more appropriate response by farmers to falling real product prices is to adopt farm management practices which would put them on a different production frontier. Farm management practices that are identified as appropriate include introducing irrigation and adopting new breeds of cane.

As far as product prices go, however, the action of cane farmers has little or no effect. Growers are restricted to selling their cane to the nearest mill (due to the high correlation between time since harvesting and falling sugar content) and sugar produced in Queensland is marketed through the Queensland Sugar Corporation.

In brief, the financial situation for farmers in Australia, and for cane farmers in particular, is not especially optimistic. This could result in a reduced ability of farmers to undertake on-farm environmental work which might further reduce their capacity to improve their income.

3.4 Summary Comments

This section has provided descriptive comment about the structure of the economy of the Herbert River catchment. It has shown that the economy of the lower catchment is heavily dependent on the sugar industry and the economy of the upper catchment is dependent on the cattle industry. The economic impact of these industries on the regional economy of North Queensland has been estimated showing that, together, these industries make a significant contribution (both direct and flow-on effects) to gross output and employment in the region. This information is valuable to decision-makers. It suggests that the economic sustainability of these industries is important to the regional economy.

Consideration was given also to the financial viability of sugar cane farmers generally. It was suggested that the financial viability of cane farmers in the future is not optimistic. The possibility of reduced financial viability could result in a reluctance, on the part of farmers, to engage in farm management practices which, though regarded as improving the state of the environment, may not directly improve the financial status of individual framers.

4.0 ECONOMIC EVALUATION OF THE ACTIVITIES OF THE HRCCC

An economic CBA is a process. It is a process which organises information to aid decision-making about the efficient allocation of resources. The Department of Finance (1991) suggests a number of steps in the process of conducting a CBA. These are listed below.

- What is the objective of the project or program?
- What are the constraints?
- What are the alternatives?
- Identify the costs and the benefits.
- How can the costs and benefits be valued?
- Are there additional costs and benefits which cannot be quantified?
- Calculate the net benefits.
- Conduct an analysis to deal with risk and uncertainty.
- How are the costs and benefits distributed?
- Present a report on the project.

The remainder of this report is structured to address each step in the process of conducting an economic evaluation of the HRCCC.

4.1 Objectives of the HRCCC

ICM in the Herbert River catchment was initiated in 1992 by key stakeholders in the catchment. In 1996 the HRCCC released a Draft Catchment Management Strategy. The strategy suggests a "community-based approach to solving problems – an approach that integrates the needs of individuals, community groups and industry" (HRCCC, 1996, p.1). The Coordinating Committee has identified its objectives to be:

- Coordinate government agencies and the community to pursue common goals
- Seek community involvement in catchment management
- Reflect the requirements of the wider community within the Catchment
- Identify and rectify natural resource degradation
- Promote ways to prevent and reduce natural resource degradation
- Promote the wise use of all natural resources within the Catchment
- Identify key indicators of biodiversity and monitor as a measure of catchment health
- Encourage the retention of significant natural habitats within the Catchment.

(HRCCC, 1996, p.i)

Although the objectives are couched in terms which suggest an overall policy framework for the catchment, the strategy itself is issues based. Specifically, key management and planning issues are discussed, identifying what needs to be done, who should take responsibility for undertaking the work and how the issue is to be addressed. This suggests that a feasible approach to conducting an economic evaluation of the organisation is to determine and value the extent to which the organisation has addressed its specified objectives.

4.2 Constraints to the HRCCC Activities

The major constraints to ICM which effect its ability to implement resource management initiatives are of a financial and institutional nature (eg. see Bellamy and McDonald 1999).

4.2.1 Financial Constraints

Apart from the catchment coordinator, who has been funded through the federal government's National Landcare Program (NLP) and based in the Department of Natural Resources (DNR), the organisation is staffed and supported, in terms of administrative and office accommodation, by local stakeholder bodies such as the local council and sugar industry bodies. No formal cost-sharing of resource management activities is in place. For the most part, HRCCC activities, including data collection research activities as well as specific projects and programs, are funded by grants from state and federal governments as well as industry support organisations which are awarded through a competitive bidding process. In brief, the HRCCC is financially constrained. The extent and speed with which the organisation can implement its strategy is largely determined by the level of funding it can attract. To a large extent, rather than applying for funding to support itself, the HRCCC has taken the role as coordinator or broker; encouraging and supporting funding applications from organisations including the local council or the HRIT (Bellamy and Johnson In press).

4.2.2 Institutional Constraints

The ICM organisation in Queensland does not have legislative jurisdiction. This means that it does not have the authority to legislate or pass laws to regulate resource use. The organisation is only able to influence the regulation of resource use through an organisation, such as local government, which does have this authority. Alternatively, where regulations are not enforceable, for example on freehold land, the voluntary support of the community may be the only alternative. As a result, implementation of strategies for resource management by individual ICM organisations requires the voluntary cooperation of the community, local government and government agencies.

The problems faced by organisations wishing to influence human behaviour can be described in terms of property rights and norms of good behaviour. Wills (1997) argues that "humans devise rules (more formally, institutions) as constraints on behaviour that reduce conflict and uncertainty in people's dealings with others" (Wills, 1997, p.20). He suggests that these rules include property rights and norms of good behaviour.

Property rights are legally defined and enforced rules that describe what people or firms may do with their property. When property is bought or sold, it is the rights to the property which are bought or sold, not the object itself. In brief, property rights are "enforceable claims to use and to benefit from resources" (Anderson and Hide, 1989, p.7). Norms of good behaviour, on the other hand, are "rules that govern asset use that are informal and not usually actively enforced, but are nevertheless widely observed within a community" (Wills, 1997, p.21). The constraints on the HRCCC can be described as dealing with a failure of the legislature to redefine and enforce property rights which would ensure appropriate management of land and water resources. Because the HRCCC cannot rely on the legislature to introduce and enforce property rights which would be environmentally appropriate, informal and frequently less reliable methods to encourage the adoption of norms of good behaviour have been adopted.

A more recent legislative approach towards promoting ecologically sustainable development in Queensland, the *Integrated Planning Act* (1997), does not specifically identify a role for ICM organisations in the planning and management of natural resources.

4.3 Alternatives to the HRCCC in the Herbert River Catchment

Decision-makers are interested in the apparent achievements of ICM as well as the alternatives and whether an alternative approach might have been more appropriate. This section first defines and describes the "do nothing" alternative and then it considers what other approaches might have been appropriate.

CBA is conducted on the incremental costs and benefits associated with a project or program. This means that only the costs and benefits that are additional to any costs and benefits which might have occurred if the HRCCC had not been established in the catchment are relevant. For this study, the "do nothing" alternative is defined as the situation which would have eventuated in the catchment in relation to natural resource use and management if an ICM organisation had not been established.

It is difficult to describe the "do nothing" scenario in the Herbert River catchment because ICM, and in particular the HRCCC, is not a specific project or program with readily identifiable and measurable outputs. The "do nothing" scenario does not necessarily mean that no research and no resource management projects or programs would have been implemented in the catchment. It is likely that at least some of the work which has been undertaken by the HRCCC would have been carried out by local, state or federal government agencies or by industry support organisations. For example, the Northern District Sugar Industry Production Group (NDSIPG) was formed in 1975 "to plan ways and means of optimising land usage of all Northern District Mill Areas with the objective of exploiting productivity and production" (NDSIPG, 1975). It is an industry based organisation that has provided an opportunity for a coordinated approach to resource management but is primarily focused on local issues (particularly drainage) affecting sugar production. Achievements of the NDSIPG include encouraging the Queensland Government, through the Irrigation and Water Supply Commission, to commission a number of studies which provide an overview of drainage and flood mitigation with respect to the north Queensland sugar industry. That few of the recommendations contained in the reports have been implemented in the Herbert is evidence of the need for a more integrated approach to resource management. To a large extent, this organisation has been superseded by the establishment of the

HRCCC.

ICM organisations, including the HRCCC, do not work in isolation from government agencies, industry support agencies or other ICM organisations researching and working in the area of natural resource management. Much of the research in the catchment for which the HRCCC might claim responsibility may have been undertaken at some time in the future, regardless of the HRCCC. However, it can be argued that resource management in the Herbert River catchment without the HRCCC would have been largely *ad hoc*. Decision-making would very likely have been in the form of top-down direct regulation and policy measures for resource development and management with minimal prior consultation with affected stakeholders. It is likely that this approach would have resulted in significant expenditure on enforcement of regulations and protracted negotiation about appropriate policy. It is likely that funding for research in the catchment would have been initiated by government agencies, including CSIRO, DPI, DNR and the DOE, on a need-to-know basis.

With these comments in mind, how much of a perceived improvement in the condition of natural resources can be attributable to the activities of an ICM organisation such as the HRCCC? ICM organisations are not the sole source of resource management information to farmers, agencies and the community generally. In this regard, the results from a survey of rural and urban residents in the Herbert River Catchment (Butterworth *et al.,* 1997) report that Landline was considered to be the most reliable source of information about the catchment. In addition, it was found that participants in the survey who used Landline as an information source were more likely to agree that their actions could assist in improving the environment and were more likely to agree to become involved or stay involved in a community organisation such as ICM or Landcare.

Community-based organisations such as ICM provide an alternative to top-down direct regulation and to the introduction of economic instruments to control activities which are responsible for negative externalities. Economic instruments include policies or measures that attempt to address environmental problems under the perception that market failure has resulted in an inefficient and inequitable allocation of resources. Economic measures or policies include taxes/subsidies in the form of user charges on activities or inputs which could be harmful to the environment; or, for property rights over externalities to be defined and enforced. Measures which establish property rights over externalities, which can then be traded in a competitive market, include tradeable rights such as pollution or emission permits and tradeable water rights.

There are a number of criticisms of the alternatives to community-based approaches to resource management. One of the major criticisms of property right approaches to controlling externalities is the initial delineation of the polluter and the recipient of the pollution. Temporal and spatial issues, specifically, that it is not always possible to point-source the externality and that it may be some time before the effects of the externality problem are apparent, frequently reduce the possibility of effectively implementing economic instruments.

Regulations are not necessarily regarded as being any more effective, particularly to address degradation of natural resources resulting from agriculture. They have been described as "often poorly conceived, time consuming, arbitrary and manipulated for political purposes" (Harris, 1996, p.161). The OECD (1991) is of the opinion that the acceptability of regulations is particularly important where it is not possible to point-source the externality and where enforcement costs are high. This situation is applicable for externalities associated with the use of natural resources for agriculture. The OECD recommends that one way to improve compliance would be to keep farmer organisations and/or conservation bodies involved and to take joint responsibility for managing natural resources (p.76). ICM is regarded as having the ability to promote management of natural resources through cooperation and communication with

catchment communities.

Although economists can explain the emerging resource problems in a catchment in terms of externalities and property rights, management of the problems frequently requires a scientific and technical understanding of the interaction between resource use and management and the resulting impact on the environment. In addition, once scientists and engineers, in cooperation with representatives of the catchment community, have identified what they believe to be appropriate management strategies, there is then a need for a community-based organisation, such as ICM, to validate the strategy and to implement the strategy. If the strategy is not regarded by the catchment community (and in particular farmers who are frequently the current custodians of the land) to be valid then they will not comply (the costs of enforcement of regulation can be prohibitively high).

If ICM organisations such as the HRCCC had not been established then the alternative would possibly have been direct regulation by government of land and water resource use or economic measures initiated by government which could restrict resource use. For the purpose of this study, the activities of the HRCCC are considered as contributing to, but not wholly responsible for, the alternative to *ad hoc* decision-making and project implementation. As outlined previously, a number of outcome-scenarios have been developed to evaluate the HRCCC. This approach is expected to reduce the difficulties associated with attributing specific outcomes to the endeavours of the HRCCC.

4.4 Identification and Valuation of the Costs and Benefits of the HRCCC

4.4.1 The Costs of the HRCCC

Identification and Valuation of Costs of the HRCCC

The costs associated with the Herbert River ICM organisation can be divided into establishment costs, operating costs and research and project costs.

Establishment costs include those costs which were incurred to establish the organisation in the catchment. These costs include those associated with conceptualising the principles of ICM in Queensland. Since 1992, approximately $3.1m in base funding has been allocated annually to activities associated with ICM organisations (Begbie, per.com., 1999). Although the budgeting accounts do not show the direct allocation to specific ICM organisations, at least a proportion of this grant should be apportioned to the establishment of the HRCCC. Included in this base funding is specific monies paid directly to the HRCCC to meet initial establishment costs ($2,000). In the absence of further information an amount of $20,000 has been apportioned to the HRCCC to cover government agency expenses to conceptualise and operationalise ICM in Queensland.

On-going operating and administration costs include the wages and salaries of the paid coordinator as well as the on-costs associated with equipping and servicing office accommodation, a vehicle and to cover meeting expenses. Apart from the Catchment Coordinator, the organisation is staffed and administered by voluntary support. Funding has been provided by local and state governments, by community groups as well as industry support organisations. On-going administration costs covering the salary for the catchment Coordinator and on-costs including the operation and maintenance of a vehicle, communication expenses and out-of pocket meeting expenses are estimated to be approximately $75,000 per annum.

Voluntary support for the organisation has been largely in the form of time spent on ICM matters by committee members. Voluntary support is valued in terms of the opportunity cost of members' time. Apart from the Coordinator, there are 17 members on the Committee of whom 11 are employed in some capacity in the sugar industry. Committee meetings are not held on a strictly regular basis and attendance at the meetings is not regular. However, over the period since

its establishment, the HRCCC minutes show that the Committee has met approximately 10 times per annum since 1992, with attendance, on average, being approximately 11 persons (excluding the Coordinator).

A survey of members of the committee in 1995 and again in 1997 (Bellamy and McDonald, 1998) identified a divergence of opinion between committee members over whether the time they spent on ICM interfered with their business/job requirements as well as family commitments. However, there was agreement amongst committee members that involvement in the HRCCC activities had not incurred significant personal out-of-pocket expenses. In addition, the survey established that members of the committee found involvement with the HRCCC personally rewarding. Time spent by committee members on ICM related business is estimated to be approximately 4 hours per month (Bellamy and McDonald, 1998). To calculate an opportunity cost of the time spent on ICM matters an average hourly wage rate of $14.50 (ABS, 1996) has been estimated, resulting in an annual cost of committee members' time of approximately $6,380. As 11 of the 17 non-paid committee members work in the sugar industry where the weekly wage is estimated to be as high as $50 per hour, it is acknowledged that this estimate underestimates the opportunity cost of members' time. Summary estimates of the present value of the on-going costs of administration and on-costs of the HRCCC over a period of 20 years are presented in the form of a sensitivity analysis, see Table 4.1. The average hourly wage rate and the discount rate have been varied to show the estimated present value of the establishment and on-going costs of the HRCCC using a discount rate of 4, 6 and 8 per cent and an average hourly wage rate of $14.50, $30.00 and $50.00.

Table 4.1 Present Value of Establishment and On-going Costs of the HRCCC, over a period of 20 years ($'s)

	Discount Rate		
Average Hourly Wage	**0.04**	**0.06**	**0.08**
$14.50/hour	1,049,444	900,018	781,203
$30.00 /hour	1,135,781	973,863	845,119
$50.00/hour	1,247,183	1,069,145	927,592

Using a discount rate of 0.06 per cent and an hourly wage rate of $30.00 per hour, the estimated present value of the costs of establishing and operating the HRCCC over a period of 20 years is $973,863. This estimated cost would need to be offset by net benefits earned over the same period.

Project and research costs include the funding received by the HRCCC or administered by the HRCCC to establish consultancies for research to be carried out on the catchment. These costs are estimated on a project by project basis. Typical of these costs are the data collated on the old mining dams in the upper catchment which was followed by specific projects funded by government agencies to address the perceived problems. These costs are included in the discussion and valuation of the net benefits of the activities undertaken by the HRCCC.

4.4.2 Identification and Valuation of the Benefits of the HRCCC

All of the potential benefits from implementation of specific natural resource management projects in the Herbert River catchment cannot realistically be attributable to the endeavours of the HRCCC. In addition, it could be expected that other ICM organisations, government agencies, or industry support organisations could benefit from the work undertaken by the HRCCC.

It can be argued that the benefits from an ICM approach to resource management are primarily associated with the increased collaboration between stakeholder groups. In relation to this, Marshall *et al.* (1997) regard the reduction in transaction costs associated with negotiation over

the use or management of resources over which there are no clear property rights as a major economic benefit from the process. Transaction cost savings are identified as being associated not only with bargaining for property rights over resources but with the flow of information and with the enforcement of solutions to resource degradation problems.

The problem of enforcement of property rights suggests that a cooperative approach between conflicting parties might be appropriate. ICM, because it offers a formal process for consultation and cooperation, could improve the validity and acceptance of resource management solutions and reduce enforcement costs. In this regard, Marshall *et al.* (1997) claim that the "strength of peer pressure can be expected to increase with greater involvement of parties in deliberations" (p.174).

Marshall *et al.* (1997) define ICM as an institutional instrument designed to reduce or address economic inefficiencies resulting from the incomplete specification of property rights. ICM as an organisational structure is designed to provide an opportunity for the community to identify resource problems, to formulate ways of addressing identified problems and to negotiate and to make relatively costless transactions about the ownership and transfer of ownership of property rights. In brief it can be regarded as a vehicle to reduce transaction costs which will in turn improve the allocation of resources.

Although it is assumed that the process leads to improved natural resource management, the causal relationship is difficult, if not impossible, to establish particularly over a relatively short period of time. The complexity of natural resource management is compounded by spatial and temporal considerations. The impact of the HRCCC, in terms of its effectiveness in facilitating a cooperative approach to sustainable development in the catchment, although measurable in terms of attendance at meetings and hearsay evidence of change in attitude towards stewardship of the land resulting in changed management practices, is less obvious and does not lend itself readily to measurement and valuation.

How long does it take for a change in attitude of the community to be manifested in a change in behaviour and a subsequent change in the management of resources? Again, how long does it take for change in management to manifest itself in a measurable improvement in natural resources. For example, a natural resource problem such as rising groundwater requires the cooperation of all farmers if the condition of the groundwater is to be stabilised or reversed. It might take three years before an organisation such as an ICM organisation is established in an area with a committee and a strategy in place. A further two years might elapse before a specific management strategy is identified and adopted by farmers. On top of this, it could take an even longer period of time before the pressure on the groundwater is relieved and the effects become measurable. In this regard, Blackmore and Connell (1997) report, in relation to land management in the Murray-Darling Basin where salinity is now regarded as a major threat to the ecological sustainability of the area, that even if improved irrigation management could successfully halve recharge of the groundwater "there would be no reduction in impact" on the situation in the Basin (p.1041). Further to this, the study notes that even if it is assumed that recharge of the groundwater is successfully reduced across the whole area, "it takes 50-60 years for groundwater pressure to reduce" (p.1041). The ICM organisation in the Herbert River catchment is in its infancy. Many of the benefits which could be expected to result from projects, including data collection projects, have been designed to increase community awareness and to establish the state of the natural resource base in the catchment. Realisation of the benefits from these projects involves a change in attitude towards stewardship of the natural resources in the catchment. Any future benefits can not realistically be expected to become apparent in the catchment until some time into the future.

These and other problems associated with the identification and valuation of benefits from ICM

activities in relation to the management of natural resource use have been discussed previously. To some extent these problems are addressed in this evaluation through the development of a number of outcome scenarios.

The next section provides a detailed evaluation of a number of the activities undertaken by the HRCCC.

5.0 THE HRCCC ACTIVITIES

The HRCCC has undertaken a number of specific activities to meet its stated objectives. This section provides detailed discussion and an economic evaluation of a number of these activities. The objective of the evaluation undertaken here is not to provide an accounting audit of the HRCCC but rather to provide information that indicates the extent to which the HRCCC is meeting its stated objectives. The activities discussed here are:

- Management of vegetation in riparian zones
- Preservation of natural habitats
- Management of drainage
- Management of wetlands
- Management of acid sulfate soils
- Strategic river bank protection
- Mining dams in the Herberton Shire

5.1 Management of Vegetation in Riparian Zones

5.1.1 The Issue

Erosion of river and creek banks is a natural process. To some extent, regardless of the measures taken to prevent its happening, erosion will occur. However, the State of the Environment Advisory Council (SEAC) (1996) claims that before European settlement, when vegetation in riparian zones was extensive and natural vegetation undisturbed, erosion was relatively slow and trees, which were undermined through natural water flows, fell into the water and provided a habitat for fish species and slowed sediment flows down stream (SEAC, pp.7:28-29). Two terms require definition at this point; "riparian vegetation" and a "watercourse". The Department of Natural Resources (DNR) defines "riparian vegetation" as "vegetation which is found on the banks and adjacent to a watercourse" (DNR, 1998, p.33). The Department defines a "watercourse" as:

> a river, creek or stream in which water flows permanently or intermittently:
> - in a natural channel
> - in a natural channel artificially improved or
> - in an artificial channel that has changed the course of the watercourse.
>
> (DNR, 1998, p.33)

A report on the state of the rivers and streams in the Herbert catchment describes the general state of vegetation in riparian zones across the catchment as being poor to very poor (DNR, 1996). The poor quality of the vegetation is attributed to the narrowness of the vegetation that has not been cleared for agricultural purposes and to the level of exotic plants present within the area (p.ii). Two issues arise for management of riparian vegetation: increasing the area under vegetation and improving the quality of the vegetation.

Protecting riparian vegetation has been a contentious issue for the HRCCC. McDonald and Bellamy (1997) cite a number of planning issues which need to be addressed by the HRCCC in relation to the management of vegetation in riparian zones. These include: should there be a buffer zone along watercourses or preferred flow-paths? What constitutes a watercourse? How wide should the buffer zone be? And what management requirements apply to the buffer? There

is currently no legislation to protect riparian vegetation beyond the top of the stream bank, except on leasehold land.[2] At present, there is not a definitive width for riparian vegetation on freehold land. Although there is no legislation to protect riparian vegetation on freehold land, it is recommended (DNR, 1998, p.13) that, for the wet tropical coast, the vegetated riparian zone should be at least 20m each side of the banks of all minor watercourses, wetlands and drainage lines, and at least 40m each side of major watercourses. DNR concede that "conditions vary markedly between catchments in Queensland" (DNR, 1998, p.13). As the majority of agricultural land in the lower catchment is freehold land, the only course of action available to authorities managing these areas is to improve landowner and community awareness of the importance of maintaining vegetation in riparian zones.[3] This has been primarily the role taken on by the HRCCC.

A recent mapping project of riparian vegetation areas in the lower Herbert River catchment, initiated and partly funded through the HRCCC, recommends that the riparian zone requirement be re-addressed to be sensitive to the local circumstances and needs. Specifically, it is suggested that the width of the buffer zone should be a product of consideration towards the risk of flood and bank erosion (Petroeschevsky, 1997). This recommendation is supported by the DNR (1998) which suggests that riparian vegetation zone boundaries should be determined by consideration to ecological factors including a combination of topography, vegetation type as well as its effectiveness in flood conditions.

Drummond and Associates (1993) identify a number of factors requiring consideration for the design of vegetation in riparian zones. These factors include consideration to the species composition and density of planting, preparation of the site and on-going maintenance.

Activities undertaken by the HRCCC to address the management of vegetation in riparian zones meet their stated objectives of encouraging the retention of significant natural habitats within the catchment and also of promoting ways to prevent and reduce natural resource degradation.

There is considerable support for riparian zone vegetation management from natural resource research organsations including SEAC (1996), LWRRDC (1996), DNR (1996; 1998) and sugar industry support organisations including the Canegrowers (1997; 1998), Sugar Research Development Corporation (SRDC) and the Bureau of Sugar Experiment Stations (BSES). Management of riparian zones to encourage the retention, revegetation or rehabilitation of these areas with appropriate vegetation is believed to contribute towards:

- Stabilising the banks of rivers and creeks and helping to reduce sumping and undercutting.[4] Raine and Gardner (1995) claim that tree roots physically bind the soils and reduce the water content of the soils on the river or creek bank by transpiration which reduces the incidence of sumping. In addition, some of the energy of water flow during flooding is absorbed by riparian vegetation which can reduce erosion and scouring of adjacent land.
- Providing a natural habitat and source of nutrients for river plants and wildlife. Riparian zones provide corridors for the movement of terrestrial and aquatic animals and contribute towards provision of a natural habitat and food source for fish, crustaceans and terrestrial animals.
- The provision of shade which inhibits the growth and spread of grass and exotic plants.

[2] Riparian vegetation on leasehold land is protected within 40 metres of a water course under the Qld. *Water Act 1989.*

[3] Under current legislation (the *Integrated Planning Act, 1997*) if a landowner wishes to redevelop his/her property then the proposed development must be consistent with ESD principles and submit a property management plan (PMP). This legislation provides an opportunity for local authorities to manage vegetation in riparian zones.

[4] Bank sumping occurs when river or creek bank material containing high proportions of fine sediments, which is poorly drained, collapses. Undercutting occurs on the outside bend of rivers and creeks where higher flow velocities erode the toe of the bank so that the bank collapses (Raine and Gardiner, 1995).

Inhibiting the growth of exotic plants, such as *Brachiaria mutica* (paragrass) and to some extent *Eichornia crassipes* (water hyacinth), results in the improved drainage of natural watercourses which might otherwise be choked by exotic weeds and grasses and, by reducing the light and heat reaching the stream, improves the habitat for fish and crustaceans. In addition, the reduction in the growth of grass reduces the population of rats in these areas protecting the cane from destruction by rats.

- Water quality improvements. Riparian zones provide a buffer between terrestrial and aquatic ecosystems preventing nutrient and insecticide run-off into watercourses.
- In addition to these potential benefits it is claimed that rivers and creeks which have retained vegetation are aesthetically appealing and provide a valuable asset for local enjoyment as well as for eco-tourism. Water quality improvements may reduce the number and/or size of fish-kills.

Vegetation of riparian zones is also cited as a safety consideration, where the buffer zone between the river and the area under cane increases the safety of the operation of farm machinery in these locations.

There are, however, significant costs associated with the management of vegetation in riparian zones which need to be considered. These include the cost of establishing or rehabilitating vegetation in a riparian zone as well as loss of production from land, currently under crop, which would need to be restored to native or appropriate vegetation. In the lower catchment, loss of agricultural production would be primarily sugar cane. This agricultural land, because of its proximity to a river or creek, is generally regarded as highly productive. In the upper catchment, grazing properties would potentially lose stock access to a water source.

To off-set reduced production resulting from loss of farm land in the lower catchment, there is the possibility of reduced rat damage to cane and a reduction in the infestation of cane land by exotic weeds. The establishment of native vegetation, specifically shade trees, provides natural management of exotic weeds and plants. Shade trees inhibit the growth of grass (a major source of protein for rats) and exotic weeds such as paragrass and water hyacinth which reduce the quality of the water. In addition, these weeds block drainage channels and inundate cane fields. In some areas of the lower catchment water hyacinth has been known to inundate adjacent cane fields following medium to heavy flooding. The hyacinth smothers the young cane and contributes to prolonged waterlogging which considerably reduces cane production. In such situations riparian vegetation would act as a barrier to the weed, and the canopy of the vegetation could inhibit their growth.

In addition, trees provide a habitat for owls which, by preying on the rats, provide a natural form of pest management. Crop destruction by rats in the past is claimed to be considerable (Herbert Cane Protection and Productivity Broad (HCPPB), 1998).

In some areas, the riparian vegetation provides a buffer, acting as a barrier between aquatic and terrestrial ecosystems. Water quality improvements are cited as a benefit of riparian vegetation which can act as a sink for agricultural run-off and inhibit the growth of exotic aquatic weeds which can deplete oxygen levels in streams. These water quality improvements could reduce the frequency and magnitude of fish kills.

Riparian vegetation can absorb some of the force from flood waters, reducing cane loss attributable to scouring and deposition of sediments.

Risks associated with establishing vegetation in riparian zones

There are risks associated with the establishment of vegetation in riparian zones. If river or creek banks are not appropriately stabilised before tree planting, erosion of river and banks is likely to

continue and result in loss of investment in work undertaken. Planting of trees is not likely to provide protection from erosion of the toe of the river bank (the under-water section of the bank). In addition, if inappropriate trees are planted then realisation of the potential benefits could be delayed and some crop loss might result from pests such as sulphur-crested cockatoos, although this is likely to be minimal.

Qualitatively, there are potentially significant benefits if vegetation of riparian zones is established where there is none, rehabilitated where it is not sufficiently wide or requires more appropriate vegetation or rehabilitated if it is infested with exotic plants. To quantify and estimate a monetary value for all of the potential benefits is difficult because detailed information about the willingness of people to pay for these benefits, which are not marketed, is currently unavailable. However, estimates can be made of the potential productivity benefits and of the costs associated with the initial establishment of vegetation in riparian zones across the catchment as well as for estimates of reduced production resulting from land being taken out of production. These estimates are made under a number of simplifying assumptions which may or may not be valid for an individual farmer or for a specific area in the lower catchment.

The potential benefits associated with the establishment of vegetation in riparian zones do not accrue to specific persons or groups of people. Specifically, a farmer undertaking investment to increase or establish the vegetation of a riparian zone on his/her property is not able to exclude others from enjoying the benefits associated with the establishment of this area, including improved water quality flowing down stream and/or from catching fish which have been provided with a natural habitat on his/her farm. In addition, the removal of exotic plants from the area is likely to not only improve the drainage of water through an individual farmer's property but could also improve flows upstream. In brief, the farmer does not have a property right over the benefits (externalities) created as a result of establishing or rehabilitating vegetation of a riparian zone on his/her property. Neither is the farmer able to exclude others from enjoying all of the benefits he/she has created. This raises the issue of "user pays" where those who enjoy the benefits from vegetation of riparian zones are not necessarily the same people as those incurring the costs.

5.1.2 The Estimated Cost of Establishing Vegetation in Riparian Zones

There are two primary sources of cost associated with the establishment of appropriate vegetation in riparian zones. The first is the cost of planting trees in these areas (assuming trees are appropriate). The second is the opportunity cost of the land. This cost is primarily on-farm loss of production as land is taken out of agricultural production (in the lower catchment this is assumed to be sugar cane production). Estimates of the cost of establishing vegetation in riparian zones require assumptions to be made about the extent to which an area requires re-establishment or rehabilitation. Three scenarios are considered:

a) total re-establishment of vegetation
b) some rehabilitation by removal of inappropriate vegetation and some additional planting
c) minor rehabilitation.

Estimates of cost assume an "average" cane farmer and an "average reach of a water course". There is no such person as an "average cane farmer" or an "average reach of a water course". Soils, the shape of the farm block and farm management practices are examples of factors which differentiate one farmer from another. The width of the water course, the velocity of the water, the height of the bank and the extent and quality of a reach of a water course are examples of factors which would differentiate one reach of a water course from another. Some river or creek banks might require substantial structural stabilisation before revegetation was undertaken, others might require the addition of only a small area of trees whilst other areas might require rehabilitation by replanting of appropriate vegetation. For the purpose of this evaluation, no consideration is given to the possibility of the need to stabilise a bank before planting. In short, it

is assumed that re-vegetation by planting trees will provide at least some of the potential benefits. Although estimates of cost can be made, these estimates are subject to substantial variation if the assumptions underlying their estimation are altered. It is therefore stressed that estimates of costs are made, given a number of assumptions which are set out below.

5.1.3 Assumptions Underlying Estimates of Cost

A number of assumptions have been made to estimate the cost of establishing vegetation in a riparian zone. These are summarised in Table 5.1. The average cost of planting appropriate trees along water courses has been estimated at $3.00 per tree. This is assumed to include the cost of raising, planting and maintaining the tree until it is "out of hand" (assuming that the trees will not require fencing-off) (North Queensland Joint Board (1997) Afforestation Programme). This cost can range between $2.00 and $4.00. The Wet Tropics Tree Planting Service plants between 5,000 and 10,000 trees per hectare. It is assumed, for the purpose of this study, that 5,000 trees are planted per ha in areas requiring complete revegetation; that 2,000 trees per ha are planted in areas requiring some revegetation and rehabilitation and that 500 trees per ha are planted in areas requiring minor rehabilitation. Initial maintenance of the area, including the cost of slashing and herbicide spaying is assumed to be incremental to maintaining the area required if vegetation was not established and is included in the cost of the tree.

Although the *Land Act* (1967) requires a buffer zone of 40 metres along major water courses for leasehold land, this requirement is open to interpretation for freehold land and has been discussed previously. Assuming that the 40 metre zone does not include the water course itself, and that the total zone is suitable for complete re-vegetation, then the cost per ha of planting 5,000 trees at $3.00 per tree would be $15,000.[5] As a one kilometre length of a water course with a 40 metre riparian corridor would encompass 8 ha of land, the estimated cost of establishing this area with native trees would be approximately $120,000. However, it is unrealistic to assume that within a one kilometre length of river all of the potential riparian zone would require complete re-establishment of trees. It is more likely that a part would be fully vegetated, a part would be partially vegetated and require rehabilitation, some parts may never have had vegetation and other parts may require re-establishment.

Table 5.1 Assumptions Underlying Cost Estimates for Vegetating a Riparian Zone

Cost Component	Cost Assumption	Range of Estimate
Extent of Vegetation Required	a) Total re-vegetation (5,000 trees per ha)	3,000 – 5,000 trees per ha
	b) Some re-vegetation and Rehabilitation (2,000 trees per ha)	1,000 – 3,000 trees per ha
	c) Minor tree planing (500 trees per ha)	100 – 1,000 trees per ha
Cost of planting and maintaining trees	$3.00 per tree	$2 - $4 per tree
Width of buffer zone	40metres	15 - 40metres

An estimate of the length of major water courses (the Herbert and Stone Rivers) in the lower Herbert River catchment (from Abergowrie) is approximately 105 km, 85 km along the Herbert River and 20 km along the Stone River. Petroeschevsky (1997) estimates that 7 per cent of the riparian vegetation of the stream bank of the Herbert and Stone River's are badly degraded requiring extensive revegetation. The estimated cost of re-establishing vegetation along 7.35 km of river would be approximately $882,000. A further 19 per cent of the Herbert River and 22 per cent of the Stone River water courses (20.55 km) are estimated to require 50 per cent of the area

[5] This estimate compares favourably with Bell (1996) who gives an estimate of $12,000 per ha and the Johnstone Shire $26,600 per ha.

re-vegetated (Petroeschevsky, 1997). This is estimated to cost an additional $1m. In addition, 22 per cent of the riparian zone along the Herbert River and 52 per cent of the Stone River requires minor revegetation (encompassing 29.1 km) (Petroeschevsky, 1997). This work is estimated to cost a further $173,100. In all, the cost of planing trees along the Stone and Herbert Rivers, assuming a 40 metre riparian zone, would be approximately $2m. Geographic Information surveys (GIS) would provide more detailed information about the extent to which the riparian vegetation in these areas required rehabilitation.

Riparian vegetation in cane growing areas including Trebonne Creek, Cattle Creek, Palm Creek, Victoria Creek and Ripple Creek, has been rated by DNR (1996) as very poor. Clearing of vegetation and infrastructure location is cited as contributing to the poor rating. Substantial rehabilitation of riparian zones might be required in areas where the current mean width of riparian vegetation is estimated to be between 12 and 19 metres (DNR, 1996). Insufficient information is available at this stage to estimate the area around the tributaries of the Stone and Herbert Rivers requiring revegetation or rehabilitation.

Estimates of the value of the potential loss of production (assuming that sugar cane is grown on farms riparian to rivers in the lower catchment) requires estimates of the area of land potentially effected and of the quantity and value of cane lost. The assumptions underlying these estimates are provided in Table 5.2.

Table 5.2 Assumptions Underlying Estimates of Loss of Production

Component of Cost	Estimate of Cost	Range of Estimate
Proportion of riparian zone under cane	40% of riparian zone	20 – 50
Cane yield	90 tonnes per ha harvested per annum	80 – 100
Farm gate price of cane	$27.00 per tonne	24 – 30
Cost of cane production	$13.00 per tonne	11 – 16

Along a one kilometre length of river requiring complete revegetation, an area of 8 ha could be potentially taken out of production. Assuming that 40 per cent of the riparian zone would normally be under cane, and assuming the cane yield is 90 tonnes per ha harvested per annum (Australian Sugar Year Book, 1998), then 288 tonnes of cane per annum would be lost. Assuming that the farm gate price of cane is $27.00 per tonne, then the gross value of lost production along a kilometre stretch of river would be $7,776 per annum. The net income loss, deducting the cost of production which is assumed to be approximately $13.00 per tonne, could be approximately $4,032 per annum. The net income loss along 105 km of the Stone and Herbert Rivers (assuming 7 per cent of the total area required revegetation, and adopting all previously stated assumptions) could be approximately $27,165 per annum.

The estimated income loss, expressed as a proportion of total income from the growing of sugar cane, across the entire cane growing district is relatively small (approximately 0.5 of one per cent per annum).[6] However, if the income loss is expressed as a percentage of an individual farmer's total income, the loss can be shown to be significant. A number of scenarios have been developed to show the magnitude of the estimated relative income loss to cane farmers according to the size of their cane assignment. Three sizes of cane assignment have been considered. The first reflects the financial position of farmer who is marginally viable (40 ha assignment); the second, a farmer who has a slightly larger assignment and is able to absorb some of the income loss (65ha assignment), and third, a farmer who has a 100 ha assignment and is able to achieve economies of scale and where the income loss is likely to be absorbed. If these individual farmers had a one kilometre length of their farm riparian to the Herbert or Stone River and were required to vegetate a 40 metre zone which was currently under cane, they would incur a loss of their

[6] This assumes that the gross value of sugar production from the Herbert District is $209m (Sugar Year Book, 1998).

annual income. The results are provided in Table 5.3. Table 5.3 shows that if a cane farmer with a 40ha assignment to grow cane was to take 4ha out of production to revegetate a riparian zone, then his/her income loss would be 10 per cent of his/her total income from cane production per annum. On the other hand, a cane farmer with a 65ha assignment would incur an income loss per annum of 6 per cent and for a farmer with a 100 ha assignment, the per annum income loss is estimated to be 4 per cent of total income from cane.

Table 5.3 Likely Farmer Income Loss to Re-vegetate 4ha of Riparian Zone

Size of Cane Assignment	Percentage of Income Loss
40 ha	10 per cent
65 ha	6 per cent
100 ha	4 per cent

The net income loss per annum to an individual cane farmer would be determined by the area of land he/she would need to take out of production. The point made here is that the costs to farmers of taking the riparian zone out of cane (that is, the opportunity cost of the land) is not equitably distributed across all growers, some farms have none of their property riparian to a watercourse whereas others may have a relatively substantial riparian zone. At the same time, the potential benefits associated with management of riparian vegetation cannot be enjoyed exclusively by those who incur the costs.

5.1.4 The Estimated Value of Benefits

Valuation of most of the potential benefits from vegetating riparian zones is difficult. Estimates of the catchment community's willingness-to-pay for these areas is the subject of a much more comprehensive study of riparian zones currently being undertaken (Blamey *et al.*, 1999). Although a number of potential benefits are cited, all areas of riparian vegetation do not offer the same magnitude of benefits. These will vary according to the location of the site and the particular attributes of the site. Benefits such as pest and weed management, improved drainage, water quality and fish habitats as well as visual and aesthetic improvements in the catchment are largely unquantifiable. However, information is available from previous studies or from reports of damage incurred in the catchment which might have been reduced or avoided if appropriate areas of riparian vegetation had been in place.

Reduction in Damage to Cane from Rats (*Ratus sordidus)*

One potential benefit resulting from establishing vegetation in riparian zones is the reduction in damage to cane from rats. Establishment of appropriate vegetation in riparian zones is consistent with integrated pest management (IPM) programs which have been encouraged by the HRCCC and the HCPPB over several years.

Riparian zones, planted with trees that have a good canopy, eradicate the harborage areas for cane rats (*Ratus sordidus* and *Melomys burtoni)* leaving them more vulnerable to natural predators such as birds. By increasing shade areas, weed and grass growth is reduced. Without grass seeds, rats are denied access to a valuable source of protein. This reduces their ability to breed and subsequently leads to a reduction in the rat population.

Any estimates of the value of avoided costs of rat damage requires assumptions to be made about the value of lost production due to rat damage and the area of cane which might benefit from the potential protection offered by appropriate vegetation of riparian zones. Information supplied by the HCPPB (1998) shows that rat damage in the Herbert River District has been declining since 1993. In 1993, approximately 28,265 tonnes of cane were lost compared to 6,576 tonnes in 1997. This apparent reduction has been attributed to an increased awareness on the part of farmers to the benefits from IPM programs, to poor seasonal conditions for rats as well as to a reduction in visible damage recorded as being caused by rats as a result of trash blanketing. For the purpose of

this analysis, it is assumed that the potential benefits from reduced rat damage are realised on an annual basis rather than being dependent on seasonal conditions.

If it is assumed that a one kilometre length of a watercourse with an 8ha area of riparian vegetation protects a further 48ha of cane land from rats which would destroy 30 per cent of the cane in that area, then the potential value of protection from rat destruction would be $23,328 per annum. For the purpose of this evaluation, these potential benefits have been phased in over a period of five years.

In addition to this potential benefit, there are a number of previous studies which estimate an avoided cost of baiting rats as a potential benefit of riparian vegetation (Canegrowers, 1996). As there is no longer a registered available chemical to control rats, IPM, which involves harborage eradication and field hygiene, is the only course of action available to farmers. In so saying, however, it is likely that a suitable bait may be available in the future. Given the present situation, the avoided cost of baiting is no longer a relevant benefit. However, it is likely that farmers may incur reduced costs associated with grass cutting in riparian zones when trees are well established.

Water Quality

Vegetation of riparian zones provides a buffer between terrestrial and aquatic ecosystems which reduces nutrient and insecticide run-off into watercourses. Fish kills, defined by the Department of Environment (DOE) (1998) as a "significant and sudden mortality of fish or other aquatic animals such as crabs or prawns" (p.1), resulting from deterioration in water quality including oxygen deprivation, excessive nutrient run-off or low pH levels of the water, are evidence of the damage which can be caused if excessive run-off from agricultural land or industrial waste enters a watercourse. Fish kills are generally characterised by large numbers of aquatic animals dying over a relatively short period of time, usually within a clearly defined area (DOE, 1998, p.1). Scientific research (Nowak, 1996) shows that a large proportion of fish-kill events in Australia are due to natural causes. However, there are some fish-kills which can, at least partially, be attributed to human impacts on the natural environment. Fish-kills attributable to industrial discharges or spillages of toxic chemicals provide obvious examples of human impacts on fish. However, a more common cause of fish-kills due to human impact is degradation of natural waterways by interference in natural flows, the build-up of excessive nutrients and drainage of acid sulfate soils.

In addition to reducing agriculture related contamination of water courses, riparian vegetation can inhibit the growth of exotic plants and weeds. Hogan and Graham (1994) report that juvenile barramundi are virtually absent from many of the floodplain drainages, including Cattle, Palm and Trebonne Creeks. They suggest that a possible causal factor is the extensive infestation of these areas with exotic aquatic weeds including *Salvia molesta* (salvina), and *Eichhornia crassipes* (water hyacinth). It is claimed that these weeds reduce the amount of photosynthesis that can occur within the water body, thereby contributing to oxygen deprivation. This situation is particularly prevalent during the onset of the wet season or following significant rainfall events when large amounts of organic matter are flushed into the water courses.

Hogan and Graham (1994) recorded large numbers of freshwater species of fish in the Herbert River floodplain. The habitat of freshwater fish in tropical floodplain lagoons is recognised as being the most threatened within the Wet Tropics region (Pusey and Kennard, 1994). Pusey and Kennard claim that this is due primarily to "ecological impacts associated with agricultural development including: the draining and filling of swamps, the clearing of vegetation, nutrient enrichment from farm runoff, and the use of pesticides and herbicides".

Cane farmers use organic fertilisers, including fly-ash, a byproduct from the sugar mills, to fertilise the soils after harvesting. After heavy rains this could enter watercourses, reducing the oxygen level of the water which could potentially contribute towards fish kills. By providing a

buffer between agricultural land use and aquatic ecosystems, riparian vegetation may reduce the incidence and magnitude of fish kills. That fish numbers in the watercourses is an issue of some concern to the catchment community is supported by the results from a survey of the Herbert River catchment community (Butterworth *et al.*, 1997). The results show that more than half of the respondents to the survey indicated that they were personally affected by lower fish numbers.

Barramundi (*Lates calcarifer (Bloch)*), a native Australian freshwater fish species common in the Herbert River catchment water courses, is intolerant to oxygen deprivation. Following prolonged rainfall in the Herbert River catchment, barramundi fish-kills which may be due to oxygen deprivation, resulting from excessive plant growth (including algae), run-off high in organic debris, nutrients, pesticide and acid from acid sulfate soils, are not uncommon. DOE records show that a number of large fish-kills are reported and investigated in the Herbert River catchment each year (Hogan and Graham, 1994). For the most part, investigation into the possible cause of the fish deaths is inconclusive.

Estimating a monetary value for a fish-kill is difficult because fish-kills do not necessarily involve a single species with an equal value in the aquatic ecosystem. However, DPI Fisheries estimate the value of barramundi for restocking of dams at $50 for recreational fishermen and at $25 for commercial fishermen. In addition, it is estimated that approximately one third of the barramundi are caught by recreational fishermen. (Rutledge *et al.*, 1990).[7]

A recent fish-kill (September, 1998) in Palm Creek resulted in over 1,000 barramundi deaths. This fish-kill could have had a value of $31,500 assuming that one third of the fish would have been caught by recreational fishermen and the remainder by commercial fishermen. The Department of Environment (DOE) has records of several fish-kills of this magnitude per annum in the Lower Herbert catchment. If it is assumed that over 3,000 barramundi are killed each year as a result of agriculture related contamination of watercourses in the Herbert River catchment and that appropriate management of riparian vegetation could contribute towards preventing 20 per cent of these deaths, then the estimated value of improved water quality to the fishing community would be valued at $19,500 per annum. As was the case for reduced rat damage, these potential benefits have been phased in over five years.

Inhibit the growth of exotic plants and weeds and act as a buffer between aquatic and terrestrial ecosystems
Cane loss in the Herbert catchment, attributable to inundation of exotic aquatic weeds following flooding can be significant also. For example, on one farm in the lower catchment with poor riparian vegetation, inundation of cane following a medium size flood in February 1998, is estimated to have destroyed over 400 tonnes of cane valued at nearly $10,000. Across cane land in the lower catchment, the cane loss from such events is estimated to be over 2,000 tonnes, valued at more than $54,000. These avoided losses have been modelled in this analysis as having a 1: 7 year probability of occurrence.

In addition, exotic weeds such as *Brachiura mutica* (paragrass), and hymanachne which were introduced in the catchment by cattle producers with the objective of increasing the feed from water logged areas of their farms, prevent tree recruitment and exclude native sedge communities from ephemeral wetlands. In addition, these exotic weeds invade cane land and reduce productivity. Appropriate vegetation along water courses in these situations can reduce the prevalence of these exotic weeds and reduce the possibility of reduced cane yield.

Some protection of river or creek banks from erosion and protection of farmland from scouring and sediment deposition is possible in the Herbert River catchment if riparian zones are suitably vegetated (Kinhill, Cameron McNamara (1991). Canegrowers (1996) estimates the potential value

[7] Recent net closure in the Hinchinbrook Channel may lead to an increased proportion of Barramundi being caught by recreational fishermen.

of the avoided loss of cane resulting from scouring, which has a probability of occurring during a major flood event (1:10 years), to be $1,000 for a 100ha farm. These benefits are not necessarily enjoyed by all cane farmers but by those located in susceptible areas such as the Halifax Washaway and Anabranch where washaways and scouring have historically been a problem.[8] For the purpose of this analysis, it is assumed that the area of caneland in the catchment potentially afforded some protection by vegetation of a riparian zone from major erosion, scouring and deposition of sediments for a 1:10 major flood event is 400ha. The magnitude of the cane loss following a major flood event would be determined by the period over which the cane is waterlogged and the maturity of the cane. The avoided loss of production is assumed to be 1per cent of production over the total area ($97,200). For the purpose of this evaluation, this estimated avoided loss has been modelled as having a probability of occurring 1:10 years.

5.1.5 Net Benefits of Investment in Vegetation of a Riparian Zone

A cane farmer who currently experiences loss of income resulting from damage to cane by rats, scouring and sediment deposition as well as inundation of cane by exotic weeds following flood events, may need to invest $60,000 to revegetate 4ha of land riparian to a water course. In addition, some of the area requiring revegetation may be under cane. The farmer would need to make a trade-off. He/she would need to invest in revegetation and incur a loss in income in order to avoid a possible substantial loss of income in the future. The estimated value of avoided lost production for a farmer in this situation offsets the cost of revegetation and lost production resulting from land being removed from production. Specifically, a farmer in this situation would need to invest around $60,000 on vegetating the area as well as incur the cost of reduced on-farm production (approximately $2,016.00 per annum). Over a 20 year period the net present value (NPV) of this investment using a discount rate of 6 per cent would be approximately $6,712. However, the extent to which the costs might be recovered by farmers is dependent on the degree to which damage to cane due to rat damage, scouring and inundation from exotic weeds is avoided. If a farmer did not expect to benefit from prevention of scouring or weed inundation, then the return on his/her investment in riparian vegetation is estimated to be -$5,315.

For the catchment community however, additional benefits would be likely, including those resulting from improved water quality (such as reduced fish-kills) and aesthetic improvements to the catchment environment.

The return on the investment over a period of 20 years to revegetate and rehabilitate the vegetation along a 4ha corridor along the Herbert and Stone Rivers (a 40 metre riparian area) is estimated to be approximately -$97,132, at a discount rate of 6 per cent. Calculation of this return includes the potential benefit of improved water quality to the fishing industry as well as the potential benefits to cane farmers which would be realised gradually over a period of 5 years.

Summary information about the magnitude of potential costs and benefits to the catchment community of re-establishing or rehabilitating riparian vegetation along the Herbert and Stone Rivers is provided in Table 5.4.

[8] There are areas where specific structural work to stabilise the river bank may be required.

Table 5.4 Summary Estimates of Potential Costs and Benefits of Riparian Vegetation along the Herbert and Stone Rivers

Costs		Benefits	
Component of Cost	**Estimated Value**	**Identified Benefits**	**Estimated Value**
Re-vegetation (105 km)	$2,055,100	IPM – reduced rat damage to cane	$171,460 per annum
		Improved water quality – reduced fish kills	$19,500 per annum
		Reduced cane loss from scouring	$97,200 (1:10 year)
Loss of cane production	27,165 per annum	Reduced cane loss from weed inundation	$54,000 (1:7 year)
		Aesthetic benefits including increased owl population	Not valued

The estimated NPV over a period of 20 years, at 4, 6 and 8 per cent discount rates, of the investment in managing riparian vegetation along the Herbert and Stone Rivers is provided in Table 5.5.

Table 5.5 The Estimated NPV of Managing Riparian Vegetation Along the Herbert and Stone Rivers

Discount Rate (%)	Estimated NPV ($'s)
4	195,329
6	-97,132
8	-308,608

The estimated NPV is positive only when the discount rate is set at 4 per cent or below. At more commercial rates, 6 per cent and above, the NPV is not positive. In short, to the extent that investment in managing riparian vegetation is sourced from private sector funding, where a competitive return would be expected on investment (a discount rate of over 8 per cent would be required), the investment is not economically efficient. However, if investment were sourced from the public purse, where a discount rate of 4 per cent might be argued to be appropriate, then the investment is estimated to be economically efficient. The point made here, is that the distribution of the costs and benefits associated with managing riparian vegetation is an important consideration in determining the efficiency of the investment.

5.1.6 Sensitivity and Risk Analysis

The two most commonly used methods for measuring the impact of uncertainty on project outcome are sensitivity analysis and risk analysis. Sensitivity analysis is carried out by varying one element or a combination of elements and determining the effect of that change on the project outcome, measured as project worth or performance. Sensitivity analysis is a valuable tool to identify specific variables that could have a significant impact on project outcomes. Risk analysis is variously described as an analytical technique in which probabilities of occurrences are determined for a number of significant project variables which are modelled as varying simultaneously over a specified range over the life of a project. Risk analysis calculates the probability distribution of the performance of a project, providing information about the performance of a project in terms of the probability of an outcome.

Both sensitivity and risk analysis are employed in this analysis.

Sensitivity Analysis
Estimation of the costs and valuation of the benefits associated with the management of riparian vegetation is subject to a number of simplifying assumptions. For example, cost estimates are, for the most part, based on subjective estimates including the area requiring revegetation and the proportion of this area estimated to be under cane. Valuation of the potential benefits to cane farmers is reliant on estimates of avoided loss of production due to scouring or weed inundation and the time it would take for the newly established vegetation to become established to reduce rat damage.

Table 5.6 shows the sensitivity of the estimated NPV (at a discount rate of 6 per cent) to a change in the width of the riparian area and to the proportion of the area requiring revegetation assumed to be under cane.

Table 5.6 Sensitivity of the NPV (at 6% Discount rate) to Change in the Width of the Riparian Area and to the Proportion of the Riparian Area under Cane for a 1 Km Length of River ($'s)

Proportion of Riparian Area under Cane	Width of Riparian Area		
	20 metres	**30 metres**	**40 metres**
30 per cent	31,517	31,631	31,746
40 per cent	25,974	23,317	20,659
50 per cent	20,431	15,002	9,573

The analysis shows that the NPV is particularly sensitive to the proportion of the riparian area under cane. When the riparian area is set at 40 metres wide, and it is assumed that 40 per cent of the area is under cane which would be removed from production, the NPV is estimated to be $20,659. However, when the proportion of the area under cane is assumed to be 50 per cent, the NPV is estimated to be less than half at $9,573. The sensitivity of the NPV to the proportion of the riparian area under cane is important. It indicates that additional incentives may need to be offered to cane farmers if they are likely to lose substantial areas of cane.

Table 5.7 shows the sensitivity of the estimated NPV (at a discount rate of 6 per cent) to a change in the period it would take for potential reduction in rat damage and reduced fish kills to take full effect. Predictive estimates of reduced loss of production due to rat damage are uncertain, subject to seasonal conditions rather than dependent solely on farm management practices.

Table 5.7 Sensitivity of the NPV (at 6% Discount Rate) to Delayed Realisation of Reduced Rat Damage and Fish Kills for the Herbert and Stone Rivers ($'s)

Delayed Benefits of Reduced Fish Kills	Delayed Benefits of Reduced Rat Damage		
	3 years	**5 years**	**10 years**
3 years	40,972	-83,029	-390,184
5 years	23,780	-97,132	-401,372
10 years	1,408	-192,169	-435,973

Table 5.7 shows that the estimated NPV (6% Discount rate) is sensitive to delays in the realisation of the benefits of riparian vegetation, specifically reduced rat damage and reduced fish kills. The estimated NPV is shown to be particularly sensitive to delays in the realisation of reduced rat damage. A positive NPV (at a discount rate of 6 per cent) is shown to be possible only if these benefits are realised over a period of 3 years.

Risk Analysis

In the absence of data to estimate a probability distribution for values of uncertain variables, the value of the variables included in the risk have been assigned a triangular probability distribution (minimum, mode and maximum value). These variables are modelled to vary randomly (using Monte Carlo sampling) consistent with the assumed triangular distribution. The variables included in the risk analysis and the values assigned to them are presented in Table 5.8.

Table 5.8 Variables and Values Included in the Risk Analysis

Variable	Values Assigned
Width of Riparian Area	20, 30 and 40 metre zone
Number of trees planted per ha	1,500, 3,000 and 6,000
Per cent of riparian zone currently under cane	20%, 40% and 50%
Gross value of cane per tonne	$24, $27 and $30
Percentage of cane in area of impact protected from rat damage	20%, 30% and 40%
Number of fish kills per annum	2, 5 and 10
Number of fish per kill	100, 600 and 800

The estimated NPV from the risk analysis, resulting from1,000 iterations, are provided in Table 5.9. The results from the risk analysis show the probability distribution of the estimated NPV for each discount rate.

Table 5.9 Probability Distribution of the Estimated NPV for 4, 6 and 8% Discount Rates ($'s)

	Discount Rate		
	4%	**6%**	**8%**
Minimum value	-$493,156	-$658,019	-$771,220
Maximum value	$1,023,317	$578,519	$249,649
Mean	$213,177	-$82,294	-$296,106
Standard Deviation	$279,784	$228,137	$188,348
Mode	$336,285	-$207,438	-$399,248
95% Confidence level	-$240,896	-$452,782	-$602,183

The results show that there is a substantial difference between the estimated minimum and maximum values for the NPV for all discount rates. The probability distributions indicate that the minimum value and the value at the 95 per cent confidence level are negative for all discount rates. The estimated NPV is positive for the mean and mode values, only when the discount rate is 4 per cent.

5.1.7 Implications

The implications arising from these estimates, which it is stressed are based on a number of simplifying assumptions, are that there are considerable costs associated with the establishment of vegetation in riparian zones. The estimated performance of this project is shown to be especially sensitive to the assumptions about the costs involved with managing these areas, including the width of the riparian area as well as to the assumptions underlying the loss of production. In addition, the principal benefit associated with managing riparian areas is the reduction in damage to cane caused by rats. As a result, the estimated performance of the project and the ability of farmers to recover their investment in vegetating these areas is shown to be sensitive to the assumptions about the area which would benefit from reduced rat damage as well as the time it would take for improved production to take effect.

The cost to individual landowners to establish riparian areas is potentially significant. The benefits arising from re-vegetating these areas are not contained solely on an individual farm and an individual farmer cannot prevent others from enjoying the benefits from these areas. In particular, benefits including improved fish habitats and reduced fish kills are not confined to an individual investing in riparian vegetation. It would therefore appear to be appropriate for authorities wishing to encourage the establishment of vegetation in riparian zones to offer incentives to individual farmers.

5.2 Preservation of Natural Habitats

5.2.1 Endangered Species

Mahogany Glider

The most significant of the native mammals of conservation interest in the lower catchment is the Mahogany Glider (*Petaurus gracillis).* This species is thought to be endangered (Van Dyck, 1993). Suitable habitat for the mahogany glider is claimed to be primarily within two scheme areas, Lannercost and Mandam. Its status as "endangered" is due to its diminished habitat and to the fact that most of the remaining suitable habitat occurs on freehold and leasehold land which has been classified as having a high to medium suitability for agriculture (Blackman *et al.,* 1994). Two conservation and management issues for the species identified by Blackman *et al.,* are the retention of as much of the remaining habitat as possible as well as the maintenance of a continuous habitat or corridor between habitat areas. Cooperative management between landowners, Local government, and the Departments of Environment, Lands and Primary Industries is acknowledged as a requirement for successful management (Tait, 1994). More specifically, land-use planning for the catchment is identified as necessary to avoid the loss of endangered flora and fauna in the future. The HRCCC, in its role as coordinator and disseminator of information has the potential to influence and encourage appropriate land-use planning in the catchment to preserve natural habitats of this nature.

5.2.2 Integrated Pest Management

Owl Boxes

Closely associated with activities to manage vegetation in riparian zones have been activities to encourage farmers to engage in ecologically sustainable pest management practices. A specific activity undertaken by the HRCCC has been the establishment of approximately 55 owl boxes throughout the lower catchment. Not only was this activity undertaken with the objective of promoting ecologically sensitive farming practices by cane farmers, it also represents a coordinated effort between the HCPPB, DNR, local wildlife enthusiasts and landholders. Approximately $1,500 of the cost of the project was sourced from the HCPPB, covering the cost of a cherry picker required to place the boxes.

Owl populations on the Ingham coastal lowlands have dropped noticeably over the last five years. Reduced populations have been attributed to the clearing of native vegetation to accommodate the expanding sugar industry resulting in the destruction of nesting habitats and hunting perches. In addition, the possibility of secondary poisoning linked to rat baits has been suggested.

By establishing nesting boxes for owls in areas which have virtually been cleared of native vegetation, hunting perches have been provided which has increased their hunting range and increased their chance of survival in a changed habitat.

Owls offer an opportunity to promote ecologically sensitive pest control. Halvorsen (1998) reports that "a single owl family can eat over 2,000 rats per year" (p.6). Aside from the number of rats an owl family can physically remove from the environment, there is some potential for owls to disrupt the breeding cycle of rats, further reducing their population.

Rat damage to cane in the Herbert River District has been estimated by the HCPPB to range from 28,265 tonnes in 1993 to 6,576 tonnes in 1997. The farm-gate value of the damage to cane in the Herbert District is estimated to have been $763,155 in 1993 and $177,552 in 1997.

The estimated cost of an owl box is approximately $80.00. The estimated cost of establishing 55 owl boxes across the lower catchment is approximately $4,000 (HRCCC meeting notes). Contributions towards the cost have been made by the HCPPB as well as DNR. In addition, contributions have been made in the form of voluntary labour by individual landowners and local wildlife enthusiasts (no cost has been estimated for this labour).

The value of reduced rat damage to cane production does not need to be significant to show a return to the initial investment to establish owl boxes. Specifically, the value of the avoided cost of lost cane production in the catchment would need to be approximately $350 per annum over a 20 year period to offset the initial establishment costs and periodic maintenance work (assuming a discount rate of 4 per cent). Possibly the real value of establishing owl boxes around the cane growing district, however, is that they have raised the awareness of the catchment community of the advantages of encouraging farming practices to manage native vegetation as a wildlife habitat and which aids pest control.

5.3 Management of Drainage

5.3.1 Drainage as an Issue in the Herbert River Catchment

The main feature of the lower Herbert River catchment area is the Herbert River Delta or floodplain. The delta covers an area of approximately 500km^2. Cameron McNamara (1984) describes the delta as a "typical landform of natural levees bordering river channels, backed by low lying and sometimes swampy depressions" (p.2-1). Due to the flat and low-lying nature of the delta and the high intensity of rainfall in the area, appropriate drainage systems are necessary to satisfy agricultural drainage requirements. Principal land-use in this area is sugar cane production for which drainage is claimed to limit horizontal as well as vertical expansion in the catchment.

Numerous reports have been commission by the Herbert River Improvement Trust (HRIT), Water Resources and/or the Hinchinbrook Shire Council on drainage and flood management for the catchment. Few, if any, of the recommendations made in these reports have been implemented successfully. More recent redevelopment of grazing properties in the lower catchment for sugar cane has highlighted the need for a coordinated approach to developing drainage systems through cane lands. Coordination and amalgamation of existing drainage boards has been an essential component of the area's submission for funding by the Commonwealth Government for the provision of infrastructure to assist the sugar industry under the Sugar Industry Infrastructure Package (SIIP).

Inadequate drainage is cited by DNR (1998) as a major factor limiting agricultural productivity along the wet tropical coast. Drainage problems may be the result of insufficient capacity in natural drainage paths, poorly planned modifications to natural drainage systems, or a combination of these problems. DNR (1998) recommends that drainage systems be planned on a catchment basis. Poor drainage, where drainage works are defined as "those works directed at the reduction of standing water or groundwater levels during and after local rainfall, or after major flood flow has ceased" (Cameron McNamara, 1980, p.4-1), impacts on both cane yield as well as

restricting expansion onto low-lying areas of the flood plain. In this regard, Cousens and Kirby (1979) suggest drainage to be the main drawback to bringing the available land under cane production. They acknowledge that individually, farmers are improving drainage on their individual farms but that most problems are encountered because drainage systems between adjoining farms are not integrated. Cousens and Kirby suggest that these problems may become more pronounced as cane production extends onto more marginal land. Although these comments were proffered almost 20 years ago, they are still particularly relevant, and have not been adequately addressed in 1998.

A number of factors are cited in various reports (for example Cameron and McNamara, 1980; Cameron McNamara, 1984) as contributing to the drainage problems in the lower catchment.

These include:

- Frequency of high intensity rainfall events
- Herbert River flood spillage
- Inadequate surface and subsurface farm drainage works
- Indiscriminate private construction of levee banks and drains which can aggravate river spillage and hinder drainage works which relieve pooled run-off.
- Poor integration of drainage works undertaken by individual drainage boards within the delta
- Location of infrastructure including road, bridges and rail or tramway facilities which has obstructed natural drainage creeks and floodplains.

Estimates of loss of productivity in the Herbert District resulting from a major flood event in 1991 indicate that cane production was down by almost 33 per cent on a five year district average (Sugar Year Book, 1996). BSES research (Dick, 1982) shows that sugar cane yields decline significantly when water tables are less than 0.5m below the soil surface for more that approximately 50 days of a growing season. Loss of cane yield in these situations is estimated to be 0.5 tonne of cane each day. Such situations would be likely to arise in areas fringing freshwater or estuarine wetlands.

Local drainage problems within the lower catchment have reduced the productivity of a number of cane farms. In order to increase production farmers have adopted laser levelling to improve surface drainage, and where waterlogging is severe they have been encouraged to construct artificial lagoons or wetlands. In some instances, individual farmers have constructed levee banks to redirect flood water away from their cane land. For the most part, these levee banks are claimed to have exacerbated drainage problems elsewhere (Cameron McNamara, 1980).

5.3.2 HRCCC Activities

Uncoordinated drainage systems on canelands have been a long term issue creating social conflict in the catchment (McDonald and Bellamy, 1996). Information about the problems in the lower catchment and possible measures to address the problems has been sought through studies commissioned by the Herbert Shire Council in conjunction with the Herbert River Improvement Trust (Cameron McNamara, 1980; Cameron McNamara, 1984; Kinhill and Cameron McNamara, 1991; and Drummond and Associates, 1993). One outcome from these studies has been the proposed amalgamation of a number of drainage boards into one combined body to support a coordinated and consistent approach to drainage. In addition, the HRCCC has been active in securing the recent appointment, by DNR, of a technical drainage expert for the catchment. This officer provides advice on drainage issues and attempts to resolve technical issues about drainage problems associated with planning approvals, required by the town planning scheme. The appointment of a person to provide this service is a move towards a coordinated approach to drainage management in the lower catchment.

Improved coordination and consistency in decision-making could improve the cane yield of cane farmers currently experiencing problems with waterlogging and reduce the possibility of inappropriate subsurface drainage through areas considered to be prone to acid sulfate soils. These activities have the potential to result in an increased area of land developed for sugar cane production, to reduce negative externalities imposed on others as a result of inappropriate farm management and to reduce possible transaction costs associated with protracted negotiation over drainage management.

The HRCCC has not tackled drainage problems in the catchment in a holistic sense. Instead, indirect approaches have been adopted which address specific issues as they arise and encourage appropriate farm management practices. One approach has been to encourage cane farmers to manage drainage problems on-farm, specifically to establish or restore wetland areas. Another approach has been to adopt the role of coordinator, addressing local drainage problems which have been identified as threatening productivity by coordinating the efforts of the organisations and agencies involved and identifying an appropriate course of action. These approaches are consistent with the stated objectives of the organisation: to coordinate government agencies and the community to pursue common goals, to promote the wise use of all natural resources within the catchment and to encourage the retention of significant natural habitats within the catchment.

One of the benefits from an ICM approach to resource management to address drainage problems in the catchment is primarily associated with the increased collaboration between stakeholder groups. Section 4.2 suggested that the potential reduction in transaction costs associated with negotiation over the use or management of resources over which there are no clear property rights as a major economic benefit from the process. The HRCCC activities, in relation to drainage issues, have been largely directed towards reducing transaction costs. The HRCCC has been instrumental in ensuring that appropriate information about drainage problems in the catchment has been made available and that the appropriate organisation or agency to deal with drainage problems is identified.

Levee Banks

The construction of levee banks to protect property from damage resulting from flooding is regarded as appropriate over limited sections of the Herbert River to protect particular areas (Cameron McNamara, 1980, p.4-5). A flood management study (Cameron McNamara, 1980) recommends that the construction of levees to protect property from flood damage be considered carefully. Levees may reduce spillage at one point but will tend to increase spillage elsewhere. In short, although one farmer may protect his/her property from inundation by flood water following a minor flood or local rain event, he/she could well be exacerbating a problem elsewhere. There is an identifiable conflict of interest between individual farmers over this issue which could lead to prolonged and expensive measures being undertaken to define property rights.

The role of the HRCCC in relation to the construction of levee banks has been to provide a forum for discussion about property rights to construct levee banks and to identify the body; drainage board, Shire Council or state government agency which has the authority to take action to regulate their construction. These activities potentially contribute towards a reduction in transaction costs, especially if a lengthy process was required to clarify these issues.

The issue of levee banks, and in particular those constructed along the Halifax Washaway, has been dealt with at some length in a drainage study undertaken by Kinhill, Cameron McNamara (1991) for the Water Resources Commission and the HRIT. In that study it is reported that individual landowners have constructed a large levee (1.8 km in length and approximately 1m high) at an estimated cost of approximately $3,000. The levee was constructed to reduce damage to their property and associated cane loss resulting from scouring by high velocity water,

deposition of large quantities of sediment and increased periods of inundation following flood events. Crop damage for an individual farmer following the 1991 floods was estimated to be $70,000 (Kinhill, Cameron McNamara, 1991). Claims and counter claims about the impact of the levee on neighbouring properties and about responsibility for damage suggest that a coordinated approach to this and other levee bank construction issues might reduce transaction costs.

By providing a forum for discussion, the HRCCC has the potential to contribute towards identification of a solution which would be economically efficient.

A recent HRCCC meeting (July, 1998) demonstrated how a specific drainage issue, in this case the construction of a levee bank by a cane grower, required the identification of an appropriate agency with legislative power to deal with the issue.

The case in question involved the possibility of a farmer constructing a levee bank on his/her property to protect his/her property from flooding. The impact of this action was anticipated by farmers in the area to increase drainage problems on their properties with subsequent loss of cane yield. The HRCCC acted to identify the authority (Drainage Board, DNR (Water Resources) or Local Government) who had the authority to act to prevent the construction of the levee bank. Such action by the HRCCC has the potential to avoid litigation costs as well as the costs of prolonged negotiation to determine the legality of levee banks.

To some extent the management of drainage in the catchment requires the clear definition of farmers' property rights to construct levee banks or construct drainage channels across their property. Involvement of the HRCCC in the issue of construction of levee banks demonstrates an important step towards a coordinated approach to decision-making. A coordinated approach towards addressing this issue could lead to a reduction in transaction costs.

Wharps Holding Sub-division
The HRCCC has been directly involved in addressing perceived drainage problems and also with encouraging cooperation with government agencies to ensure that the possibility of the same problems arising in the future is reduced. Two specific activities in which the HRCCC was involved actively were the drainage of the Wharps Holding sub-division and the development of the Pomona Wetlands. The HRCCC adopted the role of coordinator, organising funding and a cooperative course of action to deal with problems.

Wharps Holding sub-division, in the Upper Stone area of the lower catchment (Upper Cattle Creek), is a 1,000 ha sub-division from an existing grazing property (Wharps Holding) to provide a number of farm allotments. These allotments were regarded as suitable for the production of sugar cane. The initial drainage design was found to be inadequate for the development and potentially could have contributed towards excessive erosion, damaged existing wetlands in the area as well as contributing to waterlogging of cane farms downstream of the development. These impacts would possibly have resulted in reduced cane production and protracted discussion about property rights and management of the drainage problem.

The HRCCC undertook the task of coordinating government agencies and industry support organisations to implement necessary drainage works to reduce these potential adverse impacts. The Hinchinbrook Shire Landcare Group took up the drainage issue with assistance from the HRCCC Coordinator.

5.4 Management of Wetland Areas

5.4.1 The Issue

The expansion of intensive agriculture in the lower catchment has impacted on areas of natural wetlands. *Melaleuca* (paper-bark) wetlands once covered large areas of coastal floodplains (Tait, 1994).[9] Wetlands provide a similar function in maintaining the biological health of ecosystems as riparian areas. Raison (1995) describes wetlands, swamps, billabongs and waterholes as providing important wildlife habitats and as forming an integral part of a hydrological regime. Changes to the hydrological regime of swamps and wetlands through drainage systems are claimed to severely alter the vegetation and habitat of these areas. Wetlands are described as providing an important habitat for wildlife including birds, amphibians and fish (Raison, 1995).

More recent development of land for the production of sugar cane, which requires well-drained land, has reduced the area of wetland in the catchment. Laser levelling, where land is levelled to remove natural contours to provide good drainage across farms, has removed many areas which were natural wetlands. Expansion of the area under sugar cane in the lower catchment is estimated by Johnson *et al.*, (1997) to have resulted in the area of *Melaleuca* communities being reduced by 40 per cent between 1943 and 1996.

Aquatic habitats have been severely threatened by agricultural development which has drained and filled wetland areas and has led to increased nutrient and pesticide run-off. A number of recommendations with regard to the management of wetland areas and ecologically appropriate drainage are made by Hogan and Graham (1994). Their suggestions include the preservation of remaining wetlands, control of exotic weeds which infest wetlands, the creation of artificial wetland areas and increased attention to avoiding drainage works that obstruct fish migration.

A key problem is that the definition of a wetland is problematic and has resulted in inappropriate action or lack of action, on the part of planning authorities in the Hinchinbrook Shire to regulate or manage the development of wetland areas. Vella (1997) cites a number of problems encountered in defining a wetland, including, the differentiation between terrestrial environments and wetlands and between wetlands and aquatic and marine environments. The *Local Government Planning and Environment Act (1994)* defines a wetland as an area "whether fresh, brackish or marine, including coral reefs, mangrove areas, mudflats, sandflats, sandy beaches, seagrass beds and tidal marshes". Vella contends that this definition is inadequate because it does not "refer to wetland indicators such as the permanency of the wetland system, the frequency of inundation, predominant vegetation type, or soil characteristics" (Vella, 1997, p.46). More recently, wetlands have been defined by the Department of Environment (1996) as areas of permanent, periodic or intermittent inundation, whether natural or artificial, static or flowing, fresh, brackish or saline and including areas of marine water the depth of which does not exceed six metres. Wetlands are described as typically including areas which show evidence of adaptation of soil or vegetation to waterlogging.

The HRCCC has undertaken a number of activities to encourage farmers to either retain natural wetlands on their properties or to create artificial wetland areas as a means to improving the drainage on-farm without placing additional strain on the capacity in natural drainage paths. These activities are consistent with the stated objectives of encouraging the retention of significant natural habitats within the catchment, preventing and reducing natural resource degradation and also to promote the wise use of all natural resources within the catchment.

[9] *Melaleuca* communities are considered to be indicative of the vegetation typical of wetland areas.

Pomona Sub-division
The sub-division of a grazing property at Pomona facilitated the development of an area for cane which encompasses some marginal land including ephemeral wetland areas. This development raised the issue of indiscriminate clearing and destruction of natural wetlands in the lower catchment. Re-development of the property resulted in farmers changing the hydrology of the natural habitat in the area which could adversely impact on the biodiversity of the area. A permanent water hole as well as ephemeral wetlands were filled and levelled to provide drained caneland.

The controversy over the development raised the awareness of government agencies and local council about the inadequacy of the definition of wetland areas by the *Water Resources Act (1989)* and the *Local Government (Planning and Environment) Act (1990)* and the deficiencies of existing government agencies to deal with issues of this nature. Lack of a more precise definition has reduced the capacity of the local authorities to act to prevent or manage the development.

The appointment of an officer from DNR to resolve development issues and associated planning approvals in the future is regarded as an achievement of the HRCCC.

Artificial Wetlands
The construction of artificial wetlands on-farm has the potential to create similar positive externalities to those associated with the establishment of riparian zones. Specifically, these areas could capture silt as well as nutrient and insecticide run-off before it reaches major watercourses. They have the potential to provide a habitat for fish and wildlife which has a positive ecological and aesthetic impact. In addition, artificial wetlands provide a means to drain areas of land which cannot be put under crop or which have poor productivity because of waterlogging. Rather than draining low lying land into existing creeks and streams which could already be at full capacity, farmers have been encouraged to manage the drainage problem on their own properties and capture or internalise many of the benefits for themselves.

A retention basin is described as an area of water that is designed to retain silt and nutrient inputs from surface water runoff. An example of a retention basin is an irrigation tailwater dam. The benefits from construction of a detention basin are primarily to retain surface runoff for recycling purposes. Environmental benefits do not extend to providing flora or fauna habitats. Encouraging the restoration of wetlands or the creation of an artificial wetland is a specific activity undertaken by the HRCCC.

As was found to be the case for vegetation in riparian zones, there are number of costs associated with the establishment of these areas which require careful consideration. There are also number of risks associated with the development of these areas. Specifically, acid sulfate soils that might be exposed during excavation need to be appropriately dealt with – either by avoiding areas where they are likely to occur or by neutralising the soils. In addition, soil excavated from these areas must be disposed of sensitively so that destruction of valuable habitat areas through soil being used to build up areas which would otherwise have remained as shallow wetlands, does not occur.

5.4.2 Identification of the costs and benefits of establishing artificial wetlands or restoring wetlands

Nature of costs for construction or restoration of a wetland
The costs associated with establishing or restoring wetland areas vary according to the size and nature of the wetland area to be constructed and the siting of the wetland and the availability of suitable areas for disposal of the soil.

Components of cost include excavation and removal of soil and planting of appropriate vegetation. DNR recommends that an appropriate lagoon area be no less than approximately 0.3ha. The costs associated the establishment of 0.3ha of lagoon which is no more than 3 metres deep are estimated to range from $15,000 to $20,000 (DNR, 1996).

Potential benefits

1. Provide a valuable source of water during a dry season
2. Act as a silt trap and nutrient sink by reducing the movement of nutrients and soil off the farm
3. Help to recharge underground water aquifers
4. Serve as a breeding habitat for fish, birds and water plants
5. Provide on-farm drainage which enables areas to be put under crop or to increase production from water logged areas.
6. Aesthetically attractive

It is worth pointing out at this stage, that artificial or restored wetlands are not expected to prevent flood damage resulting from medium or major flood events. In these situations, caneland is still likely to be inundated by floodwater and crop losses would be a likely outcome resulting from scouring and waterlogging. In these situations, a wetland is not expected to prevent crop losses, but may reduce the severity of crop damage by reducing the period of inundation.

For the most part, the benefits arising from establishing or restoring a wetland are unquantifiable. However, studies have been undertaken which show the magnitude of sugar cane crop loss resulting from prolonged periods of waterlogging following inundation by floodwater (Dick, 1982; Cameron McNamara, 1980). Damage from floodwater can also result from the velocity of the floodwater as well as from the silt load and deposition of debris. The construction, or retention of wetland areas has the potential to reduce crop losses resulting from prolonged water logging and from flood related crop damage.

Consideration to the extent to which potential benefits to farmers might be realised is dependent on seasonal conditions and, in particular on the susceptibility of the sugar cane to damage.

The distribution of floods through a year as well as the period of inundation influence the magnitude of crop losses due to floodwater inundation. These are the important considerations. The whole of the Herbert River catchment is in a cyclonic and intense rainfall area. Meteorological records about the frequency of cyclones in the area, which may cause flooding in the catchment, suggest a frequency of approximately one per year. In addition to cyclones, the area experiences intense local rainfall events which are responsible for localised flooding. The most common time of the year for cyclones and intense rainfall events is shown to be between December and February. This coincides with the period following harvesting when young plant cane is particularly susceptible to damage if waterlogged for extended periods.

5.5 Management of Acid Sulfate Soils

5.5.1 The Issue

Drainage of coastal wetlands or disturbance of soils which were formerly coastal wetlands and contain sulfur compounds may lead to degradation of land and water resources. Acid sulfate soils (ASS) are the name commonly given to soils containing iron sulfides. When exposed to air, the sulfides oxidise to produce sulfuric acid which can drain off into water courses following rainfall or tidal inundation. In addition, the acidic conditions may dissolve metals such as aluminium and iron as well as potentially toxic heavy metals such as cadmium from the sediments, resulting in fish deaths from metal toxicity (DOE, 1998, p.20).

ASS occur in low-lying areas, coastal embayments and estuarine floodplains. These soils are generally located in areas where the surface elevation is less than five metres above sea level. The problem of sulfuric acid formation and run-off arises when these areas, which are frequently waterlogged in their natural state, are drained for agriculture or other development (DOE, 1998, p.20). GIS mapping of the Herbert River catchment of areas which could potentially have ASS shows that approximately 24,000ha of the catchment could be involved.[10]

Although fish-kills are the most widely recognised impact of acidification of water courses (Brown *et al.,* 1983), the issue of ASS is a primary concern for the ecologically sustainable development of Australia's coastal zone. The effects of poorly managed ASS are felt across the community including farmers, fishermen, planners engineers and people involved in land resource management in local councils and government agencies. ASS are unique in that the impacts of drainage can be so severe that they can affect engineering works, agricultural productivity and the water quality of estuarine systems.

Marked impacts on estuarine receiving habitats have included major fish kills, probable displacement of fish population, degradation and destruction of benthic food chains, and changes in riverine and estuarine planktonic structures (Crossland, 1996, p.15). Such degradation of estuary ecosystems has far-reaching implications. Degradation impacts directly on food chains and eco-system function and indirectly on coastal habitats and fisheries resources (National Working Party on Acid Sulfate Soils, 1998).

The accession of ASS products into the groundwater can severely modify and change vegetation, usually reducing productivity. As well, potable water supplies can be degraded. In addition, concrete and steel pipes and other engineering infrastructure are susceptible to acid attack.

The problem with management of ASS arises from the erratic distribution of risk areas and the lack of knowledge about their impacts. In the respect, Crossland (1996) contends that:

> our knowledge of the distribution and extent of potential pyrithic sediments, and the impacts resulting from coastal development which leads to their exposure to air, provides compelling argument for maintaining a high level of concern about ASS processes and management options (p.17).

An additional problem for management arises from spatial factors where those responsible for disturbing ASS are frequently not the recipients of the resulting impacts. The responsibility for appropriate management of ASS lies with landowners or land managers. However, it is frequently estuarine environments and sectors of the community, including the fishing industry, which depend on these environments that bear the cost of acidic discharge. Remedial action, usually at the cost of the landowner, to lessen the possibility of acidic discharge can be expensive and impact on farm productivity.

It is claimed (National Working Party Acid Sulfate Soils, 1998) that ASS underlie significant areas of coastal Australia where the majority of Australians reside. The development of coastal Australia, including urbanisation, industrialisation, agriculture and aquaculture development, requiring infrastructure and utility supply, dredging as well as sand and gravel extraction in these areas, have all disturbed ASS. The impacts of ASS threaten these industries whose estimated value is $10 billion (National Working Party ASS, 1998).

[10] The acid sulfate risk area was initially indicated by a 2km buffer strip along the coast. More detail was indicated using soil values. The following areas were shown as having a high potential towards acid sulfate soils: Brae, Mandam, Mangroves, Orient and stream channels and swamps. A number of areas were excluded as having a negligible or low potential towards acid sulfate soils: beach ridge soils, Ingham, Hamleigh and Macknade. In addition, urban areas were excluded. (Johnson and Smith (1996)

The estimated cost of the impact of ASS is suggested by the National Working Party ASS to include:

- The economic costs associated with avoidance costs incurred as a result of transferring or relocating developments to non-ASS areas. Avoidance costs include items such as reduction in the value of land and the future loss of production from industries located in ASS areas.
- Treatment and rehabilitation of infrastructure affected by ASS would include replacement of iron, steel, aluminium and concrete structures.
- Prevention of acid discharge resulting from coastal urban development in Queensland is estimated to cost over $100 million annually.
- Loss of production, resulting from land and water degradation, includes losses from fishing industries as well as agriculture.

Increased understanding of ASS, coupled with better and more available information on their management, has enabled land managers to take greater responsibility for the consequences of their farm management practices. In many instances, avoidance of ASS through careful site selection can be the most economic and environmentally sound planning decision (Blunden and Rudd, 1996).

Blunden and Budd (1996) describe coastal zone land management in the past to have been primarily concerned with agricultural production, resource extraction or for residential development. They suggest that the management of ASS should be "integrated with the management of land in a holistic and comprehensive strategy that marries productivity and environmental outcomes" (p.264). It is recommended that the management of ASS should be a part of a comprehensive management plan for land generally and should not be treated as a separate issue.

The complexity of the environmental, social and economic impacts of ASS management is regarded by the National Working Party on Acid Sulfate Soils, 1998, to require :

- Effective coordination of limited government resources and policies at all levels.
- Effective regulation by government and compliance by industry.
- Effective planning and development controls.

(National Working Party ASS, 1998, p.5)

The HRCCC has actively participated in programs supported by DNR, DOE, BSES and Canegrowers to increase the awareness of farmers to the potential problems of ASS. The HRCCC has specifically targeted a number of farms identified as "high risk". HRCCC activities in relation to the management of ASS are consistent with the stated objectives of identifying and rectifying natural resource degradation, promoting ways to prevent and reduce natural resource degradation, and promoting the wise use of natural resources within the catchment.

5.5.2 Estimated costs of preventing the disturbance of ASS

The estimated costs associated with educating the catchment community considered at risk from the disturbance of ASS are primarily associated with distribution of literature. These costs are minimal relative to the potential benefits enjoyed if these areas are undisturbed or avoided. Costs to farmers to avoid disturbing acid sulfate prone soils are likely to be in the nature of the opportunity cost of land which would remain as grazing land rather than being redeveloped for cane.

There are, potentially, 24,000ha of the catchment affected by ASS. In 1996, 790ha of this area was under sugar cane, 1,969ha was classified as grazing or grassland (which could potentially be drained and developed for sugar cane) and over 13,200ha was classified as mangroves (providing a valuable fish habitat). If it is assumed that 40 per cent of the grazing and grassland (approximately 787ha) would, in the future, have been redeveloped for cane, then the

opportunity cost of that land is the difference between the income potential of the land under cane and the income earned from this land from grazing production. As grazing land, net income per ha per annum is estimated to be approximately $900 (Ramsay, pers com., 1998). The cost to redevelop grazing land for cane is estimated to be approximately $4,000 per ha. The net income per annum from this land if redeveloped for cane production is estimated to be $1,260 (assuming cane is valued at $27.00 per tonne). The estimated opportunity cost of not developing acid sulfate prone land which is currently classified as grazing or grassland for cane is estimated to be approximately $1,772,100 per annum.

5.5.3 Estimated Benefits

The estimated potential benefits associated with managing ASS in the Herbert River catchment are in the nature of avoided costs. In particular, avoidance of fish kills and degradation of the estuarine fish habitat are of primary concern. The avoided loss of production from agricultural land resulting from deterioration of land afected by run-off from ASS is an additional benefit..

The Hinchinbrook Channel area is claimed (Coles *et al.,* 1989) to have the highest number of fish and crab species and the highest fish and crab species diversity between Cairns and Bowen. Mangroves in the Herbert catchment were also found to have abundant populations of juvenile fish and crustaceans and to have significant populations of commercially important prawns. Fish and crustacean habitats provided by a one hectare area of mangrove is estimated to be worth over $100,000 per annum to fisheries production in Queensland (Crossland, 1996, p.15). Fish kills, valued at $35,000, in the lower catchment streams have been reported (DoE, 1998). However, the cause of the fish kills has not been identified with certainty.

It would be an exaggeration to claim that the total area under mangrove in the catchment was under threat from drainage of ASS. It would also be an exaggeration to claim that the total area of land in the catchment currently under sugar cane production, or which could potentially be put under cane in the future, would be at risk if land use, and in particular subsurface drainage (open drains), was inappropriate.

Insufficient information is available to determine the area of mangrove likely to be at risk or to attribute fish-kills in the catchment to the flushing of ASS. However, GIS mapping of the potential ASS in the catchment suggests that cane is currently grown on areas of potential ASS at the outlet to Victoria Creek. Farm land with open drains in this area would drain into Victoria Creek. This area is surrounded by mangroves which could, potentially, be adversely affected by deterioration of water quality destroying the estuarine fish habitats in the area.

In addition to avoided losses to the Queensland fishing industry, there are also potential losses to the sugar industry if ASS are not appropriately managed. A 1 per cent reduction in sugar cane production currently produced on land in the ASS prone area could be valued at around $20,000 per annum.

To offset the opportunity cost of land remaining under grazing or grassland, the potential value of protection of fish habitats in mangrove areas would need to be substantial. For example, an area of 10ha of mangroves affected by runoff from ASS potentially destroying 50 per cent of the fish habitats would need to be valued at $500,000 per annum to the Queensland fishing industry to offset the opportunity costs of not redeveloping the land for cane. The estimated NPV of managing ASS prone areas by not redeveloping is presented in Table 5.10. Table 5.10 provides the estimated NPV using discount rates of 4, 6 and 8 per cent and with the value of cane varying from $24.00 per tonne up to $30.00 per tonne and the value of the mangroves to the Queensland fishing varying between $200,000 per annum to $800,000 per annum.

Table 5.10 Estimated NPV of Managing Acid Sulfate Soil Prone Areas Under a Number of Assumptions

NPV ($'s) Discount Rate 4%			
Value of fish habitats ($'s)	**Value of cane/tonne ($'s)**		
	30.00	**27.00**	**24.00**
200,000	-11,285,919	-6,571,655	-1,857,391
500,000	-7,208,821	-2,494,557	2,219,707
800,000	-3,131,723	1,582,540	6,296,804
NPV ($'s) Discount Rate 6%			
Value of fish habitats ($'s)	**Value of cane/tonne ($'s)**		
	30.00	**27.00**	**24.00**
200,000	-7,991,221	-4,232,562	-473,903
500,000	-4,550,245	-791,586	2,967,073
800,000	-1,109,269	2,649,390	6,408,049
NPV ($'s) Discount Rate 8%			
Value of fish habitats ($'s)	**Value of cane/tonne ($'s)**		
	30.00	**27.00**	**24.00**
200,000	-5,553,753	-2,520,406	512,940
500,000	-2,608,309	425,037	3,458,385
800,000	337,134	3,370,481	6,403,829

For investment in the management of ASS, by not developing these areas, to show a positive NPV, either the opportunity cost of producing cane on these areas would need to be low (value of cane below $30.00 per tonne) or the value of fish habitats would need to be valued at greater than $500,000 per annum.

As was the case for establishing riparian vegetation, distribution of the potential benefits from appropriate management of potential ASS cannot be attributed to specific individuals or groups of individuals within the community. However, the disbenefits, if ASS are not appropriately managed, have the potential to impact on the wider community.

5.6 Strategic River Bank Protection

The HRCCC has been instrumental in coordinating the endeavours of the HRIT and the Shire Council to undertake substantial river bank protection of sites identified as a major erosion threat when the river is in flood. One specific activity undertaken by the HRCCC is at the Long Pocket site. This project was undertaken to protect infrastructure, including rail and road structures from a break-through or cut-off of the Long Pocket bend of the Herbert River. It is claimed (HRIT) that a cut-off would have resulted in substantial deepening and widening of the Herbert River upstream and considerable siltation downstream which could adversely impact on the river environs. The social, economic and environmental impacts of a cut-off are identified as:

- Loss of a road bridge linking Abergowrie and Ingham
- Loss of cane railway link between Victoria Mill and the Abergowrie District
- Isolation of a number of houses located within the river loop
- Major river bank erosion upstream, resulting in the loss of remaining riparian vegetation and adjacent agricultural land
- Siltation of lower sections of the Herbert River and associated marine areas.

The project required stabilising the potential cut-off path using vegetation, rock protection and changes to land use in the area adjacent to the site.

Although this project was identified previously in reports about flood mitigation in the catchment, neither the Shire Council nor the HRIT had acted on the recommendations. The HRCCC was instrumental in coordinating both organisations to work together to apply for external funding to undertake the required stabilisation work.

5.7 Mining Dams in Herberton Shire

Mining dams, north of the township of Mt. Garnet, constructed when tin was extracted from the area (abandoned in the late 1980's) are regarded by Herberton Shire Council as a threat to the surrounding community and to the downstream quality of water in the Herbert River. (Report to the Herberton Shire Council following an inspection by Council members and officers from the Department of Lands and the DPI together with a number of landowners, April 1993). Concern arises from the lack of maintenance of the earth-filled dams and the possible increasing risk of failure through erosion. Crook's dam has been described as being undermined and needs extending into the bank to improve its stability. Other dams, including Butler and Coolgarra are leaking and in need of repairs. Sediment or settlement dams in the area, are reported as containing "highly undesirable substances, and are of great concern to all water users downstream, including domestic, agricultural, recreational and wildlife habitats. These dams are at risk of failure if failure of the water storage dams occurs.

The HRCCC action with regards to the dams meets its stated objectives of coordinating government agencies and the community to pursue common objectives, identifying and rectifying natural resource degradation as well as promoting the wise use of all natural resources within the catchment.

The HRCCC identified the need for coordinated action between government agencies and the community and obtained National Landcare Program funding of $21K per annum for three years to undertake an inventory about the state of the dams, the possible costs associated with rehabilitation of the dams as well as the current land tenure. In addition the inventory identified habitat conservation and the recreation potential of the dams. To facilitate the use of the water storage dams to supply water to properties and/or urban users as well for recreational and habitat or nature conservation, property rights over the dams might need to be renegotiated with landholders. This would reduce the costs of negotiating responsibility for repairs and access to the dams, resulting in lower transaction costs. It is proposed that the Herberton Shire Council takes up a lease over the dams from landholders on whose properties the dams are located.

5.8 Summary

The present value of the costs associated with the establishment and on-going administration of the HRCCC over a period of 20 years is estimated to be approximately $974,000. The HRCCC has undertaken a number of specific activities in the catchment to meet its stated objectives that offset these costs. These activities have been funded from both the public purse as well as from the catchment community. Evaluations have been undertaken of a number of activities relating to the preservation of natural habitats, management of vegetation in riparian areas, management of floodplain drainage, management of wetlands, management of acid sulfate soils, strategic river bank protection, and stabilisation of mining dams in the upper catchment. Most of the HRCCC activities have been aimed at awareness raising, creating a forum for cooperative solutions, influencing a range of planning processes influencing the Herbert River catchment or brokering fund-raising (eg. Bellamy and Johnson 1999; Bellamy and McDonald 1999). If the activities undertaken did result in changed resource management practices, the estimated costs and benefits incurred are summarised in Table 5.11.

Table 5.11. Summary of potential costs and benefits of HRCCC activities.

Issue	HRCCC Activity	Potential Costs of Activity	Potential Benefits
Management of vegetation in riparian areas	• Mapping of riparian vegetation • Raising community awareness of restoration and retention of riparian vegetation • Organising a Community Riparian Forum with guest speakers	*Individual landowners:* • Cost of revegetation/restoration of riparian areas varies with width required along watercourse and extent of revegetation (eg. 40m buffer corridor costs $120K/km) • Opportunity cost of land which varies with cane assignment/farm size (eg. a 4ha riparian area, with 40% normally under cane would incur a net income loss of $4,000 per annum. This would represent 4% per annum of the net income for a farm with 100ha assignment but 10% per annum net income loss for a farm with 40ha assignment)	*Individual landowners:* • Reduced rat damage to cane crop (eg. value of protection of 8ha area of riparian vegetation is $23K per annum) • Avoided cost of baiting control (where applicable) • Reduced damage to cane resulting from aquatic weed inundation • Improved drainage • Stabilisation of river bank leading to reduced risk of cane loss due to stream bank collapse and scouring *Catchment Community:* • Improved water quality downstream • Improved habitat for fish and crustacea leading to reduced fish kills • Improved natural habitat and source of nutrients for riverine plants and wildlife • Aesthetic benefits (eg. Native wildlife habitat)
Preservation of natural habitats	• Owl box program in support of an integrated approach to pest management	*Individual landowners* • Cost of building owl nesting box and hunting perches ($80/box) *Catchment Community:* • Cost of hire of cherry picker of $1500	*Individual landowners* • Reduced rat damage to cane (see above) *Catchment Community:* • Adoption of ecologically sensitive pest control • Aesthetic benefits
Management of drainage	• Lobbying for technical drainage expert extension officer • Fostering of Landcare group to resolve Wharps Sub-division drainage problems	*Catchment Community:* · Cost of drainage reparation works	*Individual landowners* • Reduction in loss of cane production due to poor drainage *Catchment Community:* • Reduction in adverse impacts of inappropriate drainage infrastructure on other land-owners and habitats • Reduced social conflicts and reduction in

Issue	HRCCC Activity	Potential Costs of Activity	Potential Benefits
			litigation and transaction costs associated with negotiation over drainage management
Management of wetlands	· Raising awareness of ecological importance of retaining natural wetlands on farm · Fostering the development of artificial wetlands on cane farms	*Individual landowners:* • Opportunity cost of land • Construction costs of wetland vary according to size and site of area to be constructed and availability of suitable areas for disposal of soil (eg. Cost of 0.3ha lagoon up to 3m deep range from $15K to $20K) *Catchment Community:* · Contribution to salary and on-costs for DNR extension officer	*Individual landowners:* • Improvement to on-farm drainage • Source of water in dry periods • Aesthetic attraction of habitat etc. *Catchment Community:* • Retention of significant natural habitats on the Herbert floodplain for fish and wildlife • Providing a retention basin for nutrients and sediments in wetland leading to improved water quality downstream • Improve recharge of groundwater • Aesthetic benefits
Management of acid sulfate soils	· Raising farmer awareness of potential problems of acid sulfate soils	*Individual landowners:* · Estimated opportunity cost of land (eg. decision not to convert grazing land to caneland) for area 'at risk' in catchment (approx. 787ha) is approx. $1,772K per annum. *Catchment Community:* · Costs of media releases and distribution of literature to "at risk" farmers	*Individual landowners:* · Avoided costs of loss of cane production (eg. 1% reduction in yield on current caneland in ASS prone areas is approx. $20K per annum) varies with size of area of potential impact *Catchment Community:* · Avoided costs (eg. Avoidance of fish kills and degradation of estuarine habitat)) varies with size of area of potential impact
Strategic river bank protection	· Joint project with Herbert River Improvement Trust at Long Pocket	*Catchment Community:* · Cost of works (eg. bank stablisation using vegetation and rock protection as well as land use changes)	*Individual landowners:* · Avoided costs of loss of cane production *Catchment Community:* · Protection of existing infrastructure (eg. cane railway link to mill and road bridge across river) · Prevention of river bank erosion upstream causing loss of riparian vegetation and adjacent productive cane land · Reduction in siltation downstream

Issue	HRCCC Activity	Potential Costs of Activity	Potential Benefits
Stabilising relict mining dams in the upper catchment	· Inventory of derelict tin dams in upper catchment to assess risk and prioritise work needed · Fostering of coordinated action between government agencies and landowners	*Individual landowners:* · In-kind contribution of time and earth moving equipment *Catchment Community:* · NLP Project grant of $21K p.a. for dam wall stabilisation	*Individual landowners:* · Improved water supply to property owners *Catchment Community:* · Improved water quality downstream · Avoidance of risk of dam failure

Overall, it was found that these activities have the potential to significantly improve or preserve the condition of natural resources in the catchment. It was found also that, for the successful implementation of a number of these activities, notably management of riparian vegetation, management of acid sulfate soils and management of wetlands, private property owners would incur considerable financial expense. In addition, it was found that, all of the potential benefits resulting from investment in these activities were not equitably distributed among farmers incurring the cost and that those who do not contribute to the cost could not realistically be excluded from enjoying the benefits. In an economic climate where the financial viability of farmers is generally deteriorating, the ability, and therefore the willingness, of farmers to invest in improved resource management is considerably reduced. Community-based organisations, which rely on the voluntary cooperation of individual resource managers, may need to take this into consideration to improve the effectiveness of their strategies.

6.0 CONCLUSION

This report presents an economic evaluation of the ICM organisation in the Herbert River catchment. To a large extent, the problems encountered in this evaluation might be encountered for similar studies of similar organisations. In particular, CBA is conducted to evaluate investment in a particular project or program. In this regard, identification of the "without" project or program scenario is important. Because ICM organisations do not operate in isolation from existing government agencies, industry support agencies and community organisations, it is difficult to isolate the impact of the activities of a specific ICM organisation on the state of the environment from the impact of other organisations researching and working in the area. To overcome this problem, assumptions are required about the extent to which organisations of this nature can realistically claim responsibility or ownership over both potential and realised improvements in the condition of natural resources. A number of activities undertaken by the HRCCC to meet its stated objectives have been evaluated in this study using CBA methodology. Detailed description has been provided about these activities identifying potential benefits and costs associated with their implementation. For the most part, causal relationships between the activities of the HRCCC and an improvement in environmental attributes such as water quality are not quantifiable. Indeed, improvements in specific environmental attributes are not, or have not to date, been measured. In order to quantify or value potential outcomes from the activities of the HRCCC, a number of simplifying assumptions have been made.

The results from the evaluation show that the activities undertaken by the HRCCC have the potential to bring about substantial improvements in the quality of the land and water resources in the catchment. However, in the majority of cases, successful implementation of these activities requires significant costs to be incurred by individual landholders in the catchment. Many of the potential benefits, however, are shown to be enjoyed by both the landholders as well as the community as a whole, and further, landowners cannot internalise all of the benefits to which they contribute or exclude others from enjoying them.

The real issue the HRCCC and other organisations of this ilk need to address, is how to encourage farmers to take on farm management practices that could result in improvements to the land and water resources, particularly when to do so could result in a shortfall in their income. The HRCCC seems to have adopted the strategy of educating people in the expectation that this will bring about a change in their behaviour. This approach may prove to be lacking in effectiveness, particularly when farmers are being asked to bear the costs and in an economic climate for agriculture, and the sugar industry in particular, which is characterised by increasing costs and lower returns.

There are a number of limitations underlying this study which may provide an opportunity for further research. Specifically, many of the simplifying assumptions which were adopted to

facilitate the quantification of costs and benefits of activities undertaken by the HRCCC need to be reconsidered and refined. For example, estimates of riparian areas requiring revegetation and the extent to which an area requires revegetation or how much of this area is currently used for cane, has been undertaken in this analysis using simplifying assumptions. These assumptions require substantiation, perhaps by employing GIS techniques the validity of the results could be increased. Also, with additional data, more sophisticated modelling could be undertaken to improve estimates of potential reduction in rat damage and fish kills.

Previous reports on community-based organisations (Sloane, Cook and King, 1997; Stone and Assoc, 1995) suggest the need for indicators to be identified which would provide a means to measure improvements in the condition of natural resources. This report concurs with those suggestions.

The Draft Herbert River Catchment Management Strategy (HRCCC, 1996) identifies three desired outcomes from the implementation of their strategy. These are:

1. An understanding by land managers of the inter-relationships between land, water and biological resources, and the effects their decisions and actions have on these resources.
2. A co-operative and co-ordinated approach to natural resource management.
3. Primary industries which are economically viable and ecologically sustainable.

(HRCCC, 1996, p.i)

Without the identification of indicators to measure these outcomes which largely rely on behavioural change on the part of the catchment community, behaviour which would demonstrate a change in the sustainability of agricultural land, neither the desired nor the apparent achievements of the HRCCC can be measured and valued with confidence. This problem is not confined to the evaluation of the HRCCC but to all organisations of this nature.

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Chapter 3

Integrated Catchment Management Communication Study: The Herbert River Catchment, Queensland

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1.0 INTRODUCTION

CSIRO are conducting research on the evaluation of Integrated Catchment Management (ICM) in a wet tropical environment. The objectives of this five year program are to:

1. monitor and document the process of implementation of ICM in the Herbert River catchment and identify the social, economic, and institutional factors that facilitate or hinder this process;

2. evaluate the key impacts of the implementation of the ICM process in terms of attitude and behaviour changes in the community and changes in the severity or tractability of the resource use conflicts for the Herbert River catchment;

3. assess the specific technical and related information needs that are relevant to an effective ICM implementation process in a wet tropical environment; and

4. develop a framework and related methods for evaluating the process of ICM implementation that will facilitate the development of more effective catchment management programs in Australia.

As the success of ICM by definition depends on communication between stakeholders to ensure coordination of inputs, the research included a pilot study on measuring and evaluating communication between significant stakeholders of ICM. Prior to this, very little research had been conducted to measure the degree of communication between stakeholders of ICM and the effectiveness of the communication.

2.0 METHODOLOGY

2.1 Structure of the questionnaire

2.1.1 Introduction

A brief introduction was read to respondents at the start of their telephone interview which explained what the study was investigating.

2.1.2 Involvement in ICM

The first questions related to respondents' involvement in ICM: whether or not they had been involved; reasons for involvement; length of involvement; and if the respondent was not involved, awareness of ICM in the Herbert River Catchment or elsewhere in Queensland. Everyone was also asked about any concerns they had regarding environmental management in the Herbert River Catchment.

2.1.3 Communication

To clarify which communications would be included, respondents were advised that communications may have been:

- formal (eg. a letter or e-mail) or informal (eg. a conversation or meeting at a social occasion);
- for one particular reason or for a number of reasons;
- personal (ie. individuals representing themselves) or official (ie. individuals representing their organisation); or
- 'one off' or a 'group' of communications with the same contact.

The following categories of 'contacts' were used throughout the questionnaire:

- state government in Brisbane;
- state government in Townsville or northern Queensland (regional state government);
- local government;

- Herbert River Catchment Coordinating Committee;
- industry or an industry group;
- individual basis; and
- other contacts.

Respondents were asked firstly how often they had communicated with each of these categories about ICM/environmental issues and secondly, with whom they had communicated. Up to six separate answers were permitted and depending on the category, they may have been departments, organisations or individuals. This was recorded by interviewers on a separate "Communications Sheet".

Originally it had been hoped to assess the nature and function of the eight communication dimensions identified for large corporations by Roberts and Reilly (1974). These dimensions were not appropriate for ICM and a more open-ended approach was developed. The key dimension, influence, was retained for this study.

The questionnaire (see Appendix A) therefore measured the following aspects of communication reported by respondents about their communication with each of the categories of contacts:
- frequency of communication with contacts over the past year;
- the topics of communication;
- who initiated the contact;
- whether respondents represented themselves or an organisation;
- the outcomes;
- the degree of satisfaction;
- any resultant change in the respondent's outlook; and
- the respondent's opinion about resultant change in the contact's outlook.

The terminology 'contacts' and 'categories of contacts' will be used throughout the report.

Interviewers referred back to the responses on the Communications Sheet to ask these questions. To prevent order biasing, interviewers used a different order for each interview. To make the administration of this easier, each category was printed in a different colour in the questionnaire and corresponding colours were written next to the categories on the Communications Sheet.

2.2 Pre-testing

Eight pre-tests were conducted with people familiar with ICM issues either in the Herbert River Catchment or elsewhere in Australia. The feedback was used to alter the questionnaire.

2.3 The Sample

The categories of respondents were:
- state government public servants (Brisbane);
- state government public servants (Regional);
- regional participants in ICM in nearby catchments;
- researchers;
- Herbert River Catchment Coordinating Committee (HRCCC) members;
- landholders and general community; and
- people active in the local community (eg local government, community/industry organisations).

Contact details for people in most of these stakeholder categories were obtained from members of the HRCCC and CSIRO researchers in Queensland. Landholders and general community were selected randomly from the telephone book and landholder lists. In categories for which

more respondents were needed, more names were gathered using the "snowball" sampling technique (see Fife-Shaw, 1995).

A total of seventy one people were telephoned to ask if they would participate in the study. Sixty individuals agreed to participate, a response rate of 84.5%. Those people were either interviewed by telephone at that time or at an arranged time. The table below shows the number of people telephoned, the number interviewed, and reasons for not participating. The actual refusal rate was very low by normal survey standards.

Response rate and reasons for not participating

	Contacted	Interviewed	Moved	Retired	Away/not available	Refused
HRCCC	17	16				1
Regional SG	14	9	1		4	
Local people	13	12		1		
SG Brisbane	6	3	2			1
Other ICM	5	5				
Researchers	4	4				
Active locals	12	11			1	
TOTAL	71	60	3	1	5	2

Interviewers were provided with the following definition to read to respondents who asked what ICM meant: "Integrated Catchment Management is a management system that attempts to integrate key resource management issues in a way that enables all stakeholders to work together towards the goal of balancing economic development with environmental protection".

3.0 RESULTS

3.1 Background

Are you involved either personally or because of other reasons in Integrated Catchment Management (ICM) in the Herbert Catchment?
Participants were asked whether or not they were involved, either personally or for other reasons, in ICM in the Herbert River Catchment. Of the sixty participants, 45 were involved in ICM. Those fifteen people not involved in ICM in the Herbert were from the following groups: local people (8), regional state government (4), and regional ICM (3).

From this point forward, those involved in ICM were asked about their communication concerning ICM and those not involved were asked about communication concerning environmental issues.

Which of the following are reasons for your involvement?
Those 45 people involved in ICM were then asked to indicate which of eight reasons were appropriate to explain why they were involved, shown in the table below. More than one answer was permitted.

Reason for involvement	% (n = 45)
Personal interest	75.6
Job related	64.4
Interest in the sugar industry	64.4
Member of a community group	57.8
Because I'm a landholder	48.9
Interest in other primary production	48.9
Live on the catchment	46.7
Scientific research	31.1
Other reasons (eg common sense, interest in a particular issue)	28.9

Three quarters of the sample agreed with *personal interest* as a reason for their involvement in ICM in the Herbert. *Job related* and *interest in the sugar industry* were selected by nearly two thirds of the sample.

Those involved in ICM were asked how long they had been involved. The mean length of involvement for each group of respondents is shown in the following table. The number of respondents is shown in brackets.

Category of respondent	Mean (years)
Researchers (n = 4)	7.2
SG Brisbane (n = 3)	6.3
Local people (n = 3)	6.0
Other ICM (n = 2)	5.5
HRCCC (n = 16)	4.9
Active local people (n = 10)	4.6
SG Townsville (n = 5)	4.4

As the HRCCC was formed in 1993 it is not surprising that the mean length of involvement in ICM for members of the HRCCC was 4.9 years and the modal response was 5 years. Of interest is the fact that researchers had been involved in ICM longer than any other category of respondent.

Before this interview were you aware of the ICM program in the Herbert Catchment and elsewhere in Queensland?

Those people who were not involved in ICM were asked whether they were aware of the ICM program in the Herbert Catchment and elsewhere in Queensland. Ten of the fifteen people not involved were aware of ICM. When asked what they knew about ICM, 5 mentioned previous involvement in ICM, and the remainder were either unfamiliar with the details of ICM, mentioned that it tackled erosion and chemical run-off or that it was related to a review of the Hinchinbrook canals.

Do you have any concerns about environmental management on the Herbert Catchment? If yes, what are your major concerns?

All participants were asked whether they had any concerns about environmental management in the Herbert Catchment and if so, to list their major concerns. For the 55 respondents who did mention concerns, the table lists the frequency of the concerns stated, separately for those people involved, and not involved, in ICM.

Concern	Involved (n = 45)	Not involved (n = 15)
Environment in general (inc biodiversity loss)	18	3
Ineffective decision making processes and communication	15	0
Water quality	10	1
Flooding, drainage and their management	8	5
Vegetation (eg clearing, revegetation and mangroves)	6	0
Impact of industry	4	0
Weeds and weed control (eg arsenic weed, lantana)	3	2
Over use and over allocation of water	3	1
Natural resource management	3	1
Other	11	7

The larger degree of concern by those involved in ICM about *ineffective decision making processes and communication*, *water quality*, and *vegetation* issues may reflect the insight gained to these issues through close involvement with government departments and attempts to address sustainability issues.

The order of concerns expressed by the HRCCC reflected the priorities of people involved in ICM except that *flooding, drainage and their management* rated much lower for the HRCCC.

3.2 Overall communication (Recorded on Separate Communications Sheet)

Over the last year, how often have you communicated with anyone from … about ICM OR environmental issues?

1	2	3	4
Frequently	Occasionally	Once or twice	Never

This question was asked for the following categories of contacts:

A. state government in Brisbane
B. state government in Townsville or Northern Queensland
C. local government
D. the Herbert River Catchment Coordinating Committee
E. industry or an industry group
F. individual basis (ie. communicating with the person as an individual, and not necessarily as someone representing an organisation).

This question was asked separately for each different contact in the 'other' category at the end of the questionnaire. The following table shows the overall frequency of communication with each of the categories of contacts, with median responses indicated with a tick.

	SG Brisbane	Regional SG	Local Govt	HRCCC	Industry	Individual	Other	Total	%
Frequently					✓			123	38
Occasionally		✓	✓	✓			✓	68	21
Once/twice	✓					✓		37	11
Never								96	30

The overall totals indicate that much of the communication that did occur was fairly frequent. The most frequent communication, on average, was with industry, which reflects the emphasis that ICM groups place on close communication with industry and industry groups.

Who did you communicate with? (Up to six responses permitted)
As mentioned above, respondents were asked to specify who they had spoken to from each category of contact. The sixty respondents reported a total of 348 different contacts they had communicated with about ICM and related issues.

For a detailed list of the different specific contacts for each category of respondent, see Appendix B. A table showing the number of different contacts for each group of respondents with each of the categories of contacts can be found in Appendix C.

Below are the various organisations or departments spoken to from each category, using names current at the time of the survey. Although names of individuals were mentioned by respondents, only the number of different individuals spoken to has been listed. Each of the contacts may have been communicated with any number of times by each respondent.

State government in Brisbane
Department of Natural Resources
Department of Local Government and Planning
Department of Environment
Department of Primary Industries
Department of Fisheries
Queensland Rail
Members of coordinating groups

Regional state government
Department of Environment
Department of Natural Resources
Department of Primary Industries
Queensland Transport
Dept of Local Government and Planning

Local government
Thuringowa City Council
Hinchinbrook Shire Council
Herberton Shire Council
Members of coordinating groups
Townsville City Council
Mayor
Council
Integrated Pest Management
Dept of Local Government and Planning

HRCCC
3 different individuals
All members

Industry or an industry group
Canegrowers Association
Cattleman's Union
Members of coordinating groups
Colonial Sugar Refineries (CSR)
Fruit and Vegetable Producers Association
Horticulture
Queensland Commercial Fisheries Organisation
Landcare
Individuals
Tropical Fruit Group

Other
CSIRO
Landcare
6 different individuals
CSR
Aboriginal and Torres Strait Islander Commission (ATSIC)
local group

The table below lists the mean number of different contacts reported per respondent over the last year with the different categories of contacts.

Categories of contacts

Respondents	SG Brisbane	Regional SG	Local govt	HRCCC	Industry	Individual	Other	TOTAL	Overall mean
Researchers (4)	1.5	1.0	2.0	2.8	1.0	1.5	0.3	40	10
SG Brisbane (3)	2.3	1.3	0.3	1.7	0.7	0.0	0.7	21	7
HRCCC (16)	1.3	1.6	1.3	n/a	2.0	0.4	0.5	114	7.1
Active locals (11)	0.9	1.2	1.1	0.8	0.8	0.7	0.8	70	6.4
Other ICM (5)	1.2	0.4	1.8	0.2	2.2	0.6	0.0	32	6.4
Regional SG (9)	0.7	1.2	1.0	1.0	1.6	0.3	0.0	52	5.8
Local people (12)	0.3	0.3	0.3	0.2	0.2	0.3	0.1	19	1.7
Overall mean	8.2	7.0	7.8	6.6	8.4	3.9	2.3		

On average, researchers had communicated with the highest number of different contacts (10 per person). This was to be expected as they were selected because of their research on ICM issues and therefore had a great deal of contact with others about ICM.

HRCCC members had made an average of 7.1 different contacts per person overall. However, while some members of the HRCCC listed a relatively high number of different contacts (maximum = 26), other members had very few different contacts (minimum = 2). Overall, the number of different contacts for the HRCCC was very high considering the voluntary nature of members' involvement, unlike state and local government respondents and researchers.

State government representatives in Brisbane had a very similar number of different contacts to HRCCC members (7 per person).

The highest number of different contacts within a specific category was reported by researchers with the HRCCC (2.8 per researcher). Researchers also communicated with local government to a relatively high degree (2 per researcher).

The second highest number of different contacts with a specific category was reported by Brisbane state government respondents with other Brisbane state government representatives (on average, 2.3 contacts).

The relatively high number of different contacts that the HRCCC had in industry (2 contacts per person) and that other ICM groups had in industry (2.2 per person) again reflects the emphasis ICM groups place on close communication with industry and industry groups and industry representation on ICM committees.

Active local people had the most even distribution of communication with the different categories of contacts. This places active local people in an ideal situation to assist in coordination efforts.

The low mean number of different contacts reported by local people about ICM or environmental issues (1.7 per person) may indicate a relatively low involvement of the general community in ICM. At this stage, there are no baseline figures of this nature available. In addition, communication with people on an individual basis was very low.
The only linkage completely missing in this matrix of communications was between Brisbane state government respondents with people on an individual basis. Very low numbers of different contacts were reported by other ICM representatives with local government, regional state government and the HRCCC and by local people with all categories of contacts.

3.3 Characteristics of communication

What were the main reasons for the communication?
All respondents were asked to explain the main reasons for each communication with the different contacts they had listed. The table below shows those reasons mentioned in over 4% of responses by each of the seven groups of respondents. The total number of responses mentioned by each group of respondent is shown in the first row. For each different reason, the percentage of the total number of responses for each group of respondents is shown. For example, 33 responses were mentioned by local people and 9.1% of those responses were *policy/planning/decision making*. It is important to note that 'reasons for communication' have not been analysed by 'who initiated the contact'.

Reasons for communication (by groups of respondents)

	Respondents							
	Local people	Local active	HRCCC	Other ICM	Regional SG	SG Brisbane	Researchers	OVERALL
Number of responses	**33**	**79**	**176**	**50**	**90**	**35**	**69**	**532**
Reasons	%	%	%	%	%	%	%	%
Policy/planning/decision making	9.1	10.1	9.7	4.0	11.1	5.7	10.1	9.2
Environmental issues	21.2	12.7	5.7	12.0	14.4			8.6
Research/project work			5.1		4.4		30.4	6.4
Follow up on catchment /strategy issues		5.1	4.5		5.6	11.4	10.1	5.3
Meeting/seminar		6.3	5.7	6.0	6.7			4.7
Exchange information	9.1		8.5		5.6			3.8
Drainage action	9.1							3.4
Information collection and follow up		8.9				5.7	5.8	3.0
Funding				4.0		14.3		2.8
Departmental/local issues							10.1	2.6
Understanding			4.5				18.8	2.4
General discussion	3.0			4.0				2.3
Advice on water licencing/allocation issues					7.8			2.1
Gain support or interest in ICM				6.0				2.1
Marine permits					10.0			2.1
Coordination/conflict resolution	6.1			4.0	6.7			1.9
General advice		8.9						1.9
Land use or management	6.1			4.0				1.5
Death of fish or fish habitats								1.3

Overall, the most frequent responses were: *policy/planning/decision making* (9.2%); *environmental issues* in general (8.6%); and *research project work* (6.4%).

The most frequent reasons for communication mentioned by specific groups of respondents were:

- *research/project work* by researchers (30.4%);
- *environmental issues* by local people (21.2%), regional SG (14.4%), local active people (12.7%), and other ICM groups (12.0%);
- *understanding* by researchers (18.8%), mainly in communication with people on an individual basis; and
- *funding* by Brisbane state government (14.3%).

The following table lists the frequency of the same reasons for communication with each category of contact. Again, only reasons mentioned in over 4% of the responses are listed. However, as the number of responses was very low for 'Other' contacts, only reasons given in over 5% of responses are listed for this group.

The total number of responses for each category of contact is shown in the first row. The percentage indicates how often each response was mentioned in communication with each category of contact. For example, for communications with Brisbane state government contacts, a total of 88 responses were listed and 12.5% of these were *policy/planning/decision making*.

Reasons for communication (by categories of contacts)

	Categories of Contacts							
	SG Brisbane	Regional SG	Local govt	HRCCC	Industry	Individual	Other	OVERALL
Number of responses	**88**	**96**	**86**	**69**	**123**	**45**	**25**	**532**
Reasons	%	%	%	%	%	%	%	%
Policy/ planning/ decision making	12.5	4.2	12.8	8.7	9.8	4.4	12.0	9.2
Environmental issues	4.5	8.3	16.3	4.3	7.3	8.9	16.0	8.6
Research/ project work	6.8	4.2		15.9	7.3			6.4
Follow up on catchment / strategy issues	8.0		7.0	13.0				5.3
Meeting/ seminar			9.3		4.9	6.7	8.0	4.7
Exchange information	4.5					8.9		3.8
Drainage action	4.5					9.0		3.4
Information collection and follow up		6.3				8.9		3.0
Funding	5.7	4.2						2.8
Departmental/ local issues				11.6				2.6
Understanding						6.7		2.4
General discussion						6.7		2.3
Advice on water licencing/ allocation issues					4.9			2.1
Gain support or interest in ICM				4.3				2.1
Marine permits					4.1			2.1
Coordination/ conflict resolution				4.3				1.9
General advice	4.5						8.0	1.9
Land use or management		4.2				4.4		1.5
Death of fish or fish habitats		4.2						1.3

Frequent reasons mentioned by respondents for communication with particular categories of contacts were:

- *environmental issues* with local government (16.3%) and other contacts (16%);
- *research/project work* with the HRCCC (15.9%);
- *follow up on catchment/strategy issues* with the HRCCC (13%);
- *policy/planning/decision making* with local government (12.8%), state government in Brisbane (12.5%) and other contacts (12.0%).

Unique reasons for communication to particular respondents and contacts

Some responses were unique to particular groups of respondents (still using the 4% cut-off). *Drainage action* was mentioned only by local people, in their communications with state government representatives in Brisbane and with people on an individual basis. This result reflects the degree of community concern about drainage in the Herbert River Catchment. *General advice* was only mentioned by local active people, and was in communications with state government Brisbane and 'other' contacts, indicating that these groups are presently viewed as the best contacts for general advice.

Similarly, some responses were unique to communications with particular categories of contacts. For example, *death of fish or fish habitats* was only mentioned in communications with regional state government representatives. *Understanding* was unique to communications reported with people

on an individual basis and was mentioned by HRCCC members and researchers. This may indicate the importance of communication on an individual basis when trying to gain an in depth understanding of certain aspects of ICM.

General discussion was only mentioned in communications with people on an individual basis and was mentioned by local people and other ICM representatives. *Advice on water licensing/allocation issues* and *marine permits* were unique to communications between regional state government respondents with their industry contacts.

HRCCC communication

The following reasons were reported by HRCCC respondents in their communications with the categories of contacts shown.

- *Policy/planning/decision making*: with all categories.
- *Exchange information*: on an individual basis; with SG Brisbane.
- *Environmental issues*: with all categories.
- *Meeting/seminar*: with local government; other contacts; individual basis; industry.
- *Research/project work*: with HRCCC; industry; SG Brisbane; regional SG.
- *Follow up on catchment/strategy issues*: with SG Brisbane; local government.
- *Understanding*: on an individual basis.

By comparison, communication reported with the HRCCC was mainly for the following reasons and was reported by the groups of respondents shown.

- *Research/project work*: by researchers; regional SG.
- *Follow up on catchment/strategy issues*: by SG Brisbane; researchers; regional SG; local active people.
- *Departmental/local issues*: by researchers.
- *Policy/planning/decision making*: by all groups.
- *Environmental issues*: by local people; regional SG; local active people; other ICM.
- *Gain support/interest in ICM*: by other ICM.
- *Coordination/conflict resolution*: by regional SG; local people; other ICM.

Four of the reasons for communication by HRCCC respondents matched the reasons reported for communication with the HRCCC, although in different orders of frequency.

HRCCC respondents mentioned *exchanging information; meeting/seminar;* and *understanding* whereas other respondents did not mention these in their communication with the HRCCC.

Other respondents mentioned *departmental/local issues; gain support/interest in ICM;* and *coordination/conflict resolution* as reasons for their communication with HRCCC members but these were not mentioned by HRCCC respondents. These particular differences are important in light of two HRCCC key objectives (1998), to "coordinate government agencies and the community to pursue common goals" and to "seek community involvement in catchment management".

Who made contact first?

For each communication reported, respondents were asked who made contact first. The table below shows the percentage of contacts for each group of respondents made in each direction:

- outward – the respondent initiated communication with the contact;
- mutual – initiated through a mutual contact, meeting or other event; or
- inward – the contact initiated communication with the respondent.

Groups of respondents (number of communications)	Outward %	Mutual %	Inward %
Local people (19)	47.4	42.1	10.5
Local active people (60)	38.3	50.0	11.7
HRCCC (108)	27.8	49.1	23.1
Other ICM (32)	53.1	40.6	6.3
Regional SG (51)	31.4	58.8	9.8
SG Brisbane (18)	38.9	50.0	11.1
Researchers (39)	23.1	43.6	33.3
TOTAL (327)	111	160	56
Overall %	33.9	48.9	17.1

Overall, approximately half (48.9%) of the communications were reported to be mutual, which illustrates the high degree of initial contact made through previous contacts or at meetings and other events. This result will be important to utilise in any attempts to improve communication between stakeholders of ICM or environmental issues.

Researchers were the only group contacted more often by others (inward) than they initiated communication (outward). The HRCCC also received a large degree of inward communication which may reflect their central role in providing information on ICM.

For details of the direction of communication between each of the groups of respondents and the categories of contacts, see Appendix D.

Were you primarily representing yourself or an organisation or both?
For each communication, respondents were asked whether they had primarily represented themselves, their organisation, or both. The table shows the frequency of each response for the categories of respondents.

Groups of respondents **(number of contacts)**	Self %	Organisation %	Both %
Local people (19)	47.4	47.4	5.3
Local active people (65)	13.8	72.3	13.8
HRCCC (113)	12.4	65.5	22.1
Other ICM (32)	6.2	93.8	0
Regional SG (45)	2.2	95.6	2.2
SG Brisbane (21)	0	100.0	0
Researchers (40)	17.5	82.5	0
TOTAL (335)	42	257	36
Overall %	12.5	76.7	10.7

Overall, approximately three quarters (76.7%) of respondents represented their organisation in communication with others about ICM or environmental issues. Members of state government in Brisbane, regional stage government, other ICM groups and researchers predominantly represented their organisations.

Local active people and HRCCC members were more likely than other groups to represent both themselves and their organisation in their communication with others.

What was the outcome?
Respondents were asked to list the outcomes of each communication they had mentioned. The following table shows the main outcomes of communication with each of the categories of contacts. (The number of responses is indicated by n).

	SG Brisbane	Regional SG	Local govt	HRCCC	Industry	Individual	Other	Overall
	n = 76	n = 75	n = 70	n = 40	n = 87	n = 31	n = 20	n = 399
Outcome	%	%	%	%	%	%	%	%
Progress	18.4	28.0	25.7	27.5	24.1	19.4	20.0	23.8
Understanding of issues	22.4	12.0	31.4	15.0	25.3	16.1	15.0	21.1
Information exchange	17.1	22.7	12.9	5.0	12.6	35.5	30.0	17.3
Unsuccessful	13.2	17.3	7.1	7.5	13.8			10.8
Resolution of issues/ decision	7.9	8.0	7.1	5.0	4.6	6.5	10.0	6.8
Gained information	7.9	4.0	2.9	10.0	6.9	6.5	5.0	6.0
Specific action taken	3.9	1.3	4.3		3.4	3.2	5.0	3.0
Other	3.9	1.3	4.3	5.0	3.4		5.0	3.0
Changed their outlook				15.0	1.1	12.9		2.8
Coordinate/ collaborate	2.6	1.3	1.4	7.5	1.1		5.0	2.3
Coordination needed	3.9	1.3					5.0	1.3
Benefit to industry		1.3	1.4	2.5	1.1			1.0
Gained involvement in project		1.3	1.4		2.3			1.0

The results of this question were generally very positive, with the highest responses being *progress* (23.8%), *understanding of issues* (21.1%), and *information exchange* (17.3%). Overall, however, 10.8% of communications were said to have been *unsuccessful*.

The highest responses (over one quarter) for communication with specific contacts included: *information exchange* with people on an individual basis (35.5%) and other contacts (30.0%); *understanding of issues* with local government (31.4%) and industry; and *progress* with regional state government (28.0%), the HRCCC (27.5%) and local government (31.4%).

Considering the HRCCC's role in coordination, it was encouraging that 7.5% of the unprompted responses regarding outcomes of communication with the HRCCC were classified as *coordination or collaboration*, higher than with any of the other categories of contacts.

Overall, how satisfied were you with this communication?

1	2	3	4	5
Very satisfied	Quite	Somewhat	Slightly	Very dissatisfied

In this question, respondents were asked to rate their satisfaction on the scale shown above. The mean satisfaction for communication with each of the categories of contacts are shown in the following table. Scores were re-coded, giving a higher score to a higher rating of satisfaction (5 = *very satisfied*; 1 = *very dissatisfied*, etc).

Contacts	Mean
SG Brisbane	3.37
Regional SG	3.56
Local Govt	4.00
HRCCC	4.11
Industry	3.83
Individual	3.71
Other	3.95
OVERALL	3.79

Overall, the mean satisfaction score was 3.79, the modal response was 4 (*satisfied*) and 8.6% of communications resulted in the response *very dissatisfied*. These results indicate a fairly high degree of satisfaction with communications although an examination of the reasons for those who were very dissatisfied may be useful. High mean satisfaction scores were assigned to communications with the HRCCC (4.11) and local government (4.00).

Do you feel that this communication changed your outlook on …ICM OR …environmental issues?

1	2	3	4	5
Very much	Quite a lot	Somewhat	Very little	Not at all

For each communication, respondents were asked firstly whether it had changed their outlook on ICM or environmental issues, on the five point scale shown above, which was also recorded for the analysis. They were also asked whether they felt it had changed the contact's outlook. The mean responses to the two questions are listed in the table below.

Contacts (number of contacts)	Change in outlook of respondents	Change in outlook of contacts
SG Brisbane	2.02	2.13
Regional SG	2.15	2.26
Local Govt	2.42	2.57
HRCCC	2.78	2.79
Industry	2.14	2.71
Individual	2.75	2.88
Other	1.74	2.24
OVERALL	2.27	2.51

Overall, there was a tendency for respondents to feel they had changed the outlooks of others more than they believed their outlook had changed due to the communication. On average, respondents rated the most change in outlook, both for themselves and the contact, in communication on an individual basis or with the HRCCC.

How?

When asked how their outlook had changed, and how the outlook of the contact had changed, the frequencies of the main responses (mentioned three or more times) were as follows.

Change in outlook	Respondents	Contacts
Greater awareness	38	40
Understanding/knowledge	34	50
Share what is happening/ideas	31	
Positive impact	16	
Too early to tell	10	
Disappointed at lack of resources/commitment to ICM	9	
Issue too politicised and too big	7	
Accept/aware of ICM		13
Learned what is happening		12
Aware of environmental problems		8
Changed views		8
Hard to get acknowledgment of problems		7
Encouragement to keep going		5
Hard to explain concepts		5

The positive nature of many of these changes in outlook of both respondents and their contacts is promising for the communication occurring on ICM and environmental issues on the Herbert River Catchment. Negative changes in outlook mentioned by some respondents were: *disappointed at the lack of resources or commitment to ICM* and *politicised, very big issues*. A couple of difficulties were mentioned: *getting acknowledgment of problems by some contacts* and *explaining concepts to contacts.*

Finally, now that we've talked about some of the different groups that you communicate with about …ICM OR ..environmental issues, are there any suggestions that you'd like to make on how these communications could be more effective?

The most frequent responses are shown below.

Response	Frequency
Seminars, workshops, field days	7
Media coverage to sell ICM	5
More regular meetings	3
More communication/involvement within government departments	3
Greater access to information	3
Better communication at local level with ICM	3
Improved communication to the general public	3
Coordinate/one vision	3
More funding	3

Very few suggestions were made on how communication could be improved, less than an average of one response per respondent. This perhaps indicates that respondents felt that few improvements were required or that they found it difficult to suggest improvements on the spot. For those respondents who had a very large number of contacts to report, fatigue may have been a factor in the low number of responses to this question.

4.0 DISCUSSION AND CONCLUSIONS

4.1 Involvement in ICM

For those respondents involved in ICM in the Herbert River Catchment, the major reasons indicated for their involvement were:

- *personal interest*;
- *job related;* or
- *interest in the sugar industry.*

Researchers had been involved in ICM for the longest period of time (on average 7.2 years) whereas HRCCC members had been involved on average for five years (when the group was formed). Two thirds of those not involved in ICM in the Herbert Catchment had heard of ICM, five of whom had been involved in the past.

4.2 Concerns about environmental management

Major concerns for those involved in ICM were:

- *the environment in general;*
- *ineffective decision making processes and communication;*
- *water quality;* and
- *flooding, drainage and their management.*

For those not involved in ICM, however, *flooding, drainage and their management* was of greatest concern. This issue may therefore need more attention by the HRCCC.

4.3 Overall communication

A matrix of contacts revealed that there was direct contact between most of the groups of stakeholders. The most frequent communication about ICM or environmental issues overall was with industry, particularly mentioned by respondents from other ICM groups, the HRCCC and regional state government. This reflects the close linkage that the HRCCC has with industry, in particular canegrowers.

The only complete gap was between Brisbane state government respondents in communication with others on an individual basis. Brisbane state government respondents also had a relatively low number of different contacts within local government. Local people and active local people reported the least number of different contacts within Brisbane state government than other categories of respondents. These results suggest that Brisbane state government personnel received information about ICM from others more closely involved with the local area and community. While this may be necessary for efficiency, it may prevent parties receiving accurate information.

4.4 Specific communication

The greatest degree of communication between specific groups was reported by researchers with the HRCCC and local government; and by Brisbane state government with Brisbane state government. While this communication, or coordination, between various organisations and agencies is very important to the success of ICM, the results suggest that communication with the general community and community involvement have been given a lower priority.

Local people reported the lowest degree of communication about ICM or environmental issues. This is not surprising as local people were chosen randomly whereas other representatives were selected due to their involvement in ICM.

4.5 Characteristics of communication

The predominant reasons supplied by respondents for their communication, and the primary contacts associated with those reasons, were:

- *policy/planning/decision making* with local government and Brisbane state government*;*
- *environmental issues* with local government*;*
- *research/project work* with the HRCCC*;* and
- *follow up on catchment/strategy issues* with the HRCCC.

Answers to the question "who made contact first?" were categorised into *outward* (the respondent initiated the communication), *mutual* (through a mutual contact, meeting or other event) and *inward* (the contact initiated communication with the respondent). Most communication was categorised as "mutual" which indicates the importance of mutual or informal ways of meeting to the functioning of ICM.

Respondents reported having initiated the communication (outward communication) more than contacts initiated the communication (inward communication). This may be true but the result may have more to do with the tendency people have to describe their own activities more positively than they describe others, in other words, 'self-others biasing' (Kurman & Eshel, 1998).

Outcomes from communication were generally very positive, the most frequent being:

- *progress;*
- *understanding of issues;*
- *information exchange;*
- *resolution of issues/decision;*
- *gained information;*
- *changed their outlook;*
- *specific action taken;* and
- *coordinate/collaborate.*

Two negative outcomes were also mentioned, which may need to be addressed:

- *unsuccessful;* and
- *coordination is needed.*

With the exception of local landholders, most perceived their communications in relation to ICM to be satisfactory. Satisfaction was highest, however, for communication with the HRCCC and local government which indicates a greater satisfaction when communication was with local bodies. It is a very encouraging result for the HRCCC.

There was a tendency for respondents to report that they had influenced the outlook of others more than others had influenced them. This may be due to self-others biasing (Kurman & Eshel, 1998) and others therefore were perhaps not changing their outlooks as much as perceived by respondents.

Respondents reported the most change in outlook (for themselves and the contact) in communications with the HRCCC and with people on an individual basis, which will be an important result to utilise in situations where attitude change is seen to be important.

The main ways in which respondents reported that their outlook had changed were: *gaining greater awareness; understanding or knowledge*; or *to share what is happening and ideas*. Difficulties mentioned were: *disappointed at the lack of resources/commitment to ICM* and *issues are too politicised and too big.* The main ways in which respondents felt the outlook of contacts had changed were:

understanding/knowledge; greater awareness; and *accept/aware of ICM.* Different difficulties were mentioned in the change of outlook of the contacts: *getting acknowledgment of problems by some contacts* and *explaining concepts to contacts.*

All respondents were asked for their suggestions on ways in which communication on ICM could be improved. Although there were very few responses, some of these were:

- *seminars, workshops, field days;*
- *media coverage to sell ICM;*
- *more communication with government departments;*
- *greater access to information;*
- *better communication at the local level and to the general public;*
- *coordinate – one vision*; and
- *more funding.*

4.6 Conclusions

This pilot study was conducted primarily to determine the feasibility of measuring the quantity, and various characteristics, of communication occurring on ICM and environmental issues in the Herbert Catchment. It is also possible to make some initial conclusions about communication between stakeholders of ICM.

The survey illustrated that linkages exist between almost all major groups of stakeholders and that most people feel satisfied with their communication about ICM and environmental issues. There were mainly positive outcomes of communication with others, including *greater awareness*, *understanding,* and *knowledge* for both respondents and perceived in contacts, and respondents *sharing what is happening and sharing ideas* and contacts *accepting or becoming more aware of ICM.*

The results of the survey indicate that it may be important for ICM to:

- communicate more with the general community;
- strengthen communication between state government in Brisbane and local government;
- strengthen communication between other ICM groups and regional state government;
- strengthen communication between other ICM groups and the HRCCC, if necessary;
- build on the 'mutual' communication occurring by creating opportunities for mutual contact allowing stakeholders to meet;
- be cautious about the perceived influence on others;
- carry out the major suggestions by respondents to improve communication in ICM: seminars, workshops, field days, and meetings;
- address the difficulty some people find in gaining acknowledgment of the problems by others and in explaining concepts to others.
- pay more attention to the issues of drainage and flooding;
- addressing the two negative outcomes of communication, generally *unsuccessful* communications and the *need for coordination.*

While it is therefore clearly possible to measure the quantity of communication occurring between stakeholders of ICM and other characteristics of that communication, there were some lessons to be learned from this pilot study.

- Respondents found it difficult to categorise their contacts correctly so in future it will be important to brief interviewers more thoroughly on the possible departments and organisations that may be mentioned.
- Interviews with those respondents who had a large number of contacts were relatively long and repetitive. One suggestion would be to allow a break in the interview to prevent fatigue and possible biasing of responses.

- Although respondents were restricted to six different contacts for each category, some people who are heavily involved in ICM may have more than six different contacts within some categories.
- The time frame used for communications may need to be shortened as some respondents found it difficult to remember communications as long as one year before the survey.
- Administration would be easier if respondents are provided a copy of the scales used in the questionnaire to refer to during the telephone interview.

5.0 REFERENCES

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APPENDIX A:

The Questionnaire
(with Communications Sheet enclosed)

Australian Research Centre for Water in

CSIRO Land & Water
Ph: (08) 9333 6265
Email: arcwis@per.clw.csiro.au

INTEGRATED CATCHMENT MANAGEMENT COMMUNICATIONS STUDY

February 1998

Respondent Details

Name: _____

Occupation _____

Gender: M .... 1 F 2

Lives on the catchment: **Yes 1**
Nos 2

Good morning/afternoon. I'm _____ from the CSIRO.

We're speaking with people in the Herbert River Catchment about communications.

☞ **Read to respondent**

A questionnaire has been developed by the CSIRO to try to understand the characteristics of communications between the different agencies involved in Integrated Catchment Management in Queensland, and in particular, the Herbert River Catchment.

By answering the following questions, you will help us to put together a comprehensive picture of communications in this area. For example:

- who people communicate with
- the main reasons for these communications
- as well as the main outcomes.

Would you like to speak with me now?

OR

Could I call back at a more convenient time?

1. Are you involved either personally or because of other reasons in Integrated Catchment Management (ICM) in the Herbert Catchment? (Circle the number).

YES …. 1 **NO …. 2**

↓

Go to Question 4

☞ **If YES - Read 'ICM' in later question**
☞ **If NO – Read 'Environmental issues that concern you' in later questions**

2. Which of the following are reasons for your involvement?

☞ **Tick as many boxes as nominated**

Live on the catchment	❑
Member of a community group	❑
Personal interest	❑
Scientific research	❑
Interest in the sugar industry	❑
Interest in other primary production	❑
Job related	❑
Because I am a landholder	❑
Other,	❑

↳ please explain _____

_____

_____

3. How long have you been involved with ICM? _____ years

↓

Go to Question 5

4. Before this interview, were you aware of the ICM program in the Herbert Catchment and elsewhere in Queensland?

YES …. 1 **NO …. 2**

↓

Go to Question 5

If **YES**, what do you know about ICM?

_____

_____

_____

_____

5. Do you have any concerns about environmental management on the Herbert Catchment?

YES …. 1 **NO …. 2**

↓

Thank you for cooperating. (END)

If **YES**, what are your major concerns?

_____

_____

_____

_____

_____

_____

☞ **Read to respondents**.

We are interested in who you have communicated with about **ICM/environmental issues** over the last year.

Communications may have been:

- **Formal** (e.g. a letter or e-mail) or **informal** (e.g. a conversation or meeting at a social occasion)
- For **one particular reason** or for **a number of reasons** (in which case, I'll ask you to tell me
- about each one)
- **Personal** (i.e. individuals representing themselves) or **official** (i.e. individuals representing their organisation)
- **"one off"** or a **group of communications** (these can be mentioned together).

******* Now, go to separate communications sheet and ask questions.

COMMUNICATIONS SHEET

NAME: _____

❑ A. Over the last year, how often have you communicated with anyone from **state government in Brisbane** about …. ICM OR …. environmental issues?

☞ **Circle the correct number.**

1	2	3	4
frequently	**occasionally**	**once or twice**	**never**
			(Go to B)

Who did you communicate with – up to 6 departments? **(GOLD pages)**

A1 _____ A4 _____

A2 _____ A5 _____

A3 _____ A6 _____

❑ B. Over the last year, how often have you communicated with anyone from **state government in Townsville or Northern Queensland** about …. ICM OR …. environmental issues?

1	2	3	4
frequently	**occasionally**	**once or twice**	**never**
			(Go to C)

Who did you communicate with – up to 6 departments? **(WHITE pages)**

B1 _____ B4 _____

B2 _____ B5 _____

AB _____ B6 _____

❑ C. Over the last year, how often have you communicated with anyone from **local government** about _____ …. ICM OR …. environmental issues?

1	2	3	4
frequently	**occasionally**	**once or twice**	**never**
			(Go to D)

Who did you communicate with – up to 6 councils? **(BLUE pages)**

C1 _____ C4 _____

C2 _____ C5 _____

C3 _____ C6 _____

❑ D. Over the last year, how often have you communicated with anyone from the **Herbert Catchment Care Coordinating Group** about …. ICM OR …. environmental issues?

1	2	3	4
frequently	**occasionally**	**once or twice**	**never** **(Go to E)**

Who did you communicate with – up to 6 people? **(CREAM pages)**

D1 _____ D4 _____

D2 _____ D5 _____

D3 _____ D6 _____

❑ E. Over the last year, how often have you communicated with anyone from **industry or an industry group** about …. ICM OR …. environmental issues?

1	2	3	4
frequently	**occasionally**	**once or twice**	**never** **(Go to E)**

Who did you communicate with – up to 6 people? **(PINK pages)**

E1 _____ E4 _____

E2 _____ E5 _____

E3 _____ E6 _____

❑ F. Next, we'd like to know if you've communicated with anyone on an **individual basis**. That is, you were communicating with this person as an individual, and not necessarily as someone representing an organisation.
So, over the last year, how often have you communicated with anyone on an individual basis about …. ICM OR …. environmental issues?

1	2	3	4
frequently	**occasionally**	**once or twice**	**never** **(Go to coloured pages)**

Who did you communicate with – up to 6 people? **(GREEN pages)**

F1 _____ F4 _____

F2 _____ F5 _____

F3 _____ F6 _____

START

APPENDIX B:

Specific Contacts
Reported by Respondents

Abbreviations:

CSR	Colonial Sugar Refineries
DOE	Department of Environment
DOF	Department of Fisheries
DLGP	Department of Local Government and Planning
DNR	Department of Natural Resources
DPI	Department of Primary Industries
Org	Organisation
Qld	Queensland

Contacts reported by Researchers

State Government in Brisbane	N
DLGP	3
DNR	2
DOE	1

Regional State Government	N
DOE	2
DNR	1
DLGP	1

Local Government	N
Hinchinbrook Shire Council	3
Local City Council	1
Individual	1
Thuringowa City Council	1
Herberton Shire Council	1
Townsville City Council	1

HRCCC	N
Individuals (5)	10
Cardwell Shire Council	1

Industry	N
Canegrowers	2
CSR	1
Individual	1

Individual Basis	N
Individuals (2)	2
Hinchinbrook Shire Council	1
Canegrowers	1
CSR	1
Other	1

Others	N
Other researchers	1

Contacts reported by Brisbane State Government Respondents

State Government in Brisbane	N
DNR	4
DOE	2
DLGP	1

Regional State Government	N
DNR	4

Local Government	N
Hinchinbrook Shire Council	1

HRCCC	N
Individuals (3)	4
All members	1

Industry	N
Commercial Fishermens' Rep.	1
Canegrowers	1

Individual Basis	N
None	

Others	N
LWRRDC	1
Individual	1

Contacts reported by HRCCC Respondents

State Government in Brisbane	N
DNR	5
DLGP	4
DOE	4
DPI	3
DOF	2
Queensland Rail	1
Members of coordinating groups	1
Individual	1

Regional State Government	N
DOE	8
DNR	8
DPI	5
CSIRO	2
Queensland Transport	1
DLGP	1

Local Government	N
Thuringowa City Council	6
Hinchinbrook Shire Council	3
Members of coordinating groups	3
Townsville City Council	2
Mayor	2
Council	2
Integrated Pest Management	1
Individual	1
DLGP	1

HRCCC	N
n/a	

Industry	N
Canegrowers	9
Cattleman's Union	6
Members of coordinating groups	3
CSR	3
Fruit and Vegetable Growers	2
Individuals (2)	2
Horticulture	1
Qld Commercial Fishing Org	1
Landcare	1
Local irrigation group	1
Irrigators	1
Tropical Fruit Group	1
Other	1

Individual Basis	N
Individuals (4)	4
DPI	2
Members of coordinating groups	1

Others	N
CSIRO	3
Individuals (2)	2
Landcare	1
CSR	1
ATSIC Local Group	1

Contacts reported by Local Active People

State Government in Brisbane	N
DNR	3
Individuals (3)	3
DPI	2
DLGP	1
DOE	1

Regional State Government	N
DNR	5
Individuals (4)	4
DOE	2
Department of Mines	1

Local Government	N
Hinchinbrook Shire Council	4
Cardwell Shire Council	3
DLGP	1
Thuringowa City Council	1
Individual	1
Durrangowan	1
Members of coordinating groups	1

HRCCC	N
Individuals (4)	8
Water Infrastructure Committee	1

Industry	N
CSR	3
Canegrowers	1
Mills Supply Committee	1
Members of coordinating groups	1
Herbert River Canegrowers	1
Individual	1
Water Infrastructure Committee	1

Individual Basis	N
Canegrowers	2
Members of coordinating groups	2
DNR	1
Individuals (3)	3

Others	N
DPI	2
Landcare	2
DOE	1
Canegrowers	1
Members of coordinating groups	1
Individuals (2)	2

Contacts reported by Other ICM Groups

State Government in Brisbane	N
DNR	4
DOE	1
DPI	1

Regional State Government	N
DNR	2

Local Government	N
Maroochy	1
Mareeba	1
Cook	1
Carpentaria	1
Taroom	1
Banana	1
Cooloola	1
Johnstone	1
Eacham	1

HRCCC	N
Individual	1

Industry	N
Dairy Beef	3
Canegrowers	2
Horticulture Groups	2
United Graziers Association	1
Irrigation Cotton Farmers	1
Department of Mines	1
Cattleman's Union	1

Individual Basis	N
Herberton Shire	1
Women's Network	1
Industry representative	1

Others	N
None	

Contacts reported by Regional State Government Respondents

State Government in Brisbane	N
DNR	3
DLGP	2
DPI	1

Regional State Government	N
DNR	5
DOE	4
DPI	2

Local Government	N
Hinchinbrook Shire Council	4
Thuringowa City Council	2
Herberton Shire Council	2
Townsville City Council	1

HRCCC	N
Individuals (1)	4
HRCCC	2
DNR	1
Canegrowers	1
Thuringowa City Council	1

Industry	N
Canegrowers	3
CSR	3
Qld Commercial Fishing Org	1
Victoria Mill Process	1
Water Board	1
Horticulture	1
Cattleman's Union	1
Sun Fish	1
United Graziers Association	1
Townsville Enterprise Group	1

Individual Basis	N
Individual	1
Canegrowers	1
Farmer	1

Others	N
None	

Contacts reported by Local People

State Government in Brisbane	N
DPI	2
DNR	1
DOE	1

Regional State Government	N
DOE	2
DNR	1
Drainage Board	1

Local Government	N
Hinchinbrook Shire Council	1
CEO	1
Individual	1

HRCCC	N
Drainage Board	1
HRCCC	1

Industry	N
Cattleman's Union	1
CSR	1

Individual Basis	N
HRCCC	1
Individual	1
Industry/landowner	1

Others	N
Individual	1

APPENDIX C:

Number of Communications with
Categories of Contacts
Reported by Respondents

	Contacts: SG Brisbane	Regional SG	Local govt	HRCCC	Industry	Indiv.	Others	TOTAL	Mean
Respondents: Researchers n = 4	6	4	8	11	4	6	1	40	10
SG Brisbane n = 3	7	4	1	5	2	0	2	21	7
HRCCC n = 16	21	25	21	n/a	32	7	8	114	7.1
Active locals n = 11	10	13	12	9	9	8	9	70	6.4
Other ICM n = 5	6	2	9	1	11	3	0	32	6.4
Regional SG n = 9	6	11	9	9	14	3	0	52	5.8
Local people n = 12	4	4	3	2	2	3	1	19	1.7
TOTAL	60	63	63	37	74	30	21	348	

APPENDIX D:

Direction of
Communication Between
Groups of Respondents and
Categories of Contacts

Respondents:		Contacts: Ind	HRCCC	Industry	Local Govt	SG Townsville	SG Brisbane	Others	TOTAL
Local people	Out	2	2	0	2	2	1	0	9
n = 11	Mutual	1	0	2	1	2	1	1	8
	In	0	0	0	0	0	2	0	2
HRCCC	Out	1	n/a	7	4	9	7	2	30
n = 16	Mutual	4	n/a	18	11	11	5	4	53
	In	1	n/a	5	4	5	9	1	25
Prominent people	Out	3	0	1	2	6	9	2	23
n = 11	Mutual	3	7	5	8	5	0	2	30
	In	0	1	2	0	1	0	3	7
Regional ICM	Out	2	1	5	4	1	4	0	17
n = 5	Mutual	1	0	5	5	1	1	0	13
	In	0	0	1	0	0	1	0	2
SG Townsville	Out	0	2	5	2	4	3	0	16
n = 9	Mutual	2	6	8	7	5	2	0	30
	In	1	1	1	0	1	1	0	5
SG Brisbane	Out	0	1	0	0	3	3	0	7
n = 3	Mutual	0	1	2	0	1	4	1	9
	In	0	0	0	1	0	0	1	2
Researchers	Out	1	3	1	2	0	2	0	9
n = 4	Mutual	1	7	3	1	3	1	1	17
	In	4	0	0	5	1	3	0	13
TOTAL		27	32	71	59	61	59	18	327

APPENDIX E:

Individual Comments

Individual Comments

- Communication slower than expected. Lack of progress. The result is less satisfying.
- Place in crisis, so many things to do, not because of bad communication.
- The Information Centre is an informative provider. [Name withheld] has wide contact. Individuals to organisations in many cases general except as indicated.
- Because of expansion there could have been an impasse on land but council has taken on more responsibilities: a major one has been that cane land expansion has been stalled for one or two years which helps to buy time for development control.
- Senior bureaucrats have a good rapport.
- Need real laws, real ICM that's consistent in its decision making, eg they're letting cane be grown on marginal land.
- No-one is doing anything constructive, sugar industry is destroying the land and water. Must protect the environment.
- Silt is coming from cattle/mining – collapsing River Banks. Need to open up river to public and let them have it (eg silt).
- But we have formed a bit of an alliance through adversity.
- No leadership has ICM/Landcare trying to combine. Nothing personal. Don't know who is the coordinator of ICM at state level. Not much contact in last year.
- Individuals – involve them to do something, develop plan for their property, environmental outcome on farms, etc, etc.
- Groups develop projects, information, talk, extension.
- Useful, most things done changing outlook or bringing people up to speed.

As a member on Local Assignment Committee – representing local growers, I have particularly wide contact with individuals but main interaction with government departments is via this committee. Thus I contribute to Committee deliberations and they are communicated through committee members. Members include representatives from various government departments – Environment; Resources; Primary Industry; Local Government; and those involved with property management as well as the wide responsibilities and information provided through Bureau of Sugar Experiment Station. Other organisations such as Resource Information Centre and Herbert River Canegrowers Executive are reference points to which inquiries are referred. The questions as posed do not cover, in this case, the meeting communication breadth, which I see as an integral part of input.

Chapter 4

Natural Resource Management Issues and Integrated Catchment Management as Reflected in the Herbert River Express 1990-1998

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Introduction

The evaluation of the Integrated Catchment Management program (ICM) conducted in the Herbert River catchment[1] was in need of some indication of the social context in which the Herbert River Catchment Coordinating Committee was operating. One method of assessing this local social context was to consider how natural resource management issues in general and integrated catchment management in particular were presented in the media.

In a survey of the catchment conducted by Butterworth *et al.* (1997) various media were found to be important sources of information about land and water resource issues. *The Herbert River Express,* the local newspaper was used more frequently than any other source of information (60%), including friends and colleagues (54%) and personal experience (39%). In the lower catchment it was the source of information for 84% of those surveyed. The Australian Broadcasting program, *Landline,* was mentioned by 44% of those surveyed. The most reliable sources of information identified in Butterworth's *et al.* were *Landline* (88%), personal experience (82%) and *The Herbert River Express* (74%). Even though an analysis of the content of Landline programs might be useful to assess the content of messages considered reliable it could not be claimed to be clearly indicative of the local social context within which integrated catchment management was placed. Preliminary analyses also indicated that integrated catchment management was not frequently presented in either *The Australian* or *The Courier Mail.* An analysis of *The Herbert River Express* therefore appeared to be a reasonable course of action to assess the social context of integrated catchment management, particularly because it was such a frequently mentioned source of information and considered reliable. In addition, it was important to use an unobtrusive research method such as a content analysis because over-surveying in the catchment was becoming an issue (Bellamy, 1997).

It is important to be clear at this stage that this research is not an evaluation of the Herbert River Catchment Coordinating Committee (HRCCC). It is an examination of how natural resource management issues were presented in *The Herbert River Express* between 1990 and 1998 to provide an assessment of the social context within which the HRCCC is/was operating. Because of other events occurring over the time period, it would not be possible to singularly assess the impact of the HRCCC though media coverage. For example, the HRCCC was established in June 1993 and other significant studies and events included:

1993: Interim Guidelines for Floodplains, Herbert River Management Plan
1994: Herbert River Workshop on the Plan
1995: Mahogany Glider Issue arose
1996: Mahogany Glider Conservation Plan, Water Infrastructure Task Force, State of the Rivers Report, and the Sugar Industry Infrastructure Package.

This study takes a social constructionist perspective of the media and its representation of environmental and natural resource management issues. That is, we are concerned with how the media assign meaning to the world and then how the world is then presented to the audience. We take the view that the media shapes as well as reflects social values (see Altheide & Snow 1979; Burgess & Gold, 1985; Hannigan, 1995; Bignell, 1997; Waitt, 1995). The aim is to examine articles on environmental and natural resource management issues in *The Herbert River Express* to provide a view of local perspectives on integrated catchment management in particular. *The Herbert River Express* is a paid tabloid with a circulation of approximately 3,200 and published on Tuesday, Thursday and Saturday of each week (AIS Media Brisbane: 1998).

[1] LWRRDC Research Project CTC7: Evaluation of Integrated Catchment Management in a wet tropical environment (Bellamy *et al.* 1999).

The framework for analysis of the content of the newspaper articles is similar to that of Xu and Bengston's (1997) study measuring forest values in the news media. Xu and Bengston (1997) distinguished four distinct ways in which people value forests – economic/utilitarian, life support, aesthetic and moral spiritual value. Figure 1 summarises the relationships between the value systems which were used to categorise the data in this study.

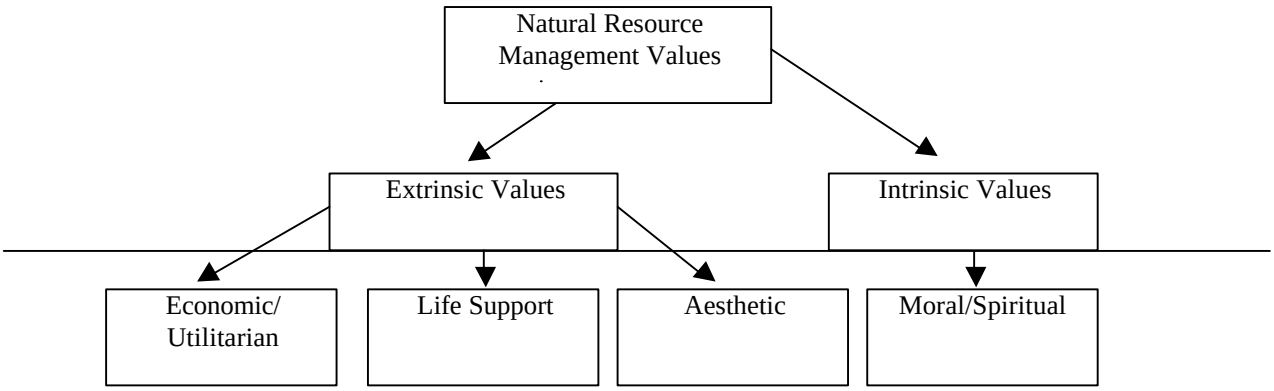

Figure 1: Natural resource management and environmental value trends (after Xu & Bengston,1997).

In this study, economic values, life support values and aesthetic values all fall under the category of extrinsic values of natural resources and the environment in general. This differs to Xu and Bengston's (1997) categorisation where aesthetics fell under the category of intrinsic values. Callicott (1989), in contrast to Xu & Bengston (1997), argues that an object may be valued for itself and not for the sake of any subjective experience such as pleasure, knowledge or aesthetic satisfaction. Economic/utilitarian value stems from the economic 'utility for achieving human ends, where the ultimate end is preference satisfaction' (Xu & Bengston, 1997:45). Life support values occur where human well-being is seen to depend on the situation. These values differ from economic values in that they are not measurable by an 'aggregation of peoples preferences or willingness to pay for an environmental service' (Xu & Bengston, 1997: 46). Aesthetic values are based on perceptions of beauty in the landscape. Moral or spiritual values relate to an affection, or reverence or respect for something

Research Methods

The specific questions we wanted to answer were:

1. **How does the Herbert River Express represent natural resource management issues over the time frame of 1990 to mid-1998?**
2. **Has there been a change in the treatment of integrated catchment management issues in the Herbert River Express over that time frame?**

This research addresses these questions through a content analysis (Gregory and Williams, 1981; Krippendorf, 1980; Rosengren, 1981; Waitt, 1995; Weber, 1985; Xu & Bengston, 1997) of the *Herbert River Express*. Because analysing newspapers is not a trivial exercise, a realistic time frame needed to be set to address the research questions. We needed a time frame for analysis which would allow us to assess the manner in which natural resource management issues were being presented in the newspaper overall, as well as prior to and subsequent to the establishment of the HRCCC. This would allow us to make an assessment of the treatment of natural resource management issues in general, and integrated catchment management in particular. Consequently, the mid 1990 to mid 1998 time frame was chosen.

The Hinchinbrook Library houses the historical collection of *The Herbert River Express*. These archives were accessed to identify articles from 1990-1998 concerned with natural resource management issues to develop a description of how natural resource management, and in particular integrated catchment management were presented. Unlike Xu and Bengston (1997) and Bengston *et.al.* (1999) who were not able to access an 'on-line' database of media articles and because this newspaper is not available on line or on microfiche, it was necessary to physically handle each issue of the newspaper to assess the content. It took eight weeks to construct a population of articles, which included 'Letters to the Editor,' on natural resource management issues and to identify the major themes. An additional two weeks was required to scan news articles into a computer database to allow a qualitative analysis to be conducted by using the NUD*IST© program. Copies of *The Herbert River Express* in this time frame were analysed broadly for articles covering natural resource management issues to form a population of articles. These were summarised into an EXCEL© database (Figure 2, and Cottrell and Rowbotham 1999.)

Data Field	Description
Date	Date of newspaper
Title	Title of article
Author/Journalist	If applicable
Category	Economic/utilitarian; life support; aesthetic; moral/spiritual
Section	Letters to the editor; rural report; etc.
Page Number	Page number on which article/letter occurs (pg).
Pages Total	Total number of pages in that issue
Title Size	In mm.
Article Position	Position on page. (RT = top right of page)
Number of Columns	Total number of columns in article
Width of columns	In mm.
Col 1	Width of each individual column in article
Col 2	
Col 3	
Col 4	
Col 5	
Col 6	
Col 7	
Picture Dimensions	In mm, size of any pictures included with the article
Description	General description of article context

Figure 2: Data collected for the population of articles on natural resource management

From an initial theme analysis, with the broad theme of natural resource management in mind, 2956 articles including 'Letters to the Editor' were extracted to form the population of newspaper articles from which a sample would later be extracted (see Cottrell and Rowbotham 1999). We included 'Letters to the Editor' because once a letter was accepted into this section of the newspaper it was rarely edited to change views presented. Indeed, local informants suggest that articles and press releases submitted to the newspaper, providing they are accepted, were changed very little. For the purposes of manageability, a random sample of 351 articles (12%) was generated using SPSS© and included articles addressing the HRCCC over the time frame of the study (see Cottrell and Rowbotham 1999). Newspaper articles and letters concerned with natural resource management issues (excluding advertising, weather forecasts and photographs not directly related to any article) were then quantified under 15 theme categories using Gregory & Williams (1981) point score scheme.

Under this scheme, each article's surface area is measured in square centimetres, including the headline and any photographs. This measure was then weighted by multiplying the area in sq mm:

- By 5 if one the front page
- By 4 if continued from the front page
- By 3 if only on the second page and,
- By 2 if on any other page.

If there was any photographic material included in the article 15 points was added and according to the headline size the following points were added:

- 15 points if headline >15 mm
- 10 points if headline 10-15 mm
- 5 points if headline <10 mm

To ensure consistency of coding one coder was employed to assess the content of the sample of 351 articles from June, 1990 to June, 1998. The coding was then checked by another coder. Categorisation on the basis of each article (Gregory and Williams, 1981) was chosen rather than on the basis of words used (Waitt, 1995; Xu and Bengston, 1997) because we wanted to retain the overall context of each article. Each article was scored and categorised using the above-mentioned scheme, according to the predominant theme of the content. The following is a concise list of the themes used at the early stage of the study:

- Sugar industry
- Forestry industry
- Tourism industry
- Land resources
- Waste management
- Fisheries
- Pests/Feral species
- World heritage
- River/Stream management
- Soil conservation
- Flora/Fauna issues
- Government initiatives
- Coastal development
- Political issues/controversies
- Other

All the totals for each theme was then compiled for each year and the total number of articles for each category was counted as a percentage of the total articles. These findings are summarised in Tables 1, 2 and 3.

Table 1: Point score values for environmental and natural resource management issues in The Herbert River Express 1990-June 1998.

	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	Total
Sugar industry	32598.17	18421.1	23001.5	24693.5	18837.5	9759	19100.5	17321.75	163733
Forestry Industry	1049	0	0	0	7861.25	12823.75	5527.5	9765	37026.5
Tourism Industry	6892.45	387.45	7974	12339.5	4365.5	1832.5	4257.5	2425	40473.9
Waste mgt	4746.5	17902.5	20341	2980	541.5	1212.5	6205	4992.5	58921.5
Land resources	3342.5	3342.5	0	548.5	711	162.5	3782.5	3782.5	15672
Fisheries	14106.1	5541	5652.8	19615.8	17490.75	13875	19521.65	19267.65	115070.8
Pest/Feral species	36997.2	24882.6	12317.9	16174	17068.5	4185.5	11804.25	20515.5	143945.5
World Heritage	18110	16093.45	6043.45	0	1130	8302.5	8636.5	1464	59779.9
River/Stream/ Water Mgt	7718.8	3171.3	23062	29780.95	52110.2	372167.5	360437	50212	898659.8
Soil conservation	9168.75	8069	562.5	4655.5	12173	8045	527.5	0	43201.25
Flora/Fauna issues	9718.7	7838.2	14682.5	8380.5	0	1320	4473	6181.75	52594.65
Gov't initiatives	3365	3365	4524	4524	1212.5	0	0	0	16990.5
Coastal develop't	0	569	4931.5	5247	17810.75	24382.5	17038.75	9582.5	79562
Pollution	0	0	0	1157.5	1157.5	0	0	0	2315
Political issues/ controversies	30648	19025	20417.25	70714.25	91153.25	44152	53737.75	41423.5	371271
Other	35221.2	168062	13595.5	8333	11562	6732.5	131275	133812.5	508593.7
Total	**213682.4**	**296670.1**	**157105.9**	**209144**	**255185.2**	**508952.8**	**646324.4**	**320746.2**	**2607811**

Table 2: Percentage values for point scores of environmental and natural resource management issues in The Herbert River Express, 1990-June 1998

	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	Total
Sugar industry	12.25%	12.70%	14.70%	11.80%	7.40%	2%	3%	5.30%	6.70%
Forestry Industry	1.00%	0%	0	0	3.10%	2.50%	0.90%	3.00%	1.50%
Tourism Industry	3.20%	0.30%	5.00%	6%	1.70%	0.40%	0.70%	0.70%	1.60%
Waste management	2.20%	12.30%	13%	1.40%	0.20%	0.20%	1%	1.50%	2.40%
Land resources	1.60%	2.30%	0	0.30%	0.30%	0.03%	0.60%	1.20%	0.60%
Fisheries	6.60%	3.80%	3.60%	9.40%	6.90%	2.70%	3%	6%	4.70%
Pest/Feral species	17.30%	17.10%	7.80%	7.70%	6.70%	0.80%	1.80%	6.40%	5.90%
World Heritage	8.60%	11.10%	3.80%	0	0.40%	1.60%	1.30%	0.50%	2.40%
River/Stream/Water Mgt	3.70%	2.20%	14.70%	14.20%	20.40%	73.10%	55.70%	15.70%	34.50%
Soil conservation	4.40%	5.50%	0.40%	2.20%	4.80%	1.60%	0.10%	0	1.80%
Flora/Fauna issues	4.60%	5.40%	9.30%	4%	0	0.30%	0.70%	2%	2.10%
Government initiatives	1.70%	2.30%	2.90%	2.20%	0.50%	0	0	0	0.70%
Coastal development	0%	0.40%	3.10%	2.50%	7%	4.80%	2.60%	3%	3.10%
Pollution	0%	0	0	0.60%	0.50%	0	0	0	0.10%
Political issues/ controversies	14.50%	13.10%	13%	33.80%	35.70%	8.70%	8.30%	13%	14.3%
Other	16.60%	11.50%	8.70%	4%	4.40%	1.30%	20.30%	41.70%	19.50%

Table 3: Number of newspaper articles of selected environment and natural resource management issues – Herbert River Express, 1990-June 1998.

	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	Total
Sugar industry	7	1	4	3	2	6	3	5	31
Forestry Industry	0	0	0	0	4	2	1	0	7
Tourism Industry	1	0	1	1	1	1	1	2	8
Waste management	1	0	2	0	1	2	0	3	9
Land resources	0	1	0	0	2	0	0	2	5
Fisheries	4	0	2	2	3	7	4	6	28
Pest/Feral species	3	6	1	5	2	5	2	6	30
World Heritage	2	3	2	0	1	5	2	0	15
River/Stream/Water Mgt	2	0	2	9	7	5	10	12	47
Soil conservation	2	1	0	1	3	1	1	0	9
Flora/Fauna issues	3	2	4	1	0	0	5	3	18
Government initiatives	0	1	1	3	1	0	0	0	6
Coastal development	0	0	1	1	1	3	4	3	13
Pollution	0	0	0	0	1	0	0	0	1
Political issues/ controversies	0	5	1	3	11	11	10	16	57
Other	6	4	1	1	6	10	4	6	38

Natural Resource Management Topics in The Herbert River Express

Over 36% of all the articles sampled from *The Herbert River Express* dealt with river/stream and water resource management. It could be said, subsequently that these issues are of great importance to the community that this paper circulates. Figure 3 shows that river/stream and water resource management theme occurs more frequently than other themes. Other themes of note were political issues or controversies (19.5%) and pest/feral species management (14.3%).

From the broad categorisation of articles, it was discovered that River/Stream and Water Management themes were the most predominant. The 42 articles on this theme were subsequently extracted to conduct an in-depth qualitative analysis of their content to provide a view of the community's perspectives on issues fundamental to integrated catchment management in the region.

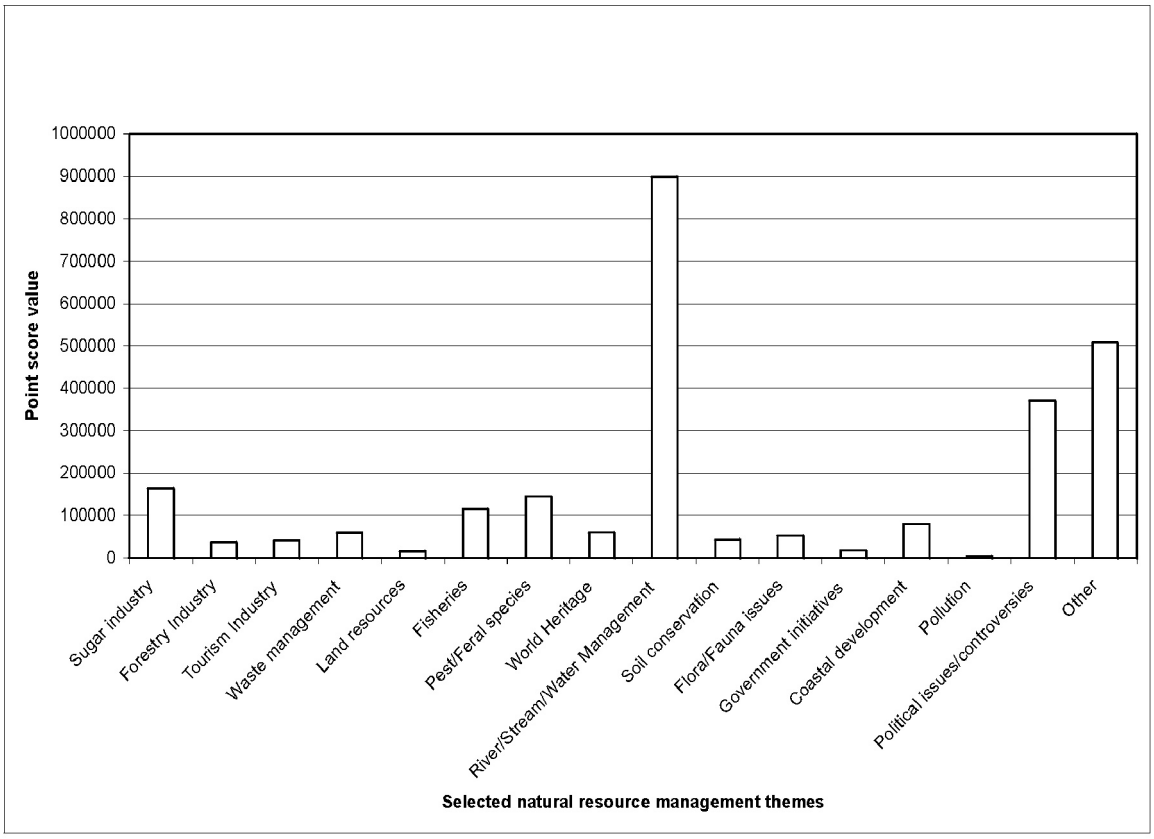

Figure 3: Point score values for selected natural resource management issues in The Herbert River Express 1990-1998.

It is not surprising that river and stream management issues would be important in the community served by *The Herbert River Express*. The community is located in a catchment subject to high intensity rainfall and subject to flooding on a regular basis. The main industry is sugar cane production which is reliant on water management.

The occurrence of articles with the theme of river, stream and water management clearly changed over the 1990-1998 time frame. As indicated in Figure 4, the total number of articles with the predominant theme of river, stream and water management increased over time. Analysis of trends over time for the other themes can be found in Appendix 1 to this report.

Although the trend over the period under consideration indicates an increase in the number of articles on this theme, the prominence of the articles as indicated by the point score values does not appear to have a consistent pattern of increase. What appears to have happened is that since 1993 there has been an increase in the prominence of articles on this major theme. Even though there have been fluctuations in the number of articles in some years, lower frequency of numbers of articles appears to have been counteracted by the prominence of those articles as indicated by the point score values. Alternatively, even if articles on river, stream and water management are not prominent in size or emphasis this seems to be offset by an increased frequency in occurrence of articles on these topics.

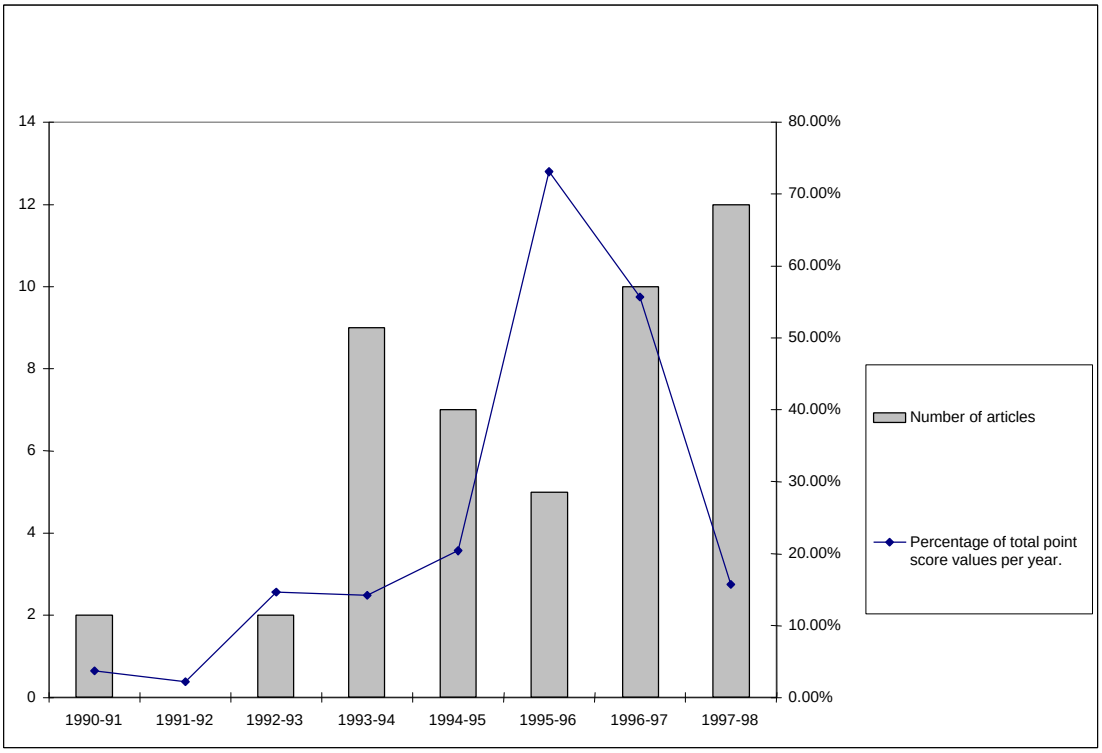

Figure 4: Change in the number of articles with the predominant theme of river, stream and water resource management in The Herbert River Express 1990-1998.

Values presented in the articles

In order to understand the newspaper's presentation of what we are taking to be the community's perception of these issues that appear to be important to them, it is necessary to consider the 42 articles addressing river/stream/ water management in depth. Intrinsic values (moral and spiritual) were not found in any of the sampled articles on river, stream and water management in the *Herbert River Express*. Therefore, extrinsic values became the focus of analysis in this study. As indicated in figure 5, *aesthetic* values were the dominant theme in 9% of the articles, *economic or utilitarian* values were dominant in 26% and *life support* values were dominant in 65% of the articles. Analysis of the values expressed for other themes are summarised in Appendix 1.

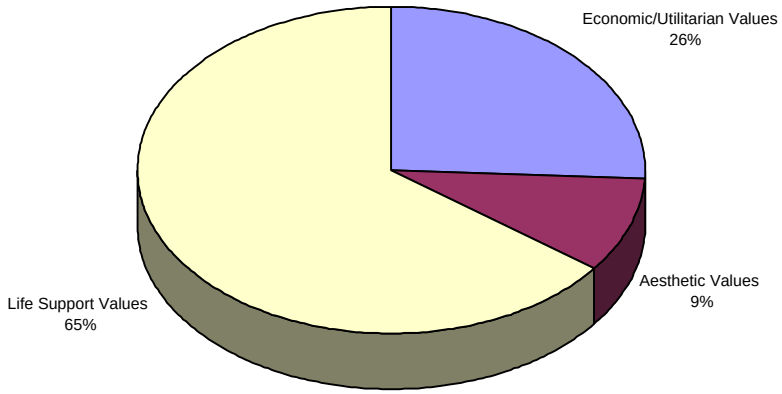

Figure 5 : Extrinsic values as expressed in River/Stream and Water Management articles in The Herbert River Express : 1990/1-1997/8

Aesthetic values

There were two articles where the predominant values were aesthetic. Under the header "Creek Bank Goes Natural" (21/10/93:3), was a report on a tree planting program which would remove 'unsightly garbage and waste on the banks of Palm Creek" and bring with it the "aesthetic benefits of a rainforest in the middle of town". The second, much longer article "Eco Park Plan for Palm Creek" (19/10/95:1) discussed the conversion of a "grass infested area" into "an oasis of high quality". This article also discusses the "Integrated Catchment Management Group" and quotes the Catchment Coordinator of the time, Rob Hunt, on the value of the project which was to create a wetland area.

Economic/Utilitarian Values

Twelve articles were categorised under an economic theme as they contained ideas and philosophies directed towards satisfying human preferences to meet human ends of an economic kind. Drainage was a key issue, this is because the focus community is located on a flood plain and good drainage is essential to such an agricultural community. As some articles emphasized 'about 11 000 tonnes of cane was lost last year because of poor drainage' (*Mangroves upset drains*, 14/2/91:3). 'Excess water is conservatively estimated to have wiped out at least 80 000 tonnes of sugar production for each of the 1990 and 1991 seasons, worth at least $45 million over two years (*Water management needs more funding*, 4/6/91:3). Drainage however, does not seem to be consistent throughout the sample of newspaper articles under the economic theme. Drainage only appears as being economically significant in these early two articles. One topic that is consistent through the economic articles is community consultation. This is where the HRCCC becomes significant. The HRCCC is presented to the community as the auspicing body for community consultation for issues relating to water, river and flood management in the Herbert River region. There are several articles which also indirectly call for such an auspicing body to be the liasing unit between the government (State, Commonwealth and Local) and the public to manage funds, disperse information and consider community interests in developments.

Other articles in the economic category seek funding from the State government to create new managerial positions at local authorities such as the HRCCC, to repair river bank reinforcements, sugar industry infrastructure projects and management strategies for the region. Economic articles emit an anthropocentric view of good management of river and water resources. For instance, one article (*Trust targets river islands*, 5/12/95:1) places emphasis on the notion of good stream management by 'bulldozing heavily vegetated sand islands which have built up due to prolonged dry seasons and relatively inactive wet seasons'.

Other articles are less focussed on the economic theme but still emit values that suit to satisfy a preference of some kind and therefore are categorised under economic values. One article (*Wetland built to improve farm drainage*, 21/8/97:8) is typical of this trend when discussing the benefits of wetlands. This article categorises the benefits of wetlands to be, in order of priority, economic (to open up low lying cane land), ecological (for species preservation) and for land and water management (as a more logical drainage line).

Life Support Values

Economic values of natural resources were not the dominant theme, however life support values of natural resources were, with 28 articles in comparison to economic (12 articles) and aesthetic values (2 articles). It is life support values of natural resources and the environment that are of priority to the newspaper. The domination of the agricultural industry, in particular the sugar industry, in the Herbert River region means that the population depends on the health and sustainability of their natural resources. As we have argued earlier, it is not surprising for articles

in the local newspaper to reflect this dependence on natural systems and resources. What is interesting is that this dependence is not presented in purely economic terms.

In an article regarding the release of a report by the HRCCC to the Minister Primary Industries, major issues confronting the catchment including the immediate appointment of a full time catchment coordinator were outlined (*Casey told full time coordinator needed*, 4/5/93:8). It was noted that the 'catchment has particular infrastructure needs for sustainable growth', with flooding and drainage (including river sedimentation) recognized as having major bearing on sustainable agriculture (*Casey told full time coordinator needed*, 4/5/93:8). Sugar cane crop yields are used as a justification for sustainable sugar production practices where it states that: 'since the floods of 1991 where sugar cane crop yields declined in the 1991 crop year by about 33% from the district's five year average, there has been major focus on the principles of integrated catchment management and near coastal zone' and 'land and water resource management is a major issue in the Herbert River Valley, particularly as the sugar industry continues to expand' (*Casey told full time coordinator needed*, 4/5/93:8). The following quote from this article encapsulates the essence of problems that the people and therefore the paper are concerned with:

> *'drainage in the lower Herbert flood plain delta is critical to crop production. It is perhaps the main limitation on much of the land which has potential for future sugar cane production and yields'.*

The mobilisation of integrated catchment management in the community via the HRCCC was presented as a solution to many of the problems that the community would have with this major river system (*Casey told full time coordinator needed*, 4/5/93:8).

In a later article, the release of a stream control plan for the Herbert River by the Herbert River Improvement Trust was to 'set the trust on track' to control the river system for the future (*River strategy plan released*, 19/8/93: 1). Management is central to this article with the Chairman of the Herbert River Improvement Trust stating the 'committee welcomed the plan and looked forward to a positive future of river management in the Herbert River district'. The front page positioning of this article and its heavy weighting (18380) emphasizes its significance to the community in general.

Tully and Murry River Reports Out (19/8/93:4) reports on the 'environmental health of the catchments'. What was considered as 'environmental health' is quite surprising in that it included:

- expansion of cane growing lands,
- levee banks
- stream bank erosion
- gravel and sand extraction

The 'management of burgeoning cane land expansion' was presented as the 'most urgent issue requiring attention' by the newly established Tully Murry Catchment Coordinating Committee. Ensuring 'controlled', 'ecologically sustainable', 'cooperative' and 'orderly' development took place, essential and 'vital' to local and state economies (*Tully and Murry River Reports Out* 19/8/93: 4).

Catchment body active, (24/3/94: 10) presents the announcement of the inception of the Herbert River Catchment Coordinating Committee (HRCCC), it scope, functions, membership and duties. This article is primarily a piece of community information containing valuable information about the HRCCC in a succinct and effective form of communication. 'The (HRCCC) are already tackling problems ranging from rehabilitation of tin mining dams to coordinating drainage for the Herbert River flood plain'. The goals of the HRCCC were also outlined in this article, further adding to its informative qualities. 'Preliminary identification of

the major issues for the catchment has been done, the first step towards developing a management strategy'. The importance of this program is also placed in the context of the communities wider agenda of community development which, through these articles, is apparently of prime importance to the target audience of the newspaper.

It is clear through such articles that the HRCCC has a profile in the community. The article – *River group heralds major breakthrough*, (21/4/94: 1) is a good indicator of the framework that the committee operates within to improve productivity without prejudicing environmental values' and where 'the Coordinators role was to find out the concerns of represented'. Funding is presented as important. However, once again, the importance of the community in the management of the catchment was stressed by the Coordinator where there 'was an opportunity for people to bring their issues and concerns together to find the solution instead of just taking what appears to be the best option'. The article – *Body coordinates focus on catchment*, (23/3/95) once again introduces the HRCCC to the community by providing the broader context in which the committee operates, an outline of their basic principles and involvement to date on particular projects. It too provides an account of these characteristics but in no different form than previous articles.

As in the articles on the *economic* theme, community consultation is presented as highly important. *Catchment body offers link in communication*, (26/5/94:6) primarily is concerned with the consultation of the community. The HRCCC is presented in this article as the solution to this problem. This consultation occurs as a system checking the State Government's activities in the Herbert River Catchment, particularly the lower catchment. 'People have had concerns over infrastructure works on the floodplain for a number of years. With the recent works they're seeing an opportunity to voice their concerns', 'the main thing is a lot of landholders are seeing new infrastructure but don't know what's really going on… we want to get (state government departments) to liaise with us and get some meaningful feedback from them; get them to tell us what they're doing' (*Catchment body offers link in communication*, 26/5/94: 6). Communication between governments and the public appear to be of great importance to this community due to its expression in the media. The HRCCC is presented as the key community representative group to "run" projects through before they commence. This is exemplified in the following: 'Mr. Hunt said the committee, a community based group suitable for conveying information between government and the general community, was willing to assist issues concerning the catchment future development'. It was stated in a letter to the editor from the chairman of the HRCCC that: 'More communication will help to bring calmness and local thinking into discussion regarding water management and drainage issues that have been featuring in the local media' *(Full water management briefing due*, 23/3/95: 6). Once again, this acts as a brief on the roles and functions of the HRCCC in the community and in the representation of all major stakeholders in the catchment area. The letter also aims to settle an issue involving a local water management issue and suggests communication is the key to managing such resources effectively.

Other players in resource management arise in this category of articles, including the Herbert River Improvement Trust. (*River trust to have more important role*, 15/10/94: 5). The wide reaching nature of catchment management is highlighted as 'everyone lives in a river catchment and river trusts will continue to have a very specific and specialised role to play for the community as the "doers" of river management, getting things done under various conditions'. This article emphasizes the role that river trusts must take in the management of the states rivers in the implementation of the 'new' integrated catchment management initiative. This article also provides an outline of River Trusts, their role and principles, origins and representativeness.

The term *Integrated Catchment Management* only begins to be emphasised around 1996 in the sample of articles. An article refers to the threat of a shortcut along the Herbert River which would reduce it in length by up to six kilometers, and cause 'increased bank erosion upstream and siltation downstream' (*River shortcut a concern*, 25/4/96: 5). This venture is termed the "Long Pocket project" and encapsulates many of the phases connected to Integrated Catchment Management and its practices. Erosion, bank stabilization scouring, native vegetation and floods were all mentioned in this article and are concepts integral to integrated catchment management. The fear of flooding for the community is evident in this article, 'many of them (landholders) have lived through floods in the area and have first hand experience with what the water does'. Informing the public, moreover, the landholders with the intricacies of the project also appears to be important in this and the other articles. This article also places river and flood management in the context of integrated catchment management. The HRCCC Chairman states 'the project was an example of how the local community could benefit from Integrated Catchment Management'.

Integrated Catchment Management

From mid 1996, Integrated Catchment Management takes some focus with many articles mentioning the principles of integrated catchment management generally and such as the article, *River trust work funded* (30/07/96:2). The Herbert River Improvement Trust and the HRCCC had secured funding from the 'government' for works that would avoid 'enormous economic and environmental impacts'. Once again, integrated catchment management is the integral component or type of management but takes another form of what could be termed, river management. The revegetation solution was not chosen for the integrity of habitat that it encourages but because 'revegetation was also much cheaper than rock work which enabled river trust funds to be used to treat greater areas'. The intention is positive, and underlines the entire process of river management, however the philosophy or paradigms in which the managers operate can not be described as "green".

River degraded, (22/10/96:1) is a large headline article with front page coverage and pictures. The focus of this article is integrated catchment management. The article refers to the State of the Rivers report for the Herbert River and tributaries and summarises the findings of the report and what this means for the region. The river was given 'eight out of ten' by the Herbert River Catchment Coordinator, Rob Hunt, thus feeding the need to quantify the state of the catchment. The article refers to riparian vegetation, fish habitat degradation and river bank erosion as the major problems facing the catchment as a whole. Once again, the problem is quantified, 'the condition (of the river) is pretty well reflected in fish catches'. This includes fisheries as a stakeholder in successful integrated catchment management. This article fits the category of 'life support values' where the river is portrayed as the life blood of the economy of this region with comments such as 'narrow riparian vegetation can create the potential for erosion, weeds and pests, which in turn reduces the environmental and financial value of land for farmers'. The emphasis is on the importance of planning development as 'people are starting to realise we need to be more careful with our creeks and rivers… there was not an endless supply of water … and there is always potential for drought.' It was also stated in this article that there were aesthetic values to be had in this catchment. "The eye is often a good indicator of the condition and health of a catchment".

Community Consultation

Community consultation is also important. (*Consult before clearing land*, 21/8/97: 9) Issues that 'will never go away' regarding river, water and flood management were reported to have split the community into a 'them or us situation concerning land use issues and natural resource management'. This article is full of information regarding integrated catchment management and the HRCCC, the life supporting nature of the environment is evident in this article. For

example, 'It was possible to have the best of two worlds… we need sugar production currently worth more than $230 million annually to the Ingham district but we also need tourism, fishing, cattle and forestry industries… we need jobs for our children, but we also need our natural resources such as streams, wetlands, lagoons, beaches and forests… these bring in tourists and makes it a pleasing region of Australia to live in'. This quote exemplifies the perspectives of the regions managers and management committees. Protection of the environment occurs to meet human ends, not to increase the integrity of that habitat or for the intrinsic value of the environment in question. Information is present regarding the HRCCC, although it is not once explicitly mentioned by name, it is however called the Integrated Catchment Management Committee who were 'currently looking for solutions on how to manage issues such as riparian areas, drainage, wetlands and roads in the Herbert River catchment'.

There is no evidence of intrinsic value of the environment. For example, *Dam study funded* (18/9/97: 11) indicated 'There could also be some environmental values' as the closing comment regarding a quarter of a million dollars allocated to a study of the effects of a local dam in the Herbert River Catchment.

Conclusions

The Herbert River Catchment Coordinating Committee was established in 1993. The issues of river, stream and water management increase in frequency in the newspaper from 1996. This suggests a time lag between the inception of the HRCCC, the Herbert River Management Plan and an increase in coverage of issues related to integrated catchment management. In addition, *Integrated Catchment Management* specifically appears from mid 1996 and is stressed as an important issue for the community. The HRCCC is portrayed as a contributor to achieving the goals of productivity, development and sustainability of the local community. The media representation of the HRCCC is positive and is clearly linked with integrated catchment management in almost all articles involving the HRCCC.

Extrinsic, 'life support' values were the predominant values presented in natural resource management issues in *The Herbert River Express*. This seems fitting as the community in the Herbert River region is agriculturally based and located on a flood plain. The community's identity and well being is dependent on the health and sustainability of their natural resources, and is clearly evident from the manner in which the local newspaper presents issues. Intrinsic values were not apparent.

An important issue here is that it seems that *The Herbert River Express* editorial policy appears to operate in a manner that excludes views that do not adhere to the dominant social values locally. However, once an item is accepted for publication there appears to be so little editorial interference that the material can be accepted as representing the dominant values held.

The use of a media as an unobtrusive source of data for research on the social context is becoming more popular as the data is becoming more readily available in 'on-line' data bases. For national media this provides a useful perspective on changing attitudes to environmental issues (Bengston *et. al.*, 1999). On the basis of the results of this research we suggest that despite the difficulties of data collection and analysis, local newspapers such as *The Herbert River Express* are rich sources of data for social context on resource management issues.

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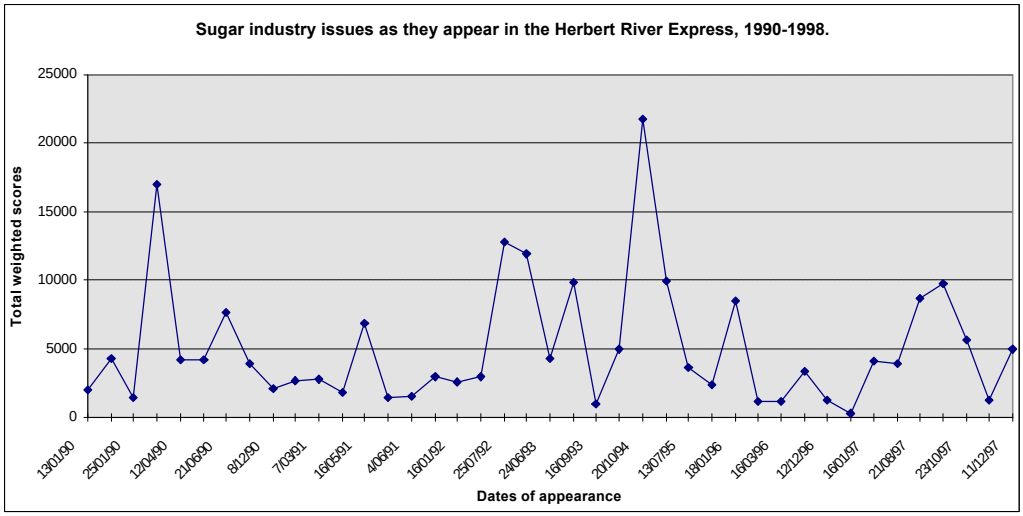
APPENDIX 1

TRENDS OVER TIME AND ANALYSIS OF VALUES PRESENTED IN ARTICLES ON KEY NATURAL RESOURCE MANAGEMENT THEMES OTHER THAN RIVER, STREAM AND WATER MANAGEMENT

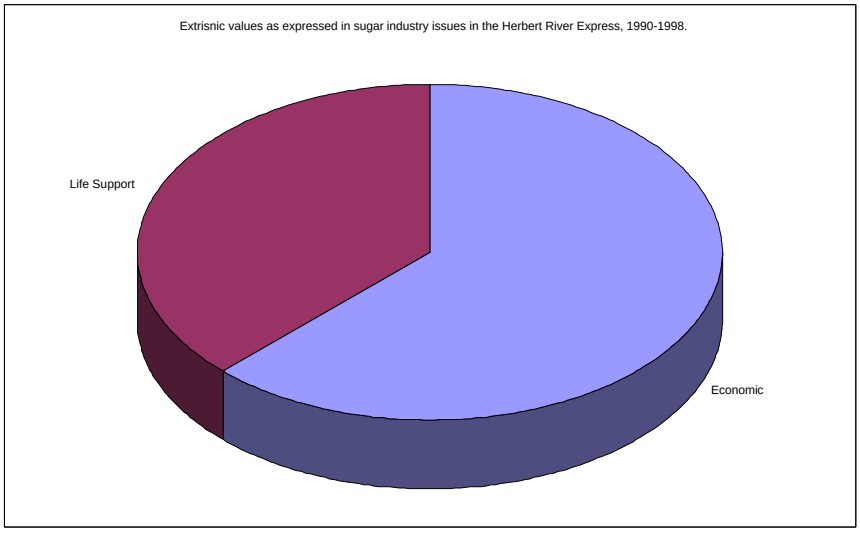
1. Sugar Industry



To unstack sugar industry issues, 4 articles, each of which exceed 10000 points on the Gregory & Williams (1981) point score scheme. Each of these articles will be looked at in turn.

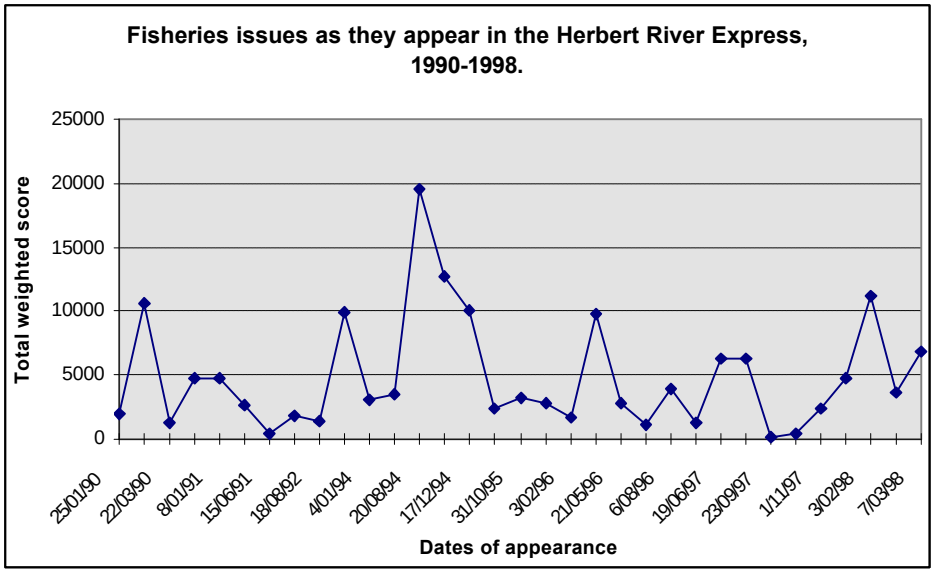
Bulk white sugar exports the 'next logical step' (1/3/90) is the first of these articles to appear over the 10000-point mark. Categorised as an article displaying a life support theme this article discusses the move for the sugar industry to push for bulk exports of white sugar from a northern refinery as 'one of the most logical next steps in exports'. With the demand in overseas, particularly Asian, markets the demand for sugar to be exported in its white form made the need for proper infrastructure to be developed accordingly.

Wharps project shelved (25/07/92) discusses the proposal for the expansion of the sugar industry in the Herbert River District being shelved due to lack of government funding for the project. This is a large article categorised as having economic themes of natural resource management summarising the issue as it expecting "to cost the district $1.5 million annually in lost revenue".



Sugar industry issues dominate the economic theme of articles consisting of 29% of all articles in that theme. 62.42% of all sugar industry articles indicated characteristics of economic values of the environment and natural resources while 37.58% of the same set of articles were associated with a life support theme with sugar industry related articles consisting of only 6% of all articles under the life support theme.

2. Fisheries



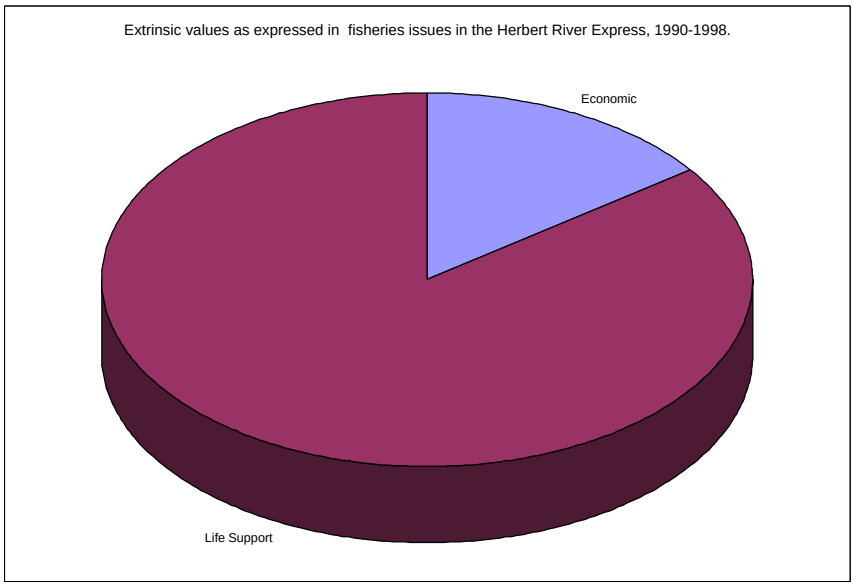
Fisheries articles appear more frequently over the time frame, 1990-1998, and the range of points they receive are varied. These articles range from the small notice about fisheries restriction infringements to major fisheries resource management issues. Many articles are major reports measuring above 10000 points on the Gregory & Williams (1981) point score scheme. *The Brambles Reef dilemma – scientists favour extended closure* (20/08/94) is a full page article with photographs. This article addresses the possibility of an extended closure of the areas closest mid-shelf reef, Bramble Reef, to bottom line fishing for fish stock replenishment after research findings suggest it to be best option for the well being of local fisheries. Pros and cons and options of reef closures and their impact on local fisheries are discussed.

Cardwell operation goes from strength to strength (01/03/90) is a large article (10680 points) with pictures featured as part of "This week in Cardwell" section of the Herbert River Express categorised in the economic theme. It focuses on the aquaculture giant, *Seafarms,* productivity and cash benefits for the local economy.

Huge fish dump is another large article (12765 points) featured on the front page of the 22/09/94 issue of *The Herbert River Express* as its headline story. This article covers the results of a huge fish stock dump allegedly done by professional fisheries in the local area. It was categorised as an article expressing life supporting values of the environment and natural resource management due to the impact this issue had on the local population's well being and state of the environment.

Pros sweat it out on payout scheme (03/02/98) is an articles that appears towards the end of the 1990-1998 timeframe. It is a front page headline story dealing with the possibility of a $5 million government commercial license buyback scheme. "It is not going to cripple the area because sugar is the mainstay but we'll end up a one company town and that is unhealthy" surmises the importance of the issue to the local area and thus its categorisation in the life supporting values. The diversity of issues dominating the fisheries issues covered by *The Herbert River Express* is important to emphasize, however, their importance (life supporting role) is also to be recognized.

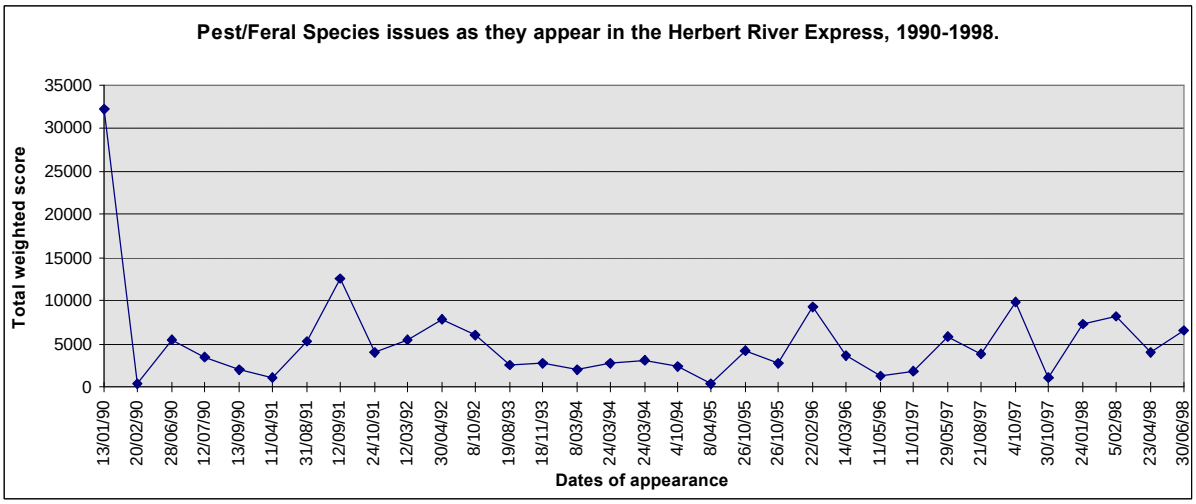
The impact of less weighted stories is not to be underestimated. Many small, less emphasised issues such as fishing authorities announcements and notification of licence infringements is also to be recognised.



Fisheries issues were a substantial component of articles in the Herbert River Express comprising of 9.7% of the life support articles and 5.45% of all economic articles. 85.06% of the articles discussing fisheries issues presented a life support theme. 14.94% of the fisheries issues articles displayed an economic theme. 33 articles discussing fisheries issues were presented in the sample.

3. Pest/Feral species

Issues concerning the threat of pest or feral species into the local area are of great importance to this community.



This is reflected in the way these issues are presented in the Herbert River Express. The topics that these articles cover vary from the immediate threat of pest invasion to the notification of new pesticides or herbicides for better productivity protection. One major article acts as a good example of the content of the articles categorised under the pest/feral species banner. *Rats on the move – canegrowers told to 'starve them'* (10/01/90) is a relatively small but front page headlining article calling for Herbert River district cane growers to take immediate action to prevent crop damage from rats.

> "At the present, conditions are favoring the rats," the spokesman said. "And we don't want to start the new decade with a rat plague. "It may be too late to eliminate grasses and weeds inside some paddocks, but it's not too late to spray out margins. "Slash headlands, keep them wide and clean from tall grass. Rats think twice about crossing bare ground or open areas." He said by keeping harborage areas such as drains, swamps and especially grasslands slashed or sprayed, food supply would be greatly diminished, resulting in the rats starving to death.

Not only were animal species of pests indicated as a concern, the threat of weed invasion also proved to be an important issue to the local area. *Weed control to protect profits* (12/09/91) was another highly weighted article (12637 points) calling for the protection of production.

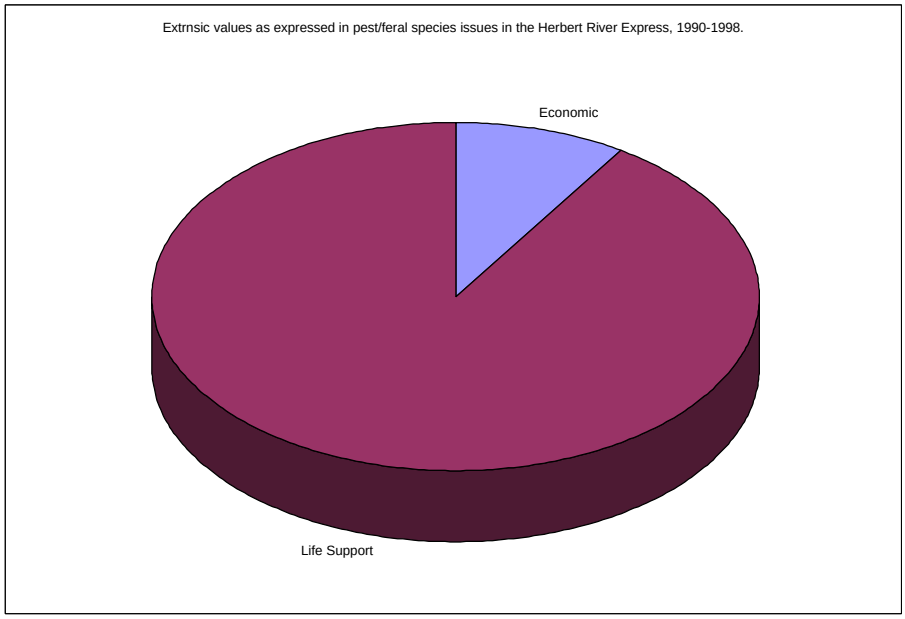
> THE RECENT downturn in the sugar price, combined with a reduction in crop just harvested, means that good management is required now to make certain the next crop is given the best possible chance of success and ensure improved incomes.

This article is a hidden promotion for Gramoxone, a herbicide found to be productive for the local area.

> Gramoxone is definitely the ammunition for your weed control strategy - it's easy on your pocket and tough on weeds. The lowest cost option remains Gramoxone, leaving other knock-down herbicides and cultivation way behind. Gramoxone is reliable, versatile and knocks down grasses and broadleaf weeds quickly.

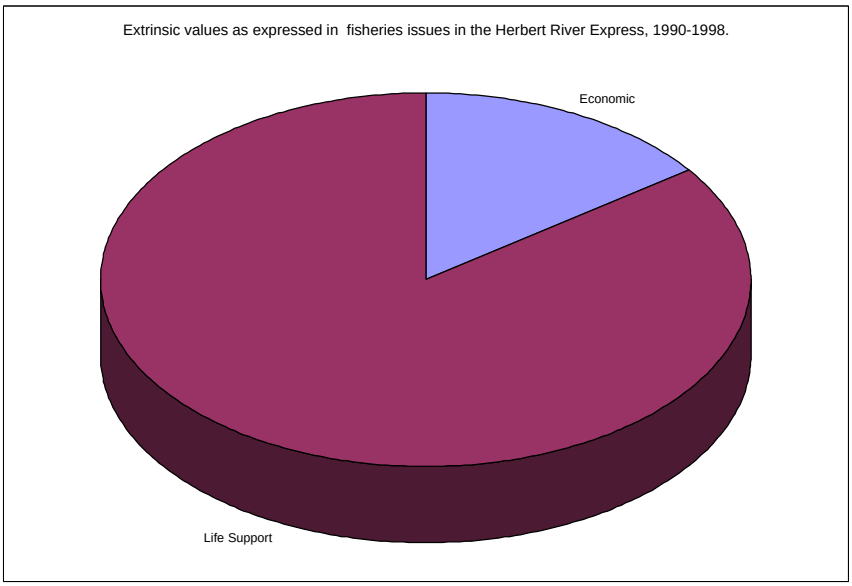
Locusts prove to be another threat to this area with an article addressing the issue ranking 7835.5 points on the Gregory & Williams (1981) point score scheme. *Farmers warned 'look out for locusts'* (30/04/92) is such an article.

The threat of the papaya fruit fly appears towards the end of the timeframe in early 1996. Many articles address this threat as it was a major event for this area. Papaya fruit fly battle enters its third phase (22/02/96) deals with this major event for the Herbert River district with the distribution of canite blocks to the local people with fruiting trees on their property to lure and kill male papaya fruit fly.



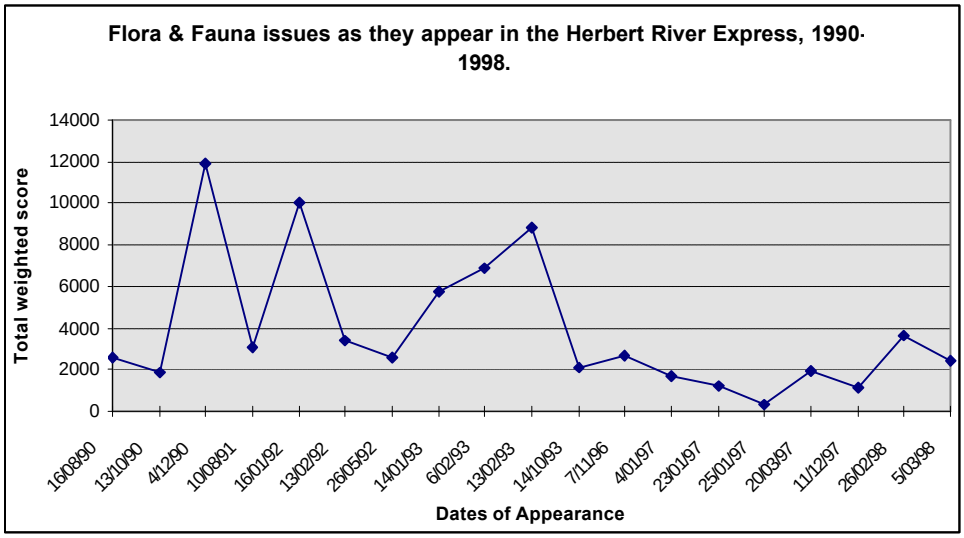
Articles presenting issues regarding pest and feral species were dominated (90.84%) by life supporting values of the environment. The remaining 9.16% of the articles expressed economic values of the environment. These issues featured highly in the life supporting, 11.10% of the articles in this category were pest and feral species issues and only 3.58% of economic articles covered this issue.

4. World Heritage



Articles of *The Herbert River Express* dealt with issues regarding world heritage predominantly with life supporting values of the environment held to heart (?) 90.75% of these articles were categorised under the life support theme. 9.25%, the remaining articles, were classified as indicating aesthetic values of the environment and natural resources. World heritage issues ranked fairly amongst the value categories consisting of 9.43% and 4.52% for aesthetic and life support values respectively.

5. Flora and Fauna Issues

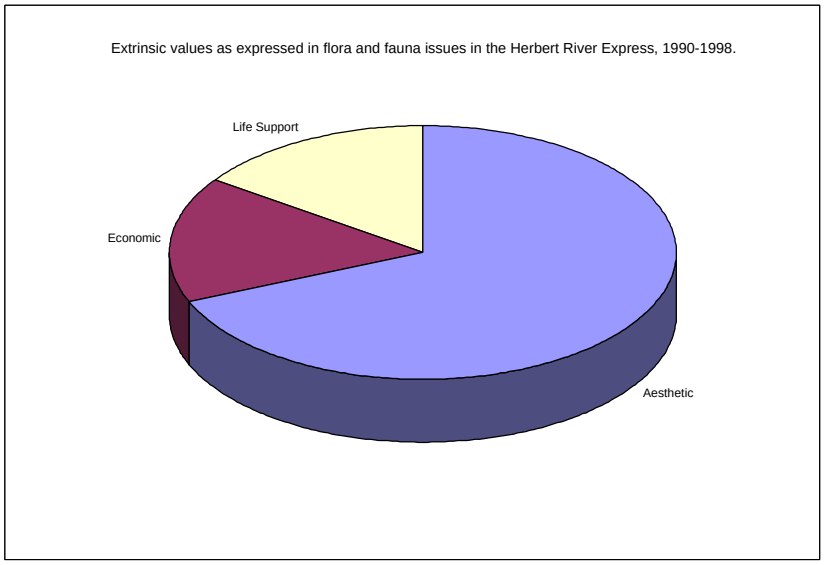


Flora and fauna issues included articles that focussed on specific species of animal or plant and gave the details of their makeup, breeding, diversity, eating habits etc. These were usually small to medium sized feature articles providing general information on various species of plants and animals. Some of these feature articles proved to gain much space in the newspaper for attention to be paid. A number of these articles scored above 6000 points on the Gregory & Williams (1981) point score scheme, including:

Spawning time on Orpheous Island (14.12.90) –
Two unique Australian monotremes (16.01.92
Kingfishers – Jewel of the rainforest (13.02.93)
Birds of prey hunt during the day time (06.02.93)

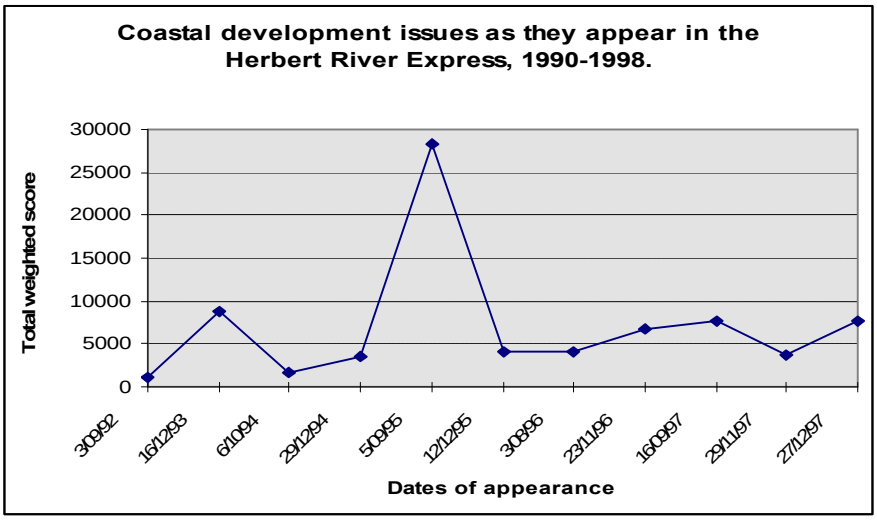
Most of the remaining articles covering issue of flora and fauna in the local area ranged between 300 and around 4000 points on the Gregory & Williams (1981) scheme. Some examples from this group of stories includes:

Herbert Valley is rich in beautiful wildlife (14/01/93)
Watch out for wasps in ants clothing (04/01/97)
Nighttime fun with owl spotting tour (11/12/97)

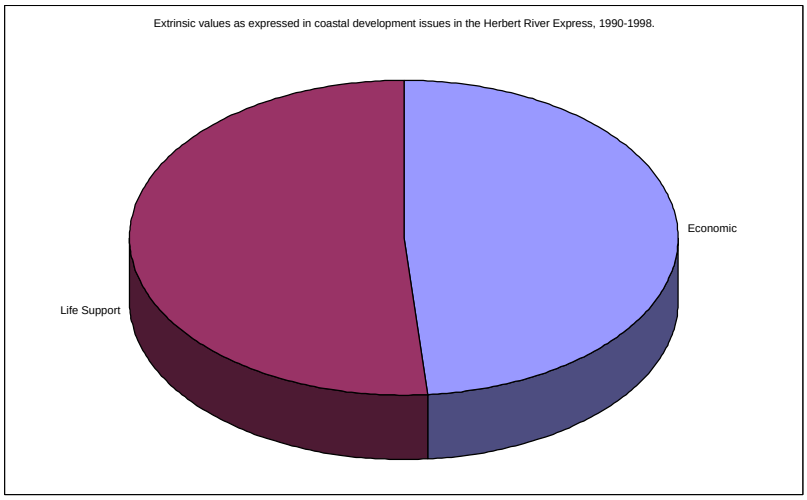


Flora and fauna issues were dominated with an aesthetic value theme towards natural resource management with 68.67% of the articles being classified under this theme. This issue was almost equally treated under the life support and economic theme with 15.27% and 16.06% respectively of the articles being dealt amongst these two themes. Flora and fauna issues consisted of 74.32% of all articles categorised under the theme of aesthetic values. These issues ranked lowly amongst the themes of the majority, that is, economic and life support values of the environment. Flora and fauna issues consisted of 2.72% of the economic theme and 0.81% of the life support values of the environment.

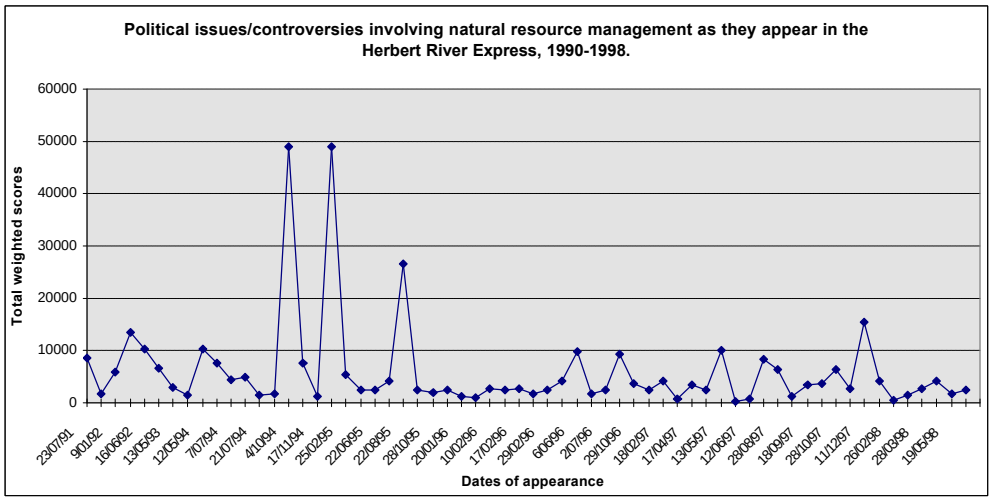
6. Coastal Development



Coastal development issues are predominantly between approximately 1000 and 9000 points on the Gregory & Williams (1981) point score scheme with the exception of one article *"Step closer to permanent Dungeness marina facility"* (05.09.95) which is a front page headlining article with pictures discussing the Hinchinbrook Shire Council's efforts for a permanent commercial waterfront facility. The article addresses the claim of some water front land, the details of the transaction and the impact the transaction will have on local development. This article was categorised under economic theme of the environment for the financial focus of the article with the council "weighing up its options on the type of development and facilities they believe will best serve the shire". The weighting of these articles remains fairly consistent over the time frame and appear sporadically through this period. Only 1 or 2 articles a year appear with relatively little emphasis on them. Coastal development articles appear not until 1992 then are fairly consistent after this time.
Coastal development issues consisted only a small part of the sample with only 11 articles in total. However, this issue was almost evenly split with 51.4% of these articles indicating a life support theme or value. 48.6% of these articles indicated an economic theme. This small category only comprised of 8.65% of all economic articles and 2.86% of all life support articles.



7. Political Issues



Political issues and controversies was a specially designed category to cover particularly contensios and complex issues for the local area. This category cover a select few issues which have proven to be of great media interest in the local area. These issues include:

- The Port Hinchinbrook/Oyster Point debate
- The mahogany glider habitat issue
- The Tully Millstream proposal

8. The Port Hinchinbrook/Oyster Point debate

This is a very decisive issue, it is a case in this community that you either are for it or against it, and this community is for it according to the local media. The local area sees it as the light at the end of the tunnel for the local economy. With headlines such as:

Dredging debate won't stop Williams (12/05/94)
Williams starts at Oyster Point (04/10/94)
Molly's folly to be revegetated (18/01/96)
Williams to pay for water (27/11/97)
Oyster Point: Rowell attacks agitators (25/06/94)
The battle for Port Hinchinbrook - Oyster Point row hots up (29/11/94)
Chamber is confident of Williams resort approval (03/08/95)
Environmental bigots (29/02/98)
Williams say 'genuine'greenies were conned (18/02/97)
The hard sell begins for controversial resort (11/12/97)

It is difficult to say that the paper overtly sides on the development side of the controversy as they "should" be non-biased reporting. Place comments from the articles to support this claim - from the major articles...

Williams starts at Oyster Point (04/10/94) is a major article (48870 points) on the Gregory & Williams (1981) point score scheme and features as major voice peice on the Port Hinchinbrook debate. This appears around the middle of the timeframe in late 1994 but by no means marks any less of a milestone for the development site and the local area.

The initiation of development works at the Oyster Point site obviously was met with protests from lobby groups concerned about the project as another major article hits the newstands, The battle for Point Hinchinbrook: Oyster Point row hots up (29/11/94) with a major 48865 points.

Later in the timeframe of 1990-1998 another prominent article concerning this particular debate arises, *The hard sell starts for controversial resort* (11/12/97) marking another milestone for the debate.

The mahogany glider habitat debate

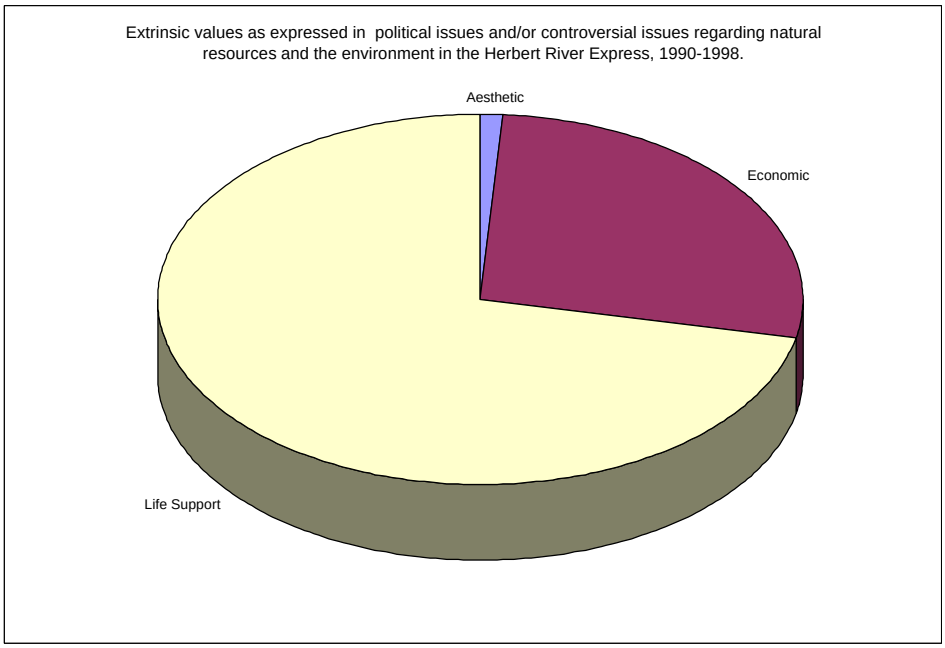
This birth of this debate coincides with an article that appears in the Herbert River Express, *Rare possum sighting puts plan on hold* (16/06/92) and culminates with *Buy back of mahogany glider habitat discussed with landholders* (22/08/95). Other headlines read:

Prawn farms lose to gliders (28/10/95
Minister committed to mahogany glider conservation plan (20/7/96)
Mahogany glider gets $1.6m home (01/03/97)
Aquisition of mahogany glider habitat just a rumour (19/04/97)
Gliders on the run (31/05/97)

Tully-Millstream hydro electric plant proposal

This is the third issue that dominates the headlines in the political issues/controversies category. Still a contentious issue and despite its lower weighting scale in the paper, this issue remains of importance to the Herbert River district. Headlines read:

Wet tropics chief 'cops flack' over Tully hydro (30/11/91)
Katter backs hydro (1605/92)
Millstream scheme 'on the backburner' (13/05/93)
Councils push for Tully-Millstream hydro by 2000 (25/02/95)
Promise to build Tully Millstream hydro scheme (08/04/95)



Political issues and controversies were dominated by a life supporting value of the environment and/or natural resource in question. 1.18% of these issues were for expressed aesthetic values and 21.02% were for expressed economic values. The sample produced unsurprising results with 22.89% of the economic articles were covering political issues/controversies as were 19.21% of life supporting articles and 6.41% of aesthetic values articles.

Chapter 5

Database for the study on natural resource management issues and Integrated Catchment Management as reflected in the Herbert River Express 1990-1998.

Cottrell, A. and Rowbotham, K.

Tropical Environment Studies & Geography, James Cook University, Townsville, 4811

Originally Published as:
Cottrell, A. and Rowbotham, K. 1999. Database for the study on natural resource management issues and Integrated Catchment Management as reflected in the *Herbert River Express* 1990-1998.

Excel database files available on Web site http://irum.tag.csiro.au or through the principal author.

Chapter 6

Spatial and Temporal Distribution of Wetland and Riparian Zones and Opportunities for their Management in Catchments Adjacent to the Great Barrier Reef Marine Park

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Abstract
This paper reviews the role of riparian and wetland areas in ensuring ecosystem function and briefly assesses the status of riparian and wetland areas in catchments immediately adjacent to the Great Barrier Reef Marine Park. We also report in detail on the results of a study undertaken on the floodplain of the Herbert River catchment, that assessed both spatial and temporal changes in the area of riparian and wetland zones. We demonstrate that there has been significant reduction in the riparian and wetland area since European settlement and provide a range of measures to show that landscape diversity and quality have also declined. In response, we introduce and discuss a range of policy, planning and management options that can contribute to more sustainable resource management in coastal environments.

INTRODUCTION

The Great Barrier Reef Marine Park (GBRMP) covers an area of approximately 350000 km^2 and spans almost 2000km of the east-coast of Queensland. Fifteen catchment divisions, covering an area of approximately 375000 km^2, drain directly into the GBRMP (Figure1) (Anonymous, 1993). Since the mid-1980's, many coastal and catchment areas adjacent to the GBRMP have experienced strong economic growth, underpinned predominantly by solid performance by their agricultural and tourist sectors (ABS, 1995). While the long-term performance of these sectors will reflect the quality of their supporting natural resource base, current environmental trends suggest a decline in terrestrial and riverine systems, and on the adjacent marine environment (Anonymous, 1993; Arthington *et al.,* 1997).

Many of the catchments adjoining the GBRMP have been extensively cleared (Russell and Hales, 1993; Sattler, 1993) since European settlement. *Melaleuca* (paper-bark) wetlands once covered large areas of coastal floodplains which are now used for intensive agriculture (Tait, 1994). Prior to clearing, these wetlands would have provided extensive buffer strips protecting coastal river systems, estuaries and shorelines. Clearing, notably for sugarcane cultivation, has left only remnants of this ecosystem (Russell *et al.,* 1996). Riparian and wetland zones in many of these catchments are frequently narrow and sparsely vegetated and have been invaded by exotic weeds, particularly para grass (*Brachiaria mutica*) and *Hymenachne*, which suppress the process of natural revegetation (Johnson *et al.,* 1997). It is likely that riparian and wetland zones in such poor condition have suffered a corresponding degradation of their intrinsic ecological values (Arthington *et al.,* 1997).

The aim of this paper is first, to briefly outline the extent of change of riparian and wetland areas in catchments adjacent to the GBRMP, and second to examine in detail, changes in space and time of riparian and wetland areas on the Herbert River floodplain. While the focus of the paper is not on impacts of these changes on terrestrial, riverine and marine environments *per se*, we discuss significant issues that are central to the maintenance and function of riverine and marine resources. In so doing, we hope that readers can make the obvious connection between land, water and marine resource management. We conclude by outlining both a broad policy and planning framework, and some simple management options, that provide significant potential in addressing fundamental resource management challenges in the region.

What Role for Riparian and Wetland Areas?

Riparian and wetland areas play an important role in maintaining the biological health of the aquatic and terrestrial ecosystems associated with watercourses (Raisin, 1995). Wetlands, swamps, billabongs and waterholes are important wildlife habitat areas and form an integral part of a hydrological regime. Changes to the hydrological regime of swamps and wetlands (eg. drainage), alter both the habitat and the vegetation. Wetlands are important habitat for birds, amphibians and other wildlife. They are also important as nursery areas for several species of commercially important fish such as barramundi. Maintenance of these values is dependent upon annual

flushing and recharge during wet season floods. Important ecological functions of riparian and wetland areas include (Bunn, 1993; Campbell, 1993; Catterall, 1993; Cummins, 1993):

- *Assisting in maintaining bank stability*. The roots of riparian plants bind stream bank materials and help to reduce slumping. This constrains the width of stream channels and may allow banks to become under-cut without collapsing, thus creating habitat for aquatic organisms (Bunn, 1993). Clearing of riparian vegetation increases the chances of stream channels migrating (Barling and Moore, 1994);

Figure 1. Catchment areas draining into the Great Barrier Reef Marine Park.

- *Providing a filter strip to reduce sediment input into a watercourse*. Riparian and wetland areas form a buffer between streams and surrounding systems which can filter nutrients, pesticides and suspended sediment in runoff water. The mechanisms of this filtering function are both physical and biological including deposition, vegetative uptake and conversion by micro-biological processes such as denitrification (Lowrance *et al.,* 1984). In a similar manner, riparian and wetland areas can act as a sink for nutrients carried in solution via overland flow during floods. Clearing and draining riparian and wetland areas prevents water from being filtered as it enters stream systems or the marine environment;
- *Creation of habitat for fish and other aquatic organisms*. Riparian vegetation provides shade and reduces both light and heat reaching the stream (Arthington *et al*., 1997). Riparian shading also alters the wavelength of light reaching streams, filtering out much of the ultraviolet spectrum and favouring green in the visible spectrum. Water temperature increases in unshaded streams (Pearson and Penridge, 1992), and this is frequently associated with a reduction in dissolved oxygen levels in the water and the progressive death of sensitive aquatic organisms. This can be particularly significant in north Queensland during the dry season when natural biological oxygen demand can be high (Arthington *et al*., 1997). An increase in water temperature at this time may eliminate some taxa from a stream (Pearson and Penridge, 1992). In unshaded streams with dense growth of aquatic plants, trophic status may fluctuate between production and respiration depending on cloud cover; several overcast days in succession may result in anoxia in such streams (Bunn and Davies, 1996; Bunn *et al.,* 1997). Shade also renders fish less visible to predators such as birds and thus provides them with some protection (Koehn, 1992). This may be especially important in streams with little structural in-stream cover. The deposition of leaf litter into the watercourse is a major component of the food chain. Riparian vegetation contributes woody debris which has an integral and often profound influence on stream morphology and ecological processes in most natural streams (O'Connor, 1986). The surface of the wood also provides habitat for invertebrates (O'Connor, 1991). This is particularly significant in large silty and sandy rivers where woody debris can be the major invertebrate habitat and is consequently also very important as feeding habitat and shelter for fish (Arthington *et al.,* 1997);
- *Provision of habitat for terrestrial birds, mammals, reptiles and amphibians and insects*. Riparian and wetland areas may also act as critical refuges for the maintenance and replenishment of wildlife populations during times of drought or after fire (Catterall, 1993). Riparian and wetland habitats provide important corridors for wildlife movement and dispersal, especially in catchments cleared for human use, where areas of riparian vegetation link bushland remnants (Catterall, 1993). Remnant wetland habitats in the coastal lowlands of catchments, such as bulkuru sedge swamps in the Tully-Murray catchment, are important as nursery areas for silver barramundi (*Lates calcarifer*). Waterfowl species are also dependent upon these wetlands. Further clearing of riparian and wetland areas on the coastal lowlands should be examined carefully, considering the generally low agricultural suitability of these areas and their important functional and habitat roles. Tait (1994) suggested that these areas be conserved and incorporated into farm drainage systems. In practice, however, there are few operational examples of such approaches.
- *Benefits for agricultural systems*. Benefits to agricultural production systems can also be gained from conserving and restoring riparian vegetation. Riparian zones, particularly riparian wetlands, play a key role in regulating the natural hydrological cycle, particularly in minimising flood peaks following heavy rainfall. They help reduce soil loss from bank erosion (Moss *et al.,* 1996) and from runoff. Riparian areas also increase the abundance of beneficial insects in adjacent crops (Lowrance *et al.,* 1985). Recent research has also clearly demonstrated that rat damage to sugarcane crops can be significantly minimised by establishing closed canopy vegetation in harbourage areas (riparian areas, drainage lines and hillsides). Shade trees impede grass and weed growth, providing a long-term solution to rat control (Tucker, 1996; Brodie, 1996).

Status of Riparian and Wetland Zones In Catchments Adjacent the GBRMP

The status of riparian and wetland areas in catchments adjacent to the GBRMP has been reviewed by a number of authors (eg Arthington and Hegerl, 1988; Anonymous, 1993; Blackman *et al.,* 1996). Accounts of these areas have increasingly confirmed their outstanding biological richness, diversity, geographical extent, and importance as habitat for a similarly rich and diverse biota. Of the 19 Queensland wetlands identified as having national importance (Blackman *et al.,* 1996), 8 are located in areas immediately adjacent to or within the GBRMP. Tables 1 and 2 provide summary information on the catchment areas that drain into the GBRMP and include an overview of the dominant tenure, land use and disturbance patterns for wetland and riparian areas.

Wetland areas adjacent to the GBRMP are only partially protected from development and specific protection is frequently restricted to the coastal fringe via the *Fisheries Act 1994* or Marine Parks legislation. In most cases, existing wetland areas are in a sound condition, however most are also threatened by competing uses and many protected wetlands are impacted upon by activities in surrounding areas. Protection for riparian areas is very poor and is almost solely confined to National Parks or Reserves. Accordingly, with the exception of areas in the vicinity of Shoalwater Bay, Townsville and NE Cape York, substantial losses of riparian and wetland areas have occurred since European settlement.

The principle causes for this decline have been: the development of intensive agriculture, mainly sugarcane and horticulture production from Sarina to the Daintree River; urban and industrial development in Mackay, Townsville and Cairns; and the introduction of grazing systems based on the use of improved and ponded pasture (particularly in the southern catchments). Of these, clearing of wetland and riparian areas for sugarcane production has had the most profound impact, particularly on areas from the Burdekin to Mossman.

Table 1. Estimated extent of coastal wetland and riparian areas and their relative conservation significance in catchments adjacent the GBRMP (Adapted from: Anonymous, 1993; Blackman et al., 1996).

Catchment	Catchment Area (km^2)	Wetland Area (km^2)	Significance
Curtis Coast	9225	462	High
Fitzroy	142645	1329	High to Very High
Shoalwater Bay–Sarina	11270	4127	Very High to High
Pioneer-O'Connell	3925	263	High
Proserpine	2485	214	High to Very High
Don	3985	110	High
Burdekin-Haughton	133510	1494	Very High to High
Ross-Black	2890	719	Very High – High
Herbert	12130	499	Very High to High
Tully-Murray	2825	504	Very High to High
Johnstone	2330	116	Very High to High
Mulgrave-Russell	2020	124	Very High to High
Barron	2175	10	High
Mossman-Daintree	2615	61	Very High
North-East Cape	43300	8376	Very High to High

Table 2. Tenure, land use and disturbance profiles for wetlands in catchments adjacent to the GBRMP (Adapted from: Blackman et al., 1996).

Catchment	Dominant Tenure		Dominant Land Use		Significant Disturbance/Threats	
	*On site**	*Surrounds**	*On Site*	*Surrounds*	*Current*	*Potential*
Curtis Coast	LH, FH, WR, NP, FHR, MP	MP, NP, LH, FH, ML	Fishing, grazing , conservation, recreation	Recreation, fishing, grazing, industrial	Few – minor	Tourism, mining, urban
Fitzroy	LH, FH, Cons, NP, H&M, MP	FH, NP, LH, MP	Fishing, grazing, transport, conservation	Grazing, urban, transport, fishing	Grazing, dams, agriculture, weeds,	Weeds, tourism, mining
Shoalwater Bay – Sarina	Milit, LH, FHR, ML, NP, MP	Milit, MP, NP, ML, LH, FH	Military, fishing, grazing, conservation,	Recreation, fishing, grazing, agriculture,	Minor, weeds	Weeds, tourism, mining, fishing
Pioneer-O'Connell	LH, FH, WR, NP	MP, NP, LH, FH	Fishing, conservation, recreation	Agriculture, recreation, fishing, urban	Minor, some clearing	Clearing for agriculture
Proserpine	LH, FH, WR, NP	MP, NP, LH, FH	Grazing , conservation, recreation	Grazing, conservation, agriculture	Minor, weeds	Agriculture
Don	LH, FH	LH, FH, MP	Grazing	Grazing	Few - minor	Tourism
Burdekin-Haughton	NP, LH, FH, FHR, NP, MP	BRIA, MP, NP, LH, FH	Fishing, grazing , conservation, recreation	Grazing, agriculture, conservation	Agriculture, BRIA, weeds, dams	Agriculture, BRIA, weeds, dams
Ross-Black	LH, FH, WSR	FH, MP, NP, LH	Grazing , conservation, agriculture	Grazing, agriculture, conservation	Weeds, water extraction	Weeds, water extraction, urban
Herbert	LH, FH, WR, NP, FHR	LH, FH, NP, SF, MP	Conservation, agriculture, recreation	Fishing, agriculture, conservation, recreation	Agriculture, weeds, runoff and drainage	Agriculture, weeds, runoff and drainage
Tully-Murray	FH, NP, FHR, Cons, LH	NP, FH, NP, MP	Conservation, agriculture	Agriculture, conservation, recreation	Agriculture, weeds, runoff and drainage	Agriculture, weeds, runoff and drainage
Johnstone	FH, AP, NP, LH	NP, FH, LH, MP	Conservation, agriculture	Agriculture, conservation, recreation	Agriculture, weeds, runoff and drainage	Agriculture, weeds, runoff and drainage
Mulgrave-Russell	FH, NP, FHR, LH, H&M	NP, FH, LH, MP	Conservation, agriculture, tourism	Agriculture, conservation, recreation, tourism	Agriculture, weeds, runoff and drainage	Agriculture, weeds, runoff and drainage
Barron	FH, LH	FH, MP, NP, LH	Fishing, recreation, tourism	Fishing, tourism, urban, industrial	Agriculture, runoff, drainage, urban	Agriculture, runoff, drainage, urban
Mossman-Daintree	NP, FH, LH	MP, NP, LH, FH	Conservation, fishing, tourism, agriculture	Conservation, agriculture, tourism, recreation, urban	Agriculture, weeds, runoff, drainage	Agriculture, tourism, urban, weeds
North-East Cape	IT, ML, LH, MP, FHR, NP	IT, ML, LH, MP, FHR, NP	Traditional, grazing , conservation, mining	Traditional, grazing , fishing, conservation, mining	Weeds, ferals, mining, tourism	Weeds, ferals, mining, tourism

*LH – Leasehold, FH- Freehold, WR – Water Reserve, NP – National Park, FHR – Fish Habitat Reserve, MP – Marine Park, Cons – Conservation Tenure, H&M – Harbours and Marine, Milit – Military Use, SF – State Forest, AP – Commonwealth Action Pending, ML – Mining Lease, IT – Indigenous Peoples Tenure, BRIA – Burdekin River Irrigation Area

On the Wet Tropical Coast (Rollingstone to the Daintree River), expansion of agricultural industries has seen widespread destruction of riparian and wetland areas. In the Johnstone River catchment, the area of wetlands has decreased by approximately 60% since 1951 (Russell and Hales, 1996). The most significant losses have been of freshwater wetlands, particularly *Melaleuca* communities. *Melaleuca* forests, notably those to the south of the Johnstone estuary have been reduced by approximately 78%. There have also been significant reductions in other wetland categories, including a 64% reduction in palm and pandanus dominated wetlands and a 55% reduction in freshwater reed swamps. Freshwater wetlands to the north and west of the confluence of the North and South Johnstone Rivers have also almost entirely disappeared during this period. In contrast, the area of mangrove patterns has remained almost stable. Of the riparian areas assessed, 72% of the coastal lowland zones were in poor or very poor condition (Russell and Hales, 1996).

In the Tully-Murray catchment, less than 20% of land systems with a high suitability for agricultural production remain under native vegetation (Tait, 1994). Large areas of freshwater wetland have been lost or degraded by clearing, draining and exotic weed invasion. The fish habitat values of remnant floodplain wetlands have been severely reduced as a consequence of agricultural drainage. Riparian vegetation of the Tully- Murray catchment has also been degraded due to clearing, erosion and exotic weed invasion. Infestation of watercourses with para grass has resulted in the prevention of establishment of riparian vegetation and a severe reduction in the value of aquatic habitat (Tait, 1994). Similar phenomena are manifest in the Herbert, Russell-Mulgrave, Barron and Mossman-Daintree catchments, and from increasing expansion in the extent of the Burdekin River Irrigation Area (Congdon and Lukacs, 1995). Unless limitations to the continued expansion of agriculture are imposed, these trends are unlikely to alter.

Catchments in the NE of Cape York have, in comparison to the Wet Tropical Coast, remained largely undisturbed (Anonymous, 1993). Cattle grazing, exotic weeds, feral animals and mining activities have all had some impact on riparian and wetland areas. It is likely that these areas will remain in a sound condition in the short to medium term. However, increasing pressure from tourism and mining pose a significant threat to the regions riparian and wetland resources. Mining and tourism also represent a threat in the Shoalwater Bay area, which remains in outstanding condition following many years of management by the Australian military (Anonymous, 1993; Blackman *et al.*, 1996).

While the current extent of riparian and wetland resources is well documented, the extent of wetland loss since European settlement is in general, poorly understood in most catchments adjacent to the GBRMP. In the sections that follow, we report on a study conducted in the Herbert catchment that quantifies the distribution of coastal riparian and wetland areas since European settlement.

Spatial and Temporal Distribution of Riparian and Wetland Zones in the Herbert River Catchment

The Herbert River Catchment drains an area of approximately 10000 km^2 to the Coral Sea and is the largest of the river systems located in Australia's sub-humid to humid tropical north east (lat. 15-19^0 S, long. 145-146^0 E) (Figure 2). Large areas of the catchment remain under natural vegetation, although approximately 35 to 40% of the coastal lowland area has been cleared for crop production or improved pastures. Agricultural and pastoral activities are the largest users of land (in area) in the catchment. The catchment has two major population centres and a population of approximately 18000 (1993 Census), of which 75% are located in the lower catchment.

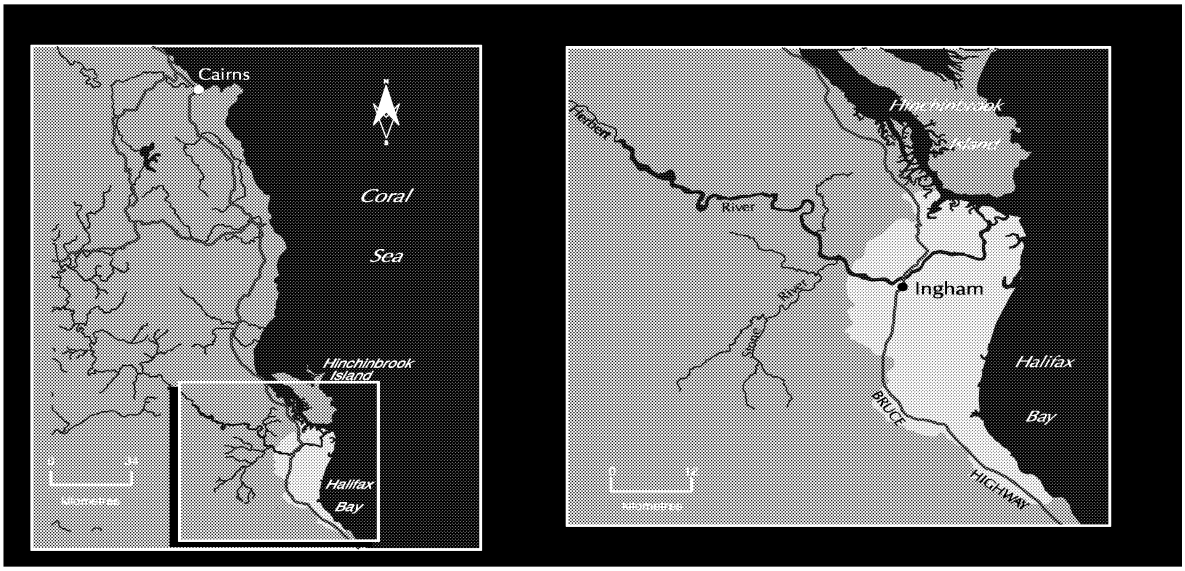

Figure 2. Location of the study area in the Herbert River catchment.

METHODS

Land cover of the lower Herbert River catchment was mapped from aerial photography acquired in 1943, 1961, 1970, 1977, 1988, 1992, 1993, 1994 and 1995. SPOT Panchromatic and MSS imagery were used to map land cover in 1996. Land cover boundaries were mapped onto a geo-referenced digital base. Classification drew heavily on previous vegetation (Tracey, 1982; Perry, 1995) and soil surveys (Wilson and Baker, 1990; Heiner and Grundy, 1994) in the region. Wetland areas were classified using the method of Blackman *et al.* (1992). Ground truthing of mapping units and mapped boundaries was conducted by vehicle and foot traverses. Classification of units and boundaries not inspected was undertaken by extrapolation from equivalent photographic units.

In addition to mapping observed land cover, an estimate of land cover prior to European settlement (early 1860's) was derived from observed relationships between remaining stands of native vegetation and the known distribution of soils, topography, relief, hydrology and rainfall. Although mapping was conducted for the entire Herbert catchment, this paper only reports on land cover on the coastal lowlands below an elevation of 13m AHD (Australian Height Datum) ie the zone of seasonal inundation with direct influence on coastal wetlands and the adjacent marine environment.

A time series was developed to elucidate spatial and temporal change in land cover, with a focus on measurement of interaction within riparian and wetland areas. An analysis of floodplain landscape pattern, emphasising the dynamics of riparian and wetland areas. Tables 3 and 4 detail mathematically the analyses performed and Figure 3 illustrates the derivation of 2 key spatial parameters. The usefulness of these measures and indices is as follows:

- Edge:area ratio quantifies the amount of irregularity in the shape of remnant stands of vegetation;
- The forest island dissection index, DI, compares the amount by which any one island is more dissected than another and, therefore, would have a greater edge to interior. Any index greater than 1 is a measure of such irregularity in comparison to an index of 1, which is circular in shape.

- Since 'edge effect' can influence vegetation composition and structure, total edge was calculated from individual edges measured for each island. The landscape dissection index (DL) measures the edge:area ratio and is cumulative for the entire landscape in which the island exists;
- The island distribution index (IDI) measures aggregation and is similar in logic to the nearest neighbour statistic. IDI emphasises the pattern of islands in the landscape. IDI = 1 in a randomly distributed population, < 1 in an aggregated population and approaches uniformity if the value is close to 2.1491, where islands would have maximum spacing, in which case they are regularly distributed in a hexagonal pattern;
- Diversity and Evenness indices compare changes in richness and landscape apportionment;
- Number and density of islands, and cover class as a % of total area, measure landscape pattern.

Table 3. Measurements and indices used to describe spatial patterns in riparian and wetlands zones in the Herbert River floodplain (Adapted from Moss and Davis, 1994 and Medley et al., 1995).

Description of individual riparian areas and wetlands
- Measurement of area (*a*) and measurement of edge (*p*)
- Edge-to-area ratio using island dissection index (DI)

Description of interactions between riparian and wetland areas
- Mean, median size of riparian areas and wetlands
- Nearest neighbour centroid-to-centroid distance r_c

Description of floodplain landscape pattern
- Landscape dissection index (DL) and distribution index (IDI) for land cover types
- Frequency of number of wetland and riparian areas
- Diversity and Evenness Indices to compare changes in richness and floodplain apportionment

Table 4. Equations used in quantifying landscape pattern and spatial relationships for land cover/use.

Forest island dissection index

$$DI = \frac{p}{\left(2\sqrt{p\ a}\right)} \qquad \text{(Equation 1)}$$

where DI = forest island dissection index
p = island perimeter (metres)
a = island area (ha)

(*Source*: Sharpe *et al.* 1981: 111)

Landscape dissection index

$$DL = \sum_{i=1}^{n} \frac{p}{\left(2\sqrt{p}\sum_{i=1}^{n} a\right)} \qquad \text{(Equation 2)}$$

where DL = landscape dissection
p = total perimeter (metres)
a = total area of the forest island (ha)

(*Source*: Sharpe *et al.* 1981: 111)

Island distribution index

$$IDI = 2\bar{r_c}(lp) \qquad \text{(Equation 3)}$$

where IDI = island distribution index
$\bar{r_c}$ = mean centroid-to-centroid distance from a forest island to its nearest neighbour (Fig.3)
λ = density of forest islands (number per ha)

(*Source*: Bowen and Burgess 1981)

Shannon-Wiener Diversity Index

$$H' = -\Sigma P_i \ln P_I \qquad \text{(Equation 4)}$$

where P_i represents the proportion of of total area in category *i* of each land cover/use type
(*Source*: Medley *et al.,* 1995)

Evenness Index

$$E = H' / \ln s \qquad \text{(Equation 5)}$$

where s = total number of land cover/use categories
(*Source*: Medley *et al.,* 1995)

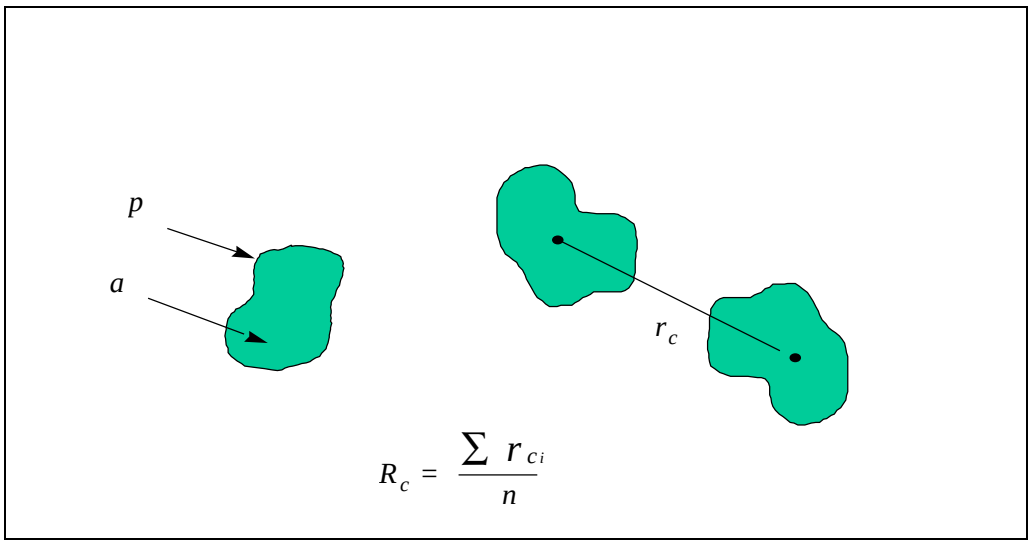

Figure 3. Diagrammatic representation of spatial parameters used in the derivation of landscape indices and measurements (Adapted from Moss and Davis, 1994).

RESULTS AND DISCUSSION

Description of riparian and wetland areas

Figure 4 shows changes in space and time of key land cover classes on the lower Herbert floodplain since European settlement. It can be seen that prior to settlement, the area was dominated by grassland, lowland rainforest, mangrove and *Melaleuca* communities. However, by the 1940's significant losses of riparian (ie rainforest patterns) and wetland (ie *Melaleuca* dominated patterns; open water) areas had occurred and much of the native grassland had been converted either to grazing or sugarcane. Land cover remained relatively stable throughout the 1960's and early 1970's, however the period between 1977 and 1996 saw a rapid expansion in the area of sugarcane. The consequences of this expansion have resulted in a 60% decrease in the area of *Melaleuca* dominated patterns (40% decrease between 1943 and 1996) and a 50% decrease in the areas of rainforest patterns when compared to pre European estimates of area. In contrast, the area of mangrove communities has remained relatively stable since 1943, while the area of sugarcane has more than tripled between 1943 and 1996.

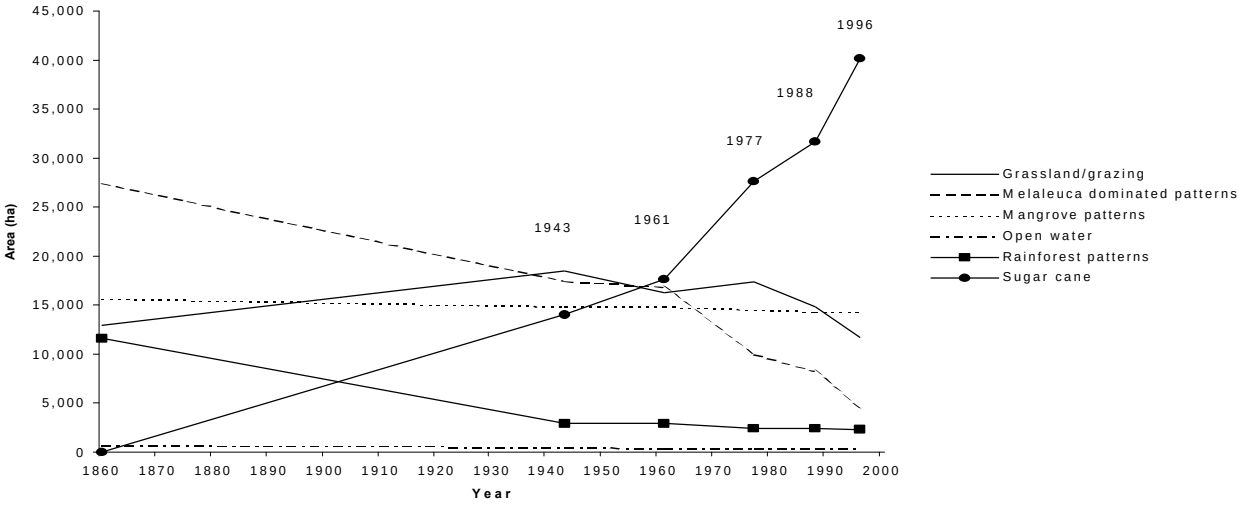

Figure 4. Spatial and temporal distribution of key land cover classes on the Herbert River floodplain.

Figure 5 shows changes in the island dissection index (DI), an index of the ratio of edge:area for land cover units. DI for wetland and mangrove areas decreased (ie > area:edge) in the period

between first European settlement and 1943 and remained relatively stable between 1943 and 1996. In contrast, DI for riparian areas increased (ie > edge:area) with time, indicating that riparian areas were increasingly becoming longer and thinner.

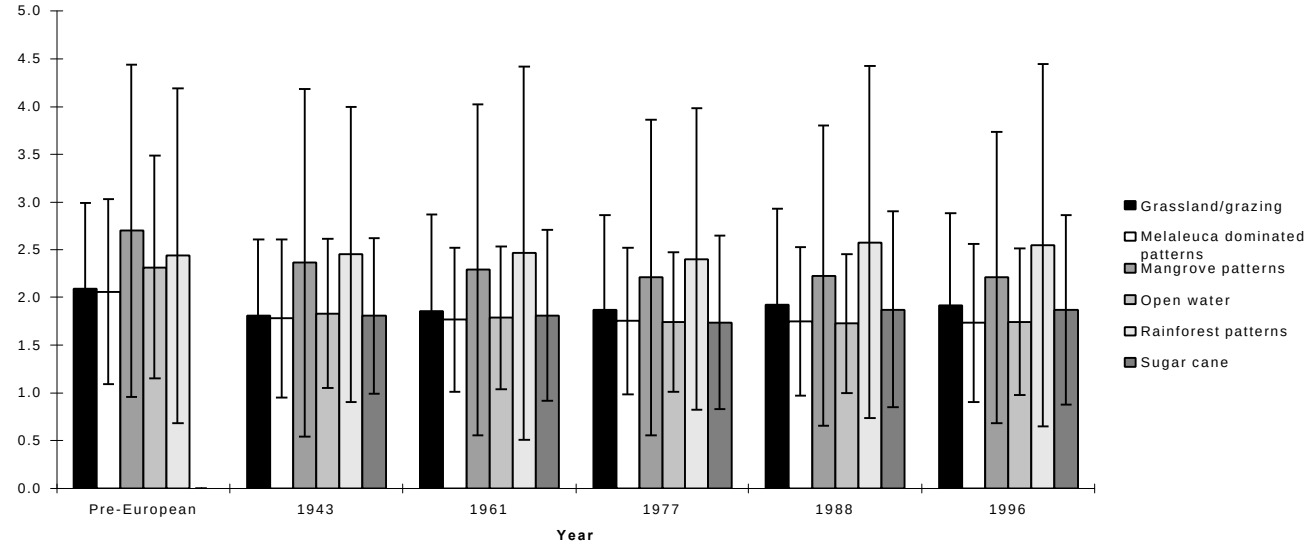

Figure 5. Mean and standard deviation of DI for key land cover classes with time.

Description of floodplain landscape pattern

Data at this level showed that although the number of riparian and wetland islands remained relatively constant since European settlement (Figure 6), mean island size for both land cover classes decreased significantly. Mean island size for riparian islands decreased from 128 ha pre-settlement to 28 ha in 1942 and 24 ha in 1996. Similarly, mean Melaleuca island size decreased from 135 ha pre-settlement to 82 ha in 1943, 46 ha in 1977 and 22 ha in 1996.

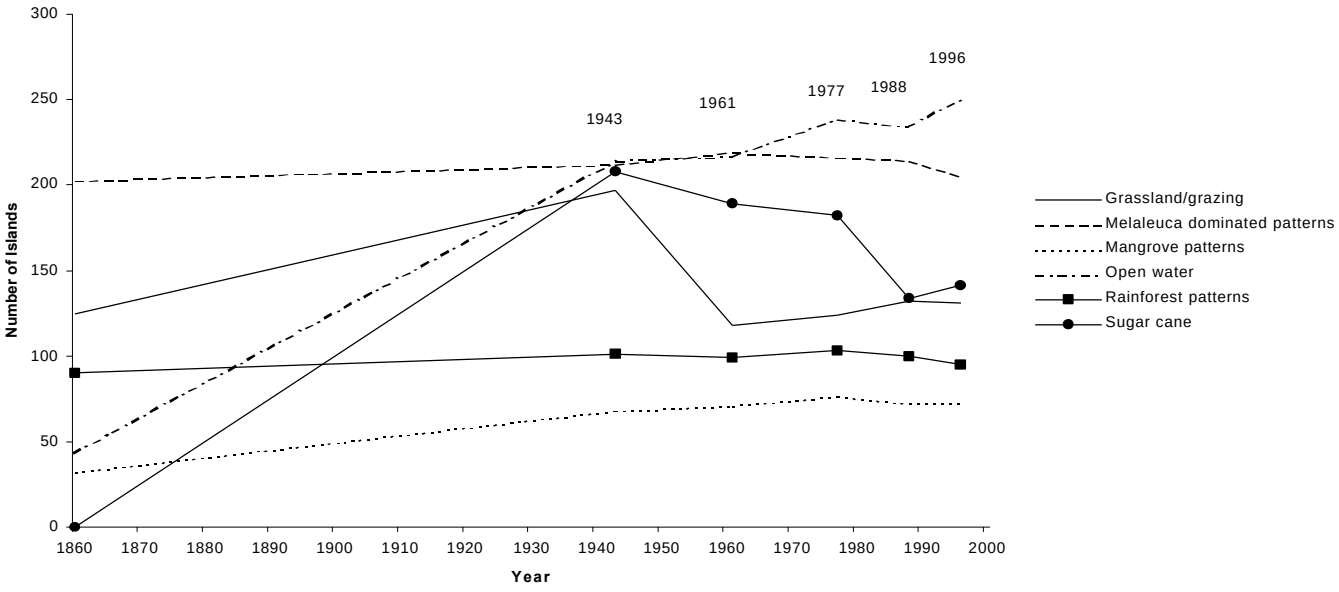

Figure 6. Changes in the number of islands for key land cover classes with time.

Island Dissection indices (IDI) for riparian and wetland areas (Figure 7) remain unchanged from pre-settlement to the 1970's, but decrease gradually after this, indicating a pattern of island aggregation. One might conclude this to be contradictory to previous results presented, however it is not unexpected given that in an ever increasing "sea" of agricultural land, remnant areas tend to occur as clusters. They appear aggregated or clumped, when land cover over the entire floodplain is considered, although as previously discussed, the mean size of each cluster is also

decreasing. Similar results were also obtained from the Landscape Dissection Index (Figure 8). The patterns observed in the IDI are supported by results obtained for measures of Diversity and Evenness, where a decline has occurred as the area of sugarcane has increased and the floodplain became less evenly apportioned (Figure 9).

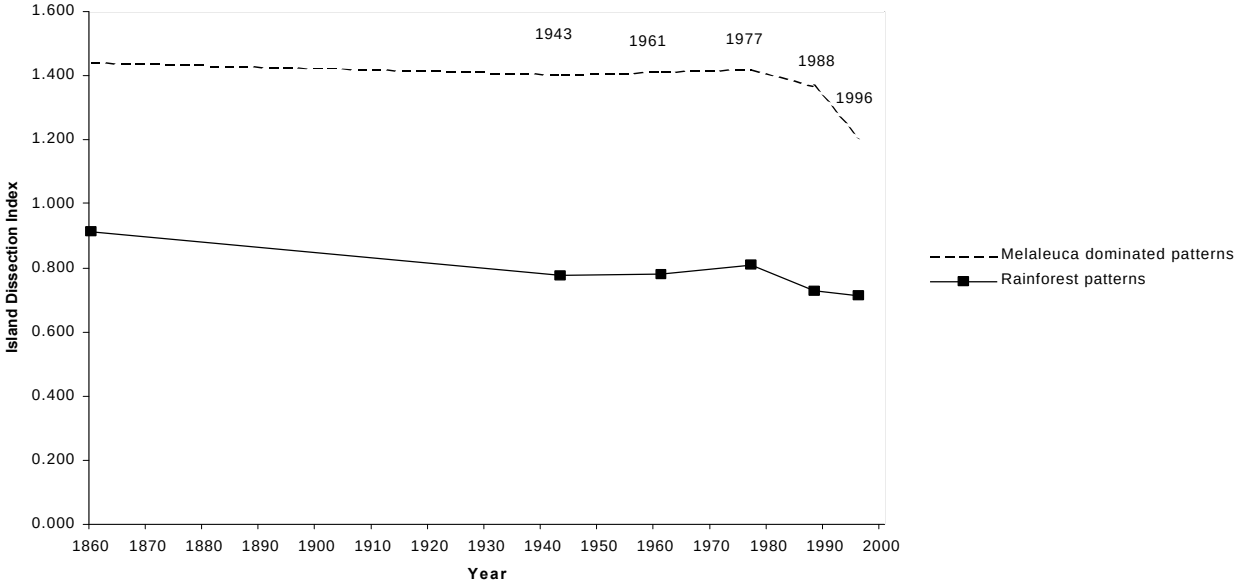

Figure 7. Changes in the Island Dissection Index for Melaleuca and rainforest dominated patterns.

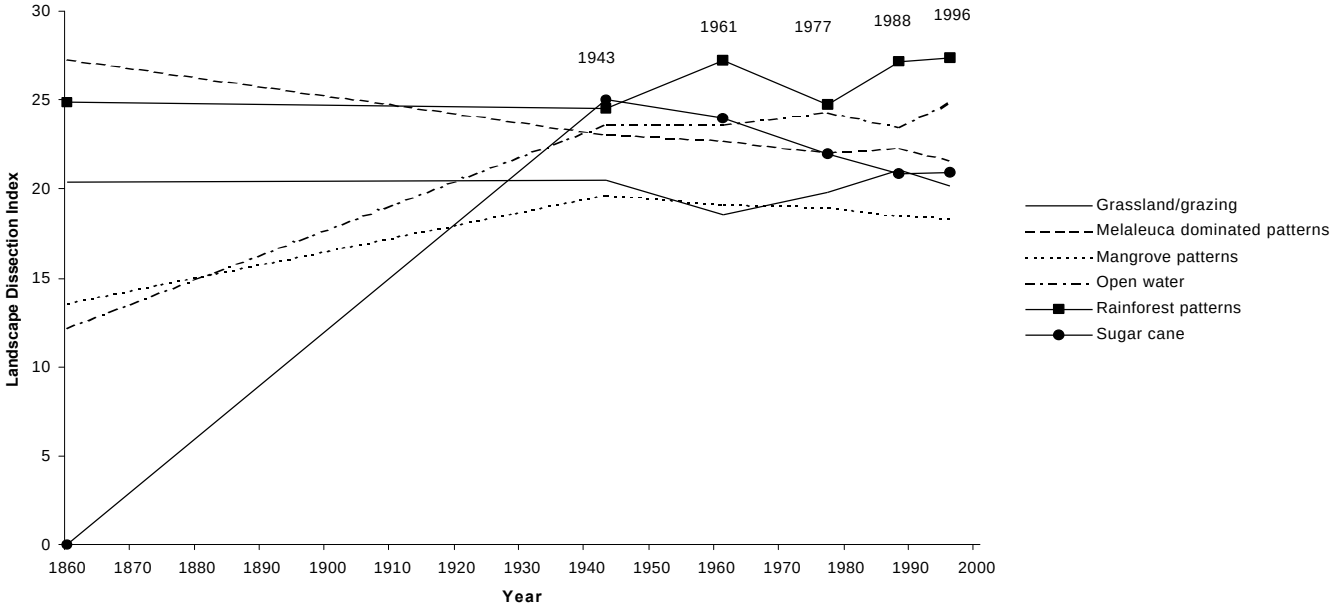

Figure 8. Changes in Landscape Dissection Index (DL) with time

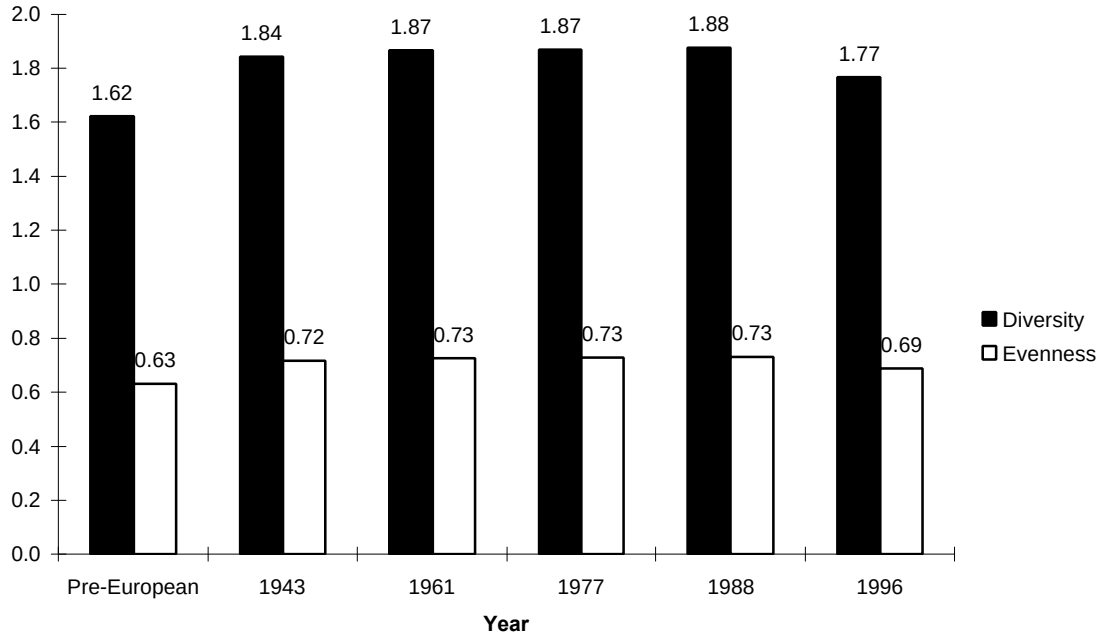

Figure 9. Measures of Diversity and Evenness for land cover on the Herbert River floodplain

Given the results presented here, it is clear that unless a change in current land management practices occurs, then the area of riparian and wetland zones on the Herbert River floodplain will be reduced to a very low level. However, it could be argued that the individual area of remnant stands of riparian and wetland vegetation are already less than is required to perform as an effective and functional biological unit. Indeed, it could be argued that rehabilitation and restoration activities are required.

In this paper we have made no attempt to evaluate the habitat status of remaining riparian and wetland areas on the floodplain. Results from the recent "State of the Rivers" analysis conducted by Moller (1996) show that the condition of remaining riparian vegetation was poor to very poor and the condition of wetland habitat moderate to poor. The trends observed on the Herbert River floodplain are not unique. Similar trends are apparent in the Tully-Murray (Tait, 1994), Johnstone (Russell and Hales, 1996), Russell-Mulgrave, Mossman-Daintree and, to a lesser extent, Burdekin-Haughton catchments. In the section that follows we attempt to introduce and discuss a range of policy, planning and management options that can contribute to the sustainable use of floodplain resources.

Opportunities for Improvement in the Management of Wetland and Riparian Zones

In detailing the opportunities for improving natural resource management in catchment areas adjacent to the GBR Marine Park, it is instructive in the first instance to provide a broader framework for future development. In so doing it is possible to draw heavily from the landmark work of Young *et al.* (1996) and place it in the context of the riparian and wetland management.

In terms of a broad policy framework, we believe that it is incumbent on industry, government and the broader community to work towards ensuring that the following objectives are fulfilled:

1. Riparian and wetland management in coastal regions is undertaken as a fundamental part of and necessary precondition for ecologically sustainable development and the implementation of the precautionary principle.
2. Responsibility for riparian and wetland management is shared between government, community and industry in a transparent manner.

3. Appropriate incentives are put in place to encourage the protection of riparian and wetland areas and to encourage their use only in ways which are ecologically sustainable.
4. Appropriate mixes of incentives are developed and appropriate weighting given to motivational, voluntary, property-right, price-based, and regulatory instruments in ways which are context sensitive and responsive to local, regional and social characteristics.
5. The Australian community as a whole - as well as users and beneficiaries of riparian and wetland areas - contribute towards the provision of incentives to industry (particularly the sugar industry in the context of coastal Queensland), whose primary responsibility is for the protection of the environment.

For this framework to be implemented, it is essential that governments at all levels develop the necessary supporting institutional capacity. Accordingly, governments at all levels must develop structures that empower local communities and industries to protect and manage riparian zones and wetlands and provide access to instruments necessary for their operation. Conversely, governments must address problems where local initiatives fail or are incomplete and importantly, must give consistent signals to resource users and consumers about the importance of riparian and wetland areas within the broader context of ecologically sustainable development.

In order to overcome some of these problems, we suggest that the appropriate boundaries for government decision making on riparian and wetlands management are bioregional. However, local government and industry, whose boundaries are rarely consistent with bioregional boundaries, have close and identifiable ties with the community, and provide an appropriate base for implementation. Hence, riparian and wetland management needs to be integrated into decision making at all levels of government, community and industry. Furthermore, stakeholders must be involved in the establishment (where they don't already exist) and operation of relevant decision making and advisory bodies (eg ICM). Improved participation of local government in the cane assignment process is also necessary. This should be done through the appointment of a local government representative(s) to Local Assignment Boards (to be known as Cane Production Boards).

Stakeholders, particularly canegrowers, also have a responsibility to ensure that their own internal processes allow real opportunities for the involvement of those at a "grassroots level". There is potential for self-interest and local needs to dominate important resource management issues. Conflict within decision-making fora represents a major potential threat to improved practice. Visible monitoring and accountability mechanisms are therefore essential pre-requisites for increased community and industry involvement, as are the development of appropriate and effective conflict resolution and facilitation processes. This is especially the case for the operation of the cane assignment system. We believe that it is more efficient to build on and adapt existing administrative and institutional structures, where possible, to address management of riparian and wetland areas rather than to create new structures. Suggested improvements in the assignment process include (Johnson *et al.,* 1996; Shrubsole, 1997):

- Reviewing the present referral process for cane assignment;
- Establishing and applying locally based conflict resolution mechanisms before requiring the formal involvement of the Queensland Sugar Corporation or Sugar Tribunal. These mechanisms should be codified in new sugar industry legislation;
- Local Boards should provide for the earlier consideration of environmental factors in the cane assignment process through existing mechanisms such as "Continuous Crushing Agreements" and corporate policies. In so doing, Local Boards can reduce the perceived need for pre-emptive clearing by adjusting the timing of the assignment process. In the Herbert River district, for example, this would see the announcement of awards in the February-March period.

Motivational and voluntary incentives

Incentives aimed at increasing levels of knowledge and understanding or requiring voluntary action, are premised on the belief that environmentally responsible behaviour is far more likely to result when people have a basic knowledge of the issues at stake, and /or a commitment to the principles of ESD (Young *et al.,* 1996). Motivational and voluntary incentives encourage all stakeholders to share information and contribute to improved management. Motivational and voluntary incentives have already been used in coastal catchments adjacent to the GBRMP, and include activities such as ICM and the Herbert Resource Information Centre (Johnson and Walker, 1996). Hence motivational incentives must be a core mechanism for improved riparian and wetland management. Two examples of a potential application would include:

- The identification of agreed wetland and riparian areas in coastal catchments to underpin negotiated agreements between landholders, government and the broader community on buffer setback widths. This activity would preferably be embedded and implemented within a broader catchment planning exercise undertaken as a partnership between government, industry and the community. In evaluating catchment resource use alternatives, stakeholders should consider existing and projected patterns in resource use and land tenure, supply and demand relationships for outputs produced, resource availability, regional and national economic indicators, environmental impacts, and community goals and expectations. Importantly, any catchment plan must include a bio-regional approach to habitat protection (Johnson and Cramb, 1992; Tait, 1994); and
- The establishment of voluntary conservation agreements between landholders and government under the *Nature Conservation Act (1992).*

For motivational and voluntary incentives to succeed, it is crucial that both the content of the information presented and the method of transferring information is appropriate and well targeted.

Property-right incentives

Two alternative types of property right incentives - covenants or management agreements, which cannot be separated from a specific resource, and those like licences to use water, which can be moved from one location to another (Young *et al.,* 1996) - are relevant in this context. Management agreements can be used to reimburse people for the costs of resource management which are not able to be recovered through normal market mechanisms. An example would be to encourage canegrowers to undertake specified management activity on private land adjacent to public conservation reserves or wetlands.

Conservation covenants are particularly effective in protecting remnant vegetation or wetlands, and can be use to underpin approaches such as management agreements. The use of conservation covenants can also be linked to other incentives, for example, the local government rating systems (for rate relief purposes), to recognise the value of uncleared land. They have direct applicability to the Burdekin, Herbert and Tully-Murray catchments. Licence and permit systems are used where there is a need to link riparian and wetland management with an economic activity, for example, pollution permits and land clearing. In the design of licence systems, there is a need to place emphasis on the dependability of the licence to protect riparian and wetland areas in an efficient and equitable manner. Central to this must be the establishment of effective monitoring strategies that not only assess specific activities (eg., cane assignment) but also general environmental performance.

Mechanisms are required which place more responsibility on developers and the sugar industry for determining the nature and extent of the serious environmental problems (eg acid sulphate soils) before review of an individual application. This may include developing and applying environmental impact assessment screening mechanisms that identify applicants who must more

adequately consider farm management and environmental issues with the submission of their assignment applications (Shrubsole, 1997).

Tradeable rights systems are frequently advocated by economists, but generally have a poor track record (Nelson, 1977). The benefit of transferable property rights are more apparent in areas where equivalent units (eg water) can be traded than where units traded may not necessarily be equivalent (eg wetland preservation schemes). Tradeable rights have a role but should never be seen as the sole solution. In virtually all cases, they need to be supported by an appropriate network of regulatory, financial and institutional measures (Young *et al.,* 1996).

Regulatory incentives

Despite advocating motivational, social and market based incentives, there remains an important role for regulation, because acting alone, non-regulatory instruments are not always effective (Napier, 1994). Regulations provide precautionary standards and an essential safety net to protect against the recalcitrant few not persuaded by other incentives. Each level of government needs to set such standards and no level of government should be able to undermine the standard set by another level of government, by a community or by industry itself. It is crucial that industry and the community be given the opportunity to contribute to the development of standards. As regulatory incentives provide protection against those who do not respond to other measure, they are particularly important when threats to riparian and wetland areas are likely to become irreversible, for example, in the case of land clearance on coastal floodplains.

Although some protection of riparian and wetland areas is currently afforded by planning controls embedded within the *Nature Conservation Act 1992*, *Coastal Protection* and *Management Act 1995*, *Fisheries Act* and *Local Government (Planning and Environment) Act 1992*, problems exist in areas subject to the provisions of the *Water Resources Act 1989* or on land with freehold tenure. An increasing regulatory role for Local Government (eg through the invocation of planning controls if consent is required for subdivision, zone change and drainage development) provides some opportunity for improved riparian and wetland management. Some of these issues are presently being addressed in the draft planning schemes of Hinchinbrook, Cardwell and Johnstone Shires. However, for improved management to occur, greater integration between local and state government, industry and the community must be a priority.

Financial Considerations

A fundamental consideration in the development and implementation of any policy or instrument mix is both the private and public cost implications. The cost of controlling and preventing damaging processes in coastal areas should be borne primarily by those who cause these problems. However, the Australian community as a whole should take financial responsibility for protecting the natural environment when the costs of doing so cannot be recovered by the use of market mechanisms. Hence, all those who benefit from non-market dimensions of protecting the natural environment, whether directly and indirectly, should contribute to the cost of its maintenance (Young *et al.,* 1996).

The tax system is an important area for reform, particularly when taxation incentives are recognised to be the most cost effective means of encouraging altruistic investments in resource conservation by the private sector (Davenport, 1995). Another method of ensuring that users pay, is the imposition of levies and charges. These have the additional benefit of making users of riparian and wetland areas aware of the cost of their activities (Young *et al.*, 1996). Acceptance of such levies is likely to be improved if the funds raised are clearly seen to be working towards resource management and protection, preferably by being placed in resource management funds administered by the local community. Opportunities also exist for the implementation of financial incentives for retention and management of high value habitat areas dedicated as Nature

Refuges or Coordinated Conservation Areas. Finally, government acquisition of riparian and wetlands of regional, national and international importance remains as an option.

CONCLUSIONS

It is difficult to judge the rate at which the first settlers on the Herbert River floodplain cleared the native vegetation and thus began to fragment riparian and wetland areas. However, in summary, the evidence presented in this paper clearly demonstrates the following:

- A rapid decline in the area of riparian and wetland zones;
- A 60% decrease in the area of *Melaleuca* dominated patterns (including a 40% decrease since 1943); triple the area of sugarcane since 1943;
- A 50% decrease in rainforest patterns;
- Riparian areas becoming narrower;
- While the number of riparian and wetland islands remained constant, mean island area decreased significantly;
- Aggregation of islands on the floodplain occurring since 1943;
- A significant decline in Diversity and Evenness measures; and
- A more uniform/less diverse landscape now exists when compared with historical patterns.

These trends measured in the Herbert are not unique and are manifest in most catchments adjacent to the GBRMP. In response to these trends we proposed a range of policy, planning and management options that can contribute to improved resource management.

It is clear that policy environment for natural resource management in coastal areas will continue to respond to changing political, economic, social and environmental considerations. While the manner in which riparian and wetland resources are managed will vary, public expectations for, and support of, effective management policies will remain. In this regard, the principles for ESD will likely form a general basis for the development of new, and hopefully improved initiatives in riparian and wetland management. The general trend of shifting management responsibilities to lower levels of government is likely to continue, although the extent will be guided by overriding state and federal government policies.

In this paper we have demonstrated that concerns relating to the decline in riparian and wetland resources in catchments adjacent to the GBRMP are justified and requiring of further attention. Given that agricultural industries in these areas are, like most other Australian agricultural industries, operating in the context of an ever-increasing community expectation for the preservation of riparian and wetland areas, conflict over the use of these scarce resources is likely to grow in the future.

We have demonstrated that the magnitude of the tasks facing stakeholders in catchments adjacent to the GBRMP, in terms of the way in which they manage riparian and wetland areas in the future, remain substantial. Accordingly, the challenge for these stakeholders, but especially landholders, is to embrace, rather than resist the inevitable trend toward greater public intervention in its affairs. The challenge facing government is to provide a stable environment in which locally relevant decision-making can occur and which is supported with appropriate and viable monitoring, cost-sharing and regulatory arrangements. Stakeholders in the region have the rare opportunity to have a significant say in their future directions. Agricultural industries in particular, need to develop their own policies and activities to guide their future developments within a wider context. In so doing, they must recognise that external pressures will evolve with time; hence planning must be a continuous activity rather than a singular exercise. Further, all stakeholders in partnership together, must develop a strategic view on where and how natural resources will be used. This view will be need to be based on the best available technical information and will occur at a regional, catchment and local level.

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Chapter 7

Land Cover Change and its Environmental Significance in the Herbert River Catchment, North-East Queensland

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ABSTRACT
There has been considerable recent concern over the amount of vegetation clearance in the wet tropics of northern Australia. This paper reports on the results of a case study undertaken in the lower Herbert River catchment in north-east Queensland, that utilised remote sensing and Geographic Information Systems (GIS) to assess both spatial and temporal changes in land cover since European settlement in the mid 19th Century. We demonstrate that since European settlement, there has been a substantial reduction in the area of *Melaleuca*, rainforest and *Eucalyptus* dominated land cover patterns. We also provide a range of quantitative measures to show that the landscape diversity, integrity and quality of these ecosystems has also declined between the 1860's and 1996. We conclude that reform is required at policy, planning and enterprise levels if the ecological, economic and social values of these systems are to be maintained in the future.

INTRODUCTION

The land cover of many of the river catchments in north-east Queensland has been extensively modified since European settlement in the mid 19th Century (Russell and Hales, 1993; Sattler, 1993). *Melaleuca* wetlands, Eucalypt woodlands and rainforest once covered large areas which are now used for intensive agriculture and grazing (Tait, 1994). Clearing for agriculture has left only remnants of these ecosystems (Russell *et al.,* 1996). In addition, remnant vegetation in many of these catchments is frequently small in unit area and degraded through exotic weed invasion (Johnson *et al.,* 1997).

It is likely that systems in such poor condition have suffered a corresponding degradation of their intrinsic ecological values (Arthington *et al.,* 1997). In the Johnstone River catchment, for example, the area of wetlands has decreased by approximately 60% since 1951 (Russell and Hales, 1996). The most significant losses have been of freshwater wetlands, particularly *Melaleuca* communities. *Melaleuca* forests, notably those to the south of the Johnstone estuary, have been reduced in area by approximately 78%. There have also been significant reductions in other wetland categories, including a 64% reduction in palm and pandanus dominated wetlands and a 55% reduction in freshwater reed swamps (Russell and Hales, 1996). Freshwater wetlands to the north and west of the confluence of the North and South Johnstone Rivers have also almost entirely disappeared during this period. In contrast, the area of mangrove patterns has remained almost stable. Of the riparian forests assessed by, 72% were degraded.

In the Tully and Murray River catchments, less than 20% of land systems suitable for agricultural production remain under native vegetation (Tait, 1994). Large areas of *Melaleuca* wetland have been lost or degraded by clearing, draining and exotic weed invasion. The fish habitat values of remnant floodplain wetlands have been severely reduced as a consequence of agricultural drainage. Riparian vegetation of the Tully and Murray River catchments has also been degraded due to clearing, erosion and exotic weed invasion. Infestation of watercourses with para grass (*Brachiaria mutica*) has resulted in the prevention of re-establishment of riparian vegetation and a severe reduction in the value of aquatic habitat (Tait, 1994). Similar phenomena are manifest in the lower Burdekin, Herbert, Mulgrave-Russell, Barron and Mossman and Daintree River catchments (Congdon and Lukacs, 1995).

While the current extent of land cover in river catchments of north-east Queensland is generally known, the spatial and temporal distribution of land cover since European settlement is poorly understood. The aim of this paper is to describe changes in space and time of land cover in north-east Queensland, using a case study undertaken in the lower Herbert River catchment. While the focus of the paper is not on impacts of these changes *per se*, the results identify a number of significant issues that are central to the management, maintenance and function of natural resources in the region.

Study Area

The Herbert River catchment drains an area of approximately 10000 km2 to the Coral Sea and is the largest of the river systems located in Australia's sub-humid to humid tropical north east (lat. 15-19^0 S, long. 145-146^0 E) (Figure 1). The Herbert River rises at an elevation of approximately 1070 m and has a total length of 340 km. The catchment has three distinct geomorphic sections; the upper catchment (6000 km^2), the intermediate catchment (1000 km^2) and the lower catchment (3000 km^2). In the upper catchment, the topography ranges from level alluvial plains to rugged, deep incised ranges. In the western parts, the land is generally gently undulating while in the eastern portion of the upper catchment, the topography rises irregularly and reaches altitudes over 1000 m. The middle catchment consists of a deep gorge before entering the lower catchment. The lower catchment consists of a coastal plain flanked by mountains in excess of 1000 m high, but commonly at 600 to 900 m with steep slopes.

The catchment normally experiences warm humid to sub-humid summers and mild dry winters. Large rainfall and temperature gradients exist across the catchment and variability of rainfall is also very high. Mean annual rainfall is 1370 mm and ranges from in excess of 4000 mm in the coastal ranges to 750 mm in the extreme west. Approximately 74% of the mean annual rainfall occurs from December to March, decreasing to a minimum in the June to October period.

Agricultural and pastoral production are the largest users of land in the catchment. In terms of arable agricultural production, the sugar industry located in the lower catchment is dominant, with approximately 65000 ha of sugarcane under cultivation. Other important industries are plantation forestry, beef cattle and small crops such as pineapple, melon and pumpkin. Less important crops include paw paw, banana, lychee and mango. Lands not used for arable agriculture are mainly under native vegetation or improved pastures for beef cattle production. This is especially the case in the upper catchment. Small areas are utilised for mining (in the upper catchment only) and industrial activities, or are alienated for urban development. The catchment has two major population centres (Ingham and Ravenshoe) and a population of approximately 20758 (1996 Census), of which 66% are located in the lower catchment.

Methods

Land cover of the lower Herbert River catchment was visually interpreted from scanned and rectified 1:25000 aerial photography acquired in 1943, 1961, 1970, 1977, 1988 and 1992 (spatial accuracy ±7m) and 1:10000 digital orthophotography acquired in 1993, 1994 and 1995 (spatial accuracy ±1m). An unsupervised classification of SPOT Panchromatic and MSS imagery was used to map land cover in 1996 (spatial accuracy ±10m). Land cover boundaries were mapped onto a geo-referenced digital base (spatial accuracy ±10m) in ARCINFO GIS. Classification drew heavily on previous vegetation (Tracey, 1982; Blackman *et al.* (1992); Perry, 1995) and soil surveys (Wilson and Baker, 1990; Heiner and Grundy, 1994) in the region. Validation of 1996 mapping units and mapped boundaries was conducted by vehicle and foot traverses. Approximately 150 sites were visited during these inspections. Classification of units and boundaries not inspected in 1996 was undertaken by extrapolation from equivalent photographic units.

In addition to mapping observed land cover, an estimate of land cover prior to European settlement (circa 1860's) was developed from a simple rule base that related remaining stands of native vegetation and the known distribution of soils, topography, relief, hydrology and rainfall. A time series was developed to elucidate spatial and temporal change in land cover.

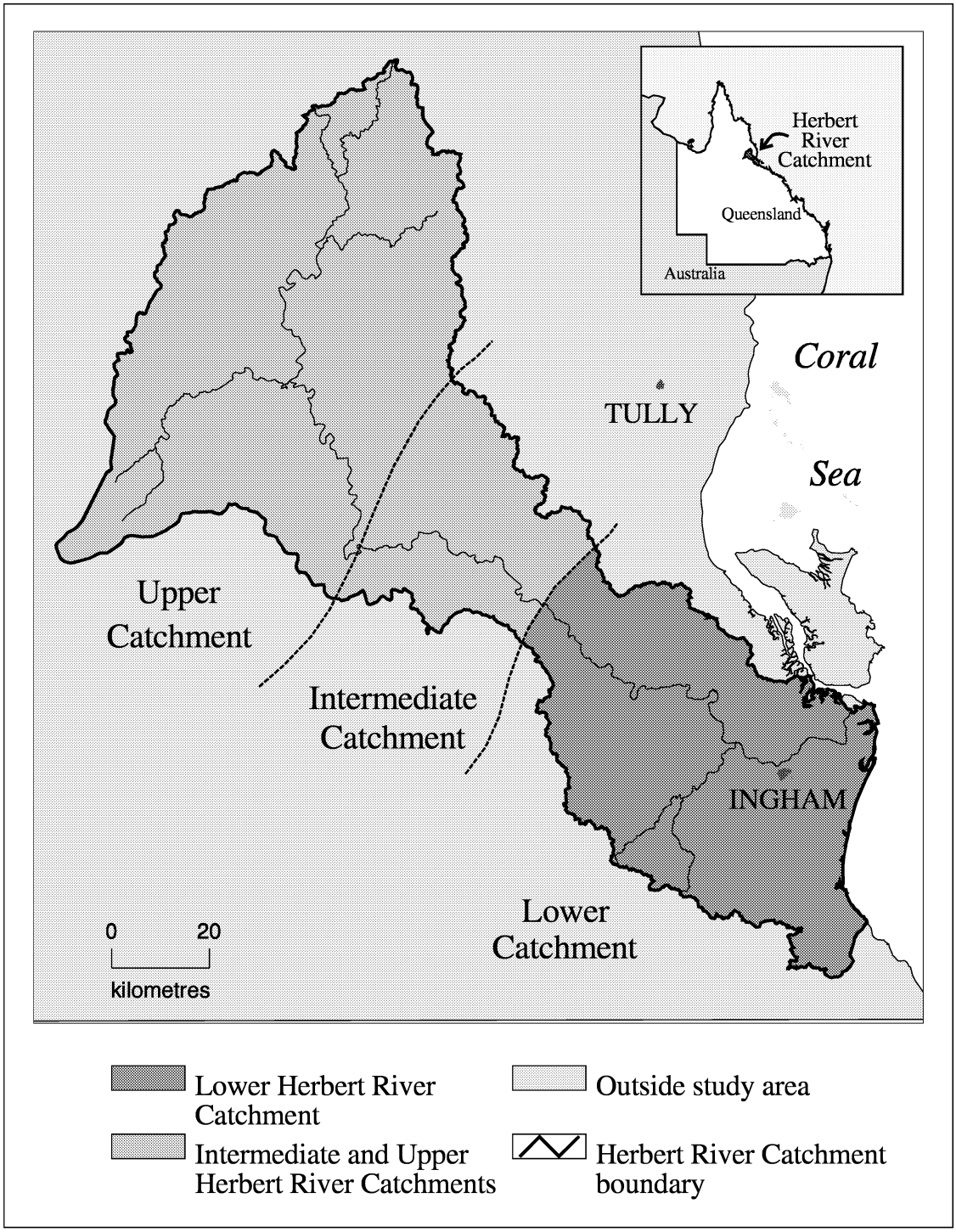

Figure 1. Location of the study area.

A spatial analysis of land cover in the lower Herbert River catchment was also undertaken. A number of key indices were calculated in ARCINFO to quantify changes in shape, size and spatial pattern of vegetation units. These indices have been successfully used in a number of similar studies:

- *Edge:area ratio*, which quantifies the amount of irregularity in the shape of remnant stands of vegetation (Sharpe *et al.*, 1981);
- *Forest island dissection index* (DI), which compares the amount by which any one "island" (or in GIS terms, polygon) of vegetation is more dissected than another and, therefore, would have a greater edge to interior. Any index greater than 1 is a measure of such irregularity in comparison to an index of 1, which is circular in shape (Sharpe *et al.*, 1981). DI can be represented by the following equation:

$$DI = \frac{p}{\left(2\sqrt{p\ a}\right)}$$

- where p = island perimeter (metres) and a = island area (ha)
- *Landscape dissection index* (DL), which measures the cumulative edge:area ratio for the entire landscape (Sharpe *et al.*, 1981). DL can be represented by the following equation:

$$DL = \sum_{i=1}^{n} \frac{p}{\left(2\sqrt{p}\sum_{i=1}^{n} a\right)}$$

- where p = total perimeter (metres) and a = total area of the forest island (ha);
- *Island distribution index* (IDI), which measures landscape aggregation and is similar in logic to the nearest neighbour statistic. IDI emphasises the pattern of islands in the landscape. IDI = 1 in a randomly distributed population, < 1 in an aggregated population and approaches uniformity if the value is close to 2.1491, where islands would have maximum spacing, in which case they are regularly distributed in a hexagonal pattern (Bowen and Burgess, 1981). IDI can be represented by the following equation: $IDI = 2\bar{r}_c(lp)$

  where $\bar{r}_c$ = mean centroid-to-centroid distance from a forest island to its nearest neighbour and λ = density of forest islands (number per ha)
- *Diversity* (H') and *Evenness* (E) indices which compare changes in richness and landscape apportionment (Medley *et al.*, 1995). H' and E can be represented by the following equations:

$$H' = -\Sigma P_i \ln P_I$$

  where P_i represents the proportion of total area in category i of each land cover/use type

$$E = H' / \ln s$$

  where s = total number of land cover/use categories
- *Number* and density of islands (ie number per unit area) and cover class as a % of total area measure landscape pattern.

Results

Land cover change in the lower Herbert River catchment

Land cover in the lower Herbert has changed substantially since European settlement. Figures 2 and 3 show changes in area with time of land cover in the lower Herbert catchment since the 1860's. It can be seen that prior to settlement, the area was dominated by open grassland, rainforest patterns, mangrove patterns, Eucalypt woodlands and *Melaleuca* communities. However, by the 1940's large losses of rainforest patterns and *Melaleuca* dominated patterns had occurred and much of the native grassland had been converted either to grazing or sugarcane. Land cover remained relatively stable throughout the 1960's and early 1970's, however, the period between 1977 and 1996 saw a rapid expansion in the area of sugarcane. The consequences of this expansion have resulted in a decrease of approximately 65% in the area of *Melaleuca* dominated patterns (comprising a 43% decrease between 1943 and 1996), a 60 % decrease in the area of beachside vegetation, a 20% decrease in the area of Eucalypt woodland

and a 10% decrease in the areas of rainforest patterns when compared to pre-European estimates of area. In contrast, the area of mangrove communities and open water has remained relatively stable since 1943, while the area of sugarcane has more than tripled between 1943 and 1996. As expected the area of urban and industrial land cover has increased since European settlement, however the total area alienated is small within the context of total catchment area (ie <1%).

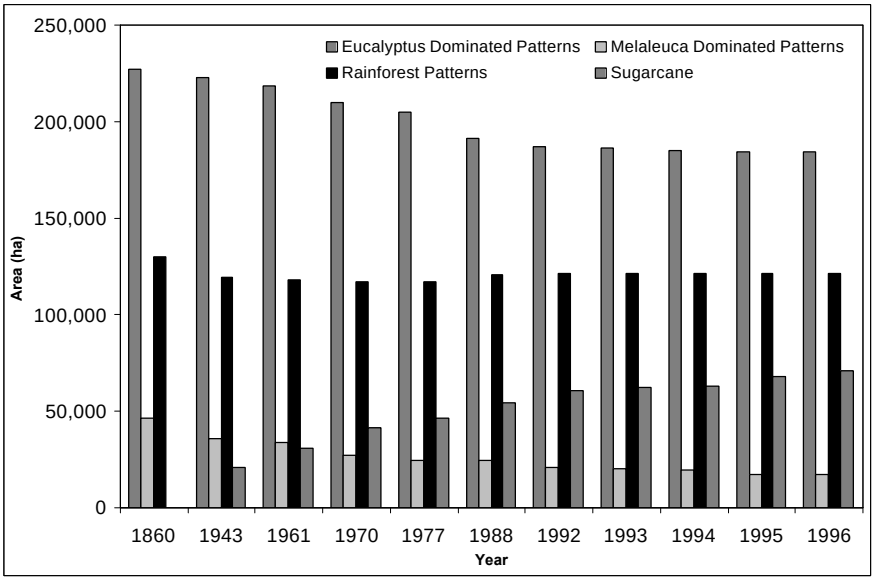

Figure 2. Changes in the area of 4 key land cover types in the lower Herbert River catchment since European settlement. The bars for each time period are from left to right: *Eucalyptus* dominated patterns, *Melaleuca* dominated patterns, rainforest patterns and sugarcane.

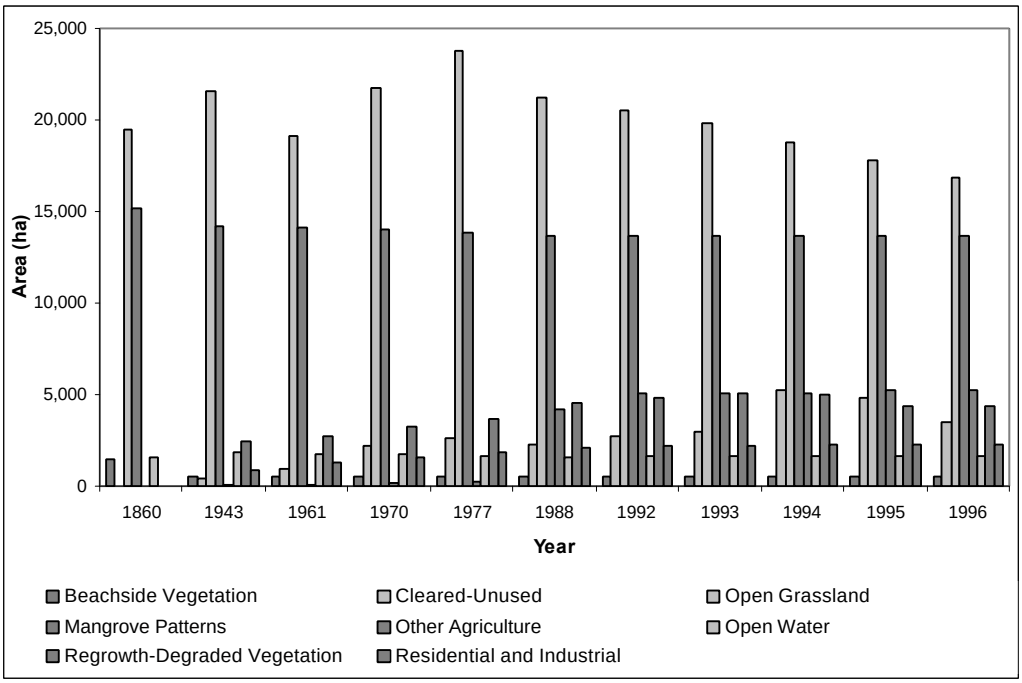

Figure 3. Changes in area of other land cover types in the lower Herbert River catchment since European settlement. The bars for each time period are from left to right: beachside vegetation, cleared-unused, open grassland, mangrove patterns, other agriculture, open water, regrowth-degraded vegetation, residential and industrial.

Landscape pattern in the lower Herbert River catchment

Figure 4 shows that with the exception of beachside vegetation, the number of *Melaleuca*, Eucalypt and rainforest islands has increased since European settlement. The number of sugarcane islands has remained relatively stable over the last 50 years, however island number peaked during major periods of sugar industry expansion in the 1970's and 1995/96. Although the number of islands increased for *Melaleuca*, Eucalypt and rainforest land cover, mean island size for these classes has decreased substantially over the last 50 years (Figure 5). For example, mean island size for *Melaleuca* forest islands decreased from 126 ha pre-settlement to 97 ha in 1942 and 43 ha in 1996. Similarly, mean island size for Eucalypt woodlands decreased from 818 ha in 1860 to 546 ha in 1943, 465 ha in 1977 and 392 ha in 1996. The number of islands of open grassland increased by 300% between settlement and 1996, although mean island area decreased by 75% over the corresponding period. In contrast, mean island area for sugarcane increased by 320% between 1943 and 1996 as sugarcane areas aggregated into larger production units.

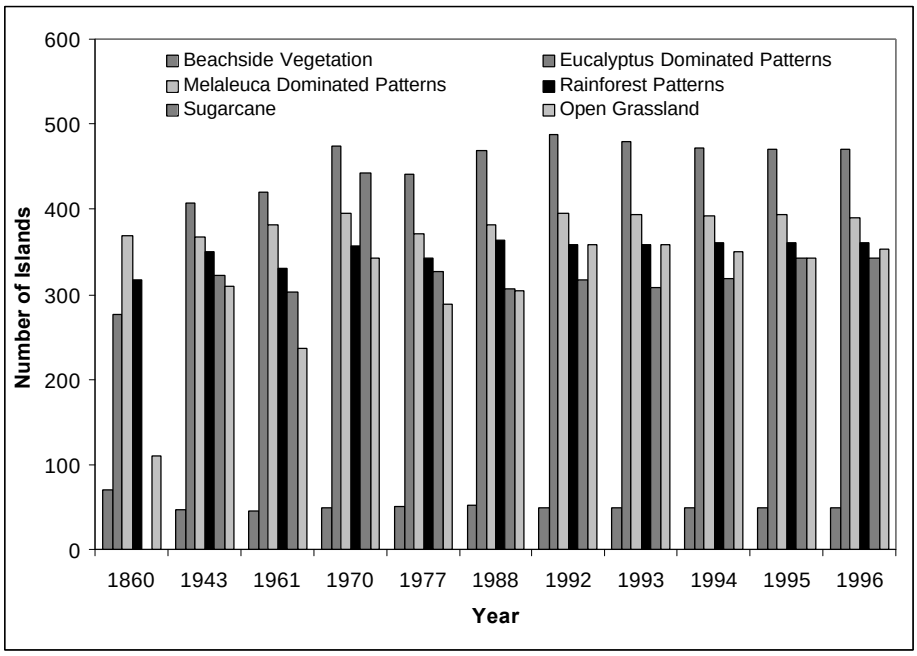

Figure 4. Change statistics for number of islands for key land cover classes in the lower Herbert River catchment. The bars for each time period are from left to right: beachside vegetation, *Eucalyptus* dominated patterns, *Melaleuca* dominated patterns, rainforest patterns, sugarcane and open grassland.

Island distribution indices (IDI) for rainforest and *Melaleuca* patterns (Figure 6) show contrasting island aggregation characteristics. Rainforest patterns show an increasing IDI, indicating that remnant cover is disaggregated, while IDI for *Melaleuca* patterns declines over time, indicating a pattern of island aggregation. It could be concluded that this contradicts results presented in Figures 4 and 5, although it is not unexpected given that in an ever increasing "sea" of agricultural land, remnant areas of *Melaleuca* tend to occur as clusters on the floodplain. However, as previously discussed, the mean size of each cluster is also decreasing.

Landscape distribution indices (DL) for rainforest patterns, *Melaleuca* patterns and sugarcane have increased since 1943, indicating that islands of these land cover classes have become longer and narrower over time (Figure 7). These results support those obtained for IDI distributions as shown in Figure 6. In contrast, DL index values for Eucalypt woodlands and beachside vegetation have remained nearly constant over the same period.

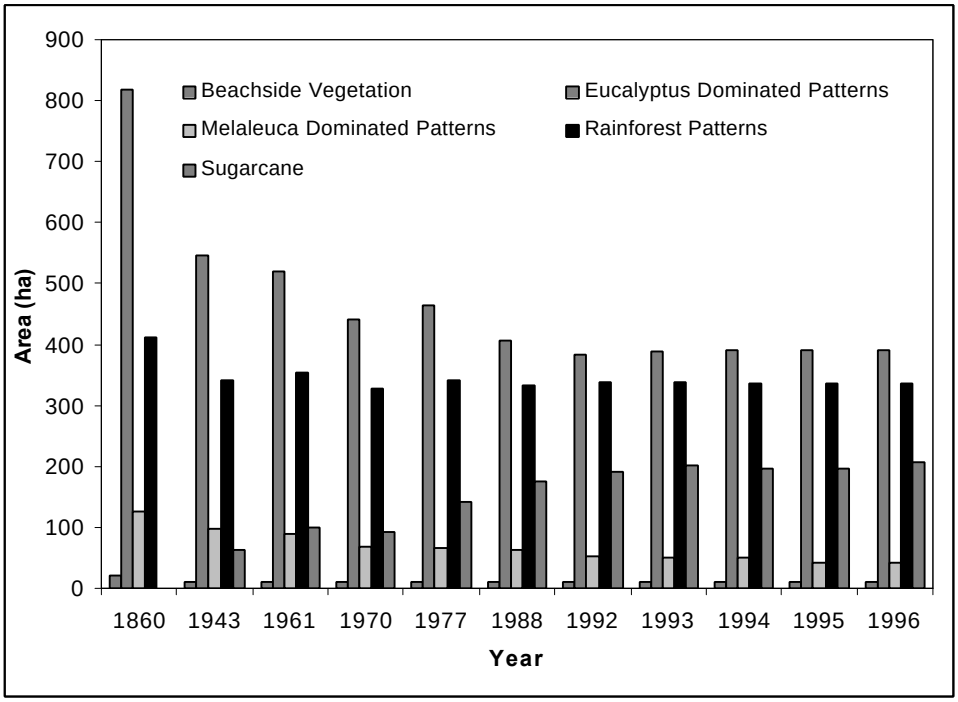

Figure 5. Change statistics for mean island area for key land cover classes in the lower Herbert River catchment. The bars for each time period are from left to right: beachside vegetation, *Eucalyptus* dominated patterns, *Melaleuca* dominated patterns, rainforest patterns, and sugarcane.

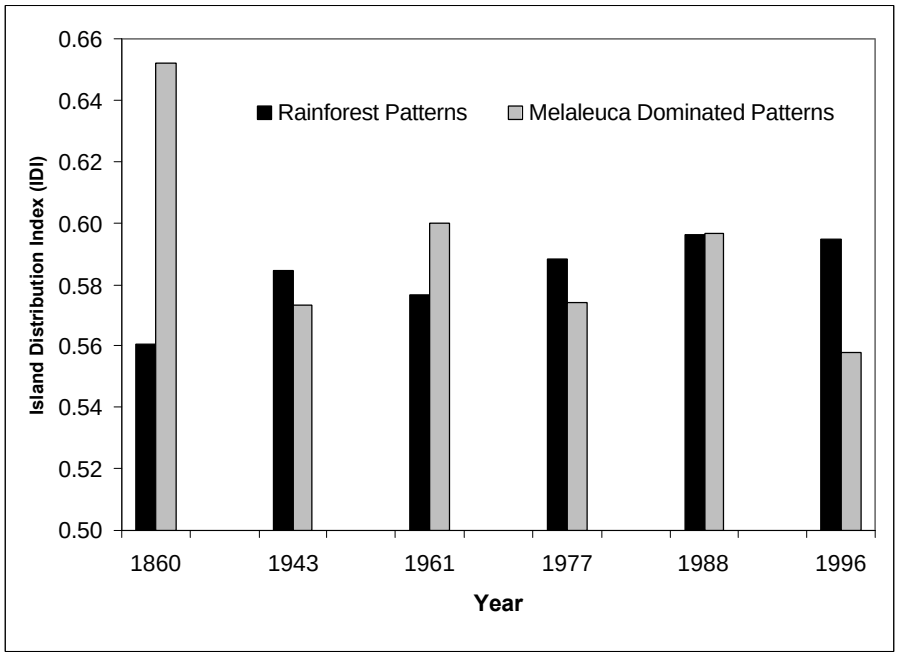

Figure 6. Change statistics for the Island Distribution Index for rainforest and *Melaleuca* patterns in the lower Herbert River catchment.

Measures of Diversity and Evenness show an increasing landscape richness and evenness in the lower catchment between European settlement and 1994, as the landscape became more evenly divided among component cover types. However both measures begin to decline post 1994, in response to the large increase in the area of sugarcane (Figure 8).

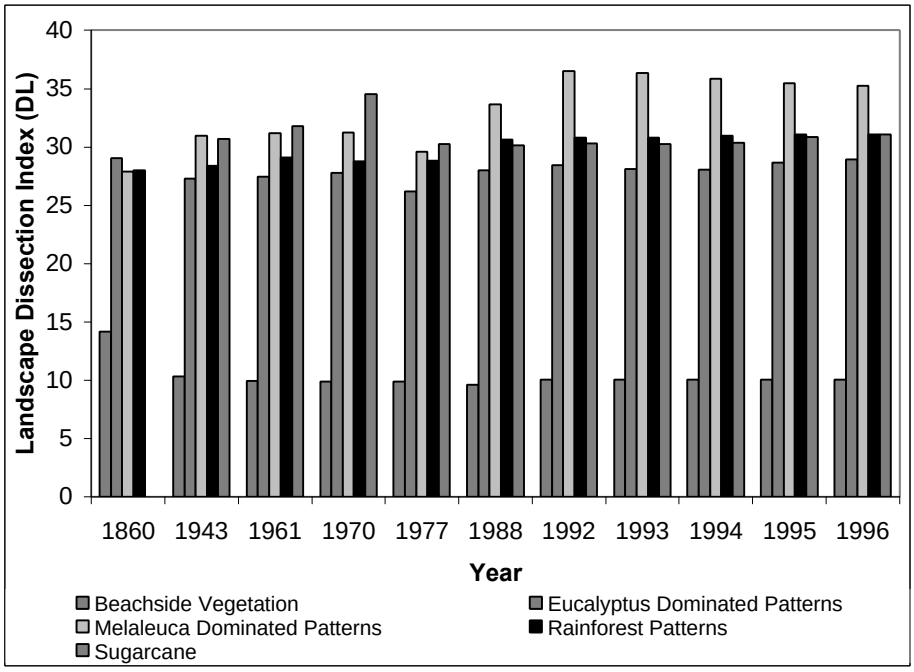

Figure 7. Change statistics for the Landscape Dissection Index for key land cover classes in the lower Herbert River catchment. The bars for each time period are from left to right: beachside vegetation, *Eucalyptus* dominated patterns, *Melaleuca* dominated patterns, rainforest patterns, and sugarcane.

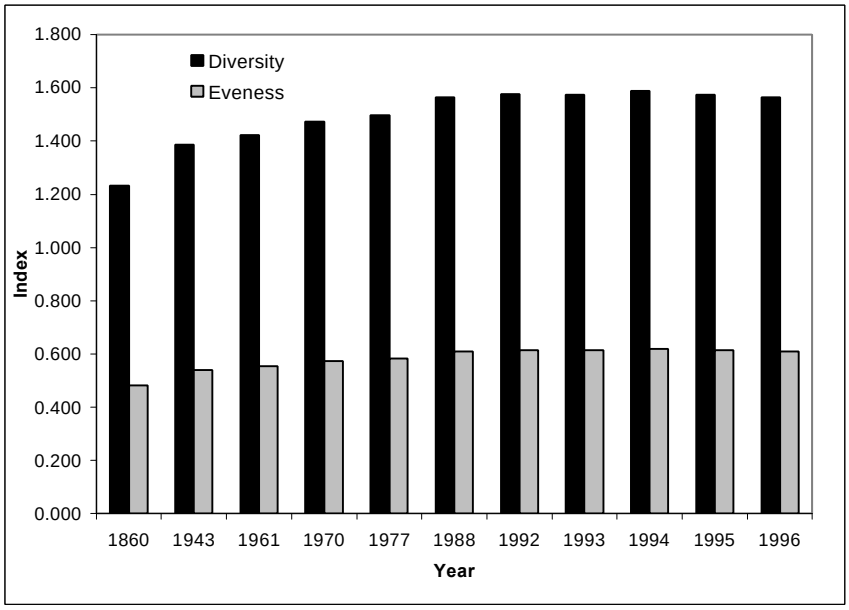

Figure 8. Change statistics for Diversity and Evenness measures in the lower Herbert River catchment.

DISCUSSION AND CONCLUSIONS

The extent and nature of vegetation clearance can provide a useful indicator of environmental quality in the Herbert River catchment. As well as providing a direct indicator of the impact of agricultural development on native vegetation, vegetation clearance can also act as an indicator of general ecosystem disturbance. Studies such as this can assist decision-makers in assessing

resource condition and addressing the broader requirements of natural resource policy development and planning. The evidence presented in this paper clearly demonstrates a substantial reduction in the area of native vegetation in the lower Herbert River catchment over the last 50 years. The significance of land cover change in the lower Herbert since European settlement can be summarised as follows:

- A 65% decrease in the area of *Melaleuca* dominated patterns (43% decrease between 1943 and 1996);
- A 60 % decrease in the area of beachside vegetation;
- A 20% decrease in the area of Eucalypt woodland;
- A 10% decrease in the area of rainforest patterns;
- No significant change in the area of mangrove communities and open water;
- A 300% increase in the area of sugarcane between 1943 and 1996;
- An increase in the number of islands of *Melaleuca*, Eucalypt and rainforest land cover;
- A large decline in mean island size for *Melaleuca*, Eucalypt and rainforest land cover;
- A 320% increase in mean island size for sugarcane;
- Rainforest areas becoming disaggregated and narrower with time;
- Aggregation of *Melaleuca* patterns between 1943 and the present;
- A recent decline in landscape Diversity and Evenness measures in response to recent large increases in the area of sugarcane ; and
- A more uniform/less diverse landscape now exists on the Herbert coastal floodplain when compared with historical patterns.

These results support those obtained in a companion study focussing on land cover changes in seasonally inundated areas of the lower Herbert floodplain (ie areas below 13m AHD) (Johnson *et al.*, 1997). This study showed that mean island size for rainforest islands decreased from 128 ha pre-settlement to 28 ha in 1942, and 24 ha in 1996. Similarly, mean island size for *Melaleuca* forests decreased from 135 in 1860 to 82 ha in 1943, 46 ha in 1977 and 22 ha in 1996. The trends observed in the lower Herbert River catchment are not unique. Similar trends are apparent in the Tully, Murray (Tait, 1994), Johnstone (Russell and Hales, 1996), Mulgrave-Russell, Mossman, Daintree and, to a lesser extent, Burdekin and Haughton River catchments (Johnson *et al.*, 1997).

Given the results presented, it is clear that ecosystem integrity in the lower Herbert has been altered substantially. Hence, unless a change in current land use policy, planning and management occurs, then the area of *Melaleuca*, Eucalypt and rainforest cover in the catchment (and indeed in other catchments in the region) will be reduced to a very low level. It is likely that the area of these classes on the floodplain proper are already less than is required to perform as effective and functional biological units (Johnson *et al.,* 1997). While we have made no attempt in this paper to evaluate the ecological status of remaining riparian and wetland areas on the Herbert floodplain, a recent ecological audit of river catchments in Queensland (Moller, 1996) has shown that the ecological condition of remaining stands of native vegetation outside of reserves and National Parks is poor to very poor. Our results have, however, served to identify those land cover types requiring priority management attention. In response to these trends we argue that improved policy, planning and management is required if areas of *Melaleuca*, Eucalypt and rainforest land cover are to be protected or maintained in the future.

In this paper we have demonstrated that concerns relating to the decline in riparian and wetland resources in river catchments in north-east Queensland are justified and requiring of further attention. Given that agricultural industries in these areas are, like most other Australian agricultural industries, operating in the context of an ever-increasing community expectation for the preservation of riparian and wetland areas, conflict over the use of these scarce resources is likely to grow in the future. Hence, the challenge facing government is to provide a stable environment in which locally relevant decision-making can occur and which is supported with appropriate and viable monitoring, cost-sharing and regulatory arrangements. In addition,

agricultural industries in particular, need to develop their own policies and activities to guide their future developments within a wider context and in so doing contribute to a reversal in the rapid historical decline of *Melaleuca*, Eucalypt and rainforest land cover in river catchments such as the Herbert.

For effective natural resource planning to occur in the wet tropics it will be important to acquire an accurate representation of land cover change in catchments other than the Herbert. It is also important that this understanding is preferentially acquired for coastal areas where serious concern exists over the ecological status of freshwater wetland and riparian areas (Johnson *et al.,* 1997). Finally, if the region is to move toward achieving sustainable development in the future, broad agreement needs to be reached between stakeholders in industry, government and the broader community as to what constitutes an acceptable level of landscape modification, or indeed if landscape rehabilitation is required.

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Chapter 8

Distribution of Coastal Freshwater Wetlands and Riparian Forests in the Herbert River Catchment and Implications for Management of Catchments Adjacent the Great Barrier Reef Marine Park

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SUMMARY
Because coral reefs are sensitive to land derived inputs of nutrient and sediment, there is concern worldwide for the effects of anthropogenic change in river catchments on reefs. Thirty-one river catchments drain directly into the waters of the Great Barrier Reef, NE Australia This case study was undertaken on the floodplain of the Herbert River catchment in north Queensland, utilising remote sensing and GIS to assess both spatial and temporal changes in freshwater wetlands and riparian forests. We demonstrate that there has been a very large reduction in the area of these ecosystems since European settlement in the mid 19th Century, with an 80% decline in their extent since 1943. We also provide a range of quantitative measures to show that the landscape diversity of these ecosystems has also declined. These changes are of importance in terms of regional, national and international trends. We argue that policy, planning and management reform is required if the remaining ecological, economic and social values of these systems and the adjacent Great Barrier Reef Marine Park are to be maintained.

INTRODUCTION

The Great Barrier Reef Marine Park (GBRMP) covers an area of approximately 350000 km^2 and spans almost 2000km of the east coast of Queensland, Australia. The GBRMP is a marine ecosystem that is recognised internationally for its unique biological and physical features. Thirty-one river catchments, covering an area of approximately 375000 km^2, drain directly into the GBRMP (Fig. 1). Current environmental trends suggest a decline in coastal terrestrial and riverine systems, and on the adjacent marine environment (Anonymous, 1993; Arthington *et al.,* 1997).

The vegetation of many of the river catchments adjoining the GBRMP has been extensively cleared (Russell and Hales, 1996) since the mid 19th Century. Freshwater wetlands and riparian forests once covered large areas of coastal floodplains which are now used for agriculture (Tait, 1994). Prior to clearing, these wetlands would have provided extensive buffer strips protecting coastal river systems, estuaries and shorelines. Clearing, notably for sugarcane cultivation, has left only remnants of these ecosystems (Russell *et al.,* 1996). Present-day wetlands and riparian forests in many catchments are frequently narrow and sparsely vegetated and have been invaded by exotic weeds (Johnson *et al.,* 1997). It is likely that wetlands and riparian forests in such poor condition have suffered a corresponding degradation of their intrinsic ecological values (Arthington *et al.,* 1997).

The status of freshwater wetlands and riparian forests in river catchments adjacent to the GBRMP has been reviewed superficially by a number of authors (eg Arthington and Hegerl, 1988; Anonymous, 1993; Blackman *et al.,* 1996). Accounts have increasingly confirmed their very high biological richness, diversity, geographical extent, their importance as habitat for a similarly rich and diverse biota, and fundamental role in ensuring the health of key GBRMP ecosystems. Of the 19 Queensland wetlands identified as having national importance (Blackman *et al.,* 1996), eight are located in areas immediately adjacent to or within the GBRMP. While the status of these ecosystems is broadly known, there have been no detailed assessments of historical changes in coastal wetlands and riparian forests in GBRMP catchments.

The aim of this study was to explore spatial and temporal changes of coastal riparian and wetland ecosystems adjacent to the GBRMP using a case study on the floodplain of the Herbert River catchment. While the focus of the paper is not on impacts of these changes *per se*, we discuss significant issues that are central to the maintenance and function of estuarine and marine ecosystems in the GBRMP.

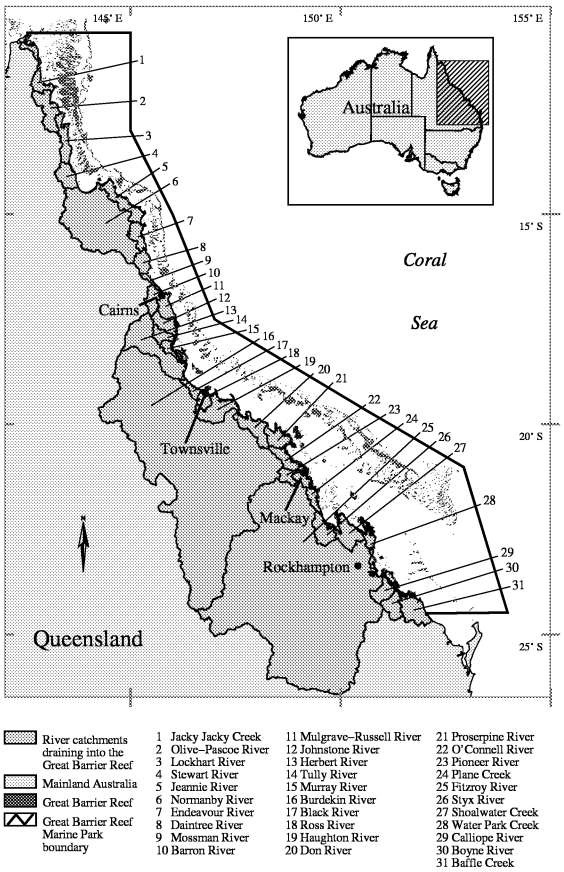

Figure 1. River catchments draining into the Great Barrier Reef Marine Park.

Spatial and Temporal Distribution of Freshwater Wetlands and Riparian Forests on the Coastal Floodplain of the Herbert River Catchment

The Herbert River catchment drains an area of approximately 10000 km^2 to the Coral Sea and is the largest of the river systems located in Australia's sub-humid to humid tropical north east (15-19^0 S; 145-146^0 E) (Fig. 2). Average annual rainfall is approximately 2500mm. Mean annual runoff for the catchment is 4991000 ML or 493 mm and the rainfall-to-runoff ratio approximately 37% (Hausler, 1991). Natural vegetation consists predominantly of open *Eucalyptus* and *Melaleuca* woodlands, with areas of open grassy plains and dense *Melaleuca* wetlands. Rainforest patterns occur on the creek and river levees. Large areas of the upper catchment remain under natural vegetation, although much of the lower catchment has been cleared for crop production or exotic pastures. Agricultural and pastoral activities effect largest area of the catchment. The catchment has a population of approximately 18000 (1993 Census), of which 75% are located in the lower catchment.

Methods

Land cover of the lower Herbert River catchment was visually interpreted from scanned and rectified 1:25000 aerial photography acquired in 1943, 1961, 1970, 1977, 1988 and 1992 (spatial accuracy ±7m) and 1:10000 digital orthophotography acquired in 1993, 1994 and 1995 (spatial accuracy ±1m). An unsupervised classification of SPOT Panchromatic and MSS imagery was used to map land cover in 1996 (spatial accuracy ±10m). Land cover boundaries were mapped onto a geo-referenced digital base (spatial accuracy ±10m) in ARCINFO GIS. Classification drew heavily on previous vegetation (Tracey, 1982; Blackman *et al.,* 1992; Perry, 1995) and soil surveys (Wilson and Baker, 1990) in the region. Validation of 1996 mapping units and mapped boundaries was conducted by vehicle and foot traverses. Approximately 150 sites were visited.

Classification of units and boundaries not inspected in 1996 was undertaken by extrapolation from equivalent photographic units. Although mapping was conducted for the entire Herbert catchment, this paper only reports on land cover on the coastal floodplain below an elevation of 13m (ie the zone of seasonal inundation with direct influence on estuarine ecosystems and the adjacent GBRMP).

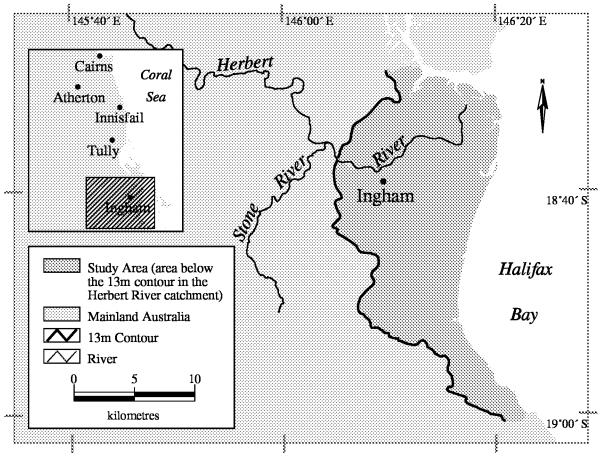

Figure 2. Location of the study area in the Herbert River catchment.

In addition to mapping observed land cover, an estimate of land cover prior to European settlement (circa 1860's) was developed from a simple rule base that related remaining stands of native vegetation and the known distribution of soils, topography, relief, hydrology and rainfall. A time series was developed to elucidate spatial and temporal change in land cover.

A spatial analysis of land cover in the lower Herbert River catchment was also undertaken. A number of key indices were calculated in ARCINFO to quantify changes in shape, size and spatial pattern of vegetation units. These indices have been successfully used in a number of similar studies:

- *Edge:area ratio*, which quantifies the amount of irregularity in the shape of remnant stands of vegetation (Sharpe *et al.*, 1981);
- *Forest island dissection index* (DI), which compares the amount by which any one "island" (or in GIS terms, polygon) of vegetation is more dissected than another and, therefore, would have a greater edge to interior. Any index greater than 1 is a measure of such irregularity in comparison to an index of 1, which is circular in shape (Sharpe *et al.*, 1981). DI can be represented by the following equation:

$$\mathrm{DI} = \frac{p}{\left(2\sqrt{\pi a}\right)}$$

  where p = island perimeter (metres) and a = island area (ha)
- *Landscape dissection index* (DL), which measures the cumulative edge:area ratio for the entire landscape (Sharpe *et al.*, 1981). DL can be represented by the following equation:

$$\mathrm{DL} = \sum_{i=1}^{n} \frac{p}{\left(2\sqrt{\pi \sum_{i=1}^{n} a}\right)}$$

  where p = total perimeter (metres) and a = total area of the forest island (ha);
- *Island distribution index* (IDI), which measures landscape aggregation and is similar in logic to the nearest neighbour statistic. IDI emphasises the pattern of islands in the landscape. IDI = 1 in a randomly distributed population, < 1 in an aggregated population and approaches uniformity if the value is close to 2.1491, where islands would have maximum spacing, in

which case they are regularly distributed in a hexagonal pattern (Bowen and Burgess, 1981). IDI can be represented by the following equation:

$$IDI = 2\bar{r}_c(lp)$$

where $\bar{r}_c$ = mean centroid-to-centroid distance from a forest island to its nearest neighbour and λ = density of forest islands (number per ha)

- *Diversity* ($H^/$) and *Evenness* (E) indices which compare changes in richness and landscape apportionment (Medley *et al.*, 1995). $H^/$ and E can be represented by the following equations:

$$H^/ = -\Sigma P_i \ln P_I$$

where P_i represents the proportion of total area in category *i* of each land cover/use type

$$E = H^/ / \ln s$$

where s = total number of land cover/use categories

- *Number* and density of islands (ie number per unit area) and cover class as a % of total area measure landscape pattern.

RESULTS

Description of wetlands and riparian forests

Figure 3 shows changes in area of key land cover classes on the floodplain of the Herbert River catchment since 1860. It can be seen that prior to settlement, grassland, riparian forests and freshwater wetlands dominated the area. However, by the 1940's significant losses in the area of riparian forest and freshwater wetlands had occurred and much of the native grassland had been converted either to grazing or sugarcane. Land cover remained relatively stable throughout the 1960's and early 1970's, however the period between 1977 and 1996 saw a rapid expansion in the area of sugarcane. As a consequence of this expansion, a 80% decrease in the area of freshwater wetlands (70% decrease between 1943 and 1996) and a 80% decrease in the area of riparian forest have occurred relative to their estimated pre-European extent. In contrast, the area of sugarcane has tripled between 1943 and 1996 (Fig. 3).

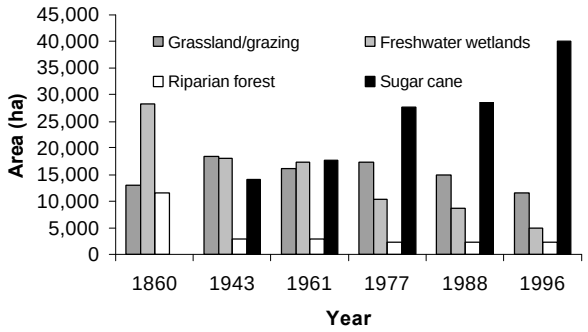

Figure 3. Area of key land cover classes on the Herbert River floodplain with time. The bars for each time period are from left to right: grassland/grazing; freshwater wetlands; riparian forest; and sugar cane.

Figure 4 shows changes in the island dissection index (DI), an index of the ratio of edge:area for land cover units. DI for freshwater wetland islands decreased (ie > area:edge) in the period between 1860 and 1943 and remained relatively stable between 1943 and 1996. In contrast, DI for riparian forest islands increased (ie > edge:area) with time, indicating that riparian forest islands were increasingly becoming longer and thinner.

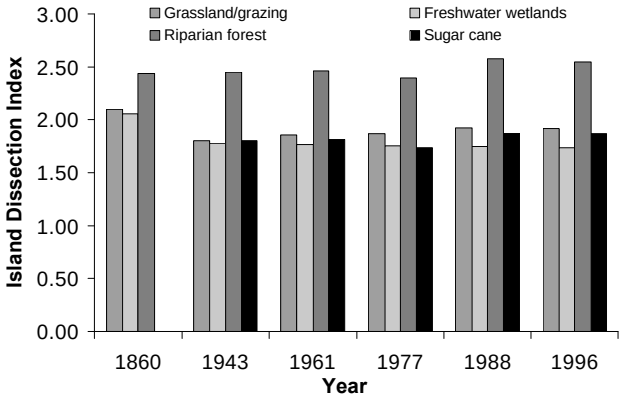

Figure 4. DI for key land cover classes with time. The bars for each time period are from left to right: grassland/grazing; freshwater wetlands; riparian forest; and sugar cane.

Description of floodplain landscape pattern

The data showed that although the number of riparian forest and freshwater wetlands islands increased since 1860 (Fig. 5), mean island size for both land cover classes decreased substantially. Mean island size for riparian forest islands decreased from 128 ha pre-settlement to 28 ha in 1942 and 24 ha in 1996. Similarly, mean island size for freshwater wetlands decreased from 135 in 1860 to 82 ha in 1943, 46 ha in 1977 and 22 ha in 1996.

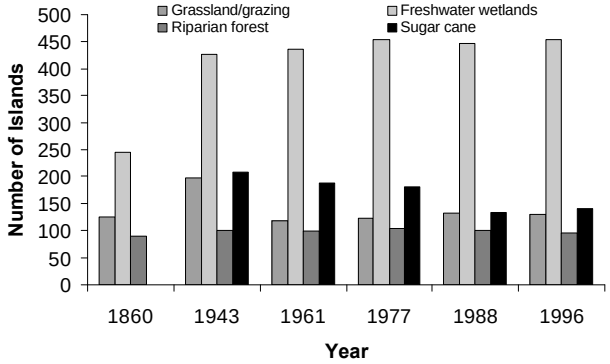

Figure 5. Changes in the number of islands for key land cover classes with time. The bars for each time period are from left to right: grassland/grazing; freshwater wetlands; riparian forest; and sugar cane.

Island distribution indices (IDI) for riparian forest and freshwater wetlands (Fig. 6) remained unchanged from pre-settlement to the 1970's, but decreased gradually after this, indicating a pattern of island aggregation. One might conclude this to be contradictory to previous results presented, however it is not unexpected given that in an ever increasing sea of agricultural land, remnant areas would tend to occur as clusters. They appeared aggregated or clumped, when land cover over the entire floodplain is considered, although as previously indicated, the mean size of each cluster was also decreasing. Similar results were also obtained from the Landscape Dissection Index (Fig. 7). The patterns observed in the IDI are supported by results obtained for measures of Diversity and Evenness, where a decline has occurred as the area of sugarcane has increased and the floodplain became less evenly apportioned (Fig. 8).

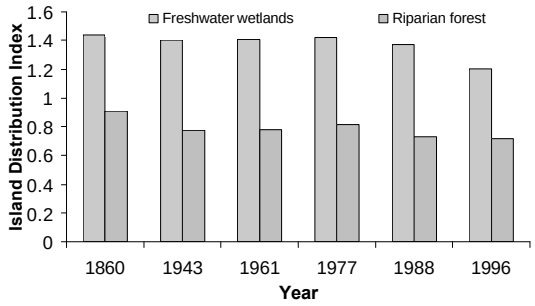

Figure 6. Changes in IDI of riparian forest and freshwater wetlands with time.

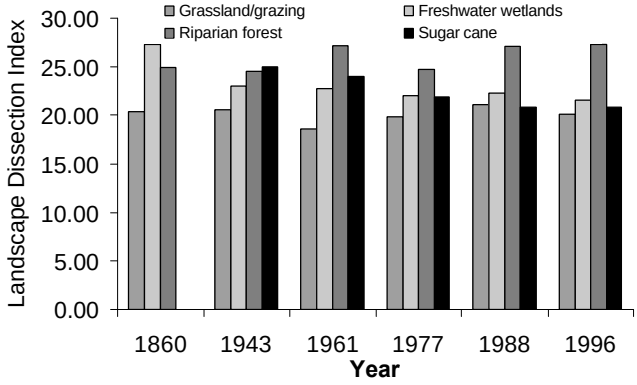

Figure 7. Changes in Landscape Dissection Index (DL) with time. The bars for each time period are from left to right: grassland/grazing; freshwater wetlands; riparian forest; and sugar cane.

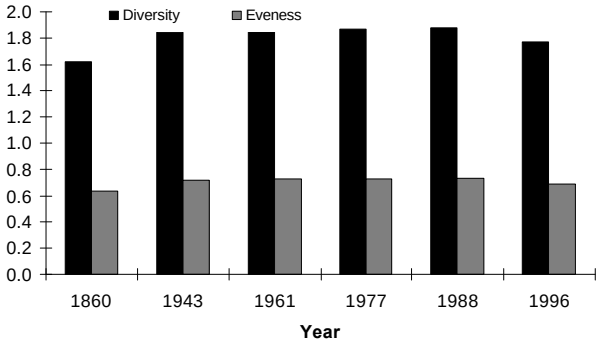

Figure 8. Measures of Diversity and Evenness for land cover on the Herbert River floodplain.

DISCUSSION

This study clearly demonstrates the following in terms of land cover change on the floodplain of the Herbert River catchment:

- A rapid decline in the area of freshwater wetlands and riparian forest since European settlement in the 1860's;
- An 80% decrease in the area of freshwater wetlands (including a 70% decrease since 1943);
- An 80% decrease in the area riparian forest since European settlement with riparian areas becoming narrower with time;
- The number of riparian forest and freshwater wetland islands increased after 1860, however mean island area decreased;

- Aggregation of freshwater wetland and riparian forest islands on the floodplain between 1943 and the present;
- Decline in Diversity and Evenness indices as the area of sugarcane increases; and
- A more uniform/less diverse landscape now exists on the Herbert coastal floodplain when compared with historical patterns.

The trends observed on the Herbert River floodplain are not unique. For example, in the Johnstone River catchment, the area of coastal wetlands has decreased by approximately 60% since 1951 (Russell and Hales, 1996). The most significant losses have been of freshwater wetlands, particularly *Melaleuca* communities. *Melaleuca* forests, notably those to the south of the Johnstone estuary, have been reduced by approximately 78%. There have also been significant reductions in other wetland categories, including a 64% reduction in wetlands dominated by palm and pandanus and a 55% reduction in freshwater reed swamps. Freshwater wetlands to the north and west of the confluence of the North and South Johnstone Rivers also disappeared almost entirely during this period. In contrast, the area of mangrove has remained almost stable. Of the riparian forests assessed, 72% were in poor or very poor condition (Russell and Hales, 1996). Similar phenomena are manifest in the lower Burdekin, lower Pioneer, Fitzroy, Boyne, Mulgrave-Russell, Barron and Mossman and Daintree River catchments (Congdon and Lukacs, 1995). In the Tully and Murray River catchments, less than 20% of coastal land systems suitable for agricultural production remain under native vegetation (Tait, 1994). River catchments north of the Daintree River and in the Shoalwater and Styx catchments have, in comparison, remained largely undisturbed either as a result of their isolation or status as a national park (Johnson *et al.,* 1997)

Given the results presented, it is clear that unless a change in current land use policy, planning and management occurs, then the area of freshwater wetland and riparian forest ecosystems on the floodplain of the Herbert River catchment, and indeed many other catchments adjacent the GBRMP, will be reduced to a very low level. It is likely that the area of remnant freshwater wetlands and riverine rainforest vegetation are already less than is required to perform as an effective and functional biological unit. While we have made no attempt to evaluate the ecological status of remaining riparian and wetland areas on the Herbert floodplain in this paper, a recent ecological audit of river catchments in Queensland (Moller, 1996) has shown that the ecological condition of remaining riparian vegetation is "poor" to "very poor" and the condition of freshwater wetlands "moderate" to "poor".

The losses of coastal freshwater wetlands and riparian forests observed on the Herbert floodplain and in other catchments adjoining the GBRMP are equivalent to or exceed losses in other parts of Australia. For example in Victoria, one-third of wetlands have been destroyed, including half the area of non-permanent freshwater wetlands (SEAC, 1996). Some 70% of wetlands on the Swan Coastal Plain, Western Australia have been lost since European settlement in the early part of the 19th Century. Similar trends can be observed in south-east Asia where reported losses are as high as 50% in Malaysia, Thailand and southern China (UNEP, 1998). What separates the north-east Australian experience from the rest of the country, large areas of south-east Asia and most of Europe and the USA, is that such a large proportion of these losses have occurred in the last 50 years and particularly in the last 20 years. In Europe and the USA, significant wetland and riparian zone restoration programmes were operational 20 years ago, a time when large-scale losses were occurring in Australia.

Current legislative protection for the environment within the GBRMP predominantly applies to ecosystems within the park boundaries. There is very little scope for direct management of adjoining areas such as coastal freshwater wetlands and riparian forests, even though fundamental linkages between these ecosystems and marine environments are known. Attempts by the Queensland government to address this deficiency through coastal planning provisions in the *Coastal Protection and Management Act (1995)* have been unsuccessful. In response, we argue

that a range of policy, planning and management reforms are required if remaining coastal ecosystems adjoining the GBRMP are to be protected or maintained. Hence, we believe that it is incumbent on agricultural industry, government and the wider community to work towards ensuring that:

- Broad, context-driven planning systems are implemented that are able to respond to the unique nature of each resource management problem and are underpinned by sound scientific input. These systems must also include areas that directly influence GBRMP ecosystems;
- Appropriate mixes of incentives (eg motivational, educational, property-rights based, regulatory) are provided to encourage the protection and use of riparian forests and freshwater wetlands only in ways which are ecologically sustainable;
- The community as a whole contribute financially towards the provision of incentives to industry (particularly the sugar industry in the context of coastal Queensland) for the protection of freshwater wetlands and riparian forests on freehold land. Hence, all those who benefit from non-market dimensions of protecting riparian forests and freshwater wetlands, whether directly and indirectly, should contribute to the cost of its maintenance.

For this framework to be implemented, it is essential that governments at all levels develop the necessary supporting institutional capacity by ensuring:

- Responsibility for riparian and wetland management is shared between government, community and industry in a transparent manner through the development of appropriately resourced bioregional management structures;
- These structures empower local communities and agricultural industries to protect and manage riparian forests and freshwater wetlands adjacent the GBRMP;
- Access is provided to instruments and resources necessary for operation of these structures;
- Intervention occurs where local initiatives fail or are incomplete;
- Clear and consistent signals are given to resource users and consumers about the importance of riparian forests and freshwater wetlands within the broader context of ecologically sustainable development; and
- Improved scientific underpinning and participation of local government in the allocation and management of agricultural land.

Stakeholders, particularly agricultural producers, also have a responsibility to ensure that their own internal processes allow real opportunities for the involvement of those at a "grassroots level". There is potential for self-interest and local needs to dominate important resource management issues. Conflict within decision-making fora represents a major potential threat to improved practice. Hence, visible monitoring and accountability mechanisms are essential pre-requisites for increased community and industry involvement, as are the development of appropriate and effective conflict resolution and facilitation processes. This is especially the case for the operation of the allocation of agricultural land on freehold tenure.

CONCLUSIONS

In this paper we have demonstrated that concerns relating to the decline in riparian and wetland resources in catchments adjacent to the GBRMP are justified and requiring of further attention. Given that agricultural industries in these areas are operating in the context of an ever-increasing community expectation for the preservation of riparian and wetland areas, conflict over the use of these scarce resources is likely to grow in the future.

We have demonstrated that the magnitude of the tasks facing policy makers and resource managers in catchments adjacent to the GBRMP, in terms of the way in which they manage riparian and wetland areas in the future, remain substantial. The challenge facing government is to provide a stable environment in which locally relevant decision-making can occur and which is supported with appropriate and viable monitoring, cost-sharing and regulatory arrangements.

In addition, agricultural industries in particular, need to develop their own policies and activities to guide their future developments within a wider context and in so doing contribute to a reversal in the rapid historical decline of riparian and wetland ecosystems adjacent the GBRMP.

ACKNOWLEDGMENTS

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Chapter 9

Quantifying Current and Historical Inputs of Fertiliser N and P to Rural Lands in the Herbert River Catchment

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Abstract
There is a need to develop practical tools to assist decision makers to evaluate the downstream impacts of changes in land use and management practices in river catchments. An understanding of historical events in a catchment is central to this activity. This paper quantifies current and historical nitrogen (N) and phosphorus (P) usage practices on rural lands in the Herbert River catchment in the context of changes in land use. It shows that since European settlement, the lower catchment has undergone 3 major phases of rural land use change while rural land use in the upper catchment has remained relatively constant. The area of rural land fertilised in 1994 is shown to be approximately 7% of the total catchment area. With increasing land area, fertiliser inputs of N (kg ha^{-1}) for sugarcane increased with time, reaching a peak in the late 1980's, while inputs of P (kg ha^{-1}) have also increased significantly over time. The area of improved pastures and associated inputs of N and P (kg ha^{-1}) have remained relatively constant. The area of exotic pine plantations has increased since the 1970's, although additions of N and P (kg ha^{-1}) have decreased since the late 1980's. The area of horticulture and small crops in the catchment has varied with time, although N and P usage (kg ha^{-1}) has remained relatively stable.

Introduction

The coastal zone of Australia is a major focus of competition between alternative uses of resources which poses serious threats to its future economic, environmental, social and cultural potential. Sustainable land and water resources management is best achieved through the informed action of individual users and managers of these resources. The existing knowledge base (e.g. data, expert knowledge, models) resides in a wide range of agencies and in a variety of data forms (e.g. raster, vector attribute, scanned). There is an urgent need to develop tools to integrate this knowledge base. It is essential that these tools operate at scales (e.g. catchment, sub-catchment) that can be used by a variety of resource users and managers to address major issues being raised by agricultural industries and the broader public. An understanding of historical events in a catchment is central to this activity.

A body of evidence (e.g., Yellowlees, 1991; Moss *et al.,* 1992) exists which shows that nutrient and sediment contaminant loads in Queensland coastal waters have increased since European settlement, although the origins of this increase are yet to be fully established and quantified.

An understanding of the nature and spatial distribution of land use and management practices in the Herbert River catchment over time is vital to the development of nutrient export budgets from different land uses in the catchment. The development of nutrient export budgets is essential for the calibration and validation of models and tools that evaluate the spatial distribution of nutrient loads in the catchment at several scales. This paper reports on the results of a study aimed at quantifying current and historical nitrogen (N) and phosphorus (P) usage practices on rural lands in the Herbert River catchment in the context of changes in land use.

Materials and Methods

Calculation of Nutrient Usage
Fertiliser usage data were obtained from the Bureau of Census and Statistics (pre 1972) and the Australian Bureau of Statistics (ABS). Information contained in these records included: land utilisation, employment, area and production of crops, fruit and vegetables, machinery, livestock numbers and production, areas irrigated and areas fertilised and quantity of fertiliser applied. Data for the period 1915-16 to 1950-51 was augmented from Pulsford (1993) and shows total crop area grown, crop area fertilised, tonnes of fertiliser used in Queensland in each year. All data pre 1915-16 were estimated from: data obtained from archives maintained by CSR Limited and the Queensland Department of Lands; and consideration of both crop areas grown and the changing proportions of fertiliser on each crop in each district. All ABS data were supplemented with records obtained from fertiliser companies operating in the catchment. All estimates post 31 December 1990 are based on fertiliser company sales records. Hence, in order

to calculate N and P it is necessary to combine data collected at three levels: statistical divisions and local government authorities; the original sales areas of fertiliser companies (these correspond in the Herbert to the sugar mill areas) and; individual dealer records for sales districts of fertiliser companies.

These estimates should be treated with caution, as complete information on changes in composition of the various fertiliser groups over time is not available. Furthermore, as Pulsford (1993) points out, the value of the results of such estimates and the calculations applied to them, depend on the accuracy of the original data. It is highly likely that census figures, in terms of areas fertilised and tonnages used, became less accurate as the complexity of the tables on the form increased and as local authority boundaries changed. This problem is reduced in the Herbert River catchment where local authority boundaries have remained relatively constant since Federation, and are closely associated with the boundaries of fertiliser company sales districts and of the river basin itself.

Allocation of Nutrients

Nutrient allocations were developed on a crop basis (i.e. the known area of each crop multiplied by the rate of usage), and then summed for the catchment over time. Allocations of sales area data to the catchments were confirmed in discussions with industry personnel and by visits to the area. While the 1991-1994 figures are likely to be the most accurate, it is believed that the earlier years sufficiently reflect previous practices. The regional totals for N and P for the 1950 to 1990 period have high accuracy, however in the 1910 to 1950 period there are no statistics available to check against individual areas of usage. The five year intervals used prior to 1960 infer average data for the particular period, rather than for the particular year. Given that the sugar industry is the dominant user of fertiliser products in the catchment, usage data are strongly correlated with changes in both the area of sugarcane and sugarcane management practices.

Results and Discussion

Since European settlement, the lower catchment has undergone 3 major phases of rural land use change. These phases are associated with expansions in the sugar industry (Figure 1) in the 1960's, 1970's and late 1980's - early 1990's and the establishment of large areas of exotic pine plantations in the late 1980's. In contrast, rural land use (predominantly grazing of unimproved pastures) in the upper catchment (areas upstream of Nash's Crossing) has remained relatively constant . Total fertiliser N and P (Figure 2) use in the catchment has increased with time, however it is important that these increases are placed in the context of changes in land use.

The total area of rural land fertilised in 1994 is shown to be approximately 7% of the total catchment area (approximately 10000 km^2), 5.5% of which is sugarcane cultivation (Figure 3). As the area of sugarcane cultivated has continued to increase, N fertiliser inputs (kg ha^{-1}) increased with time, reaching a peak in the late 1980's. Early indications are that this trend may be declining as sales of fertiliser post 1990 have declined and current BSES fertiliser recommendations for the Herbert River district advocate reduced rates of N (R. Beattie *pers comm*) (Figure 4). P fertiliser inputs (kg ha^{-1}) have increased over time as the area of cultivated land has increased (Figure 4), although both rates and total use declined for a period in the 1970's due to the removal of the government fertiliser subsidy and the energy crisis (M. Probert *pers comm*). The area of improved pastures increased until the late 1970's and remained constant until the early 1980's when pasture land was converted to sugarcane production. Inputs of N and P to pastures increased dramatically during the 1980's. The area of exotic pine plantations has increased since their establishment in the 1970's, although additions of N and P (kg ha^{-1}) have decreased since the late 1980's. The area of horticulture and small crops in the catchment has varied with time, although N and P usage (kg ha^{-1}) has remained relatively stable.

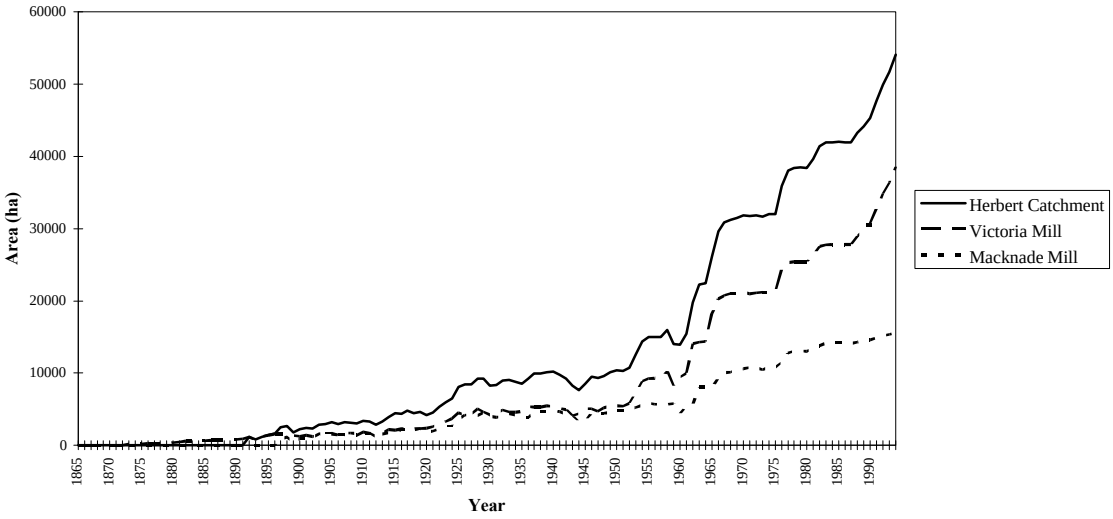

Figure 1. *Land use change for the area of sugarcane production in the lower Herbert River catchment 1892-1994 (Herbert Catchment represents the combined areas of Macknade and Victoria Mills).*

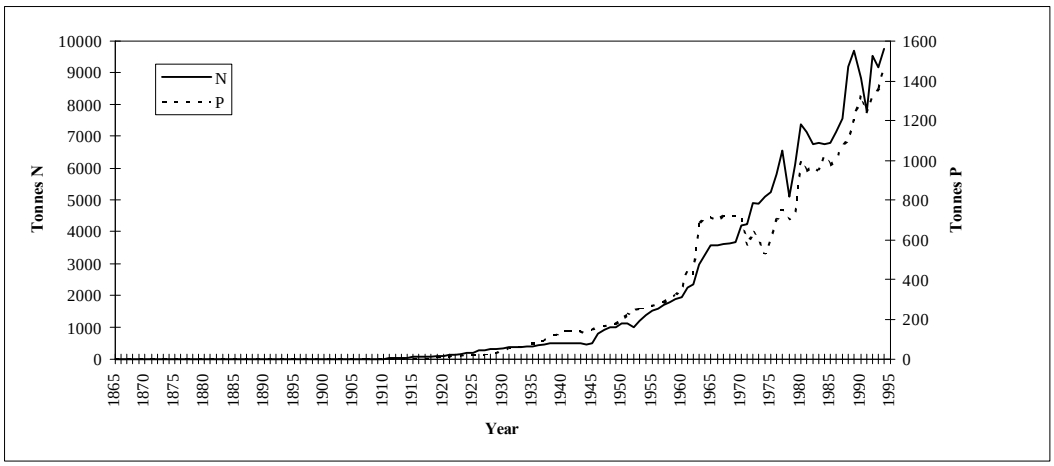

Figure 2. *Total N and P fertiliser usage for the Herbert River Catchment* (1865-1994).

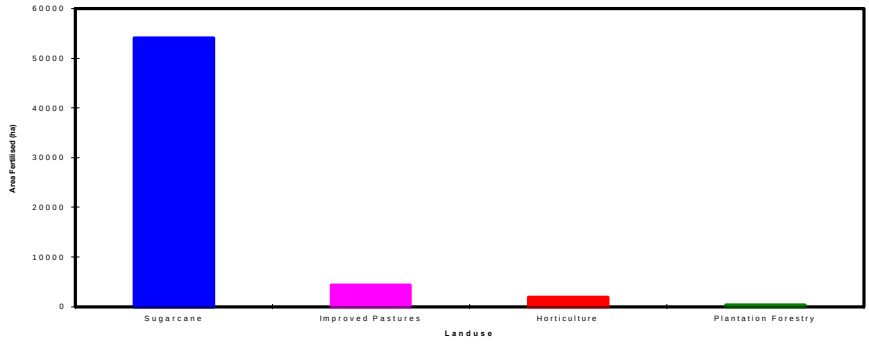

Figure 3. *Area fertilised in the Herbert River catchments in 1994.*

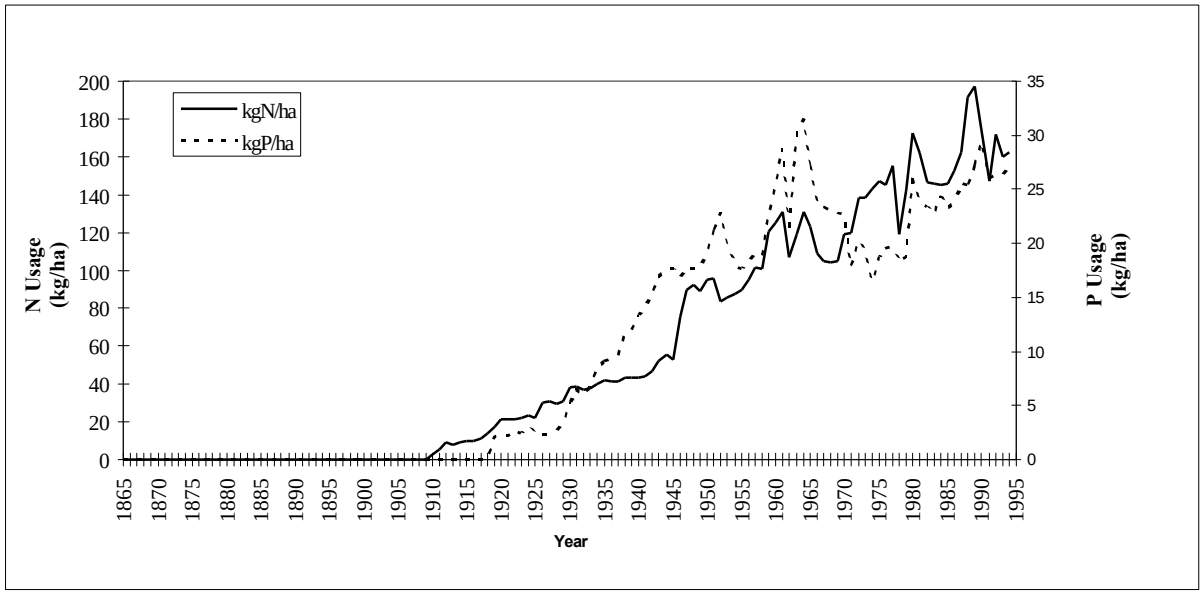

Figure 4. *N and P usage for sugarcane cultivation in the Herbert River catchment for the period 1865-1994.*

Conclusions

These data provide a valuable insight into the use of fertiliser in the context of Herbert River catchment land use. Quantifying the spatial and temporal variation of N and P usage is essential for the development of nutrient export budgets for different land uses in the catchment. These will play a major role in the future work aimed at calibration and validation of models and tools that evaluate the spatial distribution of nutrient loads in the catchment. Calculation of a nutrient mass balance will be finalised with the acquisition of nutrient output data.

Acknowledgments

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Chapter 10

Quantifying inputs of pesticides and other contaminants to the Great Barrier Reef Marine Park – A case study in the Herbert River Catchment of north-east Queensland

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Summary
There is a need to evaluate the downstream impacts of changes in land use and management practices in river catchments and associated marine environments. An understanding of historical events in a river catchment is central to this activity. This paper quantifies pesticide inputs on rural lands in the Herbert River catchment in the context of changes in land use over the last 100 years. It shows that since European settlement, 3 major phases of rural land use and land cover change have occurred on the coastal floodplain of the lower Herbert. In contrast, land use in the upper catchment has remained relatively constant. The area of rural land receiving regular inputs of pesticides is shown to be approximately 7% of the total catchment area. However, with increasing land area for agriculture, inputs of pesticides have increased significantly with time. These trends raise a number of significant challenges for agricultural industries in terms of their ability to comply with the principles of ecological sustainability.

Introduction

Fifteen river catchments, covering an area of approximately 375000 km^2, drain directly into the Great Barrier Reef Marine Park (GBRMP). The vegetation of many of the river catchments adjoining the GBRMP has been extensively cleared (Russell and Hales, 1996; Johnson *et al.,* 1999) for agricultural, horticultural and pastoral production since the mid 19th Century. Evidence also exists (e.g., Yellowlees, 1991; Moss *et al.,* 1992, Bramley and Johnson, 1995; Furnas *et al.,* 1995) which shows that nutrient and sediment contaminant loads in Queensland coastal waters have increased since European settlement. It is likely that pesticide and other contaminant loads have also increased (Hunter, 1992).

While there have been recent published estimates annual pesticide applications (eg Hamilton and Haydon, 1996), there are no published estimates of historical pesticide usage in eastern coastal catchments and only a few reports of investigations into pesticide residues in aquatic or marine environments (Hamilton and Haydon, 1996; 1997). This paper reports on the results of a study aimed at quantifying historical pesticide usage practices in the Herbert River catchment in the context of changes in land use. An understanding of the nature and spatial distribution of land use and management practices in the Herbert River catchment over time is vital to the development of contaminant export budgets from different land uses in the catchment. The development of contaminant export budgets is essential for the calibration and validation of models and tools that evaluate the spatial distribution of contaminant loads from the catchment to aquatic and marine environments.

Study Area

The Herbert River Catchment drains an area of approximately 10000 km^2 to the Coral Sea and is the largest of the river systems located in Australia's sub-humid to humid tropical north east (lat. 15-19^0 S, long. 145-146^0 E) (Fig. 1). The Herbert River rises at an elevation of 1070 m and has a total length of 340 km. Topographically, the catchment can be divided into three distinct sections. The upper catchment of approximately 6000 km^2 is bounded to the north and west by the Great Dividing Range and to the east by the Cardwell Range. In the intermediate catchment (1000 km^2) the river changes direction and flows south east for 70 km through a deep gorge before entering the lower catchment. The lower catchment (3000 km^2) is bounded to the north by the Cardwell Range and to the south by the Seaview Range.

The catchment normally experiences warm humid to sub-humid summers and mild dry winters. Mean annual rainfall for the catchment is 1370 mm and ranges from in excess of 3000 mm in the north-east of the lower catchment, to 750 mm in the extreme west of the upper catchment. Approximately 74% of the mean annual rainfall occurs from December to March. Mean annual runoff for the catchment is 4991000 ML or 493 mm and the rainfall to runoff ratio approximately 37%. Mean annual flow for the river is 3440610 Ml and highest monthly flows occur from November to May.

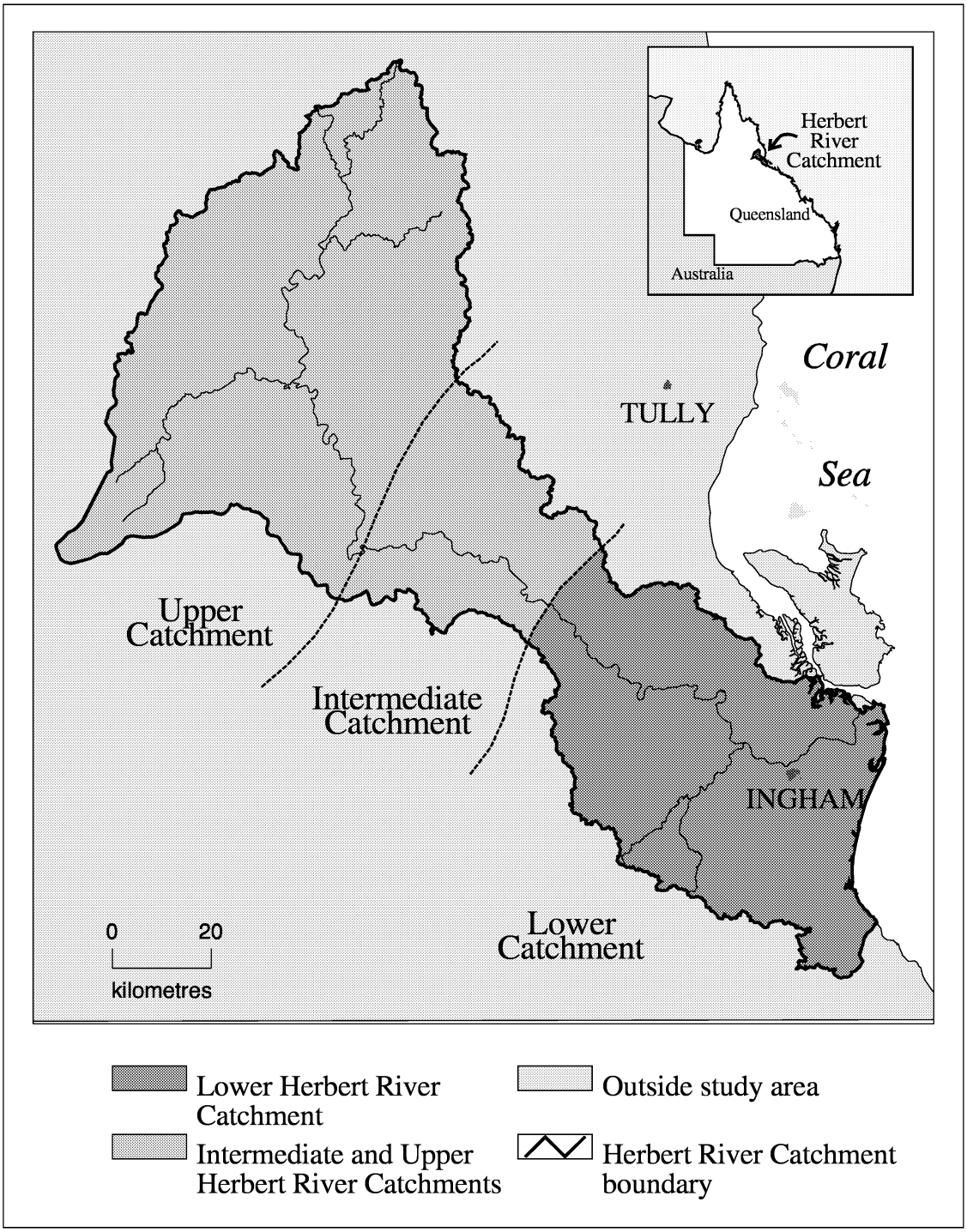

Fig. 1. Location of the study area.

In the upper catchment, the topography ranges from level alluvial plains to rugged, deeply incised ranges. In the west, the land is gently undulating while to the east, the topography rises irregularly and reaches altitudes over 1000 m. The lower catchment consists of a coastal plain flanked by mountains in excess of 1000 m high, but commonly at 600 to 900 m. The geology comprises Quaternary alluvium and beach sands, Cainozoic basalts, Carboniferous granites, Carboniferous acid volcanics and undifferentiated Paleozoic quartzite. Soils are closely related to geology and in the lower catchment heavily influenced by fluvial processes. Soils are mostly coarse textured in the upper catchment and fine textured clay/loam soils in the lower catchment. Agricultural and pastoral production are the largest users of land in the catchment. In terms of arable agricultural production, the sugar industry located in the lower catchment is dominant, with approximately 65000 ha of land supplying cane to two sugar mills. Lands not used for arable agriculture are mainly under native vegetation or used for extensive beef cattle production (especially in the upper catchment). The catchment also supports a substantial commercial and recreational fishery as well as exotic softwood plantations. Small areas are utilised for mining, industrial and urban activities. Approximately 18000 people reside in the catchment, of which 75% are located in the lower catchment.

Methods

Land Cover and Land Use

Land cover of the lower Herbert River catchment was visually interpreted from scanned and rectified 1:25000 aerial photography acquired in 1943, 1961, 1970, 1977, 1988 and 1992 (spatial accuracy ±7m) and 1:10000 digital orthophotography acquired in 1993, 1994 and 1995 (spatial accuracy ±1m). Land cover boundaries were mapped onto a geo-referenced digital base (spatial accuracy ±10m) in ARCINFO GIS.

Classification drew heavily on previous vegetation (Tracey, 1982; Blackman *et al.* (1992); Perry, 1995) and soil surveys (Wilson and Baker, 1990; Heiner and Grundy, 1994). Validation of 1996 mapping units and boundaries was conducted by vehicle and foot traverse. Approximately 150 sites were visited during inspections. Classification of units and boundaries not inspected was completed by extrapolation from equivalent photographic units.

Data on land use was obtained from the Bureau of Census and Statistics (pre-1972) and the Australian Bureau of Statistics (ABS), and was cross-referenced with the land cover data. This data was augmented (particularly for the pre-1948 period) from records held by the two local sugar mills and the Queensland Department of Primary Industries.

Pesticide Usage

Quantities of herbicide and insecticide used in infrastructure maintenance (eg roads, railways, drains, electricity poles) pest and weed control on government and leasehold lands, and government forestry plantations were obtained from historical records maintained by the relevant state or local government agency. Data for insecticide usage in the sugar industry was obtained from historical records held by the Herbert Cane Protection and Productivity Board (a statutory body responsible for the prevention of sugarcane pests and disease in the catchment). Insecticide usage for crops other than sugarcane, as well as herbicide and fungicide usage for all agricultural activities, was estimated by combining data collected at 4 levels: statistical divisions and local government boundaries (in the Herbert River catchment local government boundaries have remained relatively constant since 1900, and are closely associated with the boundaries of chemical company sales districts and of the catchment itself); the original sales areas of chemical companies (these correspond in the Herbert River catchment to the sugar mill areas); individual dealer records for sales districts of fertiliser companies; and interviews with individual agricultural producers. Chemical allocations were developed on a crop basis (i.e. the known area of each crop multiplied by the rate of usage), and then summed for the catchment over time. Allocations

of sales area data to the catchments were confirmed in discussions with industry personnel.

Results and Discussion

Land cover and land use in the Herbert River catchment has changed substantially since European settlement, particularly in the lower catchment. Figures 2 and 3 show changes in area with time of land cover in the lower catchment since the 1860's. It can be seen that prior to settlement, the area was dominated by open grassland, rainforest patterns, mangrove patterns, Eucalypt woodlands and *Melaleuca* communities. However, by the 1940's large losses of rainforest patterns and *Melaleuca* dominated patterns had occurred and much of the native grassland had been converted either to grazing or sugarcane. Land cover remained relatively stable throughout the 1960's and early 1970's, however, the period between 1977 and 1996 saw a rapid expansion in the area of sugarcane such that by the end of 1996 the area of sugarcane was approximately 65000 ha. The consequences of this expansion have resulted in a decrease of approximately 65% in the area of *Melaleuca* dominated patterns (comprising a 43% decrease between 1943 and 1996), a 60 % decrease in the area of beachside vegetation, a 20% decrease in the area of Eucalypt woodland and a 10% decrease in the areas of rainforest patterns when compared to pre-European estimates of area (Johnson *et al.,* 1999). In contrast, the area of mangrove communities and open water has remained relatively stable since 1943, while the area of sugarcane has more than tripled between 1943 and 1996. As expected the area of urban and industrial land cover has increased since European settlement, however the total area alienated is small within the context of total catchment area (ie <1%). Land cover and land use (predominantly extensive grazing of unimproved pastures) in the upper catchment has remained relatively constant.

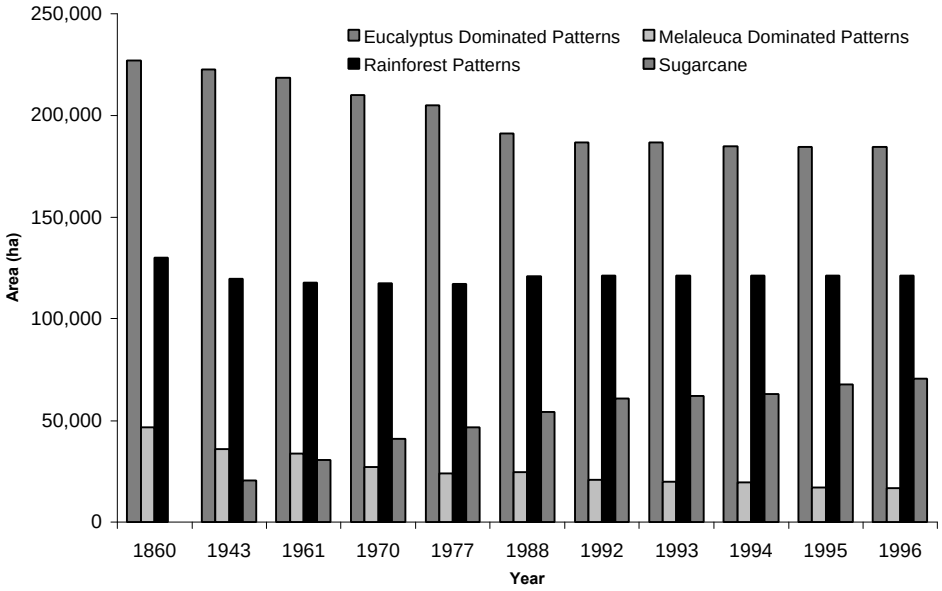

Fig. 2. Changes in the area of 4 key land cover types in the lower Herbert River catchment since European settlement. The bars for each time period are from left to right: *Eucalyptus* dominated patterns, *Melaleuca* dominated patterns, rainforest patterns and sugarcane (Source: Johnson *et al.*, 1999).

A large number of agrochemicals have been applied in the Herbert River catchment since European settlement. These include:

- *Organochlorines* (Aldrin, BHC, DDT, Dieldrin, Heptachlor, Lindane, Methoxychlor);
- *Organophosphates* (Chlorpyrifos, Ethoprophos, Fenaphimos);
- *Aliphatic acids* (Dalapon, Glyphosate, TCA);
- *Aromatic acids and esters* (Dicamba, Picloram);
- *Nitroanilines* (Trifluralin);

- *Phenoxys* (2,4-D (amine), MCPA, 2,4,5-T);
- *Triazines and triazoles* (Ametryn, Atrazine, Simazine);
- *Ureas* (Diuron);
- *Bipyridyliums* (Paraquat);
- *Mercurial Fungicides* (MMEC); and
- *Azoles* (Flusilazole, Prochloraz, Propiconazole).

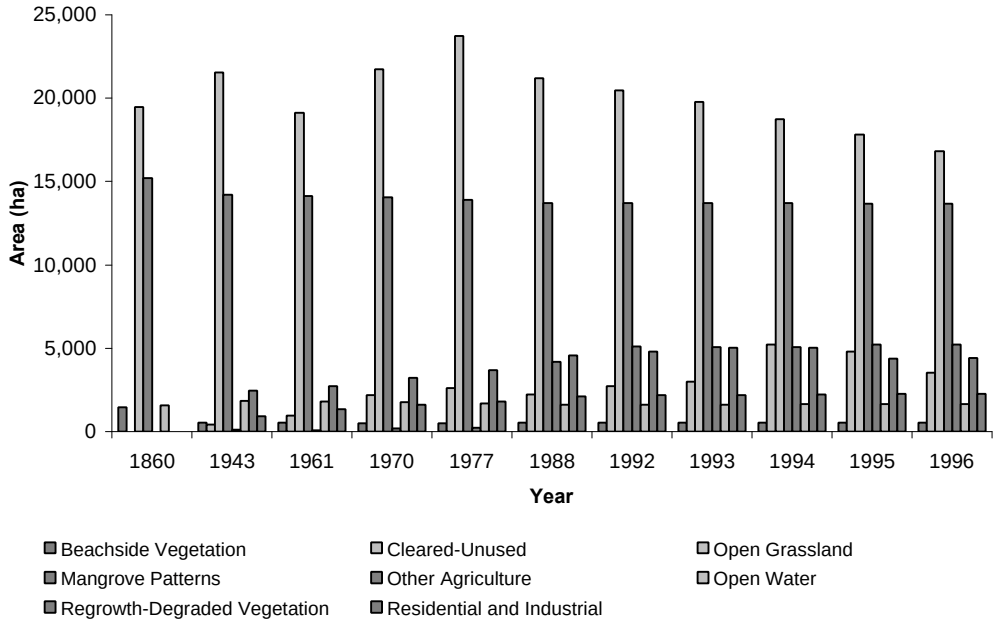

Fig. 3. Changes in area of other land cover types in the lower Herbert River catchment since European settlement. The bars for each time period are from left to right: beachside vegetation, cleared-unused, open grassland, mangrove patterns, other agriculture, open water, regrowth-degraded vegetation, residential and industrial (Source: Johnson *et al.*, 1999).

In 1995 approximately 7% of the total catchment area was receiving pesticide applications, with approximately 95% of total applications (by volume) occurring in cane growing areas of the lower catchment. With increasing land area of sugarcane and other crops (Fig. 4), inputs of pesticides have increased with time (Fig. 5-9).

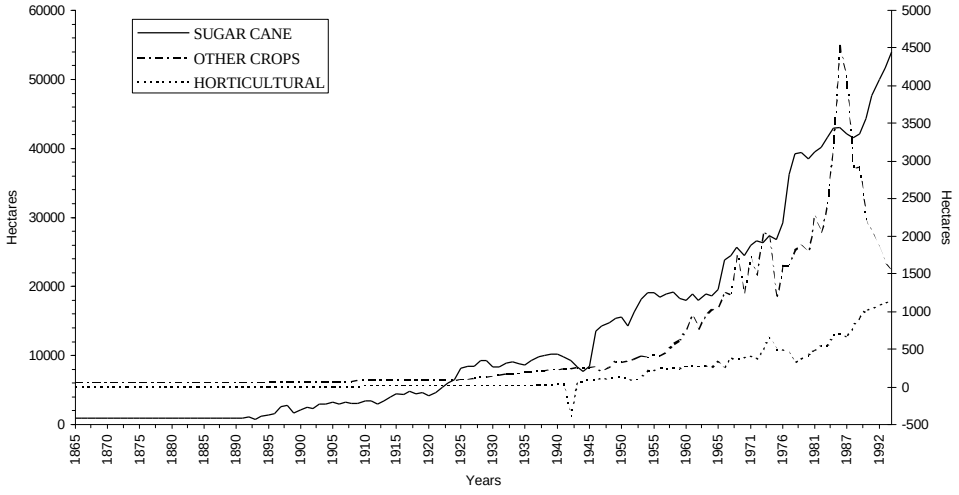

Fig. 4. Area of sugarcane and other crops in the Herbert River catchment 1865-1895. Sugarcane area is on the left side axis.

Significant quantities of organochlorine pesticide have been applied in the catchment (Fig. 5). In general these chemicals are highly persistent, sorb strongly to particulate matter, are toxic to aquatic and marine organisms and have a tendency to bioaccumulate. While many of these were withdrawn from usage in the late 1980's and early 1990's, their fate in aquatic and marine environments of the Herbert River and adjacent GBRMP are unknown (although work is in progress that examines the fate of organochlorines in the Hinchinbrook Channel).

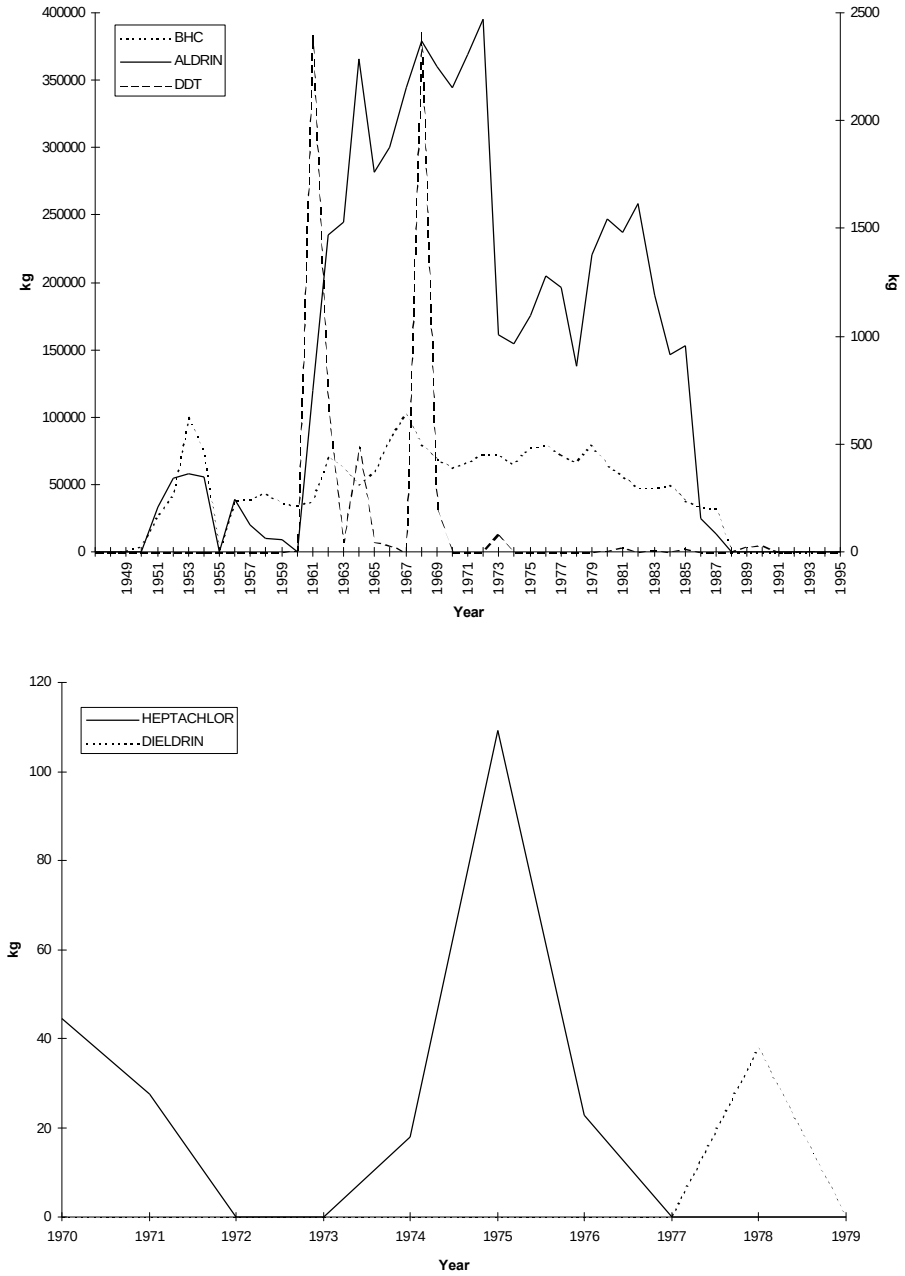

Fig. 5. Historical usage patterns (active ingredient) for selected organochlorine pesticides in the Herbert River catchment. DDT usage is on the right side axis.

Large volumes of the organophospate insecticide Chlorpyrifos continue to be applied in the catchment (Fig. 6). Chlorpyrifos has become the dominant chemical for control of cane grubs in the sugar industry. Recent increases in total volumes correspond closely in relative magnitude to the increasing area of sugarcane production. Given the significant impact that cane grub damage has on the sugar industry, this trend is likely to continue unless an effective substitute can be found. The large volumes of Chlorpyrifos applied in the Herbert are consistent with values (on a unit area basis) recorded in other catchments in which sugarcane is grown (Hamilton and

Haydon, 1996; 1997). Chlorpyrifos is persistent but effectively immobile in the soil, hence it poses little threat to ground water. However it does have the potential to contaminate aquatic and marine environments, particularly where soil erosion occurs.

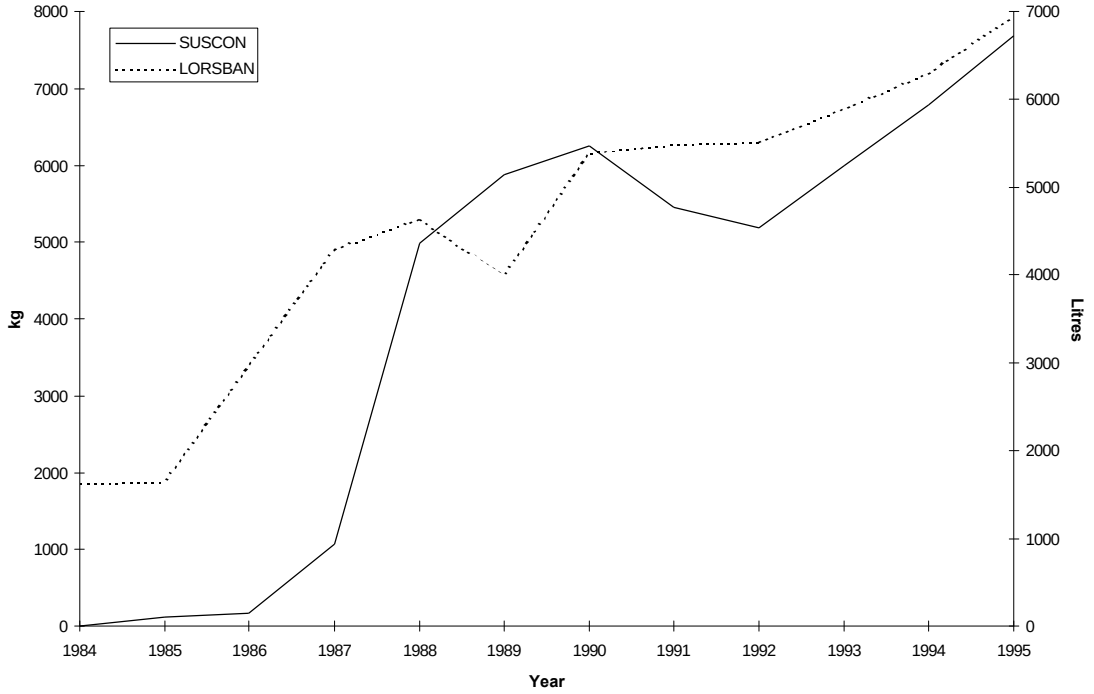

Fig. 6. Historical usage patterns (active ingredient) for the organophosphate pesticide Chlorpyrifos in the Herbert River catchment. Suscon is the trade name for Chlorpyrifos granules (kg) while Lorsban is the liquid form of the chemical (l).

The volume of the herbicides Atrazine, Diuron and 2-4,D applied in the Herbert has also increased rapidly in the last 15 years (Fig. 7). Similar trends have also been observed in neighbouring coastal catchments in which the sugar industry is a large user of land (Hamilton and Haydon, 1996). Very little is known of the residual behaviour of Diuron and 2-4,D under north Australian conditions and no information is available in terms of their persistence in ground or surface waters in NE Queensland catchments and adjacent GBRMP waters. Diuron is persistent but not highly mobile while 2-4,D is less persistent but more mobile. Given the large volumes applied of both Diuron and 2-4,D, they do have ecotoxicological potential. Atrazine, which is both highly persistent and mobile, has been detected in ground water in the Burdekin River delta (Brodie *et al.*, 1984) and similarly, has a high ecotoxicological potential.

Usage of Azole group fungicides has increased rapidly since 1982 as cane growers used these products as a substitute to Mercury based fungicides (Fig. 8). However, the small volumes used mean that a low ecotoxicological potential exists. Large volumes of methoxymethylmercury chloride (MEMC) have been applied in the catchment since 1953. MEMC has the longest continuous record of known pesticide application in the Herbert catchment (Fig. 9). Farmers perceptions of the greater efficacy of MEMC in comparison to Azole group fungicides has meant that its use has increased in the 1990's following a period of declining use in the 1980's. The environmental fate of MEMC is not well documented in the literature (Semu *et al.,* 1986), however recent studies have shown a close correspondence between known history of MEMC application, and its subsequent appearance in the Herbert River estuary and associated coastal embayments of the GBRMP (Johnson and Brunskill, 1999).

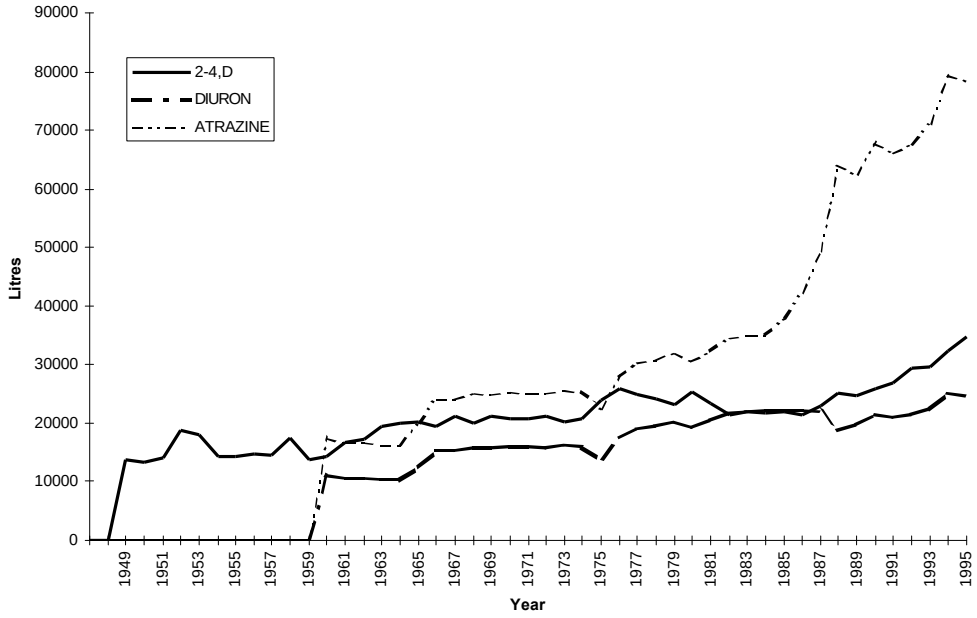

Fig. 7. Historical usage patterns (active ingredient) for selected Phenoxy, Triazine and Urea group herbicides in the Herbert River catchment.

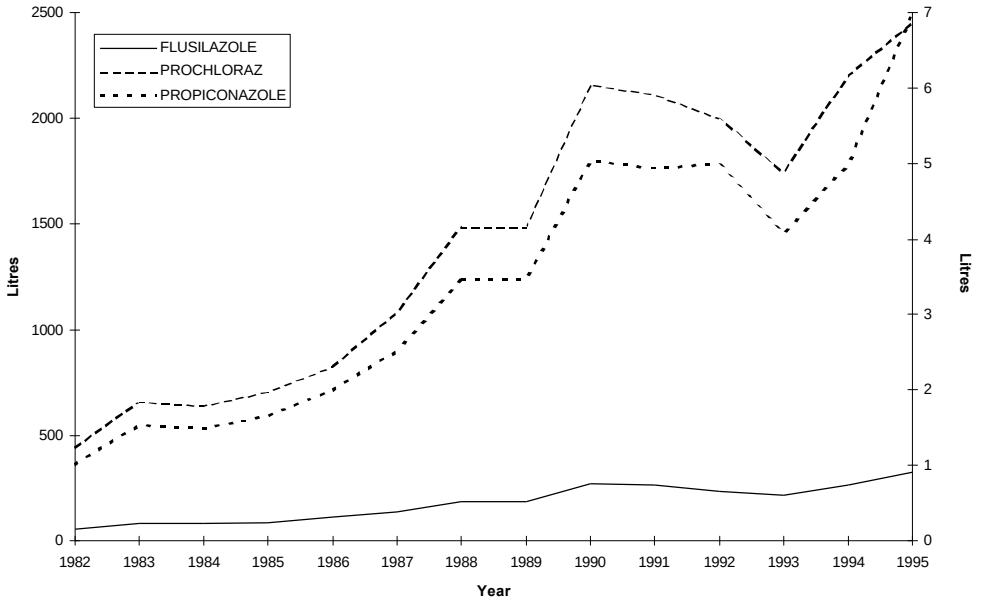

Fig. 8. Historical usage patterns (active ingredient) for Azole group fungicides in the Herbert River catchment. Propiconazole volume is indicated on the right side axis.

Fig 9. Historical usage patterns (active ingredient) for mercurial fungicide (MEMC) in the Herbert River catchment.

Conclusions

These data provide a valuable insight into the historical use of pesticides in the Herbert River catchment and hence potential sources of contaminants to the GBRMP. Total agrochemical use in the catchment has increased with time, however it is important that these increases are placed in the context of changes in land use. Given that the sugar industry is the dominant user of chemical products in the catchment, usage data are strongly correlated with changes in both the area of sugarcane and sugarcane management practices. Even though sugarcane farm management practices vary along the Queensland coast, the trends obtained from this study are representative of cane growing catchments adjacent the GBRMP. These trends raise a number of significant challenges for agricultural industries in terms of their ability to comply with the principles of ecological sustainability.

While this case study has focused on quantifying the spatial and temporal distribution of agricultural land use and management practices, it is important to understand the extent to which increasing agrochemical usage can be identified in ecological and biogeochemical signals in the adjacent Herbert river estuary and nearshore GBRMP embayments. This history is contained in the annual growth bands of fringing reef corals, and in fine mud trapped in mangrove associated mudbanks (Hopley, 1982; Belperio, 1983; Wolanski *et al.*, 1990; Carter *et al.*, 1993) and can be dated with radiochemical tools.

The biogeochemical and ecological consequences of land use changes to the GBRMP cannot easily be determined by present day monitoring of rivers or ecological studies on biota. Past episodes of natural and anthropogenic inputs to the GBR lagoon are uncontrolled experiments still in progress, and some understanding of what has happened to date can facilitate the development of predictive models for the future. From a natural resource management perspective, models that relate the known history of catchment land-use change to observed changes in coral and sediment cores in the GBR are required if future contaminant inputs and dispersal patterns are to be estimated and a management response developed.

Acknowledgments

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Chapter 11

Herbert River Catchment Atlas

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Herbert River Catchment Atlas available on Web site
http://hric.tag.csiro.au/information/atlas/index.html

EVALUATION OF INTEGRATED CATCHMENT MANAGEMENT IN A WET TROPICAL ENVIRONMENT: COLLECTED PAPERS OF LWRRDC R&D PROJECT CTC7

Compiled by Jennifer A. Bellamy

VOLUME 7

IMPLEMENTING ICM: EVALUATION AND INFORMATION NEEDS

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Chapter 1

Evaluation of science-based research and development: a review in the context of integrated catchment management

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INTRODUCTION

There is growing recognition of a class of resource use issues whose identification and management have not been effectively addressed by conventional science-based disciplinary approaches to their solution (e.g. Lange 1990a; Mitchell 1990; Resource Assessment Commission 1993; Syme *et al.* 1994). These resource use issues characteristically arise in those situations (Lang 1990a):

> *where problems are highly complex, interests and objectives are numerous and in conflict, information and knowledge are quite incomplete, ends and means are ambiguous, control is fragmented and the external environment is in flux.*

The complexity and long-term nature of many of these emerging issues requires new and integrated approaches to their management if they are to be dealt with effectively. Included in this class of issues are many which fall within the scope of integrated resource management. Integrated resource management is an approach to planning and management that attempts to place resource use problems and opportunities in a systemic or holistic framework with an aim to finding integrative solutions by addressing resource use problems and their management in the broader context of their associated land, water, social, economic and institutional attributes (Lang 1990b; Resource Assessment Commission 1993).

Conventional science-based disciplinary approaches to Research and Development (R&D) as a means to support integrated resource management and related planning activities may lead to ad hoc decision making and piecemeal action, aimed more at treating symptoms while systemic effects and emergent properties may be overlooked, long-term changes masked, and/or cumulative effects ignored (Lang 1990a; TASQUE 1992; Brown and McDonald 1993). Adoption of integrated approaches, however, requires shifts in attitudes, a longer time frame and acceptance of new approaches to resource management issues.

Catchment care programs, such as Integrated Catchment Management (ICM) on which this chapter is focussed, are a special case of integrated resource management. Such programs are being implemented in several Australian states (e.g. Queensland Department of Primary Industries 1993; Syme *et al.* 1994). The philosophy underlining these programs is an acknowledgment that there are no simple solutions, nor a single disciplinary perspective that can provide and appropriate course of action to deal with complex resource use issues within a catchment context. What contribution can science-based R&D make to ICM principles and practice? Most importantly, how should we evaluate the contribution of an R&D intervention for ICM? These questions are explored in this chapter.

The evolution and scope of integrated resource management and ICM in Australia is first explored in further depth. We then consider some key characteristics of resource use problems falling within the ICM domain, and contrast these with the problems and approaches that have been typically addressed by science-based R&D. The need for an evaluation of the effectiveness of science-based interventions in catchment care programs is addressed and potential approaches to evaluation are explored.

Integrated resource management in Australia

Characteristics of integrated resource management

Integrated approaches to resource management and land use emerged in the 1980s in Australia against a background of increasing pressure on natural resources, growing public awareness of natural resource issues, and increasing community expectations for influences in land use

decision making. At the broadest level, integrated resource management procedures involve the integration of both environmental and economic consideration at management, planning and policy levels, which is argued to be an effective means of implementing the principle of sustainable development (e.g. Lang 1990b; Resource Assessment Commission 1993).

An important characteristic of integrated resource management is that it commonly focusses on multiple objectives. For example, Mitchell and Hollick (1993) and the Resources Assessment Commission (1993) have defined five generic objectives of integrated resource management, as follows:

1. *Systems components*: to manage resources with regard to the interactions among the component parts of natural and human systems and the linkages between those systems.
2. *Balanced components*: to ensure that economic development, protection of the environment and social values are considered in all major decisions concerning resource use.
3. *Strategic components*: to emphasise key (rather than all) issues, to be adaptive to changing conditions and to set indicators against which performance is evaluated.
4. *Partnership component*: to involve individuals, non-government organisations and all levels of government in decision making, as well as in increasing awareness and understanding of resource use issues, identifying management objectives, determining the responsibilities and powers of all parties, developing mechanisms for effective communication and cooperation, and establishing conflict resolution mechanisms.
5. *Jurisdictional components*: to ensure that measures applied under several jurisdictions that cover a single system are streamlined through exchange or sharing powers or coordinated by consultation.

Lang (1990b) proposes that integrated resource management and planning needs to be strategic, interactive and adopt multiple perspectives, that is, to advance beyond technical rationality to encompass perspectives that are personal, organisational and political. Such strategic approaches have been recommended in several resource management contexts including the management of coastal resources (Resource Assessment Commission 1993), local government environmental management (TASQUE 1992; Brown and McDonald 1993), land use planning (Douglas 1990), and importantly in the context of this chapter, catchment management (e.g. Hollick and Mitchell 1991). Davis and Weller (1993) define a 'strategic approach' as one that establishes broad objectives, and identifies a process by which they may be achieved, that is, one that integrates goals, policies and strategy into a cohesive whole. In the more traditional approaches to program management, policy formulation precedes implementation. In the strategic model, Davis and Weller (1993) point out that 'an implementation process which eventually generates its own goals may be as legitimate, and as strategic, as one which follows the traditional management model of plan, implementation and control'.

The potential contribution of integrated resource management to positively influence resource use practices is seen to arise through opportunities associated with its various attributes. For example, Mitchell (1990) proposes that integrated resource management be viewed as a vehicle to positively enhance economic and social change. Syme *et al.* (1994) suggest that an integrated approach to catchment management will provide a more diverse range of means to manage resource use issues, as well as broader motivation for land managers and other stakeholders to deal with them, particularly through changes in both attitudes and behaviour.

Catchment care programs in Australia

Catchment care programs, including ICM and its close relation, Total Catchment Management (TCM), have been adopted as policy by some Australian states for catchments where there are conflicting and competing resource use problems and/or multiple institutional responsibilities.

These programs aim to achieve balanced and sustained use of land, water, vegetation and other biological resources through the coordinated and cooperative actions of individuals, community groups, industry and various levels of government. The argued need for ICM is due to environmental, economic, social and institutional factors (e.g. Laut and Taplin 1989; Syme *et al.* 1994), including:

- continuing degradation of land, water and related resources;
- conflicting government policies;
- different agencies with statutory responsibilities leading to non-complementary programs; and
- increasing public expectations for involvement in decision making.

There are no simple short-term solutions to these issues. The clear implication is that there is a need for programs that provide the attributes identified as being common to ICM strategies in Australia by the Resource Assessment Commission (1993), namely:

- management of interrelated resources with regard to ecological processes and the maintenance of environmental quality;
- involving community participation in natural resource management; and
- coordinating government, non-government and community natural resource management policies and activities.

Benefits that are generally attributed to the application of ICM processes include the development of catchment management strategies, and the planning and implementation of resource use practices on a catchment-wide basis that can lead to sustainable use, management and conservation of natural resources (e.g. Mitchell and Hollick 1993; Queensland Department of Primary Industries 1993; Syme *et al.* 1994). The implementation of such programs in Australia, however, is in its infancy, and is largely experimental. As practices, they have been primarily used as vehicles for community awareness programs (Syme *et al.* 1994). The actual approaches that have been adopted vary between states (e.g. Laut 1992; Mitchell and Hollick 1993; Queensland Department of Primary Industries 1993; Syme *et al.* 1994) but are essentially focussed on the application of science-based knowledge to resolve concerns over land and water management on a catchment basis through both community action and statutory change. The evaluation of the effectiveness of the ICM process itself in resolving land and water management problems in Australia, however, is one of the most neglected areas of resource use management.

Can science-based research and development contribute to catchment care programs?

The nature of information needs of integrated resource management is characterised by its context of complex problem settings, multiple stakeholders, divergent interests and scales of relevance and relative urgency. This seems to contrast with the characteristics of information derived from traditional R&D endeavours focussed on single, specialised disciplines, namely repetitive trialling, limited scale and medium to longer-term focus for information delivery. Moreover, traditional R&D approaches are highly analytical rather than systemic (Patton 1987). This may restrict their capacity to usefully contribute to decision making within an ICM context. The trend to more participative models of R&D management (e.g. see Chapter 7) with an increasing focus on system multi-disciplinary teams addressing complex resource management problems is a significant move away from this position (MacLeod and Van Beek 1993). The flexibility of this new approach to R&D would seem to be more closely aligned to the nature of the problems being addressed by ICM.

Given this background, three are four important issues relevant to the potential contribution of science-based R&D to ICM, as follows:

- a common mismatch between research and decision-making needs in policy-related areas, including the gap between R&D that is immediately feasible and the information needed for urgent decisions (Kaimowitz *et al.* 1990; Chelimsky 1991);
- uncertainty is integral to the biophysical, socio-economic and institutional aspects of resource management and planning (Funtowicz and Ravetz 1990; Costanza *et al.* 1992);
- ICM may require resource managers (e.g. individual landholders, industries, conservationists) to adopt practices or production systems which provide no direct or immediate economic or social benefit to themselves or the local community (Hollick 1992); and
- much science-based R&D ignores the context (i.e. political, technical, organisational, economic, social) within which its outputs will be evaluated and potentially applied and, therefore, this affects the use and relevance of the R&D (e.g. Kaimowitz *et al.* 1990; Mitroff 1993; Ormala 1994).

We ask the question of how science-based R&D might enhance the effectiveness and efficiency of ICM. The four issues are discussed in the following subsections.

Limited synchrony between R&D information and decision-making needs

The complexity of ICM issues and the immediacy of decision-making information needs will commonly lead to policy makers having to handle and synthesise information of vastly different qualities and types. Such information usually represents a mixture of qualitative (or "heuristic") and quantitative data, the later fitting more closely within the comfort zone of traditional R&D practitioners (Patton 1987). For example, hydrological data have traditionally been provided by R&D projects in a quantitative form for specific situations. However, as the scale being addressed and the type of information required to resolve land use problems becomes more complex, the ability of R&D to produce models capable of generating reliable quantitative estimates is reduced. Grayson *et al.* (1993) argue that under these circumstances, reliance on quantitative estimates should be replaced by qualitative descriptions of the pattern of hydrological response and that this information should be combined with simple reasoning to assist decision making. This relatively pragmatic approach is consistent with both the availability and quality of so-called "hard" data and the ability of R&D practitioners to represent complex natural and human systems.

Uncertainty

An important characteristic of the decision-making environment associated with ICM applications is the high level of uncertainty associated with the parameters underlying the biophysical, socioeconomic and institutional components of the managed system and their linkages. That is, there are both large degrees of uncertainty and many sources of uncertainty associated with the ecological system as well as with human behaviour. This compounds the complexity inherent in catchment resource management issues.

In many instances, problems facing decision makers may be sufficiently advanced or developed to be rendered irreversible, at least in an economic sense. Under these circumstances, Funtowicz and Ravetz (1990) suggest that the practical considerations become restricted to those of coping, presumably within the constraint of vastly changed and inferior environmental conditions. Alternatively, while a resource quality issue is not definitely known or recognised to be irreversible, it may still be considered to be too complex to resolve in a sufficiently short time, or the uncertainty surrounding its status may swamp the relevant facts that are known (Funtowicz and Ravetz (1990).

Uncertainty needs to be managed and effectively communicated so that it becomes a recognised input to decision making (Funtowicz and Ravetz 1990; Costanza *et al.* 1992). The performance of

the science-based R&D community in this area has been relatively poor (Keeney and Van Winterfeldt 1986; Hance *et al.* 1989).

Three categories are uncertainty have been distinguished by Lang (1990b) with respect to integrated resource management.

1. Uncertainty concerning 'the problem' and its context. This creates a demand for more R&D, better data, improved predictions and tools such as risk assessment.
2. Uncertainly concerning what to do about the problem, with respect to both 'ends and means'. This raises a call for better policy guidance and innovative solutions.
3. Uncertainty concerning what 'others' in related field of choice may do. This requires collaboration and coordination.

The perception of risk may be different for the R&D specialist, land managers and other stakeholders. This is, for example, consistent with the findings of MacLeod and Taylor (1992) who highlighted major differences between perceptions of land degradation problems held by a rang eof groups with an interest in sustainable management of grazing lands in Queensland. Similarly, there was a wide divergence, both between and within the groups studied, in perceptions of the solvability of sustainable resource use problems and the potential role of formal R&D in finding such solutions.

However, with the possible exception of the third type of uncertainty, there would seem to be considerable scope for science-based R&D to assist decision makers by removing some of the underlying sources of uncertainty. While it is unlikely that R&D will ever deliver a definitive solution to a given complex land resource management problem, by removing some of the uncertainty associated with resolving such problems, it should be able to make a contribution in terms of moving to a more certain position.

Non-immediacy of payoffs to ICM

Conflicts and problems arising from both single and multiple uses of natural resources within catchment areas may be non-source point in nature (e.g. Chisholm 1987a). That is, the so-called 'sources' and 'sinks' of some resource problems, including land and water degradation and the loss of other attributes of environmental amenity, may be both spatially and temporarily separated. The creators and recipients of such pollution rarely meet on a voluntary basis to seek socially beneficial solutions. Moreover, there may be little reward for individuals and groups taking independent action, in the sense that private costs and social benefits of the action may be non-coincident (Hollick 1992). These classic externalities of the economic literature commonly defy solution through market-based instruments (e.g. fiscal policies including taxes and subsidies) and require social or institutional resolution (Chisholm 1987b). Science-based R&D can offer decision makers insight into the nature of the trade-offs, particularly the technical elements of the decision problem of interest.

Contextual relevance

It has been claimed that much science-based R&D effort, including that at the 'applied' level, is conducted in apparent ignorance of the context within which potential stakeholders and policy decision-makers will have to judge its ultimate relevance 9e.g. Kaimowitz *et al.* 1990; Mitroff 1993). That is, problem definitions are commonly set in context-neutral terms or, at best, set in terms relevant to the context of only a subset of the 'identified' stakeholders. Unhappily, our personal observation would confirm this.

However, more recent work in the field of agricultural extension and knowledge systems and technology transfer has highlighted the importance of stakeholders' real and perceived circumstances, as well as the decision context, to the successful meshing of R&D ouputs and the demands for them (e.g. Van Beek 1991; Ison 1993). For example, Ison (1993) has proposed that behaviour is determined not only be attitudes, but also by its context. Different individuals will 'see' the same situation as different systems and will, therefore, perceive change and what constitutes an 'improvement' somewhat differently. Van Beek (1991) argues that stakeholders are participants in arrays of communication networks or knowledge information systems through which they exchange information and obtain knowledge relevant to their decision-making context and needs. Formal R&D bodies are only one player in the relevant knowledge information systems and their importance for a given decision problem will depend on context, which is transient.

Integrated catchment management: an environmental, social or institutional problem?
The effect of rural land use on catchment environments is frequently viewed as an environmental management problem for which technical solutions can be found through science-based R&D and farmers/resource managers adopting the appropriate technologies. While this 'technical rationality' approach has allowed specialist R&D professionals to focus on well-defined problems, it has also led to many resource management issues being examined from the narrow perspective of an individual discipline and the associated institutional clientele (Resource Assessment Commission 1993). Mitchell (1990) argues that, in so doing, it has often overlooked other societal values and interests. Lange (1990b) observed that 'conventional' resource management has several undesirable outcomes including: piecemeal action aimed at treating symptoms while systemic effects and real needs may be overlooked; being oriented to the status quo rather than being innovative; promising only limited results without realising the full potential of resource use; and omitting interests without power.

The foregoing is consistent with the findings of Thompson and Warburton (1985) who, in examining the management of environmental problems in the Himalayas, found that although the key management problem was uncertainty, it extended beyond 'technical uncertainty'. Rather, a major factor was 'structural uncertainty" relating particularly to institutional factors. They concluded that 'when the problem is to know what the problem is, we need more than one perspective'. This applies to both science-based disciplines, as well as different groupings of stakeholders.

Syme (1992) views ICM as a problem of institutional change in coping with a redefinition by the community of the problems of environmental management and the government's ability to cope with these 'new' problems. He concluded that ICM should be viewed primarily as a social rather than an environmental problem (Syme *et al.* 1994):

> *The social dynamics operating within rural communities may act to facilitate or impede efforts to sustainable approaches to resource management. As a logical extension of physical planning research, research of community nature can enrich the information and knowledge about communities, including constraints to change and factors that may facilitate change.*

There is wide recognition that sociocultural, economic and institutional factors will affect the acceptance and adoption of resource management practices (e.g. Young 1992). Some examples include the following:

- Attitudes influence farmer's decisions about whether to adopt certain farming techniques to prevent water pollution (e.g. Napier *et al.* 1986). For example, if farmers did not value the physical environment highly, they were less likely to adopt conservation technologies.

- The perception of land condition and the nature of change in land/ecosystems can be different for scientists and land managers and will affect the emphasis and values that they place on certain concerns (Ison 1993).
- The perception of risk is also significant in the adoption of 'sustainable' management practices. For example, Napier and Brown (1993) concluded that the perceived threat to family health was a significant motivation to take action to prevent contamination of groundwater resources.
- Napier and brown (1993) have found that farmers will not change production practices to protect groundwater from contamination, if the adoption of new farming systems threatens the economic well-being of the farm enterprise.
- Economic constraints, including commitments to previous investments in fixed assets and the level of farm debt, are common barriers to adoption (Hooks *et al.* 1983; Napier and Brown 1993).
- Multiple or overlapping jurisdictions of institutions, and related difficulties in collecting and disseminating information have been found significant in risk communication (Hadden 1989).

The foregoing points highlight that while science-based R&D might offer a key role and a potential contribution to complex catchment management issues, it will do so as only one of the source of information. Clearly, there is a range of important perspectives and interests that need to be recognised in any endeavour to promote enhancement in both individual and social welfare through more holistic approaches to catchment care. Nevertheless, we believe that science-based R&D will continue to be recognised as a significant contributor to ICM, and that ICM decision makers will continue to look to R&D for solutions to specific aspects of resource-use problems.

Evaluation in science-based research and development for integrated catchment management

Although there has been a considerable amount of R&D focussed on many biophysical processes and other technical issues that are relevant to ICM, there has been little research on the social, economic and institutional aspects of its implementation. There has also been little objective evaluation of the effectiveness of science-based R&D to the ICM process in resolving land and water management problems in Australia.

Evaluation is 'the act or result of judging the worth or value of something' (Prinsley 1994). The specific practice of evaluation research has been defined by Patton (1986) as:

> *the systematic collection of information about the activities, characteristics, and outcomes of programs for use by specific people to reduce uncertainties, improve effectiveness, and make decisions with regard to what those programs are doing and affecting.*

Given the uncertainty associated with the complex natural and social systems that catchment care programs operate within, barriers to adoption of 'sustainable' technologies, and the gaps between research and decision making, evaluation of R&D designed to support ICM programs is essential.

However, to be worthwhile, evaluation is not an activity that can be tacked onto the current research management process, but must be developed in conjunction with this process so that it becomes an integral part of it (Prinsley 1994). Evaluation, therefore, should be an ongoing and integral part of both the process of ICM implementation and of any specific R&D intervention in that process.

Evaluating research and development intervention in ICM

In a review of R&D evaluation, Prinsley (1994) defined the purpose of evaluation as 'providing a basis for informed decision-making in the initiation, selection, direction and termination of R&D'. How might policy makers and other ICM stakeholders assess the value of a particular R&D program as a contributor to ICM?

Georghiou (1989) argues that evaluation of R&D is a social process, and that the organisation of that process is critical to the outcome of evaluations. Catchment care programs, like ICM, are long-term and evolving processes in which the needs of the program and the perception of those needs by stakeholders within the community, industry, government and R&D agencies will also change over time. Therefore, in any R&D program it is essential for catchment care that those evolving perceptions and changing needs are assessed and monitored as an ongoing process over the duration of the program to ensure relevance of the R&D. The R&D evaluation process, therefore, also needs to be an iterative process.

Research on program evaluation (e.g. Crane 1988; Pancer and Westhues 1989) has found that the critical factors affecting program implementation will vary depending upon the particular stage of development of the implementation process. Therefore, the criteria or methods for evaluating an R&D intervention in an ICM program or process need to be flexible and vary according to the stage of implementation, as well as the nature of the particular resource problems and issues being addressed. Moreover, attempts to solve one problem may actually sow the seeds of other problems because of adverse and unforeseen consequences of actions (Ingram 1990). When dealing with complex and/or conflicting resource use issues, the most appropriate evaluation criteria may not be whether specific problem-related objectives are achieved, but rather, whether the resulting problems are more 'tractable' or manageable than the initial ones.

The role and success of an R&D intervention in an ICM process are likely to be affected by different factors in different regions. For example, the key factors in rangelands will always vary significantly from those relevant to intensive tropical cropping. The factors may be environmental, economic, social or institutional, with different weightings appropriate to the specific circumstances. Any evaluation, therefore, should focus on the opportunities, as well as the constraints of the environmental, socioeconomic and institutional context that influences the potential of that region to change and adapt to the demands of catchment management needs. In some areas, for example, there may be no financially viable solutions to existing problems. Therefore, even when new technologies or practices have been extensively researched, and even adopted, their effect needs to be monitored and evaluated within the context of their application.

The importance of involving decision makers and other information users (i.e. stakeholders) who represent a wide range or diversity of perspectives in the evaluation process is widely recognised (e.g. Patton 1986; Greene 1988; Mitchell and Hollick 1993; Prinsley 1994; Chapter 7). The major benefits claimed for stakeholder participation and utilisation are enhanced understanding of the program and evaluation findings, including how the program works, a broader view of the key issues, and acceptance or ownership of the program and its results.

A participatory evaluation approach to R&D in ICM, in which the evaluation process is an integral part of the R&D methodology, will provide opportunities for enhancing the effectiveness and efficiency of the R&D. That is, the evaluation needs to be an iterative and ongoing part of the science-based R&D methodology. Consequently, the evaluation will influence the effect of the R&D in an ongoing way. The program's goals and baselines for observing change (e.g. in attitudes and behaviour, or the effect on the environment) will evolve and, therefore, need to be

reassessed frequently. Participatory approaches are discussed in detail elsewhere (e.g. see Chapter 7; Chapter 8).

Approaches to evaluation of research and development for catchment care

Evaluation research emerged in the late 1970s within the public administration and social policy fields, with the emphasis on program evaluation. Several approaches and frameworks for evaluation that are relevant to science-based R&D programs for catchment care are briefly described below.

Some of the most comprehensive research on program evaluation has been undertaken in the context of policy science. Mazmanian and Sabatier (1983) have comprehensively evaluated factors affecting policy implementation. In seeking to explain variation in implementation success across programs and organisations, they emphasised stakeholder attitudes and behaviour, role of agencies, technical tractability, statutory structures and behaviour change within a resource-planning framework. This evaluation approach has most commonly been applied in the final stages of a program to assess the outcomes or the product of the program, that is, the extent to which the original objectives were achieved. Sabatier (1986) proposes that this approach appears to be most useful in situations in which there is either a dominant piece of legislation, or where research funds are limited. However, a major difficulty arises if the evaluation results indicate that the policy objectives have not been met (Pancer and Westhues 1989) or were inappropriate to the current situation or context. Such 'top down' approaches have also been shown to be difficult to use in situations where there are a multitude of government policies and actors (Sabatier 1986).

Crane (1988) has proposed a set of five assessment criteria for evaluation of social policies which can be adapted for the context of science-based R&D in ICM, as follows:

1. *Inclusiveness*: the extent to which the policy as implemented takes into account all of the populations at risk.
2. *Adequacy*: the degree to which the policy accomplishes its qualitative goals, for example, reduction in poverty.
3. *Equitableness*: the extent to which the distribution of benefits and risks associated with the policy impact on the different groups of people affected by it.
4. *Effectiveness/efficiency*: the cost effectiveness of the policy, relative to other possible policies, in achieving the goals established for policy.
5. *Democratic involvement*: the degree to which persons directly served, or residents of areas in which the policy is in effect, or the general public, are empowered to contribute to the planning, implementation, improvement or termination of the policy.

Taking the problem of risk assessment, Crane (1988) illustrates how these criteria can be turned into broad evaluation principles to guide the development of a research program.

Evaluation research in social policy has recently placed more emphasis on evaluating the process of program implementation and development rather than the product or program outcome *per se*. For example, Dehar *et al.* (1993) have demonstrated the importance of the application of both formative and process evaluation in leading to: (a) better designed and more effective health promotion and disease prevention programs; and (b) improved understanding of the factors influencing program outcomes. Process evaluation documents and analyses the way the program operates to assist in interpreting program outcomes and to enhance future program planning. Its primary purpose is perceived to be understanding how a program achieves what it does. Formative evaluation, on the other hand, involves the ongoing collection and feedback of

information relevant to program planning and operation for use by decision makers in developing and improving a program as it is designed and implemented. It therefore necessitates collaborative working relationships between the evaluator and those planning and implementing the program. Dehar *et al.* (1993) identify the primary purpose of formative evaluation as generating information that can be sued by program decision makers to refine and improve the program on an ongoing basis from an early stage.

Given the more recent shift in focus of research and innovation from an emphasis on scientific progress to its effect on economic and social development, impact assessment has also been identified as an essential element of R&D evaluation. Ormala (1994) ahs argued that R&D effect cannot be measured directly, but should be explored in terms of a combined set of quantitative and qualitative impact dimensions. Xu (1994) emphasises the need to incorporate within program planning an assessment of how the distribution of impacts of a program affect the sustainability of development or resource use, as well as social welfare. Ormala (1994) points out because effects are highly dependent on the specific social and economic context, they may take considerable time to become visible, and the complexity of attribution of the impact to a program or R&D intervention increases with time.

Pancer and Westhues (1989) have proposed a 'developmental stage approach' to program planning and evaluation which emphasises a need to match the evaluation research techniques, if appropriately matched to the specific stage of development, can lead to more informed decision-making at each stage, and resolve the questions that need to be answered before proceeding to subsequent stages. Although they recognised that the course of program development may not be a linear one, Pancer and Westhues (1989) identified eight general stages of program development, as follows:

- the determination of societal values;
- assessment of social needs or problems;
- determination of goals;
- design of program alternatives;
- selection of an alternative;
- program implementation;
- program operation; and
- program outcome.

They perceived each of these stages as being characterised by a central question that defines its evaluation research function, and by which research techniques might appropriately be used. These evaluation research functions include: (a) assessment of needs; (b) evaluation of process; (c) evaluation of outcomes; (d) analysis of program values, goals and logic; (e) assessment of program feasibility; and (f) assessment of program implementation. The actual research techniques may include surveys, interviews, social indicators, cost-benefit analyses and the use of other research instruments such as indexes, scales or social impact assessment. Prinsley (1994) emphasised the importance of maintaining links between each stage of the R&D evaluation, both between techniques and criteria, as well as the people who are carrying out the evaluation.

Evaluation of a science-based R&D intervention in an ICM process will invariably need to integrate several evaluation techniques. For example, Syme and Sadler (1994) and Syme *et al.* (1994) have identified some general guidelines for regional water use issues that involve an interactive partnership approach conducted in association with the community. It has three methodological components, as follows:

1. *Formative evaluation*: allowing the results of each component of the evaluation to influence the development of the ICM process.

2. *Participation*: those involved in the ICM process have an input into the design of the evaluation process.
3. *Developmental*: utilising Pancer and Westhues (1989) logical staged-approach to program development as the starting point for the evaluation.

Although there are many techniques for program evaluation, actual methodology for R&D evaluation is still in a developmental stage. There is no simple 'black box' solution that can be tacked onto the current research management procedures. Most significantly, Prinsley (1994) proposes that 'it is the process of evaluation and focussed interactions and systematic thinking of users of the evaluation techniques that is its major benefit and not the number that comes out at the end'. In other words, the process of developing and using R&D is as important, if not more so, than the R&D product itself.

Problems in evaluation

Despite the advances that are being made in developing and testing program evaluation methods, several problems areas remain. Some key issues relevant to science-based R&D in ICM are discussed briefly below.

Perhaps, at the philosophical level, the major problem facing any ICM-related evaluation will remain the lack of clarity in articulating what the program is intended to achieve, and from whose perspective. Without this clarity, evaluation of the success of an R&D intervention is clearly problematic. Some progress might be made by considering the basic question set that Patton (1987) saw as fundamental to directing any program evaluation involving qualitative research methods. The question set, which can be generalised to the broader question of evaluation *per se*, is as follows:

1. *Who* is the information for and *who* will use the findings of the evaluation?
2. *What* kinds of information are needed?
3. *How* is the information to be used? For what purposes is the evaluation being done?
4. *When* is the information needed?
5. *What* resources are available to conduct the evaluation?

In the context of ICM, as described in previous sections, answers to these questions are not entirely clear-cut. Patton (1987) argues that the major challenge for evaluation is 'getting the best possible information to the people who need it – and then getting those people to actually use it for decision making'. In doing so, he argues that any evaluation design or procedure will necessarily be 'an interplay of resources, practicalities, methodological choices, creativity and personal judgements by the people involved'.

At a more specific level, it may be difficult to establish the precise nature of the relationship between an R&D intervention or an ICM process and actual changes in management practices, or in the broader ecological or socioeconomic environment, because of the dynamic nature, number and complexity of contributing factors (e.g. Ormala 1994). This problem remains a major one for social science-based research, especially that related to the so-called 'soft-systems' approaches to situation improvement in human systems (e.g. MacLeod *et al.* 1996).

The problem of how to determine appropriate indicators of change, and what to measure about them, is an equally difficult issue for both the 'hard' biophysical sciences and the 'soft' socioeconomic sciences. In all likelihood, some indicators and measurement techniques will be drawn from the hard sciences, but others from within the context of the wider community and

stakeholder groups. Consensus on the appropriate indicators and techniques will need to be negotiated between the 'who's' of Patton's question set referred to previously.

More generally, Mitchell and Hollick (1993) have observed that catchment care programs, like ICM, require a long-term perspective and one that reflects the concerns of the broader community. They also require an appreciation that many people and agencies need to move out of their 'current comfort zones'. As a consequence, Mitchell and Hollick (1993) warn that undoubtedly any ICM implementation may well encounter 'turbulence and debate'. This will invariably also be the case for any science-based R&D intervention in ICM.

Conclusion

Within the context of catchment care, science-based R&D is a part-player in a complex process. It is not useful to think of the socioeconomic dimension as a constraint to proper catchment care. The integration of the science-based and social perspectives offers opportunities for strategic management which cannot be generated by any one set of actors alone. Traditional discipline-based science has a good deal to offer catchment care programs, particularly in the context of fillings gaps where 'hard' knowledge is required. Moreover, it can make an important contribution to reducing the uncertainty that is common to the complex resource use problems generally associated with catchment management. However, the overall contribution of science-based R&D to the success of catchment care programs will be enhanced through evaluation being an integral part of the R&D process.

Increasingly the practice of science-based R&D is changing to encompass more participatory and flexible approaches, which are essential characteristics of catchment care programs. The key issue is for science-based R&D to take an objective view of what its real contribution can be to such programs, and the rate at which the R&D can be delivered. This will require a willingness on the part of policy makers to understand some of the reality of the R&D environment, and at the same time, for R&D practitioners to understand the decision-making environment of ICM stakeholders, in order to bridge the gap between the two.

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Chapter 2

Evaluating Integrated Catchment Management in a Wet Tropical Environment: A Working Paper

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1. INTRODUCTION

Most Australian states are promoting and supporting natural resource management programs as a means of implementing sustainable resource use objectives or policy. These programs are grounded on the assumptions that natural resource management and planning should be a coordinated government process conducted in partnership with the community and should take a strategic perspective at a regional or catchment scale. Operationalising these assumptions has proven challenging to both the government agencies and the communities concerned. These difficulties can be attributed in part to inadequate attempts to evaluate the efficacy of such approaches to integrated resource management. In particular, evaluation has generally been:

- fragmented in terms of reconciling the different perspectives in evaluation,
- insensitive to the socio-political context of program performance,
- hampered by an inherent lack of assessable goals and outcome measures, and
- conducted as a cross-sectoral snap-shot in time rather than a longitudinal study (Bellamy *et al.*In Press).

2. AN INTEGRATED EVALUATION FRAMEWORK FOR ICM

2.1 Evaluation Principles

Approaches to natural resource management and planning need to be evaluated as a system that links policy to on-ground action. In this context, the evaluation of Integrated Catchment Management (ICM) in the Herbert River catchment needs to be:

(a) conducted in terms of the fundamental assumptions and instrumental hypotheses that underpin natural resource management policy, planning and management action (assumptions or hypotheses may relate, for example, to: coordination, public involvement, partnership, integration, representativeness, ecosystem management, technical support, duty of care, cost sharing, or fairness and equity).

(b) grounded in the natural resource, institutional, economic, socio-cultural and technological contexts of program implementation in practice.

In principle, evaluation should not only allow for the assessment of *impact (*i.e. environmental, economic, social, institutional, and technological) but importantly it should also be implemented as a *process tool* that:

- supports purposeful and informative stakeholder participation;
- creates improved opportunities for the incorporation of on-going learning processes at individual, organisational and policy levels;
- facilitates negotiation and mediation processes; and
- supports the move towards the amelioration of, or improvement in, the tractability of regional resource use management and planning problems.

Fundamental to an evaluation that supports this approach are the underlying principles that an effective evaluation method needs to:

(i) provide a framework for the integration of the different perspectives on evaluation of regional resource use planning processes and support mechanisms (ie., social, economic, environmental, policy and technological perspectives);

(ii) recognise the underlying assumptions and hypotheses that underpin the ICM policy and its implementation as well as ICM activities, processes or products, or body of knowledge;

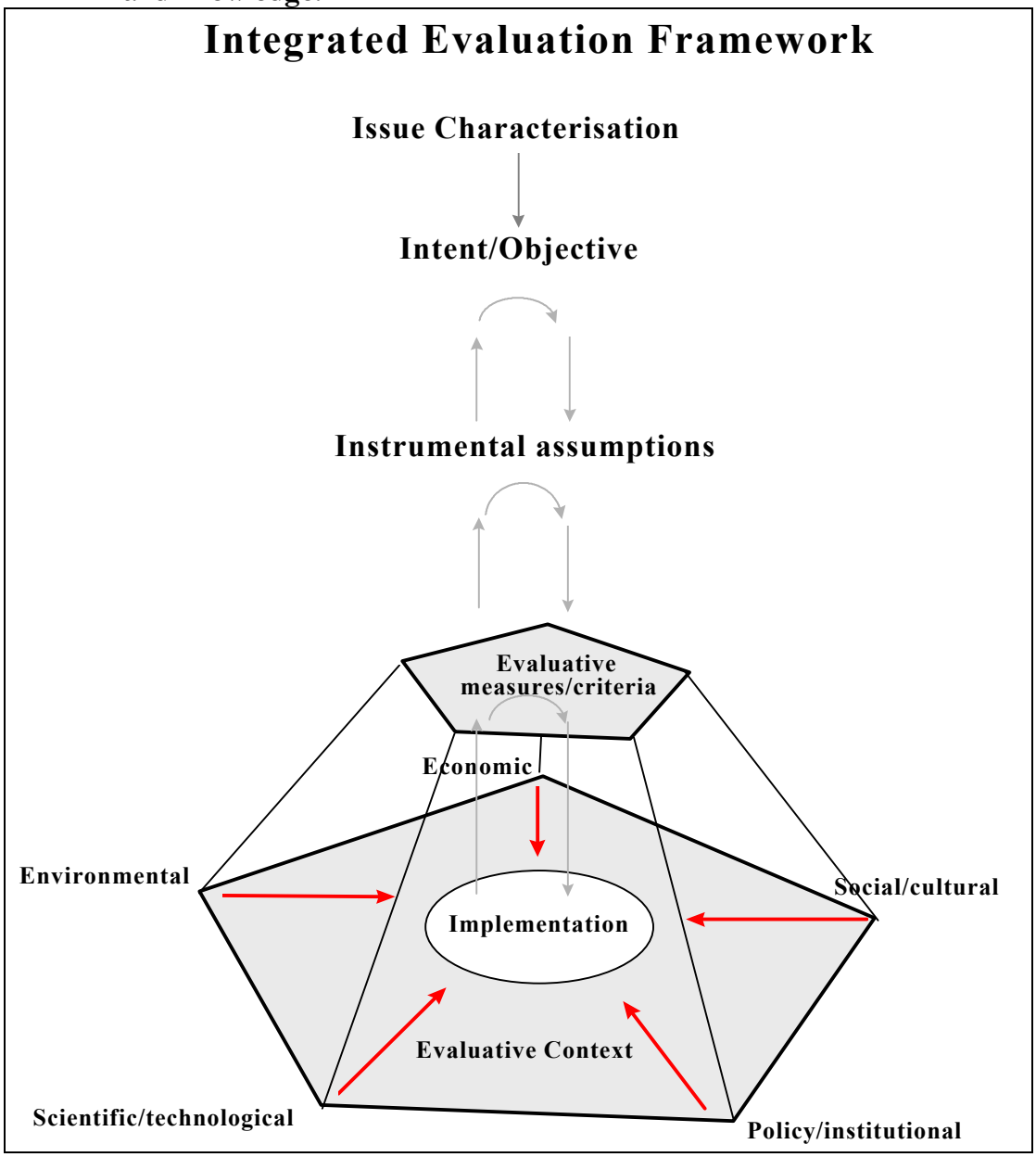
(iii) base performance assessment on the establishment of practical, valid and equitable evaluation criteria by which change can be monitored and assessed; and

(iv) ground the performance assessment within the natural resource, policy/institutional, economic, socio-cultural and technological contexts of regional resource use planning processes.

2.2 A Systems Approach to Evaluation

A multi-perspective systems framework that provides the basis for an integrated evaluation of the different perspectives (i.e. social, economic, environmental and institutional) on the natural resource management and planning process is developed to evaluate the Herbert ICM process (see Figure 1). This framework recognizes the multiple levels and nested nature of natural resource management policy, namely: problem characterization, policy formulation and intent, program logic, and on-ground implementation. It links the rationale of the IRM policy, process or tool to its implementation and impact on the ground. It also provides the basis for synthesising the multiple perspectives on the evaluation of the phenomenon or object of interest.

Figure 1. Integrated systems framework for the evaluation of IRM processes, products and knowledge.



The framework provides a systems approach to the evaluation of a IRM policy or program implementation, activity, process, tool or body of knowledge. The five key elements of this framework are defined in Table 1 and discussed below.

Table 2.1: Definition of elements of the IRM evaluation framework.

Element	Definition
Issue characterisation	The nature of the issue or problem underlying the object of evaluation (e.g. program or policy, activity, process, method/tool, body of knowledge), and the context in which the issue or problem evolved.
Intent	The objectives and intent of the object of evaluation, the expected outcomes and the key stakeholders and users of the outputs or process need to be clearly identified.
Instrumental assumptions	The underlying assumptions and instrumental hypotheses or rationality underpinning the implementation of the object of interest need to be made transparent.
Evaluative measures/criteria	Natural resource, economic, social, institutional and technical indicators which reflect on progress in achieving key objectives and outcomes, and which are interpreted within the context in which the object of evaluation is implemented and impacts.
Evaluative context	The contextual elements (e.g. environmental, economic, social, institutional, technological) that identify the constraints on performance and the factors that influence the implementation of the object of evaluation and its impact.

Issue/Problem Characterisation

The background to the object of interest being evaluated and the characterisation of the context in which it evolved.

Objective/Intent

The purpose(s) of the object of evaluation (e.g.policy, program, activity, process, method, tool, body of knowledge) need to be identified and clearly linked to the intended users and stakeholders of the research. These stakeholders will invariably be multiple including a range of government agencies, industry and community interests.

Theoretical Basis and Instrumental Assumptions

Theory describes the phenomenon of interest by identifying: (i) the boundary that defines the domain of interest, (ii) key constructs or "entities of interest" in that domain, (iii) the values or states these constructs or entities can take, and (iv) the relationship among the key constructs or entities (Eierman *et al.* 1995). Theory can be used in evaluation, for example, to propose and test links among key factors indicating the direction and degree of impact they have on IRM implementation and impact. An atheoretical research or evaluation approach may collect interesting facts but there is a danger that no unifying theme or predictable patterns or relationships emerge. Defining the construct space of a phenomenon provides the basis for establishing validity and ultimately sound measures that can be applied to a variety of contexts (Grover *et al.* 1996, p.187).

Each theory base brings with it different methodologies, assumptions and value systems. In evaluation, identifying the theory underpinning the implementation of the object of interest therefore will highlight the underlying assumptions and instrumental hypotheses, clarify what evaluation measures are needed, and contribute to an understanding of causal linkages (Bellamy *et al.* 1998). Significantly, it is necessary to make explicit and transparent the rationale of the

object of evaluation, that is the hidden or implicitly held assumptions, behaviours and motivations reflected in identified goals of that object and which influence decision-making and IRM implementation processes. Such underlying assumptions or instrumental hypotheses may relate to:

- program or policy logic;
- stakeholder involvement;
- collaboration;
- process;
- policy and institutional arrangements;
- technical information and support;
- communication;
- policy or process impacts; or
- project products and outcomes.

Purpose of an Evaluation

Clear identification of the purpose(s) of an evaluation (including its stakeholders and clients) is fundamental to planning an effective evaluation. The reasons for, and expected benefits from, undertaking an evaluation are invariably multiple. Although not necessarily mutually exclusive, five broad categories of purposes are identified in Table 2.3.

Bellamy *et al.* (1998) argue that research to evaluate approaches to integrated resource use management and planning are needed for a number of specific purposes, including:

(a) to evaluate public and private investment in alternative approaches;
(b) to develop an understanding of the most critical social, economic, institutional, environmental and technical factors that influence the implementation of a particular approach, as well as factor interrelationships;
(c) to develop appropriate performance criteria for assessing the potential impacts and influences of an approach not only on the management of natural resource systems, but also on institutional arrangements and society as a whole; and
(d) to establish guidelines and techniques for self-evaluation of progress towards the achievement of agreed objectives and planned outcomes, including consideration of equity and social justice issues.

Evaluative Measures and Criteria

The fundamental basis for evaluation is the establishment of practical evaluation criteria by which change in key evaluative measures can be monitored and assessed. They will also provide the basis for testing underlying assumptions and hypotheses relating to the policy, process, tool or activity of interest. Each evaluative measure may have one or more evaluation criteria. These criteria will be drawn from a range of disciplinary perspectives and therefore require synthesis.

The influence of the evaluative context on performance needs to be recognised and accounted for in analysing the findings. The evaluative context will be multi-dimensional having natural resource, economic, social, policy/institutional and technological elements. The relative importance of the influence of each of these elements will vary depending on the particular evaluation criteria. Importantly, each criterion will measure only a portion of the total construct space of the evaluative context.

Table 2.3. Purpose of an Evaluation.

Evaluation Purpose
Improving Program Management • Develop a common understanding of objectives and expected outcomes • Provide a basis for informed decision-making on research direction, resource allocation and attainable levels of performance. • Identify and focus attention on factors influencing program outputs and outcomes • Identify gaps in performance and insights on how they might be addressed • Facilitate a robust and integrated approach to program planning and implementation. Improving Transparency and Accountability • Evaluate costs and benefits of an investment of public or private resources • Improving efficiency and effectiveness of a project or process • Early identification of unanticipated outcomes Improving the Body of Knowledge • Identify impacts of a project, program or process • Identifying information pathways and processes and their role • Developing understanding of causal relationships • Identifying equity and social justice issues Fostering Learning • Influencing decision-making and policy development • Supporting on going information exchange, feedback and learning • Improving awareness of equity and social justice problems as they arise Improving Process • Facilitating continuous participation • Supporting the public consultation process • Building stakeholder capacity • Developing ownership of project outcomes • Providing information and a structural framework to underpin negotiations • Providing a platform for cultural change.

Evaluative measures should reflect the achievement of key objectives of the object of interest. In the context of natural resource management, evaluation measures may relate, for example, to:

- institutional structures or processes in the catchment;
- equity of resource use;
- stakeholder perspectives and behaviours on natural resource issues;
- state or tractability of natural resource management issues (social, economic, environmental, institutional; technological);
- stakeholder capacity to adapt and to undertake catchment management and planning;
- knowledge base on natural resource issues and their management;
- coordination or communication processes within and between stakeholder groups; and
- resource use and management policies, plans and practices of stakeholder groups.

Potentially there is scope for a whole suite of measures that will reflect the influences on and impacts of the IRM program, process, product or body of knowledge. For practical and efficiency reasons, each evaluation will need to focus on a selected number of critical evaluation criteria that are relatively readily measurable over time, yet rigorous and effective in reflecting change in a evaluative measure.

Evaluative Context

The implementation of approaches to integrated resource management are context-sensitive and a wide range of factors will make a difference to their implementation and impact. These influencing factors are:

(i) *environmental context*: e.g. the evolution of resource use and management systems in the region; the major resource use issues and their on-site and offsite implications and

impacts; attitudes and behaviour to natural resource management and environmental issues; nature and extent of behavioural change in resource use and management practices required across catchment stakeholders.

(ii) *economic context*: e.g. the nature and status of, and interdependencies within, the regional economy overall and on a sectoral basis; perceptions of future development and economic prospects; distribution of wealth and resources; economic vulnerability of the regional economy; financial viability of land managers.

(iii) *social/cultural context*: e.g. the regional demography and related sustainability issues; cultural diversity and related resource use issues; the nature and commonality in community expectations (both within and outside the region) regarding the catchment's environment and socioeconomic situation, as well as the catchment management and land use planning process; perceptions of equity and social justice; political and media support for catchment issues and ICM processes; social history and demographic change.

(iv) *policy/institutional context*: e.g. relevant policies and the organisational structures and processes for natural resource management across government, industry and community; resourcing and coordination characteristics of policies, plans and processes; stability and volatility of local and state political process.

(v) *scientific/technological context*:- e.g. the characteristics of the existing technology system; technical knowledge base and competencies to use advanced technologies across stakeholders; availability and feasibility of technical solutions; adequacy of scientific knowledge including appropriateness of scientific understanding and its ability to assist decision-making.

Mapping and characterising the environmental, social, economic, institutional and technological contexts that influence the implementation of the phenomenon, object or process of evaluative interest in achieving key objectives and outcomes is therefore necessary to account for the factors that influence implementation processes and their impact. The evaluative context will also impact on an evaluation and influence its analysis and interpretation.

3. AN APPLICATION TO R&D ON ICM IN THE HERBERT RIVER CATCHMENT

3.1. Problem Characterisation

Approaches to natural resource management based on the integration of community involvement, technical knowledge, and organisational structure and policy objectives are endorsed throughout Australia. The impetus for these integrated resource management (IRM) approaches has arisen from a number of factors including:

- Degradation of land, water and vegetation resources in many rural areas due to a combination of unrealistic expectations and inappropriate management over time (SEAC 1996; IC 1996);
- Federal government obligations as a signatory to a range of international treaties (e.g. Convention on Biological Diversity; United Nations Framework Convention on Climatic Change).
- Federal and state government commitment to a range of national agreements and strategies on the environment such as the National Strategy for Ecological Sustainable Development (Council of Australian Governments 1992b); National Greenhouse Response Strategy (Commonwealth of Australia 1992); National Strategy for the Conservation of Australia's Biological Diversity (DASET 1992); the National Weeds Strategy (ARMCANZ 1997) and the Intergovernmental Agreement on the Environment (Council of Australian Governments 1992a);

- Fragmentation of decision making and responsibilities for natural resource management across a number of public agencies (including all 3 tiers of government) and industry bodies;
- Trends in state and federal governments toward the devolution of responsibilities for environmental stewardship and management (e.g. land clearing and the protection of biodiversity) to the local community and municipal governance level (ANAO 1997);
- A move to greater diversification in the use of natural resource systems and increased recognition of the diversity of values placed upon these systems by stakeholders; and,
- Increasing community expectations for greater involvement and higher standards of accountability and transparency in decision-making on environmental protection and the conservation of biodiversity.

In practice, however, attempts at implementing comprehensive, integrated and flexible ways of promoting ecological sustainable development (ESD) through community-based approaches both in Canada and Australia (e.g. Dorcey 1986, 1991; Syme *et al.* 1994) have proven to be difficult; often resulting in inequitable outcomes. Such initiatives are posing enormous challenges for both rural communities and responsible government and industry agencies.

The implementation of IRM programs in Australia is in a formative and largely experimental stage. In essence, IRM is an evolving concept which lacks a well defined body of guiding principles capable of general application. Much of the conceptual development and experience relates to catchment management programs such as Integrated Catchment Management in Queensland and Western Australia, and Total Catchment Management in New South Wales. These programs vary significantly in terms of their scope and process but all involve experimentation with both the approach undertaken, and the organisational structures established (e.g. Mitchell and Hollick 1993; Syme *et al.* 1994).

To date, there has been little comprehensive evaluation of IRM in practice. Much of the focus of attention has been on the philosophy of IRM and its assumed product rather than IRM as a planning process (eg. Syme *et al.* 1994; AACM 1995). Previous evaluations have generally been limited because they have been:

(i) fragmented and conducted from the viewpoint of a single disciplinary perspective or sectoral interest rather than that of the general community (Syme and Sadler 1994; Bellamy *et al.* 1998);
(ii) rarely applied systematically to the sociopolitical framework within which decisions are made (Syme and Sadler 1994);
(iii) hampered by lack of concrete measurable goals and identifiable outcome criteria (AACM 1995);
(iv) focussed on the assessment and monitoring of 'engineering-type' biophysical or economic performance criteria, such as impacts on water quality, or soil erosion and productivity (eg. Laut and Taplin 1989), rather than more holistic social and political criteria such as attitudinal change, equity and social justice (eg. Syme *et al.* 1994), or policy learning (eg. Davis and Weller 1993); and
(v) for practical reasons, broad one-off overviews that provide a snap-shot in time rather than a systematic longitudinal analysis (Bellamy *et al.* 1998).

Significantly progress towards improvements in the natural resource base at a regional or catchment scale are yet to be systematically demonstrated. Evaluations of ICM processes may help in this context. In particular evaluation of IRM approaches is needed to:

(a) evaluate public and private investment in IRM;
(b) identify the most critical social, economic, institutional and technical factors that influence IRM;

(c) develop appropriate performance criteria for assessing the potential impacts and influences of such approaches not only on the management of natural resource systems, but also on but also on institutional arrangements and society as a whole; and
(d) establish guidelines and techniques for self-evaluation of progress towards the achievement of agreed objectives and planned outcomes, including consideration of equity and social justice issues (Bellamy *et al.* In Press).

3.2. Purpose

Policy Intent

The stated purpose of the Queensland ICM Strategy (QDPI 1991) is to integrate the management of land, water and related biological resources in order to achieve the sustainable and balanced use of these resources.

The goals identified in the ICM strategy are:

1. *Community understanding, coordination and cooperation:*
    - To have the community and government better understanding the interactions between land and water resources and related components of the ecosystem and the need to manage these resources on a catchment basis.
    - To have effective coordination within government, between government and the community, and within the community, of activities and policies relating to the management of Queensland's land and water resources.
    - To have effective cooperation between relevant government agencies, authorities, companies, industry and community groups, landholders and individuals involved in the management of Queensland's land and water resources.
2. *Common goals and priority action:*
    - To have all sectors of the community and government share common or agreed goals for land and water management.
    - To have all users or managers of land and water resources take account of the effects of their actions on these and other related natural resources.
    - To address interrelated land and water issues on a priority basis within catchments.
3. *Economic and ecological sustainability:*
    - To maintain economically viable industries within an ecologically sustainable framework.
    - To maintain, and where feasible, restore and improve the quality and productivity of land, water and related biological resources.
    - To maintain essential ecological processes, ecosystems and biodiversity.
    - To minimise detrimental environmental effects due to the development of land, water and related biological resources, within and beyond catchment boundaries.
    - To protect the wild, scenic and natural characteristics of rivers, lakes and the landscape.

Anticipated Outcomes of ICM in Queensland

As identified in the Queensland ICM Strategy (QDPI 1991), the adoption of the ICM philosophy and processes is expected to result in:

- All users and managers of land and water resources understanding and accounting for the interrelationships between these natural resources in their management decisions and activities
- All sectors of the community and government accepting their individual responsibilities for the sound management of land, water and related biological resources
- Integrated policies and programs for the management of land, water and relation biological resources

- Common goals, strategies and coordinated action by the community and government in addressing priority land and water management issues
- The sustainable use of land and water resources while providing for the material, residential, industrial, recreational and environmental needs of current and future generations
- The maintenance of essential ecological processes, ecosystems and biological diversity.

In essence, the outcomes of the successful implementation of the ICM strategy are expected to be:

- An understanding and accounting by all users and managers of land, water and related biological resources and of the effects of their decisions and actions on these resources;
- Cooperation and coordination between the community and government in their land and water resource management activities;
- Economically viable industries within an ecologically sustainable framework; and
- Clean water, fertile soil and ecologically diverse and productive ecosystems.

A more detailed ICM Strategy summary is provided in Appendix A.

3.3. Instrumental Assumptions

The fundamental assumptions and instrumental hypotheses underlying the implementation of the ICM policy initiative in Queensland relates to a number of elements which are identified below.

(i) *Policy Logic*: The underlying theory base for the Queensland ICM Strategy predominantly relates to systems theory (Ison *et al.* 1997); and the integrated resource management paradigm (Bellamy *et al.* 1998). A fundamental assumption of the ICM policy logic is the adequacy of the inferences of this theory base for achieving ICM Strategy objectives and desired outcomes/changes.

(ii) *Stakeholder or participant involvement*: The key underlying assumptions of participation or involvement in an ICM process relate to:
- expectations of the benefits and costs of a partnership approach to ICM implementation between government and the community (e.g. expectations of the role and influence of an ICM processes; development of synergies; value of informational exchange; prevention and resolution of conflict; development of understanding or learnings; acceptance and ownership of outcomes);
- inclusiveness (i.e. the extent to which the process as implemented takes into account all relevant stakeholder groups who have a stake in natural resource management);
- adequacy of the provisions/arrangements for access by stakeholders and the general public, including continuity of involvement;
- empowerment to plan and effect action; and
- the acceptability and ownership of the ICM process and its outcomes by the catchment community.

(iii) *Process*: The key underlying assumptions relating to an ICM process and its implementation are:
- the representativeness of stakeholder groups and peak bodies on the CCC;
- the degree to which persons directly influenced or the general public are empowered to be involved in ICM (i.e. its planning, implementation, improvement or termination);
- perceptions of appropriate roles, responsibilities and influence of catchment stakeholders;
- perceptions of community processes that need to be put in place;
- stakeholder perceptions and understanding of the ICM's objectives, process and outcomes;
- expectations on fairness and equity of processes;
- expectations of cooperation amongst stakeholders;

- perceptions of stakeholder needs and expectations of the process;
- adequacy and perceived value of public participation/involvement in an ICM process;
- responsiveness of policy formulation and institutional learning processes;
- adequacy and sufficiency of technical knowledge base or understanding to guide substantive action;
- acceptability of solutions identified.

(iv) *Policy and institutional arrangements*: The key underlying assumptions relating to policy and institutional arrangements are:
- the role and value of coordination across levels of decision-making; including all three tiers of government;
- alignment of objectives with government priorities and policy objectives;
- adequacy of guiding principles underlying government policy (such as for Landcare and ICM etc.) or statutory and regulatory controls: (e.g. water allocation, land management and control, local government planning schemes) or industry or voluntary standards (tree clearing, pest management, etc.) in accomplishing their goals/intent;
- clarity, understanding of, and consistency in, policy objectives and outcomes.
- existence or effectiveness of a complementary implementation process beyond strategy development;
- resourcing, commitment and skill of those responsible for implementation; and
- support of stakeholders and politicians for policy or arrangements.

(v) *Technical information and support*: The key underlying assumptions relating to the role and effectiveness of information in integrated catchment management processes are:
- the adequacy and accessibility of information or technology in practice;
- stakeholder information and knowledge needs; and
- the needs for information, technology and other technical support in an ICM process.

(vi) *Communication:* The key underlying assumptions relating to communication and interaction in integrated catchment management processes are:
- adequacy and effectiveness of feedback mechanisms to constituents;
- equity in access to information and other communication mechanisms; and
- the adequacy and effectiveness of the network of social interactions at individual and organisational levels and their linkages to decision-making.

(vii) *Outcomes:* The key underlying assumptions relating to the outcomes of an ICM process are:
- cost-effectiveness and efficiency of an ICM approach relative to other possible alternative approaches in achieving ESD goals;
- equitableness (e.g. the extent to which the distribution of benefits and risks associated with the impact of the ICM policy initiative on the different groups of people affected by it are fair and just);
- adequacy and effectiveness of expected outcomes in achieving ICM goals objectives;
- and behaviour as outcomes; and
  - alignment of outcomes with government priorities and policy objectives as well as community needs and expectations.

3.4. Evaluation Criteria

Evaluation Objectives

The purpose of this evaluation is:

1. To identify the social, economic, and institutional factors that facilitate or hinder the process of implementation of ICM in the Herbert River catchment.

2. To evaluate the key impacts of the implementation of the ICM process in terms of attitude and behaviour changes in the community and changes in the severity or tractability of the resource use conflicts for the Herbert River catchment.
3. To assess the specific technical and related information needs that are relevant to an effective ICM implementation process in a wet tropical environment.
4. To test an integrated framework and related methods for evaluating the process of ICM implementation that will facilitate the development of more effective catchment management programs in Australia.

Purpose of Evaluation

The principal reasons and expected benefits of the evaluation are to:

- support the accountability needs and communication requirements of R&D providers and funders and other relevant collaborators;
- contribute to the effectiveness of the ICM implementation process in the Herbert River catchment (through, for example, provision of information to, and support for on-going learning within the Herbert River Catchment Coordinating Committee (HRCCC); influencing decision-making and policy development processes of HRCCC member organisations);
- provide the basis for a multi-perspective synthesis and an evaluation of the Herbert River ICM process that is applicable to community-based catchment management programs in Australia;
- improve the effectiveness of the R&D process and synthesis of research findings across all project activities;
- early flagging of equity and social justice issues arising from the research project implementation;
- early identification of unanticipated outcomes so that they may be identified, and ameliorated or, if appropriate, capitalised to advantage; and
- contribute to the development of ownership of the evaluation and its findings by ICM stakeholders.

The evaluation of the Herbert River ICM process has a number of elements that provide the basis of an analytical framework for evaluation criteria:

(i) the tractability of resource use issues and tensions in the catchment;
(ii) institutional structural capacity to address natural resource issues at a catchment scale;
(iii) adequacy and equity of community processes; and
(iv) technical understanding and needs to support ICM implementation.

Evaluative measures will be broadly focussed encompassing a range of different criteria, including social, cultural, institutional, economic, environmental, and technical. A framework for evaluative measures and criteria is provided in Table 1 that clarifies their role in the evaluation.

3.5. Methods of Evaluation

A range of methods are required to measure and assess the ICM process in the Herbert. Each performance measure will require multiple methods to assess performance criteria. The principle methods will include:

1. On-going monitoring and document analysis of the ICM implementation process.
2. Bench-marking (e.g. of attitudes, perspectives and behaviour) through surveys with key stakeholders of the Herbert community.
3. Bench-marking (e.g. of attitudes, perspectives) through semi-structured interviews with the HRCCC members as well as key players in ICM implementation in Queensland
4. Interactive annual forums/workshops with HRCCC members and other Herbert ICM stakeholders.

5. Open-ended interviews with key players in ICM from implementing agencies.
6. Organisational studies of institutional arrangements for ICM in Queensland (including institutional mapping).
7. Characterisation of the natural resource, policy/institutional, social and technological context of ICM implementation in the Herbert,
8. Meta-analysis of other activity specific evaluations.
9. Economic analysis/valuation
10. Content analysis
11. Spatial analysis
12. Focus group studies

Proposed methods for each criteria for evaluating ICM in the Herbert River catchment are provided in Table 3.1.

Table 3.1: A framework of measures and criteria for evaluating the ICM process in the Herbert River catchment.

Evaluative Measures	Evaluation Criteria	Methods
1. The tractability of catchment resource use issues and tensions .		
1.1 External environment vigilance	Community ability to identify significant external economic and political influences and opportunities that impact on ICM: ♦ alertness to economic and political changes that influence ICM; ♦ Number of presentations, guest speakers, and HRCCC agenda items on changes in policy, etc.	• On-going monitoring and document analysis of the ICM process. • Content analysis of newspapers. • On-going monitoring and document analysis of institutional arrangements for NRM in the catchment.
1.2 Characteristics of the catchment's resource use context	Characterisation of natural resource use and management within the catchment including: ♦ the change in the nature and distribution of land cover/use in the catchment over time; ♦ the degree of community involvement and the role of institutions (eg. government, industry, and R&D organisations) in initiating an integrated approach to resource management in the catchment; and ♦ nature and level of disputes and degree of conflict on resource use. ♦ the change in economic signals that affect resource management. ♦ media support for natural resource issues and ICM activities.	• Spatial analysis of land cover/use in the catchment • On-going monitoring and document analysis of the ICM process. • On-going monitoring and document analysis of institutional arrangements for NRM in the catchment. • Content analysis of newspapers. • Economic assessment
1.3 Understanding of community attitudes and behaviour	Degree and direction of change in the community and the HRCCC member perceptions on natural resource management and the ICM process in the Herbert catchment including perceptions on: ♦ the key catchment resource management issues; ♦ agreed objectives for ICM; ♦ desirable outcomes for ICM ♦ the role and function of the HRCCC ♦ community/individual behaviour in respect of natural resource use and management, ♦ resource use and management responsibilities and influence. Change in attitudes (and behaviour) of resource users and managers to natural resource management in the catchment including: ♦ the nature of stakeholder understanding of key NRM issues/conflicts (e.g. importance; means and ease of resolution or management; impact; cause and responsibility for resolution).	• Benchmarking of attitudes, perspectives and behaviour through semi-structured interviews with HRCCC members. • Interactive annual forums/workshops with HRCCC members. • Open-ended interviews with key players in ICM implementation. • Benchmarking of attitudes, perspectives and behaviour through surveys of the Herbert community. • Benchmarking of attitudes, perspectives and behaviour through semi-structured interviews

Evaluative Measures	Evaluation Criteria	Methods
	♦ the compatibility or degree of conflict in community and stakeholder attitudes and perspectives amongst stakeholders ♦ Improved recognition of importance of a catchment perspective on resource management including an ICM process ♦ the cost/benefits of change in natural resource management practices to landholder and community/society at large ♦ Degree and nature of stakeholder participation in catchment management and land use planning	with HRCCC members. • Interactive annual forums/workshops with HRCCC members. • Economic assessment/valuation
2. Institutional capacity for catchment management		
2.1 Adequacy of community-based planning at the catchment level.	Community ability to plan and implement future initiatives including: ♦ evolution of ICM process in catchment; ♦ adequacy and continuity of communication within and between stakeholders represented on the HRCCC. ♦ stakeholder involvement in HRCCC meetings and activities. ♦ structures and mechanisms for negotiation on issues; ♦ opportunities for interactions across stakeholder groups; ♦ degree of enhancement/building of HRCCC linkages into regional development management and planning processes ♦ commitment and skill of implementing staff/agencies ♦ commitment of financial resources to support ICM. ♦ support from political and industry leaders. ♦ use of media.	• Benchmarking of perspectives through semi-structured interviews with HRCCC members. • On-going monitoring and document analysis of the ICM process. • Interactive annual forums/workshops with HRCCC members and other stakeholders.
2.2 Institutional processes for natural resource management and planning at the catchment scale	Policy frameworks and institutional arrangements for catchment/natural resource management including: ♦ clarity and consistency of roles and objectives of agencies ♦ adequacy of policy, plans and decision rules of implementing agencies. ♦ adequacy and diversity of representation of interests within government processes. ♦ coordination amongst responsible government agencies and industry bodies; ♦ the nature and degree of involvement of responsible government agencies; ♦ accessibility and availability of technical support and financial resources.	• On-going monitoring and document analysis of the ICM process. • On-going monitoring and document analysis of policy frameworks and institutional arrangements for NRM. • Benchmarking of perspectives through mail-out surveys of key players in ICM implementation. • Interactive annual forums/workshops with HRCCC members and other stakeholders. • Organisational mapping. • Open-ended interviews with key players in ICM implementation.

Evaluative Measures	Evaluation Criteria	Methods
2.3 Capacity to identify and address resource use issues at a catchment scale.	♦ opportunities for formal access by wider community. Scientific and other technical capacity to address catchment management issues including: ♦ the level of understanding of the causes and sources of technical problems across stakeholders; ♦ economic constraints to addressing issues. ♦ the level of technical understanding relating to the resolution or improved management of the problem; ♦ accessibility and use of technical/scientific information to conceptualise the problem and negotiate solutions); ♦ availability of, and equity of access to, body of knowledge relating to natural resource issues, their management and use. ♦ mechanisms and protocols for sharing of information across institutions and stakeholder groups.	• Benchmarking of perspectives through semi-structured interviews with HRCCC members. • Meta-analysis of other evaluations of NRM technologies and information needs • Focus group studies. • Benchmarking of perspectives through mail-out surveys of key players in ICM implementation.
3. Adequacy and equity in community processes		
3.1 Adequacy of Stakeholder involvement	Mechanisms for communication or interaction on catchment issues. ♦ Degree of interactiveness in catchment management and planning systems (including the desire for, trust in, and nature and degree of interactions amongst stakeholder groups). ♦ Perspectives on information flow (e.g. free flow of information or information as a power tool). ♦ Representativeness of stakeholder groups on the HRCCC. ♦ Level of strategic alliances/partnerships developed to exploit synergy; ♦ Presence of a sense of control of change (e.g. gaining realistic support) and meaningful involvement (e.g. practical outcomes) in natural resource management and planning process	• Bench-marking of attitudes, perspectives and behaviour through community surveys and semi-structured interviews of HRCCC members • Phone survey of key players in ICM. • Interactive annual forums/workshops with HRCCC members. • On-going monitoring and document analysis of the ICM process.
3.2 Equity of opportunity for involvement in resource use and management .	Perceptions of fairness in resource use management and planning systems and related decision-making processes including: ♦ Perceptions of sufficiency of allocation, and fairness in terms of distribution, of government and industry resources provided to address regional resource use issues. ♦ Feelings of being unfairly ascribed the blame for environmental problems. ♦ Degree of belief that decision-making processes have been fair to all. ♦ Degrees of tension relating to indigenous rights of use.	• Bench-marking of attitudes, perspectives and behaviour through community surveys and semi-structured interviews of HRCCC members • Interactive annual forums/workshops with HRCCC members. • On-going monitoring and document analysis of the ICM process. • Economic valuation

Evaluative Measures	Evaluation Criteria	Methods
	♦ Perceptions of trust in government and its acceptance of responsibilities. ♦ costs and benefits of use and management.	
3.3 Adequacy of opportunities for future collaboration and involvement	• Support/satisfaction of stakeholder with participation in ICM; • Degree and nature of involvement of stakeholders. • Emergence of local champions. • Vitality of cross-stakeholder collaboration in natural resource management projects. • Degree of enhancement of communication and coordination between stakeholders; • Degree of strengthening of institutional capacity at community level (including technical, financial, skills development and training) to support meaningful and viable participation/collaboration. • Endurance of collaborative mechanisms established. • Commitment of stakeholders to future collaboration/cooperation. • Perceptions of costs and benefits of participation/involvement.	• On-going monitoring and document analysis. • Benchmarking of attitudes, perspectives and behaviour through semi-structured interviews. • Interactive annual forums involving representatives of all stakeholders.

4. EVALUATIVE CONTEXT

The effect of contextual factors on a process and its impact are well recognised. The implementation of integrated approaches to resource management is context-sensitive and a wide range of factors will influence their implementation and outcomes. The key contextual factors influencing ICM are:

(i) *environmental context*: e.g. the evolution of resource use and management systems in the region; the major resource use issues and their on-site and offsite implications and impacts; attitudes and behaviour to natural resource management and environmental issues; nature and extent of behavioural change in resource use and management practices required across catchment stakeholders.

(ii) *economic context*: e.g. the nature and status of, and interdependencies within, the regional economy overall and on a sectoral basis; perceptions of future development and economic prospects; distribution of wealth and resources; economic vulnerability of the regional economy; financial viability of land managers.

(iii) *social/cultural context*: e.g. the catchment demography and related sustainability issues; cultural diversity and related resource use issues; the nature and commonality in community expectations (both within and outside the region) regarding the regional environment and socioeconomic situation, as well as planning processes; perceptions of equity and social justice; political and media support for catchment resource use issues and land use planning processes; social history and demographic change.

(iv) *policy/institutional context*: e.g. relevant policies and the organisational structures and processes for natural resource management across government, industry and community; resourcing and coordination characteristics of policies, plans and processes; stability and volatility of local and state political process.

(v) *scientific/technological context*:- e.g. the characteristics of the existing technology system; technical knowledge base and competencies to use advanced technologies across regional stakeholders; availability and feasibility of technical solutions; adequacy of scientific knowledge including appropriateness of scientific undertakings and its ability to assist decision-making.

The evaluative context will therefore impact on an evaluation and influence the interpretation of findings. A key issue is that ICM is only one of a number of processes influencing resource use management and planning in the Herbert River catchment and therefore any attribution of benefits need to be seen in this context. Table 3.2 provides a framework for considering the ICM contribution to a criteria (given that ICM may be only one of the contributors to change).

Table 3.2

Evaluative Measure	Evaluative Criteria	Result/Findings	ICM Contribution

Table 3.3. Implementation Plan

Evaluative Measure	Evaluative Criteria	Action	Responsibility	When

Chapter 3

Evaluating Integrated Resource Management

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Abstract

Approaches to natural resource management based on the integration of community involvement, technical knowledge, and organisational structure and policy objectives are endorsed throughout Australia. The emerging paradigm of resource management supports a more flexible and adaptive approach to address the uncertainty, complexity and interconnectedness associated with natural resource and human management systems. The translation of this concept into practice however is proving difficult and proactive evaluation should help. But the evaluation of the effectiveness of integrated resource management (IRM) approaches both in Australia and internationally is relatively more neglected. This paper discusses issues of IRM evaluation and proposes a conceptual evaluation framework that identifies a range of technical, institutional, economic and social criteria that may influence the success of IRM in practice. This framework should facilitate the proper formulation of the natural resource management problem and its underlying characteristics.

Australian governments are investing considerable resources in integrated resource management (IRM) programs with high community expectations for the outcomes. The fundamental challenge of these programs is to improve the way our natural resources are used and managed with a long term perspective. However, the translation of the concept of an integrated approach to resource use and management into practice is proving difficult (Syme *et al.* 1994; AACM 1995). IRM is an evolving concept which lacks a well defined body of guiding principles capable of general application. The basic assumption that IRM approaches contribute effectively to the better management of our land and water resources has not been systematically or critically addressed.

Evaluations of the nature and impact of IRM programs are needed to: (a) evaluate public and private investment in IRM relative to alternative approaches; (b) identify the most critical social, economic, institutional and technical factors that influence IRM; and (c) develop appropriate performance criteria for assessing the potential impacts and influences of such approaches not only on the management of natural resource systems, but also on society as a whole. In this paper we examine the concept of IRM and review issues of evaluation of IRM in practice. A conceptual framework for the evaluation of IRM programs is developed that encompasses technical, economic, social and policy science perspectives.

The Evaluation Problem

Numerous studies focus on the biophysical and institutional aspects of natural resource management (eg. Chisholm and Dumsday 1987; McTainsh and Boughton 1993), or how integrated resource management should be conceptualised and structured (eg. Lang 1990; Mitchell and Hollick 1993; Syme *et al.* 1994; Margerum 1996). The evaluation of the effectiveness of integrated programs in resolving or ameliorating natural resource use and management problems, however, is one of the more neglected areas of IRM research.

Previous evaluations have generally been limited because they have been:

(i) fragmented and conducted from the viewpoint of a single disciplinary perspective or sectoral interest rather than that of the general community (Syme and Sadler 1994);
(ii) rarely applied systematically to the sociopolitical framework within which decisions are made (Syme and Sadler 1994);
(iii) hampered by lack of concrete measurable goals and identifiable outcome criteria (AACM 1995);
(iv) focussed on the assessment and monitoring of 'engineering-type' biophysical or economic performance criteria, such as impacts on water quality, or soil erosion and productivity (eg. Laut and Taplin 1989), rather than more holistic social and political criteria such as attitudinal change, equity and social justice (eg. Syme *et al.* 1994), or policy learning (eg. Davis and Weller 1993); and
(v) for practical reasons, broad one-off overviews that provide a snap-shot in time rather than a systematic longitudinal analysis.

Integrated Resource Management

The Emerging Paradigm

Demands for intergenerational equity and social justice are challenging the way we utilise and manage our natural resource systems. On-going resource degradation of our waterways, pastoral and agricultural lands, and concern for biological diversity is creating considerable public and community tension. It is widely advocated by both Commonwealth and most state governments in Australia that traditional approaches to resource use and economic growth need to be changed to ensure that development is sustainable and environmental qualities are maintained or enhanced.

Past policies and programs in Australia largely treated environmental management and conservation as a separate arena to mainstream political activities, such as economic management, infrastructure development, and social planning. Traditional approaches to resource management and planning have been identified as being responsible for *ad hoc* decision-making and piecemeal action aimed at treating symptoms of environmental problems, while systemic or cumulative effects and emergent properties are overlooked, long term changes masked, and social values and interests ignored (eg. Lang 1990; RAC 1993). However, the concept of ecologically sustainable development endorses the notion of the interrelatedness of environmental, economic, social and political aspects of resource use. In this context, the emerging paradigm of IRM supports the replacement of fragmented and frequently reactive sectoral or mono-disciplinary approaches with more flexible and integrated approaches that seek to reflect the complexity and interconnectedness of natural and human systems. Identifying the theory underlying any IRM program or policy highlights the assumptions, clarifies what evaluation measures are needed, and contributes to developing understanding of the causal linkages. Table 1 provides a comparison of the typical characteristics of the 'traditional' and emerging paradigms of IRM. These encompass elements relating to natural systems (eg. Gunderson *et al.* 1995; Funtowicz and Ravetz 1990), political systems (eg. Sabatier 1988; Boehmer-Christiansen 1994), social systems (eg. Crane 1988; Syme *et al.* 1994; Syme and Sadler 1994; Vanclay and Lawrence 1995), and technology (eg. Orlikowski 1992; Boehmer-Christiansen 1994; Holling 1995). The emerging paradigm identifies the fundamental basis for the resolution or amelioration of natural resource management problems as being the recognition of these four elements and their interdependencies. The characteristics of these elements reflect the complexities and breadth of the concept of IRM, as well as the difficulties of IRM evaluation in practice.

The Rationale for IRM

Advocates of IRM promote it as an approach to planning and management that places resource use problems and opportunities in a systemic or holistic framework with an aim to finding integrative solutions. Mitchell (1990) defines IRM as incorporating four components: (i) multiple purposes, multiple means, multiple participant strategies; (ii) blending of various resource sectors; (iii) using resource management as a mechanism for social and economic change; and (iv) striving for accommodation and compromise. Programs based on such approaches are designed with the intent of addressing resource use issues and their management in the broader context of their associated biophysical, economic, social and institutional attributes.

Table 1. Comparison of the typical characteristics of the traditional and the emerging paradigms of resource management.

Traditional Paradigm	Emerging Paradigm
Natural System: • Sustained yield: maximising production of a single resource and use for sustained economic development. • Ecosystem development characterised by ecological succession with fixed stable states, ie. predictable, causal linear dynamics. • Environmental concerns (eg. habitat protection, soil erosion) as constraints to output maximisation. • Conservation of individual resources (eg. soil) and preservation of natural resources in a reserve system. • Best management practices based on optimisation models. • Management focus on the scale of parcels of land. • Multiple use of a parcel of land in terms of productive values.	• Ecosystem management: maintenance of resource condition and long term sustainability of ecological relationships in complex evolving systems. • Ecosystem development characterised by long term change and chaos with a number of different pathways available, ie. unpredictable, discontinuous, nonlinear, self-organising and multivalued properties. • Environmental concerns (eg. biodiversity preservation, downstream effects) as the goals of resource management. • Holistic management of natural and human systems including off-reserve management and preservation of biodiversity. • Best management practices based on assessment of environmental, economic, and social trade-offs. • Management focus on the scale of landscapes and regions/catchments. • Multiple use of natural resources in terms of environmental, social and cultural values.
Political System: • Strategic analysis and planning; administrator as neutral expert. • Multiplicity of public agencies; sectoral division of responsibilities; fragmentation of initiatives. • Centralised procedural approach; sequential process of planning, implementation and regulatory control.	• Public participation and collaborative decision making; strategy development as an emergent process. • Institutions linked formally and informally; decentralised coordinated structures. • Learning organisations: on-going structural adaptations and change in institutions and organisations, and flexible adaptive policies.
Social System: • Rational behaviour, focussing on maintenance of profitability. • Dominant use of technical information in a rational decision making process. • Contextual neutrality; spatial and temporal distribution of resource commodities disassociated from its human and cultural context.	• Adaptive management, focussing on equity and social justice. • Conceptual use of information in decision-making processes dominated by political considerations. • Contextual relevance; landscape and resource management have a broad range of meanings across individuals and social groups linked to the cultural history and values of a place.
Technology: • Based on reductionist science, controlled and experimental research. • Disciplinary scientists as neutral expert. • Single scale focus, typically short term and local. • Technology an autonomous process, ie. a product of objective and rational knowledge. • Communication process focussed on teaching; linear model of technology transfer (expert to novice).	• Based on participative R&D process involving a multi-disciplinary team from biophysical, economic and social sciences in partnership with stakeholders. • Scientist becomes a participant in the process (rather than a "detached" expert) • Interdisciplinary focus, typically long term and cross scale. • Technology as the product of man, ie. a social construct that integrates/blends scientific and local knowledge. • Interaction process focussed on facilitating learning (individual, organisational, policy); adaptive and iterative.

Integrated approaches are described in the literature by a number of terms including integrated resource management (eg. Lang 1990; RAC 1993), integrated environmental management (eg.

Margerum and Born 1995), integrated catchment management (e.g. Mitchell and Hollick 1993; DPIQ 1993), watershed management (e.g. Mitchell 1990), environmental planning (eg. Armitage 1995), and bioregional planning (eg. Lambert and Elix 1996). Situations demanding integrated approaches have been defined as:

> *"…. where problems are highly complex, interests and objectives are numerous and in conflict, information and knowledge are quite incomplete, ends and means are ambiguous, control is fragmented and the external environment is in flux."* (Lang 1990, 3)

New strategic initiatives in a number of Australian states are attempting to integrate resource use management and planning (eg. Laut and Taplin 1989; Mitchell and Hollick 1993; Syme *et al.* 1994; AACM 1995). These initiatives inevitably focus on situations where there are competing and conflicting resource use issues and/or multiple institutional responsibilities. The guiding principles of integrated approaches to resource use and management have been stated as:

- Management of interrelated resources with regard to ecological processes and the maintenance of environmental quality;
- Involving community participation in natural resource management;
- Co-ordinating government, non-government and community natural resource management policies and activities (eg. RAC 1993).

The underlying philosophy of such programs is that there are no conceivably simple or short-term solutions, nor a single perspective that can provide an appropriate course of action to deal with complex resource use issues within a regional or catchment context. Current resource use and management problems are viewed as the result of the interaction between people and their environment, rather than simply a problem for the environment per se. They are also perceived to be beyond the scope of purely technological solutions or the resources and actions of governments alone. IRM programs are promoted therefore as long term processes of managing change in natural resource use through the continuing integration of community action and statutory, policy and institutional adjustments.

Claims made in the literature in support of the benefits of these programs include: the development of catchment management strategies with community-wide ownership (eg. Mitchell and Hollick 1993); improved awareness of catchment processes (e.g., AACM 1995); the resolution or amelioration of conflicts among catchment stakeholders (eg. Syme *et al.* 1994); the planning and implementation of resource use practices on a catchment wide basis that lead to sustainable use, management and conservation of natural resources (eg. DPIQ 1993); the development of new complementary institutional arrangements (e.g., Mitchell and Hollick 1993; Margerum 1996); and the establishment of an interactive participative process that links policy formulation and implementation so that lessons are learned and incorporated in the policy process (eg. Davis and Weller 1993).

Most of these perceived benefits relate to IRM processes rather than improvements in the health and integrity of natural resources. Moreover, while assumed, linkages clearly attributing these processes to improvements in natural resources are hard to identify or measure in practice. The level of complexity and nonlinearity of natural systems tends to reduce confidence in predictability. Separation in space and time of cause-and-effect relationships at the catchment level mean that closely defined relationships are very difficult to demonstrate (eg. Boehmer-Christiansen 1994; Funtowictz and Ravetz 1990).

Under the emerging paradigm, the broad and dispersed nature of many natural resource problems means that coordinated and community-based action for change is required to effect change. A major issue in achieving such change, however, is that although at the catchment scale, the practices of resource management may need to change, at the individual resource user level it may not be socially acceptable or economically viable to do so. A key aspect of this issue is that the focus on the improvement of resource management, rather than increased economic

performance, means costs are bourne by the individual resource user at least in the short term, while the benefits may accrue to society as a whole (Vanclay and Lawrence 1995). In sum, considerable challenges exist in the implementation of community-based programs that attempt to foster an integrated approach to natural resource use and management.

Integrated Resource Management in Practice in Australia

Like the emerging resource management paradigm, the implementation of IRM programs in Australia is in a formative and largely experimental stage. Much of the conceptual development and experience relates to catchment management programs which involve experimentation with both the approach undertaken, and the organisational structures established (e.g. Mitchell and Hollick 1993; Syme *et al.* 1994). Further, approaches vary across the different Australian states. For example in New South Wales, Total Catchment Management is a statutory program (Cunningham 1986), while in Queensland Integrated Catchment Management is a policy or planning process implemented through administrative and financial arrangements by the State Government (DPIQ 1991).

These multiple institutional processes and arrangements are evolving and generally in a state of flux within the confines of their sectoral responsibility. This situation mitigates against the facilitation of a change from a commodity focus to a more integrated or holistic approach to resource management. Moreover, IRM programs in general are poorly resourced; relying heavily on federal funding, lacking substantial local or state government support for implementation, and substantially limited by only short term financing arrangements and work plans. Commonly IRM approaches in Australia have focussed on technical solutions often with little regard to addressing the public and private costs and benefits of their implementation and their social impact. These factors create considerable uncertainty and challenges for community-based IRM programs.

To date, there has been little comprehensive evaluation of IRM in practice. Much of the focus of attention has been on the philosophy of IRM and its assumed product rather than IRM as a planning process (eg. Syme *et al.* 1994; AACM 1995). Significantly progress towards improvements in the natural resource base at a regional or catchment scale are yet to be systematically demonstrated.

Evaluating Resource Management Programs

General Paradigms for Program Evaluation

Patton defines evaluation research as:

> *"... the systematic collection of information about the activities, characteristics, and outcomes of programs for use by specific people to reduce uncertainties, improve effectiveness, and make decisions with regard to what those programs are doing and affecting."* (Patton 1986, 14)

The main focus of an evaluation may vary depending on the purpose of the evaluation and the stage of the program. The Department of Finance (1994), for example, recognises four types of evaluation:

(i) *appropriateness evaluations* which focus on the extent to which program objectives or desired outcomes align with government priorities and policy as well as client needs;
(ii) *cost effectiveness evaluations* which focus on the relationship between inputs expressed in dollar terms and outcomes, where the outcomes may not be readily expressed in dollar terms;
(iii) *effectiveness evaluations* which focus on the extent to which project outcomes are achieving program objectives,

(iv) *efficiency evaluations* which focus on the extent to which program inputs are minimised for a given level of program outputs, or to which outputs are maximised for a given level of inputs.

Figure 1 illustrates this framework and shows the links between the types of evaluation. Within this framework, many evaluations will encompass: the measurement of factors that affect the achievement of outcomes; the establishment of cause-effect interpretations as to whether the outcomes were caused by the program, or external factors; and the identification of any unanticipated outcomes which are contributing to the achievement of objectives or impacting negatively on clients (Department of Finance 1994). This implies that the evaluators can establish a causal connection between the changes brought about by the project, changes due to other factors, and thus the net effect of the program compared with a baseline of no-program.

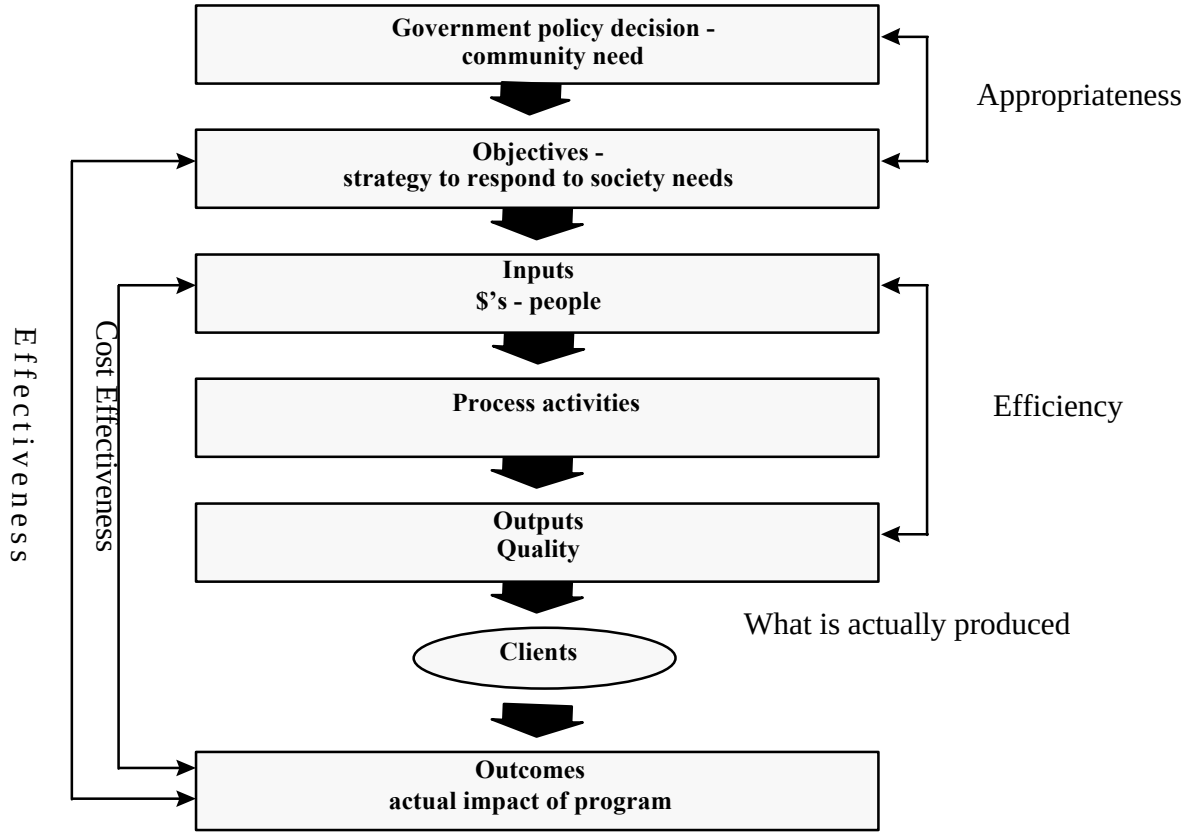

Figure 1. Levels of program evaluation. Adapted from ANAO and Department of Finance (1996).

Issues in Evaluating Natural Resources Management Programs

A review of the literature shows that of the relatively few attempts at evaluating natural resource management programs, most concentrate on the inputs alone (eg. ANAO 1997). While there may well be conceptual links between the inputs and goals achievement, measures of the inputs alone is a poor basis for designing program improvement. Several evaluations go beyond input measures to discuss the operation of management processes, although the measures in these studies are almost always limited to the opinions of the parties involved (AACM 1995). Some studies focus predominantly on the processes themselves on the grounds that related outcomes are improved community decision making processes themselves (eg. Syme and Sadler 1994;

Syme *et al.* 1994). The greatest difficulty for IRM program evaluation is that the critical outcomes are long term and can not be readily measured.

Most IRM programs are experimental. The literature is full of enthusiastic presentations as to why such programs will solve many problems - *ex ante*. The effects of resource management programs however are highly dependent on the specific social and economic context, and they may take a considerable time to become visible. To evaluate different models of natural resource management program implementation therefore requires, in particular, a focus on program processes and activities rather than the output of the program per se.

In a recent review of the literature on policy evaluation in natural resources, Wallace *et al.* (1995) identified three common problems facing implementing agencies of natural resource management policies: how to respond to a general call for increased public participation in policy making; how to evaluate programs in light of poorly defined and understood objectives; and how to monitor programs in light of new scientific understanding and changes in management philosophy and practice. In practice there is a general lack of use and development of substantive policy evaluation theory. Wallace *et al.* also claim that the traditional empirical model of evaluation, in which the referents for study are the formal programs and goals and objectives articulated in legislative acts or policy statements, is not a practical tool for most natural resource policies. Natural resources policy statements are often vague and unclear about their objectives and their intended policy effects and, hence, difficult to achieve or even define. Palfrey *et al.* (1992) propose an evaluation approach that ultimately refers effectiveness back to the 'guiding principles' in which the policy is embedded. Valid indicators of mental constructs such as justice, equity, equality and choice are however difficult to establish. Palfrey *et al.* point to the relevance and importance of 'processes' as indicators of both efficiency and effectiveness of policy implementation. 'Process' in this context refers not only to administrative, organisational and legislative mechanisms, but also the total network of operations involved in implementing and sustaining policy in action, including social interactions and participant perceptions of issues and how the program is progressing.

In an evaluation of public involvement in water resources planning, Syme and Sadler (1994) subscribed to the philosophy that evaluations of such exercises must be pragmatic and clearly linked to decision makers and their decision making context. They argue that decision making on natural resources management is improved "by processes that lead to informational exchange and joint evaluation of alternatives" (Syme and Sadler 1994, 525). In particular they advocate a partnership approach between the community and the agency to evaluation that incorporates evaluation on an on-going basis to provide timely direction to any public involvement program. In this sense program evaluation may be implemented as an ongoing collaborative learning process that will challenge institutions to adapt as much as the catchment community.

In recognition of these issues, frameworks for evaluating IRM programs need to take into account the fact that:

- IRM programs have social, economic, technical and institutional attributes;
- they are characterised by broad societal goals and task complexity;
- they generally lack clear goals and quantifiable and measurable outcomes;
- they are evolving processes in which the needs of the process and the perception of those needs amongst stakeholders in the community, government agencies and technical expertise are also changing;
- their influence or impacts are often incremental and accumulative, and generally accrue over a long timeframe; and
- they are inevitably undertaken in the context of changing political and institutional climate; that is, one that is in a state of flux.

Evaluation needs to be directed toward influencing what emerges in a positive and constructive way, rather than focussing only on *post hoc* evaluation related to mere achievement of initially proposed means of reaching objectives. The evaluation may be influential in modifying the objectives themselves. The importance of involving decision-makers and other stakeholders who represent a wide diversity of perspectives in such an evaluation process needs also to be recognised. The major benefits of stakeholder participation are seen as prevention or resolution of conflict and enhanced understanding of the program and evaluation findings (eg. Syme and Sadler 1994), including how the program works, a broader view of the key issues, and acceptance or ownership of the results. Moreover, as there are no universally accepted models for evaluation, the purpose of an evaluation should be clearly identified and agreed upon with all stakeholders in its planning.

An Integrated Framework for Evaluating IRM Programs

Because of the evolving and holistic nature of the concept of IRM, evaluations of IRM programs or processes require criteria from the biophysical, social, economic, and institutional/policy perspectives, and need to recognise the interrelationships between these evaluation criteria. This requires a multi-faceted evaluation methodology that provides a general analytical framework within which: (a) an evaluation can be planned to account for the broad range of issues encompassed by the integrated resource management concept as well as objectives of documented policies; and (b) the nature of IRM as an evolutionary process of managing change is recognised.

An Analytical Framework

Figure 2 presents a conceptual framework for evaluating IRM programs that identifies a range of technical, institutional, economic and social factors. Identification and understanding of the nature of these variables, their interrelationships, and their relative importance within a particular problem context needs to underpin the formulation of the IRM problem and the identification of its underlying characteristics by stakeholders. In this framework, the IRM problem definition and strategies for addressing them are an iterative process and evolve during implementation.

This evaluation framework also provides a structure for undertaking multidisciplinary research on the effectiveness of IRM programs. It adapts the Mazmanian-Sabatier framework of policy implementation model[1] (Mazmanian and Sabatier 1981; Sabatier 1986), but also includes socially significant evaluation indices[2] (eg. Crane 1988), and recognition of the principles of the PRIME procedural model (Syme *et al.* 1994). This latter model reminds us that evaluation needs to cope with multiple parallel tasks occurring at all times. Some of these tasks will be dealing with planning; some with research monitoring and evaluation. It also recognises that there should be appropriate areas of influence in the evaluation process by the community as well as agencies.

The evaluation framework provides a conceptual model for identifying the causal elements impacting on IRM programs and for establishing the hypotheses to be tested. In specific policies which have inadequate definitions, the hypotheses can be drawn from documentation and supplemented by the suggestions presented here for the framework. The four key elements of the evaluation framework are:

- Natural resource issue characterisation
- IRM program context
- Institutional structure
- Community processes.

For each of these elements, the framework identifies variables that may potentially influence the IRM program implementation process and its outcomes. These have been derived from policy documentation but more specifically from professional experience and analysis of IRM literature. The relevant variables for an evaluation will inevitably change depending on the social, economic

and political context as well as the stage of development of the IRM process. The proposed framework also incorporates an effective process of continuing feedback and improvement to the IRM implementation process as a whole. The stages in the evaluation process will therefore be iterative, interactive and inevitably influential.

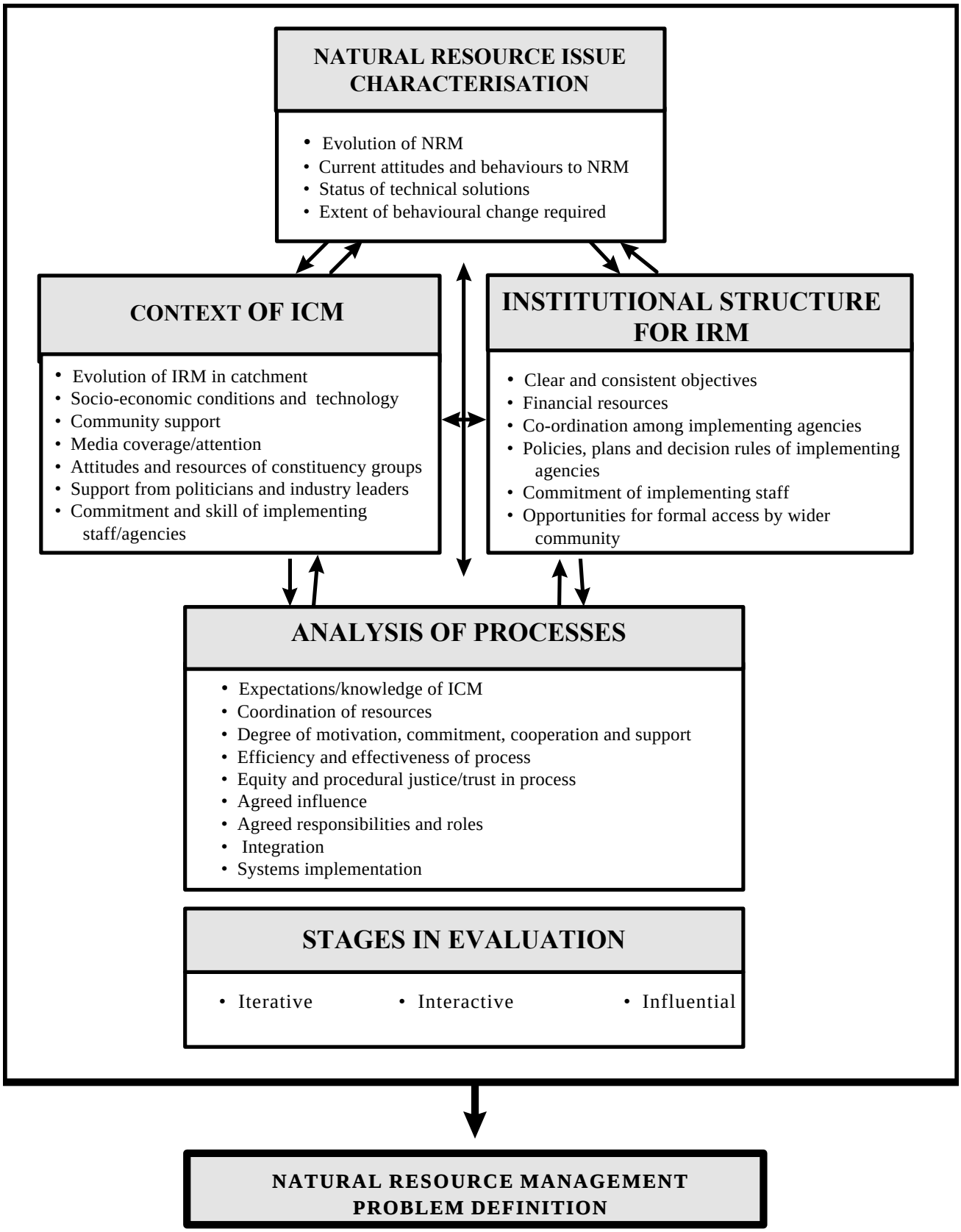

Figure 2. Conceptual framework for evaluating IRM programs.

Natural Resource Issue Characterisation

The first set of criteria aims to define and characterise natural resource issues and the context in which they came about. In particular it adapts and builds on the concept of the tractability of natural resource problems as identified in the Mazmanian-Sabatier framework (Mazmanian and Sabatier 1981; Sabatier 1986). The rational for this IRM component is that the natural resource, social and technological context of implementation will influence program performance and outcomes. The issue characterisation component of the framework therefore has four key criteria.

The evolution of natural resource use within the catchment: The importance of understanding an evaluation of a program or process within the historical natural resource, economic, institutional, social, and cultural context of resource use and management is well recognised.

Perspectives on natural resource use and management across stakeholder groups: The perspectives, expectations and behavioural responses on resource use and management may vary significantly across stakeholders and over time, and may be in conflict or contested by others. This means that the evaluation model must incorporate community as well as agency views.

Status of technical solutions: The technical knowledge base (ie. scientific, disciplinary and local expert) that can be brought to bear on the natural resource issues of concern and their community acceptability to guide substantive action is a key influence on the potential for achieving sustainability in practice.

Extent of behavioural change required: This criterion addresses natural resource issues in terms of the severity and extent of environmental threat, the number of persons responsible for its existence and management, the divergence in stakeholder opinions on the problem and its perceived solution, and how much the likely solutions are at variance from current practice.

IRM Program Context

The second set of criteria addresses to the specific circumstances and context in which the IRM program was initiated and has subsequently evolved. The following factors for evaluating the context of implementation of IRM may significantly influence the way IRM implementation proceeds, and determine the specific factors that are most likely to foster or hinder progress.

Evolution of IRM: The historical background to the initiation and development of an IRM program is an important contextual influence on its implementation.

Socio-economic conditions and technology: This criterion relates to the nature of, and variability in, socio-cultural and economic contexts within the catchment community and the capacity to change.

Community support: The community attitudes, perceptions, involvement and awareness of the IRM process can significantly influence the effectiveness of the IRM process.

Media coverage and attention: The nature and degree of media coverage on IRM and the environment in general may significantly influence stakeholder perspectives.

Attitudes and resources of constituency groups: This criterion addresses the nature of involvement of, and support provided by, community/interest groups and industry.

Support from politicians and industry leaders: Stakeholder perspectives and attitudes to natural resource issues can be significantly influenced by the opinions of, and support provided by, political and industry leaders.

Commitment and skills of implementing staff/agencies: The quality and capability of implementing staff and their supporting agencies is an important criterion.

Institutional Structure for IRM

The third set of criteria consider the organisational structures and processes for IRM. While the Mazmanian-Sabatier framework was created for evaluating statutory initiatives, the framework can be extended to a wider range of formal policies and programs as long as they are discrete and have explicit government proclamation. Proclamations state the policy decision being implemented and its objectives and program documents shape the implementation process by selecting the implementing agencies; by providing legal powers and financial resources to the agencies; and in diverse ways, influencing the commitment of implementing staff and the processes by which others may be involved. Closely following the Mazmanian-Sabatier framework, the following criteria for evaluating the institutional structure of IRM define the institutional conditions under which IRM programs are most likely to succeed.

Clear and consistent objectives: Objectives that are clearly worded and prioritised are essential to guide agency staff, others given key tasks (such as the catchment committees) and indeed to anyone potentially affected.

Finance: Although the relationship between ability to achieve program objectives and funding available finance is program dependent, at least some funding is necessary for program implementation.

Coordination: Coordination of the activities of agency programs and activities within and between levels of government and with community in general is a core requirement of IRM programs. Therefore one of the most important attributes of any program is the extent to which it can coordinate implementing agencies and activities of this diversity of interests.

Guidance to implementing agencies: The extent to which the program defines the processes, and as Mazmanian-Sabatier term, the "formal decision rules of the implementing agencies" will condition the progress of implementation. What are the implementers supposed to do - or is this undefined?

Staff commitment: Commitment of staff in the core implementing agency and those allied agencies that can substantially influence outcomes is essential to the success of programs.

Provisions for access by outsiders. The specification of an IRM program, its funding and staffing can influence the participation of external agencies, program target groups and the community. The key consideration is whether provisions have been made for adequate influence by community groups.

Analysis of Processes

The final set of influences, that is the community assessment component of the framework, aims to highlight factors that have the potential to influence the process of IRM implementation. For example, community awareness and attitudes towards land and water management and their links to existing levels of participation, intentions to participate and so on.

The rationale for this component of the evaluation framework is based on the basic premise that IRM - with its 'community-driven' emphasis - needs to be informed by the attitudes and actions of people living in the catchment or region of interest. Far from being passive recipients of natural resource management policy initiatives, different communities may show differing levels of involvement and commitment, and deal more effectively than others with any required change. For these reasons, 'recipes' for participation are untenable (Syme *et al.* 1994). Context is all important and, therefore, any method for evaluating processes should function in generic form, where proposed components are adapted to the situation at hand; that is, the particular catchment and program/policy being evaluated. The Processes component of the evaluation framework contains the following elements: expectations of the process by stakeholders, including the degree to which they are shared or separate; coordination of resources; degree of motivation, commitment, cooperation and support; efficiency and effectiveness of the process; equity and procedural justice / trust (in the process); agreed influence; agreed responsibilities and

roles; integration (that is degree of incorporation of processes in structure and context); and systems implementation.

Ideally the analysis of processes should cover all significant actors in the IRM process according to an overarching model such as PRIME (Syme *et al.* 1994). This model recognises that activities such as planning, research, implementation, monitoring and evaluation tend to occur simultaneously rather than in the rational order proposed by some natural resource programs. Therefore the evaluation process needs to deal with all activities simultaneously rather than sequentially. It provides a series of hypotheses for appropriate responsibilities and influence against which the evaluation can measure progress in a developmental context. Theoretically, this analysis can be done in a formative sense.

Implications for Integrated Resource Management

Approaches to natural resource management problems based on the integration of community involvement, technical knowledge, and organisational structure and policy objectives are endorsed throughout Australia. The emerging paradigm of resource management supports a more flexible and adaptive approach to address the uncertainty, complexity and interconnectedness associated with natural resource and human management systems. Operationalising these approaches to achieve sustainable development is proving to be a considerable challenge. There is not necessarily consensus on the emerging IRM paradigm as the solution to the problem. Evaluations of IRM programs can potentially contribute to a better understanding of the IRM process in terms of the technical and support needs, policy and institutional arrangements, and the community processes that need to be put in place.

The complexity associated with the evaluation of the effectiveness of IRM requires difficult trade-off decisions. Much of the difficulty arises because of the unique nature of natural resource programs in providing intangible services with broad social functions. In fact it is almost impossible to explicitly measure their fundamental impacts using traditional scientific methods of comparing the "with" and "without" scenarios. Evaluations are especially inhibited by: the separation in both space and time of cause and effect relationships in natural resource management; the fact that such programs are only 'one of many' influences on resource use and management such that attribution is a problem; and program objectives and goals that are often unrealistic or vague given the resources that have been committed to the program.

It should not be presumed however that IRM approaches are the best methods for achieving more sustainable use and management of our natural resources. Although conceptually appealing, they may not be the most effective or efficient approach. The fundamental questions evaluations need to address therefore include: Does integration work, ie. does it make a fundamental difference to the way resources are used and managed in the long term? What can realistically be expected of IRM approaches? If IRM approaches do work, what makes them work? What fosters or inhibits the IRM implementation process in terms of improving the severity or tractability of resource use problems? Or finally, how do they work best? That is, what are the necessary arrangements, procedures and processes that need to be put in place? This paper describes a logical framework that provides a tool for structuring a complex R&D approach to address these fundamental questions.

The evaluation framework is currently being tested in a five year longitudinal study being undertaken by a multi-disciplinary team of researchers in the context of a largely community-driven Integrated Catchment Management process in the Herbert River catchment of north Queensland. Researchers from different disciplinary backgrounds are addressing the four components of the framework simultaneously. The framework is being developed with the cooperation of the community of the catchment. The different perspectives are providing a more comprehensive understanding of IRM, as any one theoretical perspective will offer only a

partial view of such a complex process. Integrating the divergent views provides the opportunity to develop a new theoretical perspective that has a broader explanatory capacity than the initial disciplinary perspectives would provide in their own right. The challenge therefore is how to integrate the different disciplinary and community views on the evaluation of ICM, that is how to make an integrated evaluation. This is as difficult a process as it is for implementing IRM itself. Integration can be achieved if the different perspectives are seen as providing alternative 'worldviews' of IRM. We expect that the integration of the different community and disciplinary perspectives on the Herbert catchment case study may lead to modifications to the evaluation framework as it is presented here. Whatever evaluation model eventually emerges however will require testing for robustness or generality to ensure that more top down or legislatively-based IRM programs are also accommodated by the framework.

Notes

1. In seeking to explain variation in implementation success across programs and organisations, Mazmanian and Sabatier (1981) identified three sets of independent variables relating to: the tractability of the problem(s) being addressed by the statute; the ability of the statute to favourably structure the implementation process; and the net effect of a variety of non-statutory variables on the balance of support for the statutory objectives.

2. Crane (1988) identified a set of five assessment criteria for the evaluation of social policies which are equally relevant to natural resources program evaluation: inclusiveness; adequacy; equitableness; effectiveness/efficiency; and democratic involvement

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Chapter 4

Doing Things Differently: The Policy Revolution

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Doing things differently: the policy revolution

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Abstract

This paper provides a brief history of public policy and its administration in the primary industry sector in Australia. Major changes have occurred in the last decade, including the rise of Environmentally Sustainable Development as a focus for planning and implementation for Natural Resources Management. Increased community demand for input into policy and planning and decreased government resources devoted to policy implementation and institutional restructuring within government have been forces for change. These changes are demonstrated in the rise of the Landcare movement and community-oriented Integrated Catchment management programmes. Discussion pertaining to the successful implementation of these programmes identifies specific challenges concerning the effective vertical and horizontal integration of decision making among community, industry and government stakeholders. The tension between long term aspirations and short term decision making is explored. We suggest that a conceptual model for evaluation of policy implementation in this area is urgently needed and a tentative one is offered with suggestions about how to make it work. We conclude that, despite the problems associated with policy changes, the goal of environmental sustainability and changed government roles provide a major opportunity for the sugar industry. The concept of a 'green' sugar industry should provide a core platform for its operation in the next century.

Chapter 5

Integrating R&D into decision-making for natural resource management in coastal northern Australia

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Abstract

A brief analysis of the requirements in fostering mechanisms for the integration of recent and current research into decision-making is undertaken in this paper. This analysis is illustrated by some of the activities of the CSIRO Coastal Zone Program in north Queensland, particularly the development of a decision-support environment for addressing the off-site impacts of land use change and development of the Herbert Resource Information Centre. This collaborative and community-based resource is aimed at improving the basis of decision-making in natural resource and related management in the Herbert River Catchment.

Introduction

The 1992 Inter-governmental Agreement on the Environment commits all levels of government in Australia to achieving a balance between economic development and environmental integrity through the concept of Environmentally Sustainable Development. The impacts or potential impacts of increasingly intense natural resource exploitation in the coastal zone on the marine environment, the Great Barrier Reef being of particular note in north eastern Australia, are well recognised (Resource Assessment Commission, 1993). As a result, strategies are demanded that balance economic development in the coastal zone with downstream impacts, such as that on the marine environment (Brown, 1995).

Scientists traditionally respond to such challenges by advocating that further research is needed to fill gaps in our understanding. This reflects the pre-eminence of a belief system that asserts that there can be rational and objective management of natural resources (Lang, 1990; Funtowicz, and Ravetz, 1990 for a more general discussion). Indeed Boehmer-Christiansen (1994) asserts that "*The very success of physical and natural sciences … lies in the self-seeking belief which scientists (but few others) tend to share that there is a very direct link between more knowledge and appropriate action.*"

Continued research may be needed to enable more informed and appropriate management of natural resources at the terrestrial-marine interface in northern Australia. The rational scientific approach is increasingly being challenged by our greater understanding of the complexity and indeterminism of natural systems and by the apparent irrelevance of much research to decision-making (in as far as it often has minimal impact on practical resource management). Together these have eroded the belief that knowledge is all that is required. In order to more effectively integrate scientific understanding into the decision-making process, researchers are now seeking to understand the process itself.

In this paper, we propose that the adage that "further research is needed" provides scientists with little opportunity to have a positive impact on sustainable natural resource management. Only by being prepared to invest in understanding the context of decision-making and by finding novel ways of facilitating the uptake of past and future research by decision-makers can scientists hope to have a significant and consistent impact on practice. We explore this new role for R&D providers by reference to some current activities in integrated natural resource management at a catchment scale in the Herbert Catchment of North Queensland.

Limitations to the contribution of science to natural resource management

Research addressing natural resource management issues is based on an unwarranted confidence that it will lead to "objective and rational management of natural resources". This implies that there are demonstrably correct solutions to natural resource management problems; that is that we can achieve decisions based on unanswerable and irrefutable logic. This is naive, in that it does not recognise that natural resource management is *inherently* a political process in which different needs and interests are balanced. Where policy is presented as being based solely on scientific evidence, this is almost inevitably a politically expedient 'fig leaf' for more complex motivations and compromises (Boehmer-Christiansen, 1994). Effective natural resource management can occur without formal research but not without an effective political process.

Quite apart from the political nature of natural resource management, "objective and rational management" may often be unattainable. Science is itself a political process (though highly institutionalised), being based on attaining consensus amongst peers with the consensus achieved in ecology is generally more speculative than in physical sciences. Predicting processes at an ecosystem scale may simply be an intractable task since issues may be so complex and indeterminate that predictive understanding may be practically, or even theoretically, unattainable. Certainly, a strong case can be made that process-based understanding of ecosystem behaviour in response to stresses can often only be weakly predictive (Peters, 1991). Catchment scale resource management deals with complex ecological, social and economic interactions in a dynamic situation with long time-frames and often considerable separation between cause and effect and the potential for irreversible outcomes (e.g. Norton *et al.,* 1996). As a result, uncertainty and ignorance need to be managed and communicated so that they become recognised inputs to the decision-making process (Funtowicz and Ravetz, 1990; Costanza et al., 1992; Dovers, 1995).

In short, the traditional assumption that science can provide unambiguous answers becomes hard to defend when applied to natural resource management. Given the uncertain and complex nature of ecosystems, we have to accept that more scientific knowledge does not necessarily lead to better answers at a scale and within a timeframe appropriate for action.

Maximising the contribution of science to decision-making

While research rarely solves natural resource management problems, it clearly can contribute to their solution. We argue that, in order to optimise this contribution, researchers need to :

- understand the context of decision-making;
- understand and seek to facilitate the processes of analysis and synthesis for natural resource management; and
- seek to facilitate the integration of research outputs into these processes.

Understanding the decision-making context

The context of decision making encompasses legislative, economic, historical and social considerations. Knowledge and data are the fuel for the decision-making process in natural resource management, but the same fuel can be placed in different engines to quite different effect. A failure to appreciate context of application, the nature of the engine, is a recipe for irrelevant research.

Northern Australia has a history of limited planning and control. Government planning and management remains an anathema to many rural residents, particularly in the north. So, while effective natural resource management is agreed as being necessary, the process is politically unacceptable. At the same time, centralised government resources are being constantly reduced. In response to both these pressures, the State and Federal governments' preferred direction for natural resource management in northern Australia is towards negotiated and consensual management by multiple stakeholders and decision-makers (Brown, 1995). Initiatives such as Property Management Planning, LandCare and the Integrated Catchment Management (ICM) programme in Queensland are prominent examples of this ethos.

The participants in these initiatives have become major clients for research in rural north Queensland. However, in order to meet their needs, the processes themselves must be understood. What is required in, for example, understanding ICM as a decision-making context?

In October 1991, an Integrated Catchment Management Strategy for Queensland was released by the State Government. The Strategy is intended to provide a framework for fostering cooperation and coordination between landholders and other resource users, community groups and government agencies involved in the use and management of natural resources. It is

dependent on landholders, the community in general and government having a sound understanding of the interactions between natural resources and the need for a coordinated catchment-wide approach for addressing issues affecting these resources

To understand the implications of this initiative, we need to evaluate the process of implementation of ICM; to identify social, economic and institutional factors that facilitate or hinder this process, to evaluate the impacts in terms of attitude and behaviour and the tractability and severity of resource use conflicts and, thereby assess the specific technical and related information needs for effective ICM in a wet tropical environment. This demands consideration of the resource use and social history of a catchment, the legislative and institutional context of resource use, community and stakeholder attitudes and, of course, the nature, availability, distribution and use of current knowledge about relevant biophysical processes. A current multi-disciplinary project over five years is undertaking precisely this type of evaluation in the Herbert catchment of north Queensland.

Understanding and facilitating analysis and synthesis in natural resource management
If research providers can be criticised for failing to understand the context of application, they can also be criticised for failing to facilitate the uptake of existing knowledge. While there is much research relevant to catchment scale natural resource management in northern Australia that needs to be done, there is a lot that has been done already. This includes both formal research results and the vastly greater pool of experience of landholders, natural resource management professionals and the broader community. Much of this knowledge is, for one reason or another, inaccessible to those involved in the natural resource management decision-making process. Research providers should be able to re-package it to make it accessible, or provide the necessary tools to access and use it in its present form.

In 1995 a series of interviews were held with advisers from three state government agencies and industry working in the Herbert catchment of north Queensland. These interviews sought to characterise natural resource management tasks undertaken by these individuals at that time (see Walker and Johnson, 1996) and to obtain a broader perspective of the needs they had and constraints under which they operated in providing advice on natural resource management issues to decision makers such as local government. Some of the constraints and opportunities that they identified are described below under five headings that characterise steps in the process.

Step 1 - Problem formulation The activities of the advisers interviewed involved comparatively little routine work, but advisers were often faced with questions on quite new issues. As a result, one of the first problems faced by many advisers in addressing a new situation was - what is important here? What should I be considering? Addressing these questions demands a systems level view of biophysical issues, which is rarely effectively provided by research agencies. The challenge for research providers is how best to provide the information that advisers need to decide the issues that merit consideration in any particular context.

Step 2 - Task analysis Having decided on a range of issues that merit consideration, the adviser must decide how to address them. This requires an understanding of the level of accuracy and precision required, but also an understanding of the data resources and analytical tools available for use in analysis, and the limitations associated with these resources. Where does this information come from and who should provide it?

Step 3 - Data analysis Data analyses may take a number of forms. In many instances experience may be enough. In other instances accessing and interpreting data about a site may suffice. However, there will be instances where informed advice demands a more sophisticated analysis. Researchers can make a large contribution to the accessibility of data resources, both by expanding the natural resource data that is available and by developing means of allowing

potential users to find and interpret those data effectively. When advisers need to perform structured analyses, they are generally applying generic analytical tools that are research outputs to their particular instance. Researchers are accomplished at providing generic tools but less so when it comes to providing guidance in the application of those tools to site specific contexts. For example, any analytical tool will be based on a set of assumptions. These may be implicit or explicit but either way are often not effectively communicated to potential users.
Step 4 - Synthesis A response to a request for advice on a complex natural resource management issue will often require the synthesis of a range of analyses and arguments. A typical issue here was how best to integrate local knowledge and experience with more formal analyses of data, how to interpret the former in terms of the latter or *vice versa.* Research advances in systems perspectives on resource use are not easily accessible to practitioners.

Step 5 - Presentation The politics of natural resource management, particularly where contentious, put pressure on advisers for unambiguous answers. However, these will often not be available. Appropriate presentation of what is available and what it means is, therefore, very important (Funtowicz and Ravetz, 1990). Advice must be accessible and defendable. It must be presented at an appropriate levels of abstraction, for example predicting trends and presenting scenarios, rather than providing precise but quite possibly incorrect predictions. Uncertainties and assumptions must be clearly stated without undermining the advice. The data/knowledge must be plausible - particularly where using predictions as evidence.

Given the above requirements, the task of the professional natural resource manager is challenging. There are, however, many opportunities for research contributions. For example, the above analysis has underpinned the development of an advanced decision support environment for natural resource management called NRM Tools (Walker and Johnson, in press). The toolkit is designed to provide the flexibility of application demanded by users (Walker and Johnson, 1996) in combining and recombining analytical functionality to meet the demands of particular tasks. As such, NRM Tools is a powerful environment in which to package and deliver research outputs. NRM Tools provides a mechanism whereby decision makers can make use of quantitative models. It also provides means of delivering qualitative or semi-quantitative knowledge and guidelines produced by research by developing knowledge-based systems (most familiar in the form of expert systems) that can be integrated into decision-support tools. NRM Tools not only provides a means of making this analytical functionality more readily available to users, it also provides means of facilitating their use. In particular, modules are currently under development that *support* problem formulation ('I've been asked to comment on this change in resource management - what possible implications should I be considering?') and task analysis and tool construction ('I want to assess the implications of this land use change on water quality and flooding risks - what data and analytical tools do I have to help me do this?').

Facilitating the uptake of research outputs
Research initiatives such as the development of NRM Tools add value to biophysical research in making it available to managers. However, this is only true where the technologies upon which such outputs are based are themselves accessible. They may often not be. Here again, there are opportunities for researchers.

The Herbert Resource Information Centre (the HRIC) was established because many such decision makers in the Herbert River catchment did not have adequate access to basic information about the catchment. The HRIC is a community-based and collaborative joint-venture which integrates a large range of high quality data about the Herbert catchment into a GIS (Geographic Information System). The partners to the HRIC are the Hinchinbrook Shire Council, CSR (the sugar milling company in the catchment), the Herbert Productivity Board, the Queensland Department of Natural Resources and CSIRO. Two Centre staff manage the data

sets and undertake advanced analyses as required. Much routine analysis is undertaken directly by staff in the participating organisations.

As well as introducing GIS to the catchment, and thereby providing much more effective access to the range of data available about the catchment than was previously available, the HRIC provides both the technical requirements and ethos required for the use of NRM Tools by managers within the catchment. CSIRO's involvement in this project has, therefore, both been of benefit in establishing a resource that is useful in its own right and has fostered a context for uptake of research outputs, in this case NRM Tools.

The HRIC provides a context in which data, scientific knowledge and method can be better integrated into local political processes by local people. The collaborative nature of the centre can be expected to have an impact on the flow of information and the course of debate in the catchment.

Conclusions

The creation of new knowledge usually involves institutions that are different from those concerned with its application and dissemination. However, what is clearly increasingly required is that the former better understand the latter if they intend to justify their existence in terms of impact on natural resource management rather than advancement of knowledge *per se*. Boehmer-Christiansen (1994) identified seven ways that experts can further their own interests in policy development. The first three of these are : emphasise uncertainty and incompleteness of knowledge; emphasise complexity and difficulty; emphasise threats that can be tackled with more science and technology. We would suggest that the reality of natural resource management in the 1990s means that these strategies are a fast-track to irrelevance. We suggest it is far better to invest effort in exploring techniques by which scientific expertise can be transformed into information relevant to natural resource management.

Science is often more comfortable in providing advice on what ought to be done and why, rather than practical advice on how it might be achieved (Boehmer-Christiansen, 1994). Initiatives such as the NRM Tools and HRIC are designed to provide practitioners with access to scientific resources which they can then apply to the "how" problem. Our vision is one in which data, knowledge and scientific judgements of that data / knowledge can all be made available for integration into a negotiation process that attempts to deal with inherent uncertainty. Therefore, there is a considerable focus on communication of the principles, values and assumptions underlying analyses. Ideally initiatives such as NRM Tools and HRIC should ultimately lead to co-design of research in which researchers and local stakeholders interact to explore the extent to which applied science can make a contribution to effective and sustainable natural resource management.

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Chapter 6

Integrating R&D into Decision-Making for Natural Resource Management at a Regional Scale

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Abstract
The operational reality behind the rhetoric of integrated natural resource management poses significant challenges for resource managers, resource use planners and research scientists. A variety of frameworks for integrated resource planning and use have been espoused. These tend to reflect the bias of the discipline or stakeholder group fostering the approach and may therefore be unpalatable to, and ignored by, other groups. In this paper, we are concerned with improved integration of research outcomes into decision making. Rather than propose a framework, we take a pragmatic view of the roles of managers, planners and scientists. In doing so, we draw principally on practical experience derived from a series of initiatives in a rural catchment in tropical Australia. On this basis, we argue for a particular and emerging role for a 'decision support systematist' in designing approaches to adaptive decision support that provide real opportunities for integrating research outcomes into decision-making.

Introduction

While the global imperative to achieve ecologically sustainable development has become something of a truism, the particular problems associated with operationalising this imperative are far from resolved. Management scale is one such challenge. Off-site impacts, cumulative impacts and other externalities have precipitated interest in seeking more effective natural resource use, management and planning at diverse geographic (enterprise, catchment, and regional) and temporal scales (or within what Gunderson *et al.,* 1995b:522-3, have called panarchies) such that the impacts of actions at any one level of operation in the hierarchy of spatial and temporal scales can be managed at other levels. Such initiatives pose substantial methodological and operational challenges, and provide a significant opportunity for research and development (R&D) initiatives.

The requirement for integration across multiple scales generates a "convergence zone" for a range of different resource management paradigms. Thus, catchment or regional-scale natural resource management is strongly influenced by experience in, and approaches to sustainable resource management at an enterprise scale (as in Farming Systems Research and Extension); approaches to resource use planning at a broader, traditionally agency-driven, scale (as in regional resource use planning); while an increasing emphasis on management of the environmental impacts of resource use exploitation has lead to growing interest in ecologically-based methods such as adaptive management. While valuable, these approaches modify theory and practice from disciplines with different objectives operating at different spatial scales. In effect, they attempt to fill a disciplinary void in approaches to integrated resource use and management through adaptation of precepts developed in quite different contexts. This convergence and adaptation is manifest in the pragmatic realities of initiatives seeking to foster improved integration of natural resource management activities at a catchment scale.

Notably, all three disciplines mentioned (FSR/E, regional resource use planning and adaptive management) have been strongly influenced in recent decades by the growing influence of more participatory approaches to management activities than traditionally applied. At the enterprise level, the shift from a linear 'science-push' technology transfer model for agricultural R&D to the FSR/E paradigm has been enormously influential (Chambers, 1992). Participative democracy has concomitantly emerged as an increasingly influential paradigm in the evolution of approaches to resource use planning in the post-war period. Traditionally, most decision-making in planning has been vested with regulatory authorities. However, in recent years policy in many countries has increasingly sought to involve the community in the decision-making process, on the premise that more robust and workable solutions will eventuate (Hyman & Stiflel, 1988). Similarly, adaptive management has progressed from an expert-based process relying primarily on extensive quantitative modelling to a more inclusive and participatory paradigm (Dovers & Mobbs, 1997). Assumptions about what is required to achieve sustainable resource use, particularly the role of technocrats, resource users and the broader community in resource use decision-making have been challenged accordingly.

Thus, the move towards community-driven natural resource management at a range of scales that integrates impacts at the enterprise (e.g. farm) level up to the regional has implications for roles and relationships between the diversity of stakeholders operating across these scales. In this paper, we explore these roles and responsibilities, with a particular emphasis on the integration of increments to understanding gained through research initiatives into the decision-making process. Our assessment is based on consideration of our experience in a set of research-based initiatives in a rural catchment in tropical Australia. Lessons from this experience lead us to propose that the requirements of integrated resource management and planning generate a critical role for natural resource professionals concerned with designing tools, methods and structures for integration. We propose the term 'decision support systematist' to describe this emerging role.

Context – The Herbert River Catchment

The Herbert River catchment drains an area of approximately 10 000 km^2 in Australia's sub-humid to humid tropical north east (lat. 15-19^0 S, long. 145-146^0 E) to the Coral Sea. Large areas of the catchment remain under natural vegetation (much managed for extensive cattle grazing), although approximately 35 to 40% of the coastal lowland area has been cleared for crop production or improved pastures. The catchment has a population of approximately 21 000 and is bounded by two World Heritage listed areas, the rainforests of the Wet Tropics on the steeper slopes of the central catchment and the Great Barrier Reef immediately adjacent to the catchment.

The area has experienced, and continues to experience, strong economic growth underpinned predominantly by its agricultural and tourist sectors. The sugar industry dominates the local economy with 70 000 ha of production and two sugar mills producing (Aus) $ 235 million worth of sugar in 1996/7. A plethora of government and statutory industry agencies claim, or are assigned, responsibility for different aspects of the management of the catchment and a number of agencies also contribute to management through the provision of research and development outputs and expertise.

The Herbert catchment, like many other parts of Australia's coastal zone, is a major focus of competition between alternative uses of resources with competition between agriculture, forestry, conservation, tourist and recreational uses, urban encroachment, public utilities and hobby farms. Growing competition has occurred in the context of increasing community expectation for the preservation of the natural environment, involvement in decision-making and effective conflict resolution.

The sugar industry has the potential for significant environmental impacts in the Herbert catchment (Johnson *et al.,* 1998). Soil erosion is recognised as a potential threat to long-term productivity, although the adoption of green cane harvesting-minimum tillage practices has been an important step in decreasing sediment supply to the coastal zone from sugar cane lands. Considerable areas of the riparian vegetation have been removed from the stream banks in sugar cane growing regions. Large areas of riverine rainforest with patches of eucalypts and the riverine rainforest have also been cleared. The wetlands, swamps, billabongs and waterholes of coastal areas are important wildlife habitat areas and form an integral part of a hydrological regime. Clearing for sugarcane has significantly reduced the area of this habitat. Potential exists for diffuse source pollution to generate water quality problems in both ground and surface waters. This has been perceived to be of particular concern given the adjacency of the Great Barrier Reef.

Growing concern about potential environmental impact is balanced by a recognition of the regional and national importance of an economically vibrant sugar industry. The economic terms-of-trade of the sugar industry and competing land uses are under pressure due to the

influence of increasing global competition, meaning that increased areas and yields are required in order to remain internationally competitive.

In order to achieve and maintain ecological and economic sustainability within the Herbert catchment, effective means of managing and reconciling industry imperatives at the farm and regional scales with the requirements of other users of the catchment (including conservation and environmental services) are required. In recognition of such issues, Governments have sought to implement integrated approaches to resource management to avoid the environmental and social damage sustained by conflicts in land use has gained prominence. In the Herbert, this has included for example, an Integrated Catchment Management program (Anon, 1991). In practice, the effectiveness of such initiatives is often constrained by a paucity of data at spatial and temporal scales relevant to decision-making, poor co-ordination or communication between participating stakeholders, limits to the data processing and analytical capabilities of participants in the decision-making process, and a poor understanding of key issues in sustainable resource use.

Case Study : Integrating R&D into decision-making in the Herbert River Catchment

In 1992, the CSIRO (Commonwealth Scientific and Industrial Research Organisation) initiated research in the Herbert catchment to assess the implications of land use change and land management strategies in the catchment with a particular emphasis on water quality. This initiative involved significant biophysical research (see e.g. Mitchell *et al.*, 1996) but also incorporated the development of a decision support system (DSS) to integrate the outputs of this research into decision making. In practice, what appeared to be a focussed and predominantly technical objective in the development of decision support (Walker & Johnson, 1996b) evolved into a much more substantial activity.

The research started from the premise that a technical decision support approach was warranted. However, the literature demonstrates that only a small proportion of decision support systems for resource management achieve operational uptake. The research group were, therefore, particularly concerned with balancing scientific with operational applicability. We therefore sought to:

- design tools, methods or structures for decision support that were adapted to the decision-making context;
- undertake capacity building to facilitate the application of new tools and ways of thinking to new problems in integrated resource management; and
- develop effective means of evaluating the impact of the process and product on decision-making.

These requirements were considered to be mutually dependent, thereby dictating the broad project lifecycle presented in Figure 1. In this section we recount this experience in integrating R&D into decision making before considering implications for scientists, planners and resource managers.

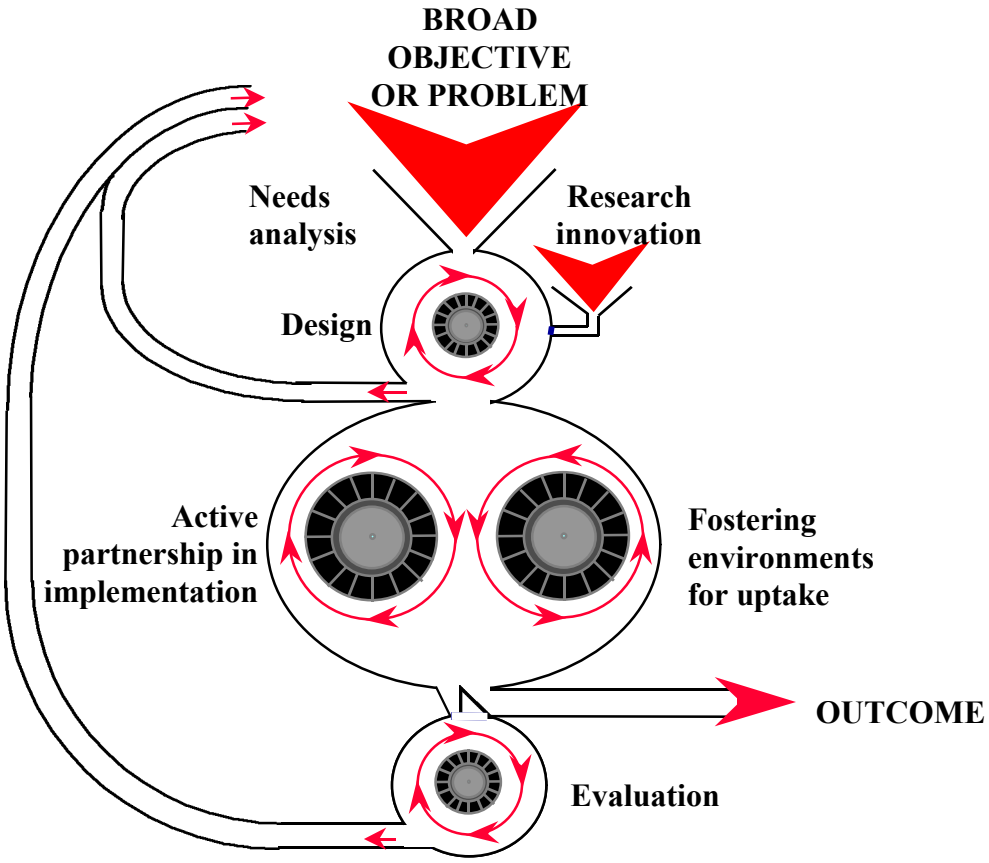

Figure 1 : A schematic presentation of the project lifecycle.

Designing appropriate interventions

The design of tools, methods or structures adapted to the decision-making context demanded the integration of a needs analysis process with technical and research innovation. For a project group with a research bias, the needs analysis process was a significant departure from standard practice.

Investigation of context as a basis for the design of R&D-based interventions is a well developed and widely applied process in many disciplines, including, for example, Rapid Rural Appraisal and the many associated methodologies that parallel, or have evolved from, RRA(Chambers, 1992). There was, however, a particular challenge to be faced in the establishment of interventions for natural resource management in the Herbert catchment. Such interventions were being developed for application in circumstances in which there was no tradition of substantive resource management at the scales (spatial and temporal) necessitated by the dictates of ecologically sustainable development. Therefore, the research group was faced with the challenge of investigating a decision-making context in which current structures and processes were acknowledged as inadequate and a substantial objective of the research process was their improvement.

This experience is by no means unique to our experience in the Herbert and may be a general feature of interventions for integrated resource management at a catchment scale. For example, in companion work to identify the opportunity for developing and delivering decision support systems in support of a regional resource planning project in the Central Highland of Queensland, Australia, Zhu and Dale (in review) had to apply a soft systems methodology (Checkland & Scholes, 1990). They did so in order to consider developing conceptual models of current practice, thereby providing a basis for designing desirable and feasible changes that might

be precipitated by the development and delivery of appropriate decision support systems (Zhu & Dale, in review).

Once the present context, the vision of the desired context and, thereby, potential R&D based interventions have been identified, it may often be possible to test the appropriateness and viability of proposed interventions through a formal, hypothesis-based analysis. The primary technical intervention that we developed for resource use planning in the Herbert catchment was called NRMtools. The broad design specifications of NRMtools, were formally tested before detailed design and prototyping was undertaken through interviews with a range of potential users to characterise current tasks, their context, constraints encountered and the viability of initiating a DSS –based solution (Walker & Johnson, 1996a).

This process substantially altered the course of the project. Thus, early scoping revealed that decision-making in the context of catchment management was characterised by the occurrence of many occasional or one-off tasks rather than routine, frequent and standardised processes. As a result, planning and action tended to involve the intuitive and highly flexible combination of available data and understanding, and use of techniques for synthesis and interpretation to meet a broad range of objectives. A decision support system focused solely on, for example, the impact of land use change on water quality, was seen to be of limited relevance in that it only provided a means of addressing one issue amongst many. Furthermore, a broad range of spatial and temporal scales was considered relevant and a complex and evolving legislative environment was described. As a consequence, while a potential role for decision support for helping to deal with this complexity was evident, it was not clear that a single system would meet a useful proportion of requirements. As a result, rather than a decision support system specifically and restrictively focussed on, for example, water quality issues, it was proposed that an attempt should be made to develop a broader and more flexible toolkit-based approach. This conceptual design (i.e. the research innovation) was formally tested through a further interview-based process (Walker and Johnson, 1996a).

Capacity building

It was apparent from the relationship established with potential users that the decision support tool under development for the Herbert potentially fulfilled a significant role in resource use planning in the catchment but that it was unlikely to be adopted given the existing capacity – in terms of data, information technology infrastructure, technical skills and decision-making structures – in the catchment. As well as developing the analytical tools, a concomitant investment in capacity building in the catchment was therefore required.

Johnson and Walker (1996) describe the approach used to facilitate the development and implementation of a collaborative Geographic Information Systems (GIS) facility involving industry, community, government and research agencies in the Herbert – the Herbert Resource Information Centre (HRIC). Geographic Information Systems have demonstrated capability to improve decision-making in resource management and underpin many of the decision support technologies for catchment scale management.

Development and implementation of the HRIC involved significant investment of time and resources on the part of stakeholders. Over a two year period, six stakeholders in the catchment (CSR Sugar Mills, Herbert Cane Protection and Productivity Board, Hinchinbrook Shire Council, Canegrowers Herbert River Executive, CSIRO and the Queensland Department of Natural Resources) developed a 10-year collaborative agreement to formally establish the HRIC. The agreement secured the financial and non-financial (in-kind) support of the stakeholders and bound them to support the HRIC's foundation philosophy of being a non-profit, community based collaborative GIS facility designed to support ecologically sustainable development in the Herbert catchment. The HRIC is staffed by 2 full time GIS specialists, whose role is to provide high level expertise and skills to facilitate the collection, storage, maintenance and analysis of natural resource data. Their role is also to ensure the products of these activities are delivered in

an efficient and timely manner to HRIC stakeholders. As such the HRIC offers a bureau service to its stakeholders, provides free GIS consultancy and project management skills and acts as a conduit for the transfer of relevant R&D products.

This initiative was a significant undertaking for a rural community. The CSIRO research team played a critical role in instigating and facilitating the initiative, including provision of technical inputs such needs and cost benefit analyses (Johnson and Walker, 1997). This role took us outside the normal activities of a scientific research group but was a critical contribution that could not have easily been made by the resource managers or planners working in the catchment.

Evaluation of process and product
The objectives of the HRIC can be summarised as:

- improved quality of data available for the Herbert catchment;
- improved access to data;
- better informed decisions in planning and implementing data collection and use projects;
- better informed decisions in natural resource management; and,
- improved collaboration.

The process of evaluating progress against these objectives fell beyond the remit and expertise of the resource managers and planners whose collaboration underpins the HRIC. As a consequence, the research team undertook a formal evaluation process which addressed the above objectives and also provided for the evaluation of less tangible aspects in relation to changed perceptions, attitudes, understanding and behaviour, particularly in relation to collaboration between groups, as a consequence of involvement in the HRIC.

The evaluation was conducted using qualitative research techniques. Individual, face-to-face interviews using a semi-structured interview schedule were conducted with key participants in the HRIC each year over three years. In the first round of interviews, anticipated impacts were elicited. In the second and third rounds, anticipated and actual impacts to date were elicited. At the end of the three-year period, the entire data set was entered into a qualitative data analysis package and tagged against key evaluative criteria providing a basis for a qualitative analysis. The evaluation is reported in full in Walker et al., 1998.

As well as providing a detailed assessment of progress as a management tool, the evaluation provided valuable insights into the applicability of this case study as a model for other catchments. While many regional planning activities promote a consultation process, few have been successful in devolving the decision-making capacity (as opposed to mandate alone) to the community. The HRIC is an example in which community groups have control and ownership of resource information. As such, the HRIC has generated significant interest and is widely viewed as a model for similar initiatives elsewhere. The local partners to the HRIC do not have the remit to evaluate the applicability of their experience to other areas and to extend the results. This role is increasingly falling back on the CSIRO research team (see Walker et al. 1998 for examples of such evaluation).

Lessons learnt : roles in integrated resource management

The preceding narrative describes our experience as a research team established to contribute to the resolution of catchment scale issues in integrated resource use through traditional science-based R&D. We have found that over a five year period that we have come to play quite a different role. In the remainder of this paper we examine this new role and discuss its implications for the conduct of R&D in integrated resource use and management.
We have already stated that integrated resource use and management represents a convergence zone for a range of disciplines. The convergence of practice and a range of theoretical

perspectives in integrated approaches to regional natural resource management provides opportunities for synergies (although in practice competition for 'territory' is often more evident). In particular, disciplinary diversity allows 'triangulation' of theory and methods to make effective use of complementarity between different disciplines – particularly in ameliorating the flaws of any one perspective or methodological approach (Yin, 1994). Nevertheless, the lack of a common and agreed theoretical basis suggests that integrated natural resource management is a domain more of praxis (integrating interpretation, empirical research, dialectic analysis and practical action – Lather 1986) than a disciplinary domain with a potential unitary theoretical basis. We argue, therefore, that the adaptive core of integrated resource management should remain as a shared objective and ethos (or paradigm in the strict sense) in which Yin's triangulation can occur, but should not be formalised. We propose that from a pragmatic and theoretical perspective, approaches to integrated resource use and management might best be considered from the perspective of tasks, roles and requirements. For the sake of discussion, we distinguish four broad categories of activity which equate broadly (but imperfectly) to four categories of 'actor' widely recognised as being involved in integrated resource management at a catchment scale. We will then present the case for a fifth role that we came to fill in our research in the Herbert. Our four categories are as follows.

- **Resource use** The activities of industry and community in interfacing with the resource base.
- **Resource management** We use the term Resource Management here to refer to the operational control of resource use activities as undertaken by managers within Government departments and resource managers within the private and community sector (including primary producers). Resource managers are, therefore, the clients for the integrated R&D products discussed here.
- **Planning** The planning function has traditionally been the domain of professional planners. However, the evolution of planning theory and practice has substantially broadened and redefined this role, such that the resource use planning undertaken by individuals with no formal planning background, who may not even recognise their activities as planning, is being increasingly recognised and fostered in policy. Thus individuals who would be described as activists or facilitators in a farming systems context are, at a catchment or landscape scale, performing a planning function.
- **Incrementing understanding of the systems being managed** Scientific rarely solves resource management problems, but can clearly contribute to their solution. As the domain of the professional scientist (including socio-economic as well as biophysical researchers), advancing understanding of the systems being managed is frequently the activity most removed from decision-making. However, participatory research method and a growing recognition of the role of local knowledge mean that an increasingly inclusive view of opportunities for incrementing knowledge is becoming recognised.

With the exception of the resource user, these categories may be viewed either as activities in integrated resource management or disciplines and professions that play a role in the process. This duality reflects the value and role of strong professional associations and the reality that professional monopolies on research, planning and resource management potentially inefficient and anti-democratic. Scientists, planners and resource managers are recognised occupations with professional and institutional structures that foster efficacy and rigour. While valuable, these structures provide challenges for integrated approaches. This is analogous to the conflict between participatory research and academic success (Cancian, 1993). Furthermore, it is axiomatic that increasingly participative approaches to resource use planning require community representatives to assume some research, planning and management roles.

Our needs analysis in the Herbert context clearly illustrated the general observation that, whether achieved through legislative control or self-regulation through participative policy, approaches to integrated resource use and management in an attempt to achieve ecologically sustainable development significantly complicate the activities of the resource user or manager.

Management for sustainability, both on-site and off-site, is inherently more complex than managing solely for maximum productivity or conservation. More facets of the resource base need to be monitored and managed, and a more holistic view of the range of potential impacts - particularly cumulative impacts - must be considered. In short, a complex system of interactions must be managed for multiple rather than single objectives.
In order to make defendable and effective decisions, resource managers and planners require:

- effective access to information pertinent to resource use and its impacts;
- the 'tools' to make effective use of that information;
- the capacity to make appropriate use of those information and tools;
- an appropriate decision-making environment (including legislative and institutional structures); and
- effective means of evaluating the outcomes of decisions made and planning activities and processes used.

The adoption of participatory approaches to resource management and the increasing complexity of the domain of resources being managed and the objectives associated with their management, extend the range of pertinent information, the range of tools required and the skills needed to use them. Much of this increase in complexity can be attributed to the expectation that resources can be managed effectively at multiple spatial and temporal scales. This places demands on managers, planners and scientists to take a highly integrated and comprehensive view. As discussed in the next section, they may struggle to fulfil these demands without the contributions of the decision support systematist.

Role and requirements : the natural manager

As decision-making becomes a more complex process addressing more complex issues such that a broader domain of information needs to be considered, managers are increasingly likely to lack the necessary expertise, and, therefore, capacity to make use of this expanded range of information and the tools to process it. Thus, in assessing options for expanding the area of cane production in the Herbert, the sugar industry which has traditionally have been able to assess land use suitability and economic viability on the basis of experience and local knowledge, is expected to investigate a much broader range of issues such as potential off-site impacts and cumulative degradation to the resource base at spatial and temporal scales beyond traditional expertise – necessitating the development of new skills to consider new information and apply new ways of thinking to consideration of that information. Given that sustainable resource management is the application of the outcomes of resource use planning processes, which are inherently political in that they balance the needs and interests of different stakeholders, the challenges associated with these changing requirements have significant implications for relationships between stakeholders. In consequence, these changes can be a significant source of stress for both individuals and communities.

This has important implications for the integration of R&D into decision-making for catchment or regional scale natural resource management. Our experience in the Herbert demonstrates that one of the constraints to moving towards ecologically sustainable development in the context of rural resource management is the capacity for resource users and managers to make the necessary shifts in their ways of operating. An external agency may be required to facilitate this transition as in our role in the Herbert. This includes :

- development of means of providing effective access to the broad range of technical data, local knowledge and process information that might be germane to decision-making;
- the development of operationally applicable tools for analysing (or 'ways of thinking about') the potential impacts of resource use in contexts in which testable predictions may be practically (or even theoretically) impossible; and
- a role in building the capacity to bring these into existing and evolving decision-making processes.

Role and contributions : the planner

A common assumption is that 'planners' belong to a discrete profession, and are most frequently employed within government agencies. Further, it is widely assumed that the enterprise of planning, despite recognition of inequities in planning process, is largely centrally driven in response to regional need. However, understanding of the planner and the planner's role is looking increasingly beyond state agencies to include both community and capital (after Alexander 1994) such that, "...planning is a general approach to decision making and is not tied to the activities of any profession or department of government." (Faludi, 1973:3).

It is useful to track the evolution of the planners role, at least in the body of theory, and of the planner themselves over the last half century. As with any of the 'professions', planning has undergone a substantial intellectual revision removing the modernist assumption of the technocratic planner maintaining critical distance, preparing blueprints for society to follow. Although this perspective remains, a necessary response to the challenges wrought by recognition of structural (power) and rational (knowledge) inequities in planning process has been the redefinition of the planner away from agency, programmatic characterisations toward multiple actor and role definitions. The planner is now *inter alia* technician, administrator, mobiliser, mediator, entrepreneur, advocate, adviser, interpreter, communicator, each emerging in response to the planning context. Each of these roles carries with it specific skills, with the agency planner in a regional context expected to fulfil each and frequently all. Far from remaining a specific disciplinary field, planning is therefore increasingly having to internalise inter-disciplinary perspectives and functions. The development of methodologies to accurately reflect community preference in the planning process, other than through a review of draft plans, is perhaps the most significant ongoing aspect of this transformation.

Where the resource user/manager/community representative is cast in the role of planner, the requirements are less clear. Nevertheless, both for agency-based and community-based planners (as in the Herbert) a key issue relates to access to appropriate tools (technical, information, language) to facilitate the planning process, and the integration of planning perspectives arising at multiple stakeholder scales. From the perspective of integrating R&D into decision making, the planner must play a key role in informing the research agendas and in linking the outputs into the broader set of activities that comprise the planning process. However, the range of demands already on the planners means that they are unlikely to have the capacity to integrate 'raw' research outputs into forms appropriate for inclusion in the planning process.

Role and contributions : the scientist

We argue that the research scientist is also not best placed to undertake this role of integration. Research addressing natural resource management issues is often based on an unwarranted confidence that it will lead to "objective and rational management of natural resources". This implies that there are demonstrably correct discrete solutions to natural resource management problems; that is that we can achieve management outcomes based on irrefutable logic. This reflects the pre-eminence of a belief system that asserts that there can be rational and objective management of natural resources (Lang, 1990; Funtowicz and Ravetz, 1990 for a more general discussion). This view probably persists more usefully in science than in planning or management. Indeed Boehmer-Christiansen (1994) asserts that "*The very success of physical and natural sciences … lies in the self-seeking belief which scientists (but few others) tend to share that there is a very direct link between more knowledge and appropriate action.*" The view of the role of science that Boehmer-Christiansen identifies is naive, in that effective natural resource management can occur without formal research but not without an effective political process.

Quite apart from the political nature of natural resource management, "objective and rational management" may often be unattainable. The scientific consensus achieved in ecology and

resource management is generally more speculative than in physical sciences. Predicting processes at an ecosystem scale may simply be an intractable task since issues may be so complex and indeterminate that predictive understanding may be practically, or even theoretically, unattainable (Oreskes *et al.*, 1994). Certainly, a strong case can be made that process-based understanding of ecosystem behaviour in response to stresses can often only be weakly predictive (Peters, 1991). Catchment scale resource management deals with complex ecological, social and economic interactions in a dynamic situation with long time-frames and often considerable separation between cause and effect and the potential for irreversible outcomes (e.g. Norton *et al.,* 1996). In short, the traditional assumption that science can provide unambiguous answers becomes hard to defend when applied to natural resource management. Given the uncertain and complex nature of ecosystems, we have to accept that more scientific knowledge does not necessarily lead to better answers at a scale and within a timeframe appropriate for action. As a result, uncertainty and ignorance need to be managed and communicated so that they become recognised inputs to the decision-making process (Funtowicz and Ravetz, 1990; Costanza et al., 1992; Dovers, 1995).

Nevertheless, the challenge to the rational scientific approach resulting from greater understanding of the complexity and indeterminism of natural systems and from the apparent irrelevance of much research to decision-making (in as far as it often has minimal impact on practical resource management) may have dangerous consequences. While research rarely solves natural resource management problems, it clearly can contribute to their solution. The adage that "further research is needed" may have provided scientists with little opportunity to have a positive impact on sustainable natural resource management in the past. However, undermining the scientific process by demanding that scientist become participatory, political or post-modern may seriously undermine the ability of the scientific establishment to make valuable contributions to resource management issues. So, while scientists must be prepared to invest in understanding the context of decision-making and its implications for R&D (see, e.g. Barnes et al., 1997 for an example based on our work in the Herbert) they are not necessarily productively placed as integrators and facilitators.

An emerging role: The development of adaptive mechanisms for decision support.

The key thesis in this paper is that the process of integration of R&D outputs and the development of adaptive mechanisms for decision support is an increasingly important activity in seeking inclusive, equitable and defendable decisions in resource allocation. In the previous section we have argued, on the basis of our experience in the Herbert, that this role is distinctly different to those of manager, planner or scientist and not one that sits appropriately within any of these categories. The objective is to design methods, tools and structures for the synthesis of information (including data and knowledge about systems function) into integrated resource management activities. In resource management for single objectives (whether of productivity or conservation) this would equate to technology transfer or extension. However, in the context of planning in complex environments with multiple competing objectives, this role becomes quite different. We propose that it involves the development of integrative tools or methods to support decision making but also a role in capacity building in the use of such tools or methods and the provision of evaluative processes for tracking their role and impact. Our experience in the Herbert, as reported here, illustrates each of these functions. For the purposes of discussion, we describe this as the domain of the 'decision support systematist'. This term is intended to reflect a decision-centred approach to decision support, which takes a much broader view of means-to-an-end but includes, *inter alia*, the development of effective means of integrating research output into decision-making process.

Discussion and Conclusions

Science is often more comfortable in providing advice on what ought to be done and why, rather than practical advice on how it might be achieved (Boehmer-Christiansen, 1994). Our work in the Herbert has led us to focus particularly on this latter challenge. The design of adaptive decision support mechanisms through initiatives such as the NRMtools and HRIC is intended to provide practitioners with access to scientific resources which they can then apply to the "how" problem. The challenge for the decision support systematist is to develop approaches by which data, knowledge and scientific judgements of that data / knowledge can all be made available for integration into a negotiation process that attempts to deal with inherent uncertainty. Therefore, there is a considerable focus on communication of the principles, values and assumptions underlying analyses.

Identification of this role does not imply adoption of any particular framework or approach to integrated resource management. A variety of frameworks, paradigms and methods for integrated resource planning and use have been espoused – including adaptive management (Gunderson et al 1995), communicative planning (Healy 1997) and community-based approaches such as Integrated Catchment Management (Anon, 1991). These frameworks tend to reflect the bias of the group fostering the approach. As a consequence, they may be unpalatable to, and therefore ignored by, other groups. So, while they seek to provide a rigorous framework, such approaches may, in fact, be brittle. Our intention in taking a role-based view of the process of improved natural resource use planning and management has been to attempt to avoid such problems.
We argue that the functional design (as opposed to the implementation) of decision support tools, the design and facilitation of capacity building exercises such as the HRIC and the design and implementation of evaluative strategies for assessing the impact of the process of such initiatives and their products represent an increasingly important role for natural resource planning professionals. Furthermore, while often and successfully performed in an *ad hoc* manner by scientists or planners, we believe that this is not a science or planning role.

We propose that the development of decision support mechanisms such as those outlined in this paper is an increasingly widespread activity. Recognition of these activities and the role of the decision support systematist will allow the comparative evaluation of methods and the establishment of best practice. It may also help to counteract the pressures on managers, planners and scientists to seek practical and theoretical approaches to comprehensiveness in all their activities and to thereby become equally and competitively involved in sloppy science, poorly executed planning processes and unprofessional resource management.

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Chapter 7

GIS through community-based collaborative joint venture: an evaluation of impacts in rural Australia

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Abstract
Fostering effective use of GIS amongst a broad range of stakeholder groups and in the community as a whole requires investment in capacity building as well as in data integration and provision. Community-based collaborative joint ventures can achieve both these objectives. This paper reports the evaluation of one such initiative in tropical Australia and, on the basis of this experience, infers a set of issues that may determine the success or otherwise of similar ventures elsewhere.

Introduction

Sustainable resource use and participative democracy have emerged as increasingly influential paradigms in the evolution of approaches to resource use planning and management in the post-war period. Traditionally, most decision-making has been vested with regulatory authorities. In recent years significant changes have occurred to involve the community in the decision-making process (e.g. McKenna 1995). Assumptions about what is required to achieve sustainable resource use, particularly the role of technocrats, resource users and the broader community in resource use decision-making have been challenged accordingly. In the Australian context, a rhetorical move towards participatory resource planning has underpinned much policy (legislation and funding) in natural resource management and rural development for the past decade (Dale & Bellamy, 1998). This puts Australia at the forefront of international experience.
Experience suggests that in order to enable effective community participation in resource planning, four fundamental requirements must be met. Stakeholders must have :

- effective access to information pertinent to resource use planning;
- access to the analytical tools required to make effective use of that information:
- the capacity to make appropriate use of those analytical tools and data sets; and
- a legislative and institutional environment that fosters effective participation.

Community-based decision-making represents a change in the organisation and operation of information systems. A planning strategy is an aggregate of: (a) knowledge about the state-of-the-environment as a rolling audit of existing conditions and resource issues, (b) a management plan showing planned activities, (c) information services to analyse design constraints and options, and (d) evaluation to refine and modify the progress of activities. In the traditional agency-driven approach to resource use planning, the community is informed about the state-of-environment and the consequent plan. Increased community involvement may result in consultation or even negotiation about the interpretation of the former and the structure of the latter. However, delegation to the community means that they have to be responsible for these processes and have the capacity to undertake analysis and evaluation. So, the key distinction between an agency driven approach and a community driven approach is control of the information, evaluation and decision-making process. Empowerment of community based groups means they have involvement and ownership of both information and decision processes.

Appropriately structured community-based organisations can play a lead role in fulfilling these requirements. Historically, the local axis of industry representative bodies (such as the United Graziers' Association and Canegrowers) and other special interest lobby groups have played this role. More recently, advances in information technology have opened new opportunities for improving local capacity and participation in planning. As a result, a number of initiatives to create community resource information centres have arisen across Australia. Many of these initiatives are not specifically aligned with particular interest groups but aim to foster broader community sectors to participate in planning and decision-making. In this paper, we report on one such initiative and use consideration of this case study to identify key issues to be considered in establishing such ventures.

Case Study : The Herbert Resource Information Centre

The region

The Herbert River catchment drains an area of approximately 10 000 km^2 in Australia's sub-humid to humid tropical north east (lat. 15-19^0 S, long. 145-146^0 E) to the Coral Sea. Large areas of the catchment remain under natural vegetation (much managed for extensive cattle grazing), although approximately 35 to 40% of the coastal lowland area has been cleared for crop production or improved pastures. The catchment has a population of approximately 21 000 and is bounded by two World Heritage listed areas, the rainforests of the Wet Tropics on the steeper slopes of the central catchment and the Great Barrier Reef immediately adjacent to the catchment.

The area has experienced, and continues to experience, strong economic growth underpinned predominantly by its agricultural and tourist sectors. The sugar industry dominates the local economy with 70 000 ha of production and two sugar mills producing (Aus) $ 235 million worth of sugar in 1996/7. A plethora of government and statutory industry agencies claim, or are assigned, responsibility for different aspects of the management of the catchment and a number of agencies also contribute to management through the provision of research and development outputs and expertise.

The Herbert catchment, like many other parts of Australia's coastal zone, is a major focus of competition between alternative uses of resources with competition between agriculture, forestry, conservation, tourist and recreational uses, urban encroachment, public utilities and hobby farms. Growing competition has occurred in the context of increasing community expectation for the preservation of the natural environment, involvement in decision-making and effective conflict resolution.

The sugar industry has the potential for significant environmental impacts in the Herbert catchment (Johnson *et al,* 1997). Soil erosion is recognised as a potential threat to long-term productivity, although the adoption of green cane harvesting-minimum tillage practices has been an important step in decreasing sediment supply to the coastal zone from sugar cane lands. Considerable areas of the riparian vegetation have been removed from the stream banks in sugar cane growing regions. Large areas of riverine rainforest with patches of eucalypts and the riverine rainforest have also been cleared. The wetlands, swamps, billabongs and waterholes of coastal areas are important wildlife habitat areas and form an integral part of a hydrological regime. Clearing for sugarcane has significantly reduced the area of this habitat. Potential exists for diffuse source pollution to generate water quality problems in both ground and surface waters. This has been perceived to be of particular concern given the adjacency of the Great Barrier Reef.

Growing concern about potential environmental impact is balanced by a recognition of the regional and national importance of an economically vibrant sugar industry. The economic terms-of-trade of the sugar industry and competing land uses are under pressure due to the influence of increasing global competition, meaning that increased areas and yields are required in order to remain internationally competitive.

In order to achieve and maintain ecological and economic sustainability within the Herbert catchment, effective means of managing and reconciling industry imperatives at the farm and regional scales with the requirements of other users of the catchment (including conservation and environmental services) are required. In recognition of such issues, government agencies in most Australian states have sought to implement integrated approaches to resource management to

avoid the environmental and social damage sustained by conflicts in land use. Initiatives in the Herbert have included an ICM (Integrated Catchment Management) programme (Johnson *et al.*, 1996). In practice, the effectiveness of such initiatives is often constrained by a paucity of data at spatial and temporal scales relevant to decision-making, poor co-ordination or communication between participating stakeholders, limits to the data processing and analytical capabilities of participants in the decision-making process, and a poor understanding of key issues in sustainable resource use.

The establishment of the Herbert Resource Information Centre

In mid 1993, the Commonwealth Scientific and Industrial Research Organisation - CSIRO (one of the principle Federal scientific research agencies in Australia) initiated discussions with key stakeholders in the Herbert catchment to address the first of these constraints – inadequate data - by acquiring essential base data at a scale of 1:10 000. The costs of acquiring this data exceeded the individual financial capacity of any one of the interested stakeholders. In response, a joint venture (the Herbert Mapping Project or HMP) was developed between 11 agencies (industry, community, state, local and federal government) to fund the acquisition of digital orthophotography, cultural data (eg utilities, farm boundaries), natural features (eg streams, topography) and cadastral data for the lower catchment. The HMP was completed in July 1996.

As the HMP neared completion, it became evident to many stakeholders that the utility of the data collected could only be maximised through advanced analysis of the data in digital form. GIS provided the best means of satisfying their requirements for data analysis and presentation. A further collaborative joint venture, the Herbert Resource Information Centre (HRIC) was therefore proposed and a needs analysis and a cost-benefit analysis conducted.

The needs analysis involved the use of a four-part questionnaire to assess perceptions of the opportunities and constraints associated with GIS should it be adopted within the stakeholder groups. The results of the needs analysis clearly demonstrated that a collaborative GIS facility was commensurate with the organisational background, organisational requirements and operational characteristics of the potential participating organisations and provided the basis for designing a detailed business plan. This in turn provided the basis for a cost:benefit analysis which indicated an overall ratio of discounted benefits to discounted costs of 8.8:1. The results suggested that the collaborative GIS was both an attractive public and private investment. Full details of the needs analysis and cost:benefit analysis can be found in Johnson & Walker, 1997.

Having demonstrated the appropriateness and viability of a collaborative approach, six stakeholders in the catchment agreed to begin negotiations with a view to establishing a formal agreement. Four of these stakeholders (CSR Sugar Mills, Herbert Cane Protection and Productivity Board, Hinchinbrook Shire Council and Canegrowers Herbert River Executive) represent local industry and community while two (Queensland Department of Natural Resources and CSIRO) represent state and federal government respectively.

In August 1996, a 10 year collaborative agreement was signed by the six stakeholders to formally establish the HRIC. The agreement secures the financial and non-financial (in-kind) support of the stakeholders and binds them to support the HRIC's foundation philosophy of being a non-profit, community-based collaborative GIS facility designed to support both economic and ecologically sustainable development in the Herbert catchment.

The four local stakeholders provide a high level of representation of the community in the catchment. Given the highly democratic nature of local government in rural Australia, the involvement of Hinchinbrook Shire Council, as the local elected Government provides an

important avenue of representation to all ratepayers in the catchment. Furthermore, the sugar industry representatives in the HRIC represent a significant sector of the community. Of a population of 21 000, 18 000 of whom live in the lower floodplain, there are some 840 canegrowing families and a total of 7 000 employed in the sugar industry. The Canegrowers Herbert River Executive is the local branch of the representative body for cane producers in Queensland and plays a key role in industry planning and representation and is funded by grower levy. The milling sector (CSR Sugar Mills) are the biggest employer in the catchment and play a central role in many of the resource use planning and management issues addressed in the catchment. The Herbert Cane Protection and Productivity Board is a local organisation funded equally by levies from cane farmers in the catchment and the milling sector to provide a range of technical services back to the growers. These four local stakeholders provide all the funding for the HRIC. The State and Federal government representation provides in-kind support in the form of data and some technical skills.

The structure of the HRIC is intended to result in a genuinely community-based GIS initiative. Thus, the HRIC's mission statement is "*To manage the acquisition and dissemination of geographic information within a collaborative framework, to the advantage of all interests in the Herbert River Catchment*". A strong schools program and documented use of the HRIC's services by a range of community organisations and clubs as well as local Aboriginal groups bears witness to this community orientation. In this sense, the HRIC builds on a strong history in rural Australia of active community and representative groups playing a key role in local politics and governance.

The HRIC is staffed by 2 full time GIS specialists, whose role is to provide expertise and skills to facilitate the collection, storage, maintenance and analysis of natural resource data and to ensure the products of these activities are delivered to HRIC stakeholders. As such, the HRIC offers a bureau service to its stakeholders, providing GIS consultancy and project management skills and acting as a conduit for the transfer of relevant R&D products. Furthermore, HRIC staff undertake a core function in assisting relevant stakeholders to implement GIS as part of their business operations. An additional function is to promote an environment for the facilitation of improved communication and collaboration between the HRIC stakeholders.

Within each of the stakeholder organisations, GIS groups were formed to facilitate the planning and implementation of GIS within their host organisation (although the state and federal government stakeholders already had significant GIS capability at the time of HRIC formation). Capacity building had begun, without being recognised as such, within the mapping project in so far as participation in the mapping project lead to an understanding of the need for GIS through user identification of a need and technical input providing options. Capacity building within the Mapping Project, the HRIC and stakeholder organisations has therefore enabled rapid adoption of GIS, a technology unknown to many of the participants three years ago.

Evaluation

Objectives

It was evident to the Mapping Project participants that contiguous with realising the Project's primary objective, production a high quality base data set for catchment management, participation had made a significant impact on the way that participants went about their business in relation to resource management in the catchment. Participants felt they had gained a sophisticated view of the nature of spatial data, its uncertainties, limitations and potential range of application. Furthermore, collaboration seemed to have fostered a new spirit of understanding and co-operation between agencies. It was anticipated that the HRIC would likewise have significant impacts. In order to be able to demonstrate these impacts rigorously (rather than

relying on anecdotal evidence) and derive lessons from the HRIC in establishing best practice for community-based resource centres, a three-year evaluation programme was established.
The objectives of the HRIC can be summarised as:

- improved quality of data available for the Herbert catchment;
- improved access to data;
- better informed decisions in planning & implementing data collection & use projects;
- better informed decisions in natural resource management; and,
- improved collaboration.

These objectives were explicitly addressed in the evaluation but there was also provision for the evaluation of less tangible aspects in relation to changed perceptions, attitudes, understanding & behaviour, particularly in relation to collaboration between groups, as a consequence of involvement in the HRIC.

Methods

The HRIC evaluation was conducted using qualitative research techniques (see Denzin and Lincoln (eds), 1994 and Patton, 1987). Individual, face-to-face interviews using a semi-structured interview schedule were conducted with key participants in the HRIC each year over three years. Nineteen people were interviewed in February 1996 (6 months before completion of the joint venture agreement and employment of HRIC staff), follow-up interviews were conducted in February 1997 (19 interviewees) and March 1998 (17 interviewees). Each interview took approximately 90 - 120 minutes and was tape-recorded. There was some change in key participants such that a total of 41 individuals were interviewed over the three years with a core group of 7 individuals being interviewed at each of the three times. The issues addressed in the survey are summarised in Box 1. In the first round of interviews, anticipated impacts were elicited. In the second and third rounds, anticipated and actual impacts to date were elicited.

Box 1 : A summary of issues covered by the evaluation

Operational Impacts

- Intentions in using new data sets that became available, implications for existing data, constraints to use.
- Impacts of involvement in the HRIC on data availability, data collection, data storage, data access, complexity of decision-making, efficiency of decision-making, quality of decisions made, presentation of decisions.
- Impact of the HRIC on the resolution of resource management issues within the catchment.
- Impacts of participation in the HRIC on the types of activities agency involved in.

Evaluation of Process

- Importance of HMP in triggering HRIC.
- Constraints to use of HRIC.
- Impact on other agencies.
- Use of the HRIC by non-partners & impacts on those users
- Interaction with other organisations: changes to general levels frequency of interaction; understanding of the objectives of each agency; understanding of the constraints under which each agency operates; understanding of the data needs of each agency, willingness to work with the other agencies, nature and process of interactions, confidence in other groups.
- Evaluation of the dynamics of the process (key participants; positives, negatives).

Changes in Understanding

- Awareness of the quality and availability of data.
- Credibility of data resources.
- Understanding of the limitations associated with spatial data.
- Understanding of data resources used by other groups in the project.
- Understanding of the data needs of other groups.
- Most important things learnt from involvement in HRIC.
- Understanding of the tractability of resource management issues
- Understanding of the quality and limitations of data; awareness of the availability of data

After each set of interviews, interviewee responses were transcribed and collated. At the end of the three year period, the entire data set was entered into the NUD*IST qualitative data analysis package (QSR, 1997) and tagged against key evaluative criteria providing a basis for the qualitative analysis reported here.

Outcomes

After the two and half years of formal operation of the HRIC covered by this evaluation, the HRIC and the partners to the HRIC have collected, collated and synthesised a high quality spatial database for the catchment. The resources in the HRIC had been widely used by individual partners for routine activities in planning infrastructure developments, assessing the resource bases and integrating monitoring activities. Direct (private) benefits had accrued to each of the joint venture partners. In some cases these benefits were already substantial while in others, substantial benefits were anticipated in the near future.

The extent and speed of operational impact across the range of activities in partner organisations is illustrated in Figures 1a and 1b. As well as providing detailed descriptions, interviewees were asked to rank both predicted and actual impacts against the range of criteria discussed above, both for their own organisation (1a) and for all the others (1b). It is interesting to note that predictions tended to be higher for others than for self-assessment. This may reflect the inevitable concerns about equity in a collaborative venture but may also reflect a more accurate understanding of the informants' own agency than of others – leading to assessments that are more informed and better reflect reality. The graphs do not provide any evidence for any period of disillusionment so often associated with ventures based on a new technology. It is likely, however, that the annual time step of the evaluation has simply failed to capture short term crises of confidence that were reported anecdotally by the partners. Furthermore, it is possible that the capacity building outcomes of the HMP equipped participants with more realistic expectations of timelines and outcomes possible in such a project. Predicted impacts were generally stable or climbing over the three years. Equally, impacts perceived to have occurred were high and climbing up towards anticipated levels of impact – demonstrating that the venture had started to meet expectations very rapidly.

Figure 1a. Self Assessed Impact
0 = no impact, 3 = very significant impact

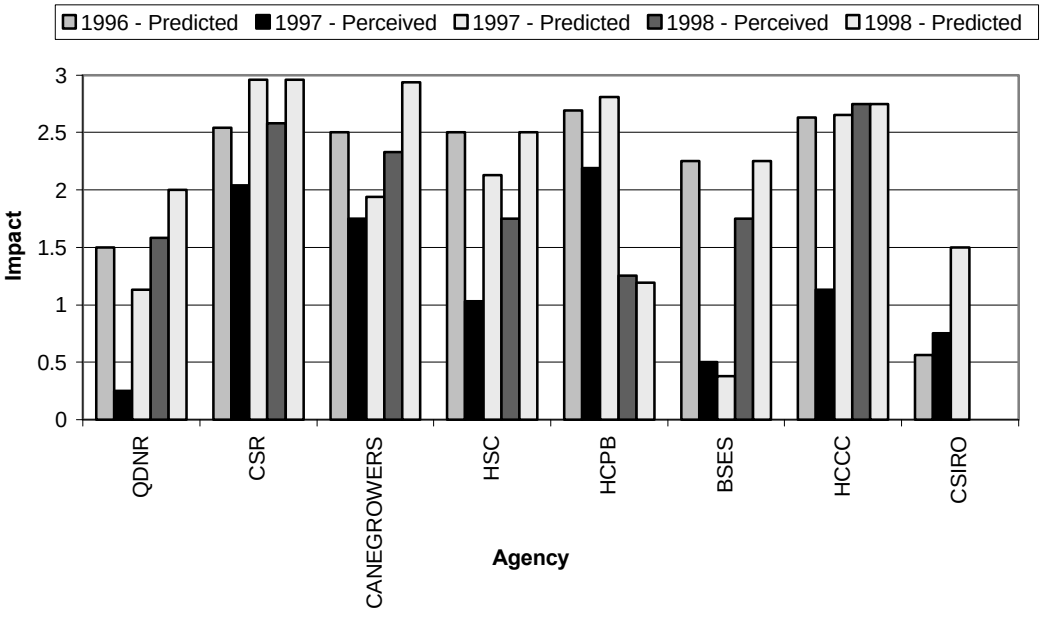
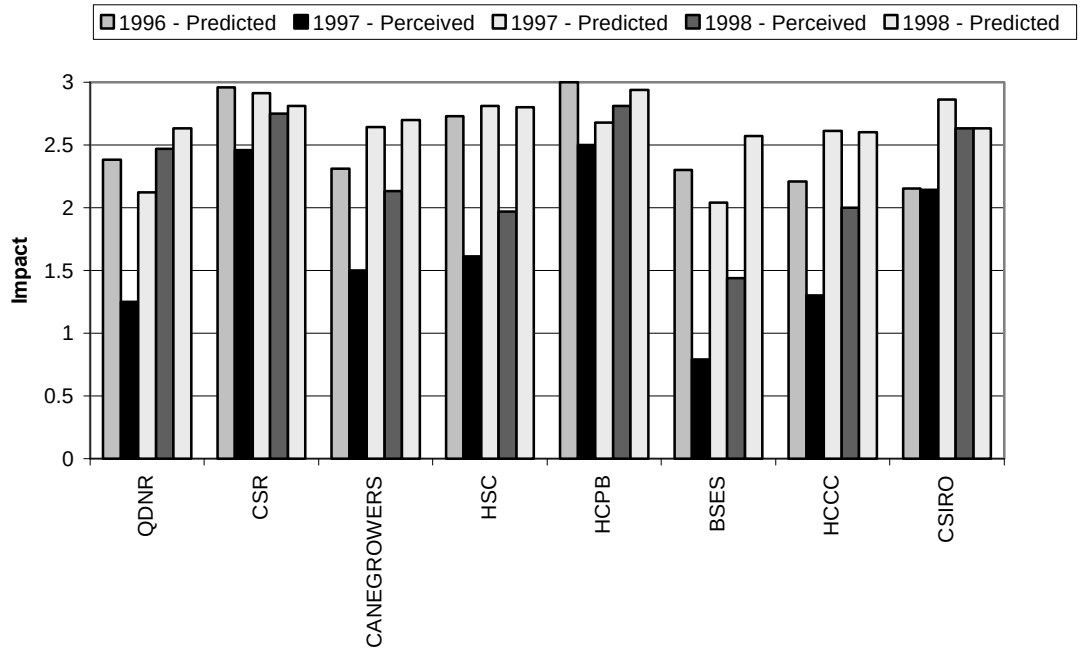


Figure 1 b. Predictions by all partners
0 = no impact, 3 = very significant impact



Specific outcomes against the HRIC objectives were as follows.

Improved quality of data available for the Herbert catchment and improved access to that data.

"Totally replaced and enhanced previous data."
"A very significant impact on data access…Not only have we been accessing data, but government agencies as well."[1]

Data access improved dramatically with participants becoming more aware of the range of data available and having access to all but that which was 'commercial-in-confidence'. There were still significant differences in perception between individuals of the general quality of data available in the Herbert, particularly between active users and less active users. Nevertheless, many participants had come to better understand the limitations of key data sets, including, for example, an increased understanding of the implications of scale on use, as well as limitations of the data. Paradoxically (or at least unexpectedly), this had made them more confident in use of that data (although it may be that this rise in confidence is confounded by improved access to better data sets). This understanding of the data in combination with a knowledge that all parties were operating with common data resulted in higher levels of confidence in using the data.

Better informed decisions in planning and implementing data collection and use

"Changed from pen/paper in drawers and files to digital form…that sort of software gets better/easier to use…Main constraint is going to be money."
"The staff expertise really came through in the technical advice on how to go about our project."

While processes for data collection were only moderately impacted for most parties, compatibility with other data had become a significant criteria such that data storage and management collectively and individually had been significantly impacted. Furthermore, for some activities, radical changes in data collection (e.g. from field survey to ortho-photo and satellite imagery) had

[1] These and the following quotes are directly taken from interview material

been instigated. In general, while the interviewees saw compatible data collection and storage as important, and indeed the project would fail if it did not occur, other factors were seen as more important. Common 'ownership' of the HRIC generated agreed, common and trusted data sets. In this context, issues of absolute data accuracy might, perhaps, be less significant than the opportunity to discuss differences in interpretation of the meaning of those data sets.

Better informed decisions in resource management

"Efficiency and quality of decisions gets better…(also) presentation of decisions."
"Quality of decisions is high. Without HRIC could not make decisions for (sugar) crushing agreement effectively because we did not know the exact area under cane."

Formal spatial analyses were being used in planning decisions, often with a substantial cost saving and resulted in decisions perceived to be as good as, and frequently better than, would have been achieved with previous processes. GIS-based products were increasingly being used in negotiations regarding resource-use. However, improved consideration of complex resource management issues that cut across sectors and stakeholders resulting in more efficient and better quality decisions were still anticipated but not yet achieved. There was, however, a general perception that achieving this objective was a question of time rather than a function of more fundamental constraints, although it had become increasing apparent to participants that data itself does not make decisions.

Improved collaboration

"HRIC has made me more aware of the …way people think and other people do business…drawn into a lot of projects."
"Everyone's willingness to share…it has changed attitude…not 'what's mine is mine' but what's ours is ours'…to get a large public company and a shire council to work together is incredible…"

In terms of motivation for involvement and strategic direction, many initially saw the HRIC as a data source and a means of cost sharing in data collection. However, a shifting emphasis towards a role in skills development, skills sharing and project brokering was unanimously supported. The HRIC was increasingly seen as a significant force for changing planning processes rather than a technical service. Certainly, the key assumption that collaborative joint venture was an appropriate mechanism for fostering broader uptake of GIS technologies in the catchment was perceived to have stood the test of time. An initial mixture of optimism and uncertainty was replaced over the three-year period by a very positive view of the HRIC and a sense of real pride in what had been achieved. For the people interviewed, involvement in the HRIC has meant additional work, meetings and a requirement to quickly develop new skills in emerging fields. In some cases it has also meant developing working relationships where none would have existed previously. However, all participants saw this as a positive experience both for themselves and their community.

Equally significantly, the collaborative nature of the initiative had important impacts. Willingness to work together increased amongst the partners to the Centre and external use of the HRIC by businesses and the broader community began to occur (although issues of user payment for HRIC services and third party data remained a complex challenge). Improved collaboration between agencies was not reported for all the combinations of partners however, in no case were relationships reported as having become worse. Some concern was expressed, however, about groups that did not become formally involved in the Centre becoming somewhat marginalised in key developments in the area.

Contributions to success

The evaluation presented here demonstrates that from the participants' perspective, the first three years of the HRIC have been a success. The interview material demonstrates that the participants in the HRIC believed that certain key features of the catchment and the agencies involved were important in the success of the establishment of the HRIC.

Skilled professional staff

Although the capacity of hardware and software was a necessary base from which to operate the centre, the interviewees tended to attribute a significant proportion of the success of the HRIC to the qualities and skills of the staff employed by the Centre. The importance of the Centre staff was recognised from the outset – the Board making a conscious decision to provide attractive terms and conditions in order to recruit staff with the mixture of negotiation / facilitation, management and technical skills required. The change in Centre Manager at the end of the second year of operation had consequences that provided further evidence of just how critical these appointments were. While only two staff are employed by the Centre, one of their key roles has been to build capacity in the partner agencies through the provision of training courses and high level support for staff in those organisations. As a consequence, some 40 people have received formal GIS training over the course of three years with several of those now spending a significant proportion of their time on GIS-based work within their organisations. This has meant that the Centre staff have played an increasingly strategic role in support of a growing range of individuals, thereby avoiding overload in the face of burgeoning use of GIS within the catchment. The qualities and skills of the staff have certainly facilitated the success of the HRIC. Nevertheless, while it is reasonable to argue that the Centre staff might, had they been less competent, have caused the failure of the Centre, it does not follow that their skills in themselves totally explain the HRIC's success.

Common goals

The overwhelming dominance of the sugar industry in the catchment meant that, while not always in agreement, key players had very significant interests in common – none of the partners are, for example, competitors in terms of resource use.

Existing infrastructure

Similarly, the fact that GIS infrastructure and investment within the catchment (as opposed to the Government agencies involved) was negligible meant that there were no vested interests within agencies to overcome in designing and implementing a collaborative venture.

Location

The 'neutrality' of the Centre was also important in avoiding conflicts of interest. The Centre and its staff are not viewed as being overly aligned to any one of the partners in the venture (although an early arrangement whereby the Centre was located within the offices of one of the agencies was viewed as a problem from this perspective and was changed at the earliest possible convenience).

Credibility

Having established a structure that avoided potential barriers to effective collaboration, the success of the Centre depended on establishing credibility as rapidly as possible in order to

maintain and enhance commitment to the joint venture agreement and associated financial contributions. Early projects that clearly demonstrated benefits to partners were therefore very important early in the Centre's operations. Outcomes of broader collaborative or public benefit were not required immediately, however, there was significant pressure for benefits to accrue to individual partners early in the process to maintain commitment.

An evolutionary history

The evolution of the HRIC from the Herbert Mapping Project was very significant. The completion of the HMP meant that the HRIC started with a high quality base to which the data provided by partners could be rectified relatively rapidly such that it wasn't necessary to spend a substantial period at the outset collecting data. More importantly, many of the participants in the first round of interviews stressed that involvement in the HMP had provided them with experience and understanding that was invaluable in the early stages of the HRIC in that it provided them with practical experience in a successful joint venture and demonstrated that they could work together effectively for mutually beneficial outcomes. Even so, a highly evolutionary approach to establishing the Centre (and a great deal of good will) was required at the outset. Interestingly the importance of this evolutionary approach was not widely acknowledged amongst participants in the third round of interviews. Many informants felt that in establishing the HRIC again, they would seek to employ staff, generate a strategic plan and so on at the very outset. Consideration of the interview material from the first two years suggests that this would not have been realistic.
Despite overall success, some significant threats had been encountered, as follows.

Issues of intellectual property

In so far as significant problems and threats to the HRIC had been encountered, many related to issues of tightening data access policy, both amongst partners and external (particularly within Government agencies) and related issues of Intellectual Property and liability. These remain a significant challenge.

'Head office'

Another significant set of threats that had to be carefully managed by the participants was the need to ' sell' the initiative within their own organisations. While individuals and local offices were enthusiastic and committed participants, it was necessary for all those agencies to sell continued involvement and financial contribution very carefully to other parts of their organisations in order to be able to protect their continued involvement from cuts associated with general 'resource squeeze' in their parent agencies.

Over-commitment

As awareness of what the Centre could offer spread, demand for the HRIC's services grew rapidly. As a result, prioritisation of tasks and effective restriction of access to services was necessary to avoid serious over-commitment and the danger of failing to meet critical objectives.

Towards best practice

We are not aware of equivalent data sets to the evaluation reported here for other initiatives in Australia. Nevertheless, the evaluation of the HRIC presented in the previous section provides

an appropriate means of considering key issues that may need to be addressed in the establishment of information centres.

- The HRIC provides access to integrated data sets but also plays a project brokering and capacity building role. How does the impact of this dual approach compare with initiatives solely targeted at information provision?
- The HRIC has a tight regional focus covering a rural catchment centred on a single population centre and dominated by a single industry. What implications might a wider geographical area of mandate or more complex community structure have?
- The relative socio-economic homogeneity of the catchment means that the individual goals of the partner organisation to the HRIC and the common goals of the HRIC are highly compatible – there are no dominant resource use conflicts between partners. Would the Centre have succeeded in a more complex environment with more substantive conflicts?
- The HRIC evolved from the Herbert Mapping Project, an initiative with a very specific and tangible technical objective. In the early rounds of evaluation this evolutionary approach was seen as critical to success. Could a similar centre have been established without this initial focussed output?
- Although initially facilitated by State and Federal Government, the HRIC has a high (and growing) level of local ownership. Furthermore, the initiative was seen as being 'neutral' rather than the associated with any particular local agency. All stakeholders agreed that this was key to the success of the venture - that the HRIC was seen as an independent broker of information for the explicit reason that all parties had a stake. What implications does this have for future initiatives that are locally initiated by one party (eg. Local Government)?
- How important are private benefits in enabling a contribution to the public good? Individual partners in the HRIC have tangible and specific business oriented objectives for being involved, for which they can see an early return on investment that in its own right justifies their involvement. As a consequence, they felt able to be thoroughly committed to the notion that the HRIC provides a greater public code, educational & capacity building role. Does this mean that initiatives more specifically targeted at these public rather than private benefits are less likely to succeed?

Conclusions

While many regional planning activities promote a consultation process, few have been successful in mitigating the decision-making process completely to community stakeholder groups. The Herbert Resource Information Centre, is an example in which community groups have control and ownership of resource information and related decision-making. This initiative is an exceptional example of community based decision-making, an exemplifies an emerging trend for self determination and community empowerment in undertaking the planning process. The most distinctive features of the HRIC are its capacity building function for stakeholders and the enthusiasm and willingness to learn on the part of the participants. Both are derived from a healthy balance between individual (agency) interests and community spirit. Commitment to joint projects was directly related to a sense of ownership and involvement in the decision-making process. It is reasonable to assume that this level of interest maybe more difficult to instigate and sustain in more complex regional communities. The HRIC model will not be applicable across all circumstances – the level of community involvement that can be attained is likely to remain across a spectrum of possibilities from community consultation to community initiated ventures.

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Chapter 8

Local knowledge and its implications for ICM

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Abstract
This paper discusses local understanding about catchment processes and its potential contribution to the progress of Integrated Catchment Management (ICM) and reports on some trial exercises undertaken in the Herbert River Catchment. The paper contrasts two approaches to local understanding: 'technical knowledge' and 'landscape literacy'. This is followed by a discussion of what would be involved in development of a method for identifying and evaluating differences in local knowledge and the role of these differences in an ICM context. The first section of the paper considers some of the conceptual pre-requisites to how local knowledge can be incorporated into ICM. The final section considers some of the pragmatic issues which were encountered in some trials conducted in association with this paper.

Introduction

The origins of this paper stem from an evaluation process of a research program on Integrated Catchment Management (ICM) in the Herbert Catchment of north Queensland. Throughout the evaluation process, interviews and workshops with farmer groups demonstrated that farmers and researchers have significantly different understandings of the landscape they interact with. Whilst researchers were comfortable with the notion of a catchment and the processes which occur within it, the evaluation demonstrated that the concept was not natural for farmers, who were focussed at a farm scale. This raised the issue of considering the role of different approaches to knowledge, and their relevance to ICM. To investigate these issues, a series of interviews and workshops were designed with farmers and resource professionals on the subjects such as sediment entering the water ways and land clearing for cane farm expansion.

This discussion paper considers the outcomes of these interviews and workshops, and the reasons for incorporating local knowledge into ICM generally. It considers two main approaches to investigating local knowledge. The first of these is consideration of Indigenous Technical Knowledge – which has involved the study of specific knowledge that local peoples have developed about the resources they use. This knowledge is based on intimate interaction with a resource on a small scale. Unlike science, the knowledge does not necessarily attempt to explain broad phenomena with common principles. The individual ways that farmers and other resource users have interacted with the natural world can offer insights that the broad application of scientific principles and experiments may overlook. The second approach to local understanding discussed in this paper considers the ability of land users to read the health and status of the environment they interact with. This approach has been termed 'landscape literacy' or 'land literacy'. Given it's broad approach and consideration of the cultural and historical factors shaping the way humans interact with the environment, it has much potential in the evaluation of ICM.

Conceptualising local understanding

The nature of local knowledge
Local knowledge has been viewed and defined in a number of contrasting and, perhaps for different purposes, equally valid ways. Local agroecological knowledge is often a contemporary and dynamic explanation of how the world works with potentially universal application. It can be primarily derived from observation and experimentation by farmers, or it can be a system of unique and idiosyncratic elements of traditional knowledge that are culturally bound, predominantly heuristic and passed on through generations.

Indigenous knowledge and scientific knowledge.
For the purposes of better understanding indigenous knowledge, a useful comparison can be made with scientific knowledge. Whereas scientific knowledge aims to discover universally applicable phenomena such as gravity and temperature, the scale and focus of indigenous knowledge local. It is concerned with explaining local circumstances, and as such indigenous

knowledge has only limited experimentation. By contrast, scientific knowledge relies on almost infinite replication through experiments to prove the universal consistency of phenomena. Unlike the formal modes of distributing scientific knowledge -journals, seminars and scholastic instruction, indigenous knowledge is distributed through informal mechanisms such as the knowledge a parent passes to a child. There is no significant difference in terms of accessing scientific and indigenous knowledge. Both tend to be reasonably open unless providing access to the knowledge is going to disadvantage those who hold it. A final difference is that supernatural explanations may be present in indigenous knowledge, whereas they are absent in scientific knowledge.

Knowledge as Understanding that can be Articulated

This approach requires some important definitions. Data are a recorded set of observations (which may be quantitative or qualitative). Knowledge is the outcome, independently of the interpreter, of the interpretation of data. Understanding is the outcome, specific to the interpreter, of the interpretation of data or knowledge: the comprehension that the interpreter achieves. So, the interpretation of observation may advance an individual's understanding. Some part of this advance can be articulated and communicated as knowledge. The distinction between what can and cannot be articulated is of importance in taking a practical view of local knowledge and its contribution to R&E. Furthermore, it is compatible with the knowledge engineering paradigm that underpins many powerful theoretical, methodological and implementational advances in cognitive science and artificial intelligence.

Knowledge is thus seen as a central aspect of culture, derived from education and experience, that may be used, in conjunction with consideration of a value system and competing priorities and possibilities, to make decisions and, therefore, lead to actions (such as farming practice). Actions may also be intuitive, short circuiting the consideration of knowledge in their genesis. What is perceived about the natural world, however, is influenced by what can be observed, and, the way in which perceptions are transformed into knowledge is influenced by the mode of learning, which may differ from one society to another. It is clear then, that the way in which knowledge is acquired and transformed into decisions, depends on the cultural context but knowledge is distinguishable from other aspects of a person's, or a community's, culture. This definition of knowledge as being something that can be separated from the person who knows it, essentially a position that conforms to a Popperian philosophy of science (Popper, 1972), is quite different to the more widespread sociological definition used within the recent farming systems literature which views the two as inseparable. So, for example, Scoones and Thompson (1994) challenge 'the assumption of a positivist view of investigation that sees knowledge as a tangible stock or store to be tapped' and see 'the process of knowing' as 'engaged, value-bonded and context determined' they argue that the 'human mind is not simply a mirror that accurately reflects a reality' but that 'interpretation, translation and representation are social acts that cannot be assumed to be neutral and objective'. Taking this perspective further, Röling (1996) states that "Reality is not assumed to exist independently of the human observer or to project itself on the mind through the senses…". Blaike et al.(1997) put these theoretical considerations into context by stating "These processes [of advancing ideas], and hence knowledge, are inextricably linked to the social, environmental and institutional contexts within which they are found. For example, a partly deforested hillside in the tropics may be viewed very differently by a local subsistence farmer ..., a cattle rancher, and an NR scientist...". In addressing perceptions of landscape, Colquhoun (1997) takes the view that knowledge includes "intangible deep feeling of what meets us in a landscape". These definitions make local knowledge essentially indistinguishable from local people conflating knowledge, values, perceptions and even emotions.

Local Knowledge, Indigenous Knowledge and Technical Knowledge

The terms 'local knowledge' and 'indigenous knowledge' have often been used interchangeably. However, here local knowledge denotes locally derived understanding which is based more on

experience and real world observation than indigenous knowledge, which may reflect cultural beliefs and values to a greater extent. This distinction has important practical implications. So, investigation of indigenous knowledge (principally the realm of anthropological and ethnographic research, which are particularly concerned with mapping and explaining cultural differences), has tended to focus on knowledge that is idiosyncratic and culturally bound, often being traditional and handed down orally. Such investigation has practical as well as academic application – of 242 published papers retrieved from a search of CAB Abstracts for 1996/7, 85 are concerned with medicinal aspects of rare ethno-botanical knowledge or the ethics associated with the search for such knowledge. Some indigenous knowledge, and hence research into it, has profound implications for resource management and development. Historically, for example, it has been suggested that the cultural beliefs held by Mayan Indians that people were literally made of maize (thus making it a sacred plant) precluded commercial exploitation of this crop by indigenous people, whereas Hispanic settlers were not so restricted (Asturias, 1949). Such cultural beliefs can be pervasive, the sacred nature of maize in the previous example was bound up with notions of soil fertility and its decline through continuous cropping. Sallas (1994), working today in the Peruvian Andes, reports similar culturally derived constraints to the adoption of modern potato varieties, that although higher yielding than local varieties, are less resistant to some pests and diseases and require inputs of chemicals for yields to be achieved. The modern potato varieties and the chemicals applied to them are considered by older people in the community to 'bring more diseases' and to be 'poisonous' both to 'mother earth' and to the people who eat the potatoes.

Indigenous Technical Knowledge (ITK)

Sinclair and Walker (1999) contend that many management actions undertaken by farmers have an explanatory basis, although such explanations may differ from a scientific rationale and may require careful interaction with farmers to elicit. Unfortunately, farmers' explanations for agroecological phenomena, have not received adequate attention, and in the present enthusiasm for moving from considering what people do, as in studies of ITK - or farmer's performance, to the cultural context in which knowledge is generated - or the process of knowledge generation and development (Scoones and Thompson, 1994), there is a risk that the gains from explicit representation of farmer's explanatory understanding will continue to be overlooked. The key issue here, once again, boils down to whether it is valid to abstract farmers' knowledge about ecology from the broader set of considerations that govern agricultural practice and whether this can be done without overly distorting it. A major confusion has arisen here between the limitations of using external scientific ('etic') explanations of local practice and seeking the farmer's own ('emic') explanation. So, for example, Richards (1989) in an influential article, explains how complex intercropping layouts in a field, that scientists may interpret as a carefully planned arrangement based on consideration of inter-specific competition and weed and pest control may, in fact, represent a set of contingent responses by the farmer to various events throughout the season so that what is observed at the end of the season is the result of a completed performance (influenced by a range of unfolding ecological and socio-economic factors), rather than the result of a specific plan in the mind of the farmer at the beginning of the season. However, while it is clear in this case that the farmer may not have planned the design from the outset, and that what transpired over the season and why can only be interpreted by considering the sequence of events that actually occurred in time (which may be impractical if the dialogue begins at the end of the season), knowledge of plant ecology on the part of the farmer is not precluded, it has not, in fact, been adequately sought.

Sinclair and Walker (1999) argue that a major justification for abstracting farmers' ecological knowledge from other social and cultural aspects determining agricultural practice, is that it can be postulated that core knowledge about natural processes is likely to have some applicability across contexts, rather than being entirely unique to the situation and society in which it was derived. This is a somewhat contentious view that flies in the face of postmodernist approaches to anthropology Tyler (1987). There is, however, some compelling evidence to support this

likelihood. Firstly, Berlin's seminal work on ethnobiological classification (Berlin 1992) reveals widespread regularity in the way in which people classify and name plants and animals in quite different non-literate societies. Thus, he asserts that when people function as ethnobiologists they 'discern' rather than 'construct' order from their observation of a biological reality, in which groups of plants and animals appear as a series of discontinuities, whose structure and content are seen by all human beings in essentially the same way. He contrasts this with other areas of human experience which are culturally constructed and to which anthropologists have devoted much study, such as social organisation, ritual, religious beliefs and notions of beauty, for which no such universal regularity may be expected.

An ability to read the landscape

The body of theory on indigenous knowledge tends to concern information about some means of achieving an objective. However, the use of this 'technical knowledge' as a basis for evaluating understanding is fraught with difficulty. Technical knowledge may be purely empirical or based on some explanatory or mechanistic understanding. This is significant because the origins of technical knowledge may dictate the extent to which it can be extrapolated to providing solutions to different but related problems. Empirical technical knowledge may be brittle while that derived from some sounder model of system functioning may be more robust. This means that while investigation of the current state of technical knowledge may provide a basis for planning R,D&E priorities, it does not provide a very effective means of monitoring change in local understanding. Even characterising the current state of technical knowledge for research planning purposes is problematic. For example, when is technical knowledge inadequate? When resource managers can not solve a problem? What about instances where they can not see a problem? Furthermore, taking a problem-oriented perspective makes it difficult to distinguish the biophysical, social, institutional, legislative influences on and components of solutions.

An integrated approach : 'landscape literacy'

In recognition of the constraints associated with a problem-oriented perspective, some researchers working in the field of local knowledge have instead focused on, for example, the indigenous ecological knowledge that appears to underlie management practice and technical knowledge. The term that we use here to describe this hypothesised deeper, mechanistic understanding is 'landscape literacy'. This approach refers to the ability to 'read' the health and status of individual's surrounding environment (Campbell 1996).

Landscape literacy, sometimes termed 'land literacy', has been investigated in Australia in association with the National Landcare Program (NLP). The NLP has triggered a series of 'watch' and 'care' type programs which have been popular with state and federal resource management agencies and resource users alike (Campbell 1996). Examples of these include 'Saltwatch', 'Rivercare' and 'Coastcare' and they involve community monitoring of biophysical phenomena. The 'land literacy' approach has included some original approaches, such as farm fly overs to observe land management issues from the air Campbell (1996).

This involved taking farmers for a flight over their farms to demonstrate visually the position of the land in the context of a catchment. This enabled farmers to see catchment scale biophysical phenomenon such as erosion unfolding through their farms. It also enabled farmers to better see how run-off can be an issue at a farm level. Whilst such initiatives can illustrate the difference between the scale at with which the farmer is familiar and that at which biophysical processes operate, it doesn't represent a 'meeting of minds' as such, because the onus is on the farmer alone to change his or her thinking.

According to Campbell (1996) the most significant aspect of the 'land literacy' approach is the speed and effectiveness with which they transmit local environmental knowledge and share techniques to encourage people to 'read' the health of their landscape. Yet the programs he describes have had difficulty proving themselves significant data gathering through rigorous

processes. Yet even if the technical credentials of land literacy programs are confirmed, there remain further problems with this approach. For example, whilst community based monitoring 'watch' and 'care' programs foster an increased understanding of biophysical processes amongst the rural community, they only represent a 'meeting of minds' if resource users share their version of catchment processes. Structured ways of incorporating their knowledge therefore need to go beyond the level of recording biophysical data into a centralised database.

A further problem with landscape literacy is that it is more a concept than a measurable attribute. Direct measurement of the current state of landscape literacy is probably therefore exceedingly difficult. However, detection of significant changes in landscape literacy through a structured program is achievable and likely to be more relevant. One such measure could be the assessment of changes in the quality of 'problem formulation' by the community or groups within the community in response to natural resource management challenges. Given that the assessment of integrated approaches such as ICM is more concerned with detecting broad changes in thinking and behaviour, landscape literacy provides a powerful means of evaluating ICM. The study of landscape literacy is also more relevant to the analysis of broad orientations to landscape and the delineation of different groups within a catchment based upon their perceptions of their surrounds. Moreover, it provides a useful framework for considering the differences in perception between resource researchers and resources users.

Why might the assessment of local understanding be relevant to an ICM strategy?
We argue that there are three broad categories of reasons for considering assessment of local knowledge as a contribution to the ICM process.

1. ICM promotes a holistic or systems perspective on resource management issues. This must include consideration of the differing perceptions and understanding of resource management issues across different stakeholder groups.
2. Investigation of local knowledge provides a means of targeting and evaluating implementational, research and extension priorities. This can be achieved by helping to identifying constraints on action (understanding, processes, institutional structures…), by helping to educate the resource management professionals involved in the ICM process on issues from the local perspective and helping to identify key gaps in understanding as identified locally.
3. Evaluating the impact of an ICM process. Given that ICM is a participatory process that places considerable emphasis on capacity building, an ability to characterise changes in local knowledge provides a powerful tool in the assessment of the impact of an ICM initiative.

Systems thinking and participation
One of the fundamental goals of Integrated Catchment Management (ICM) is to address problems experienced by resource users in an holistic manner. However, this is complicated by the fact that diverse members of a management regime –such as a catchment- do not view and understand their world in exactly the same way. Furthermore, it would be a mistake to assume that stakeholders and resource users conceive or understand the catchment in the same way as resource professionals and researchers. This is simply because different people develop their knowledge of a resource or environment in their own individual way, and this is shaped by cultural and historical processes. Unless this is acknowledged and accommodated, integrated approaches to resource management such as ICM may be constrained by misunderstanding. It follows, therefore, that, systems approaches may seem as foreign to resource users as conventional research and development strategies. This is because systems approaches, like reductionist science, are an abstraction applied to simplify reality sufficiently to improve understanding. To achieve this, they are based on assumptions and objectives - different assumptions and objectives allowing different understandings. The research question for this paper concerns where a given management approach -in this case a systems understanding of a catchment- is inconsistent with how the human agents within the system (eg. farmers, resource users) conceptualise it. Where a model of system function which is based entirely on an external

perspective (whether integrated or not) is used to underpin research development and extension programs, the relevance of this research (and hence support for it) may be compromised.

Local knowledge as a means of targeting and evaluating research and extension
Assessment of local understanding in relation to catchment management could contribute to an ICM programme by providing a basis for targeting research and extension activities and providing a basis for evaluating the impact of an ICM process.

Targeting research and extension activities.
One of the essential questions facing research , development and extension providers intending to facilitate participatory initiatives such as Integrated Catchment Management is the extent to which natural resource management at a catchment scale is constrained by an inadequate technical understanding of bio-physical processes (ie. a problem that can be tackled through analytical research) and the extent to which it is constrained by inadequate process. If bio-physical understanding is demonstrably inadequate then further bio-physical research is merited. If bio-physical understanding is adequate but process inhibits appropriate response to the implications of that knowledge, then biophysical research is of lower priority. If some mixture of ignorance and inadequate process applies, the implications for R,D&E are concomitantly more complex. The use of local knowledge has the potential to assist targeting research priorities by analysing local observations of biophysical phenomena. Furthermore, if external research staff consider these observations, then the research program may not only be better targeted, but more accepted by local communities.

Educating Professionals
In many circumstances research and extension staff have only a limited appreciation of local knowledge and, in some cases, of local practice. This clearly constrains their ability to understand the nature of the problems facing farmers, the constraints they are under and the opportunities for improvement. It also affects their ability to communicate with farmers, affecting both their ability to obtain information from farmers about their system during diagnosis and then their ability to disseminate information and other products of research to farmers in the extension phase. Farmers' knowledge may also be more developed in some aspects, particularly those that are locally important, than that of researchers and the scientific literature. There are some stark examples of where ignorance of farmer knowledge and practice has led to inappropriate research and extension efforts and how systematic documentation of such local knowledge has led to researchers changing their behaviour (Sinclair and Walker 1999).

Local Perception Of Inadequacy Of Knowledge
In certain circumstances farmers may be aware of aspects of their knowledge systems which are less well developed than they would like, which then constrains their ability to manage their farming practice. This represents articulation of research requirements by farmers (Sinclair and Walker 1999).

Evaluating the impact of an ICM process
One of the main objectives of ICM as a policy initiative is to foster an ability at a local level (including both the community and local state government representatives) to conceptualise and agree on natural resource management problems as and when they arrive and, thereby, agree on and implement solutions in an integrated and holistic manner. There are various ways in which changes to this capacity might be measured, including case study consideration of 'on the ground' activities. While important, this measures some synthesis of change in local understanding and motivation with institutional, financial and other circumstantial factors. Direct consideration of changes in local understanding of catchment issues and processes helps to deconvolve these factors and, therefore, provides one line of enquiry in evaluating improvement or otherwise in the capacity of the community within the catchment to achieve the sustainable and balanced use of natural resources. In summary, an increasing understanding

of the state of the environment and impacts on the environment can be an important indicator of the efficacy of the ICM process.

Approaches to investigating local knowledge

In the previous sections we have discussed the nature of local knowledge and explored the potential relevance of the investigation of local knowledge to ICM processes. Any practical application of approaches to investigating local knowledge in order to inform and evaluate program initiation would need to be based on some approach to knowledge elicitation and analysis. For example, assessment of the impact of an ICM process through consideration of impact on the 'landscape literacy' of resource users and managers in a catchment might document changes over time in the characterisation of the bio-physical aspects of a key set of natural resource management problems (both causes and consequences) and proposed solutions to these problems. Analysis might consider the extent to which consensus as to the nature of pertinent problems and potential solutions has evolved and evaluate the extent to which changes in perception are supported by data and, thereby, assess the contribution of ICM to any such changes. These objectives would need to be underpinned by a series of workshops and interviews with a range of different community groups within the catchment. In this section we explore some of the tasks that might be tackled ad some approaches to those tasks.

Key research tasks

For defined groups within the catchment a study would need document the following on an annual basis.

1. Characterisation of each issue
   For example,
   How is the issue conceptualised / perceived (causes, implications etc.)?
   How much consensus is there in characterisation of the problems?
   Can differences be delineated into broad groups of approach?

2. Completeness of understanding for each issue
   For example,
   Has the perceived problem / issue been demonstrated to be a real problem / issue?
   If not, why not?
   In particular, what further information is required if the problem is to be adequately understood?

3. Availability of potential solutions for each issue
   For example,
   What are the perceived solutions to the problems?
   What is the nature of the proposed solutions (including type eg. technical intervention, institutional change, fiscal change, economic change, social change..) ?
   What consensus is there on potential solutions?
   What further information is needed in order to further develop and evaluate potential solutions to a point where application is appropriate?

4. Analysis of change over time.
   For example,
   Are stakeholders becoming aware of differences in approach amongst other groups?
   Are the differences in local understanding becoming more or less pronounced throughout the ICM process?

To investigate the some of these issues, a series of trials were conducted with resource users and professionals in the Herbert River catchment. These trials were useful in revealing some of the pragmatic and operational issues involved in the elicitation of local knowledge. Two main

approaches were trialed: work with individuals and work with small groups. The trials involved a combination of structured interviews, semi-structured interviews and scenario based discussions. A summary of these trials is discussed below.

Trial 1: knowledge elicitation, representation and analysis: interviews with individuals

A trial of methods was designed to explore a range of approaches to eliciting technical knowledge relating to catchment management (with an initial focus on characterisation of the physical nature of issues / problems) in order to scope out some of the operational issues that would be involved in the design of a large scale research project. The trials contributed to a broader evaluation exercise for the ICM research program in the catchment. The overall evaluation exercise addressed issues such as water quality; water quantity (availability); drainage; flood protection; riparian zone management; habitat management and protection; soil erosion and sedimentation; and pest management, and the local knowledge trials reflected these broad categories. Given the 'integrated' nature of ICM individual issues were not treated in isolation. For the individual interviews, three techniques to knowledge elicitation, representation and analysis were investigated. Two farmers, two researchers and one drainage engineer were interviewed. Each completed all three parts of the trial in a single interview of between one and one and a half hours.

1. Questionnaire survey.
A number of statements of problems, causes and consequences within the catchment were derived from the overall ICM evaluation program. Informants were asked to react to these statements by using a 5 point scale. Analysis of responses to the questionnaire survey enabled some quantitative measure of consensus of understanding on the physical nature of issues in the catchment across and within groups concerned with catchment management. The questionnaire survey was well received by all informants and seemingly both straight forward and of interest to them. The results are presented in Appendix 1. These results are of interest but fail to capture much of the detailed understanding displayed by the different informants. The results of the questionnaire apparently identify a considerable diversity of views across informants without obvious patterns in terms of informant type. However, this masks an impressive convergence of opinion between informants that was clear during the interviews. Although significant effort was put into the structure and content of the questions, it is clear that at the very least much more sophisticated questions are required. However, on the basis of these trials it is unlikely that this type of questionnaire survey alone will adequately reveal the structure of perception.

2. Semi-structured discussion
This part of the interview focussed on soil erosion in the Herbert and what happens to soil from paddocks in both the upper and lower catchments once it is washed off the paddock and into the stream system.
The following were focussed on in particular:
i) The factors that determine whether significant soil erosion will occur as a result of rainfall.
ii) Factors determining how much sediment enters the river system
iii) The fate eroded soil once it enters the stream system
The semi-structured interviews investigated the potential for explanatory knowledge to be used to help create a formalised knowledge base, with a view towards developing consensus models of the behaviour of the physical system. It was also considered a potential way to capture a range of inconsistent perceptions across the informants. By contrast with the questionnaire, most informants found the semi-structured interview seeking explanatory knowledge uncomfortable. Although this did produce some interesting results, notably in the different approaches to explanation taken by the different informants, it was not found to be a very successful means of eliciting knowledge. Although the semi-structured interviews were not very successful, the knowledge elicited, as well as much of the subsidiary information collected while completing the

questionnaire were highly amenable to representation within the formal grammar and knowledge base structure used.

The questions for the semi-structured interviews are reproduced as Appendix 2. An excerpt of these interviews is reproduced in Box 3.

Box 3
The following excerpt provides an example of local knowledge being used to explain the relationship between rain impact, ground cover and sediment flow: In this example, the informant can see some benefits from ground cover being used to reduce sediment entering the waterflow, however, he has difficulty seeing on-farm benefits from stream side vegetation:
INTERVIEWER : In terms of ground cover side of things, why does that minimise soil erosion?
INFORMANT: It minimises and might even reduce rain drop impact. It also slows down the speed at which the water flows over the land and therefore removes most of its erosive energy and also the energy that it has available to carry sediment as it moves.
INTERVIEWER : Those are the two main impacts?
INFORMANT: Yes I think so.
INTERVIEWER : And vegetation along the stream banks is important?
INFORMANT: Yes but all that does is to cause energy reduction at the top of the stream bank rather than over the whole paddock behind it and as I said before, in my opinion, having that sort of track is probably beneficial to the waterway but its not necessarily beneficial from the point of view of conserving the soil resource because you could envisage the situation where you allow the stuff to build up until you had a great big build up of sediment behind whatever track you had and what are you going to do with it then? You could dig it up with a spade and spread it back on the paddock but it would just get washed up again, so I tend to think the use of vetava [grass], whilst its not a bad idea, its bit of a band-aid measure. You're better of stopping the stuff from being removed from its point of generation to start from.

3. A scenario-based approach

This exercise was based on three fictitious plans for cane expansion in a fictitious catchment. Information was provided in the form of a map and three scenarios presented in relation to that map. Informants were asked which they would favour and, more importantly, their justifications for favouring that plan. The scenario-based exercise was recorded and the taped interaction was used to explore, for each informant, a representation of the argument and evidence that they used to present and justify their selection. Two means of doing this were explored : descriptive analysis and use of a formal grammar designed to capture the structure of an argument.
The scenario-based exercise proved more difficult for the informants than was expected. However, it was extremely successful in that it captured a considerable amount of information about the interpretation and application of knowledge as well as the knowledge itself. Despite general consensus on physical issues of concern in cane expansion, each of the three scenarios (which have different potential environmental impacts and implications for productivity) was selected by at least one informant. This range of responses can be attributed to different values, different views of what the future holds and different interpretations of the implications of common understanding. These factors are obviously at the heart of ICM.
The text of the scenario exercise is reproduced as Appendix 3. An excerpt from the scenario based approach is represented in Box 4.

Box 4
Excerpt from scenario based approach to eliciting local knowledge.
INTERVIEWER : I want your ideas on how you go about considering which option would be most appropriate
INFORMANT: I feel that I wouldn't want to be draining this area here through that eastern block, I feel it needs something like that would have to be done
INTERVIEWER : Why would you not want to do this?
INFORMANT: I think it would be too much downstream effect not only on landholders but also on this whole wetland area
INTERVIEWER : What would that be?
INFORMANT: You going to be putting water from one catchment area into another catchment area which already is a huge catchment area to start with and your sending it the longest way to get to the coast.
INTERVIEWER : It would be an increase in water coming through that grazing land and into the wetland?
INFORMANT: That's right I would say that if a study was done into what the drainage capacity of this area would be, it wouldn't be able to handle that also, because you've got all these streams running into it also. The other thing is that you have a lot of problems with drainage schemes. I don't think enough consideration is taken into the fact that not only the water from the farms ends up in that drainage scheme but the land around it the surrounding country side tends to go into that area, we've seen this happen in the Herbert before where drainage schemes haven't been planned properly

Trial 2 : Making comparisons across groups: workshops with multiple participants

Following the first series of trials, the use of small groups was investigated as a means of eliciting local knowledge. It was decided that a number of different (but preferably related) scenario selection exercises would provide a useful trial, considering different management options in a fictitious catchment. Maps of the topography and hydrology of the hypothetical catchment, current land use and tenure, soils and land use suitability for sugar cane were prepared to support the exercise, and a scenario description was also prepared (see Appendix 4). Two groups of 8 farmers each were approached, each representing having different demographic characteristics and different levels of experience in sugar farming. The first consisted of farmers over 50 with more than 20 years cane farming experience. The second consisted of farmers under 40, all of whom were at least second generation cane farmers. All of the first group attended the workshop. Some members of the second group accepted the invitation but did not in the end attend.

Both workshops resulted in considerable and heated discussion, thereby providing a considerable insight into farmers' perceptions of catchment scale issues. While the scenario provided a useful point of departure and reference for this discussion, it proved hard to keep the discussion focussed on the scenario, such that it proved impossible to get a clear justification for the group for selection of a particular scenario. It is anticipated that altering the scenario rules and moving towards a scenario selection and vote at the end of this workshop would mitigate this problem. On the basis of the trial only, it was difficult to clearly delineate differences between groups of farmers. Nonetheless, some interesting insights from this introductory study are worth noting, an example of which is reproduced in Box 5.

Box 5

The group workshops indicated that there were different perspectives amongst farmers. However, based on the scale of the study it was difficult to delineate significant broad trends in perception. The same applied to the farmer's ability to 'read the landscape' or 'land literacy'. Some comments gave isolated examples reflecting farmer's land literacy. Though insufficient to draw significant conclusions on the basis of this land literacy, it revealed that it could be elicited reasonably well with minor changes to the workshop process.

As part of the group based workshops, farmers were asked about expansion into wetland's areas. For this group of farmers most agreed that wetlands were best left untouched because they thought that wetlands helped to absorb nutrient runoff from farms and provided wildlife habitat. These farmers tended to think beyond their own farm into the surrounding area (workshop comments in different font).

"Should there be expansion into the wetlands area?"

"Wetlands shouldn't be touched - not allowed to. "

"I don't believe they should be drained - they are important wildlife habitats and they help to preserve aquifers. "

Other farmers were more focussed on their own farm operations. If wetlands should be expanded into or not was a case of whether wetlands were suitable for cane growing:

"When a wetland is next to a creek it is impossible to keep it drained."

"Forget about trying to drain mangroves - no other land use is worthwhile."

"It depends on what you call a "wetland". If you conserve everything; you can't grow cane. On the other hand, you could knock it all over and have nothing but cane. Up till now the policy has largely been; knock it down and grow cane."

Other farmers looked at the question from a dual perspective:

Box 5 continued.

"Some of the wetlands should be kept but not all of it - some would be OK to develop."

This group of farmers were mostly agreed in their approach to clearing remaining patches of rainforest. The economic argument was the strongest:

"What about the remaining patches of rainforest - are they worth keeping?"

"Many of the trees in these areas are not original vegetation - in fact they are more recently grown - 80 years or less."

"There is pressure to clear for economic reasons. The government or the community needs to be prepared to buy back the land at the market value."

"The landowner will always go the way of economics."

"If the community wants to preserve the forest then it should be prepared to buy it. The farmer had to buy it first."

The discussion continued on the basis that clearing is acceptable and it shifted to consider how close clearing should get to streams.

Catchment Coordinator: "The Water Resources Act (1993) protects the top of the banks but the River Trust does have the power to enforce wider restrictions."

"The River Trust and the BSES need to accept responsibility to assess clearing to river banks in order to determine how much protection is required. This should be tied up with legislation."

"This would be hard to police."

"Could there not be registered easements between all properties which would be tied up by law."

Other Issues for Consideration

The workshops attempted to use hypothetical situations to trial elicitation of local knowledge. It became apparent that the use of hypothetical scenarios were problematic. What emerged was that farmers were much more confident with knowledge which applied specifically to their farm. This reveals something about the nature of local knowledge. An advantage is that it provides experience and perspectives that may be overlooked by scientific method, however applying outside of the farm requires ingenuity and initiative. An example of this issue is presented in Box 6.

Box 6
Identifying problems from first hand experience
It became evident that farmers were having difficulties making predictions about the hypothetical catchment because their understanding was so intrinsically tied to their own individual circumstances. Whilst asked to consider some potential scenarios, farmers spoke almost entirely of their first hand experience:
'Around my house, floods have dropped sediment – as much as 4 inches.'
'My local creek is now always dirty – never clear'
The workshop highlighted some important characteristics of local knowledge. Unlike scientific method, the predictive capacity of local knowledge is low. The advantage of local knowledge is that it can provide an impressive level of detail and insight by drawing on personal experiences, and inform an agenda for systematic research.

The validity of an investigation of local knowledge

The interviews and workshops with farmer groups in the Herbert Catchment described in the previous section were undertaken as methodological trials and were not intended to produce particular insight into local knowledge and ICM in the Herbert. Nevertheless, assessment of the material elicited illustrates that while farmers knew precisely what the word 'catchment' meant, they did not naturally view the landscape that they live and work in as being part of a catchment and, therefore, did not see the catchment as a natural unit of management. By contrast, for natural resource professionals who were the authors and champions of ICM, a model of the landscape as a set of catchments that provided natural units for rational management was both intuitive and powerful. The limitations of this simple but external model of the landscape makes the expected 'meeting of minds' between the two groups more demanding than would otherwise have been anticipated.

This simple example illustrates the basis for a view that while local knowledge is a critical component of initiatives such as ICM, this does not provide a justification for its explicit and professional investigation. As the pendulum swings away from an interventionist external paradigm for development to an increasingly participatory one, it is being argued that development professionals should leave the systems thinking to the target communities – if provided with the range of technological solutions available, local communities can undertake their own systems synthesis to generate solutions (Blaike et al., 1997). It would appear to follow from this that farmers do their own analyses, research and information exchange and there is no need for a systems perspective on the part of development professionals. It is increasingly fashionable to put this view forward in terms of contrasting hard and soft systems approaches (Scoones and Thompson, 1994) with the implication that since rural development is inherently a process played out by various people making decisions (referred to as actors), that only soft systems methods (Checkland and Scholes, 1990), that concentrate on the social organisation of knowledge (Engel, 1995) are appropriate. In this frame of analysis, attempting to obtain a systematic understanding of what local people know about the ecology of their environment and farming practices is criticised as being inherently extractive, because it is assumed that it must entail the imposition of an external rationality (Scoones and Thompson, 1994). This view questions the validity of systematic study of local knowledge by development professionals as a part of the development process but, notwithstanding its current popularity, unnecessarily polarises the debate on relevant methodology for working with rural people and their knowledge, and raises concerns, which on further examination, are invalid.

In reality, hard and soft systems methods are not mutually exclusive but, in fact, play different roles and are appropriate for different purposes and hence for application at different hierarchical levels. The 'hardness' of a system is determined by how well defined, stable and quantitative the system mechanism and purposes are. It is, therefore, useful to conceive of resource management activities as consisting of harder ecological systems at the organism, field, farm and catchment levels that are managed by people within household and other social

structures, thereby creating increasingly soft systems as more of the social structure is included. Farmers, therefore, albeit within a complex soft systems framework, are managing the ecology of their farming practices, which can be tractably understood, at least to some extent, using a blend of hard and soft systems methods. Thus, partial views of the relatively 'hard' ecology of a farming system are a useful and valid tool, providing their partial nature is fully understood, in as much as what farmers actually do in their farming practice is determined by other social and cultural factors, as well as their knowledge of agroecology. Indeed, a systematic appreciation of farmers ecological knowledge can sometimes help to distinguish the action of socio-economic determinants.

Although it is a danger that has often been apparent when researchers have analysed local knowledge, seeking to obtain a systematic view of local knowledge does not necessarily imply the imposition of an external rationality. It is possible to seek local explanations and to represent them. The western scientific tradition does not have an exclusive claim to systematic understanding of ecological processes and it would be patronising to posit that farmers do not have locally derived understanding that may be systematic. There is, in fact, increasing evidence from various agrarian societies, from studies using a variety of different methods, that farmers often possess a sophisticated, locally derived and general understanding of agroecology comparable with, although different from, scientific formulations (Berlin 1992; Fairhead and Leach 1994; Richards 1994; Thapa, Sinclair, and Walker 1995). It is important then not to confuse the development and use of formal methods with the imposition of a particular rationality. Quite different explanations for particular ecological phenomena or the efficacy of farming practices can be codified using formal notation. Indeed, dealing with local knowledge explicitly, may assist in revealing where external interpretation occurs, as well as common ground between different knowledge systems. The use of formal methods to represent local knowledge (a process of abstraction rather than extraction) can, therefore, be seen as according rural people's knowledge a status on a par with scientific knowledge rather than as an 'extractive' process that somehow diminishes or distorts it. However, empowerment of local people in a participatory development process does not necessarily preclude the need for strategic research and extension by development professionals. In fact, the existence of sophisticated ecological knowledge amongst farmers, based on their own observation and experimentation, improves the prospects for research to be done by supporting institutions that address fundamental questions that farmers have difficulty tackling because of resource constraints or limitations in their ability to make observations. While in many situations it is unlikely that professional researchers can improve on farmer's adaptive research, they may well be in a position to contribute by doing strategic research and extending information about ecological mechanisms that farmers find difficult to observe. To design such strategic research and extension activity on the basis of what farmers require and to be able to communicate effectively about agroecology, development professionals need to be aware of what farmers already know (Sinclair and Walker, 1999). It is for these reasons that a more suitable reaction to the failings of a systems approach based on external perspectives, is to seek an internal (local) construction of a model of the system that development professionals can access and use. Furthermore, this approach is both compatible with, and complementary to, participatory approaches to research and extension.

In summary, it is reasonable to propose that initiatives that are aimed at impacting on management (implying that people change their behaviour) are likely to be much more efficient where premised on the conception of the system used in management than on some external conception or none at all. This does not mean that the models of system functioning held by farmers are more correct than the models that might be generated by external professionals. However, the farmer's model of the system is an important consideration for ICM and a representation of a local community's view of the systems and practices under development will seriously enhance research, development and extension.
The discussion of local knowledge presented in this paper provides some useful insights into the complex set of issues involved in elicitating, recording and analysing local understanding of

catchment processes. Conceptually, there are some clear advantages of incorporating local knowledge into ICM processes, notably in terms of targeting and evaluating research. A review of literature revealed that educating natural resource professionals about farmer knowledge and practice has the potential to change their perception of what is important, the terminology they use and the type of research they do. It may reveal important understandings of the catchment which scientific inquiry has overlooked.

Where attitudes and behaviour are unsustainable, it is important to understand why these attitudes and behaviours exist, and what sort of perception of the land they reflect. The literature review and the trials confirmed that local knowledge has the potential to play a significant role in addressing these issues. It can assist research and external managers to understand the ways catchment groups perceive their environment, and what the implications of these perspectives are. Local knowledge is also a key consideration for improving rates of adoption in research, development and extension programs. Through the analysis of local knowledge, ICM programs can be developed in such a way that public participation is meaningful to both researchers and resources users alike.

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Appendix 1 : questionnaire survey

Codes for informants in questionnaire results :
1 - Farmer
2 - Farmer
3 - Researcher
4 - Researcher
5 - Drainage engineer

Response codes:
SA - strongly agree
A - agree
NS - not sure
D - disagree
SD - strongly disagree

Water quality (pollutants)

	SA	A	NS	D	SD
The problem					
Water quality within the rivers, streams, estuaries and ground water in the Herbert is declining.		3	4	125	
Nutrient loads within the rivers, streams, estuaries and ground water in the Herbert are unacceptably high.				123 45	
Pesticide residues within the rivers, streams, estuaries and ground water in the Herbert are unacceptably high.			34	125	
Causes					
Urban areas are a significant source of pollutants in the Herbert catchment.		134	25		
Agricultural production is a significant source of pollutants in the Herbert catchment		34		125	
Mining is a significant source of pollutants in the Herbert catchment		124 5		3	
Aquaculture is a significant source of pollutants in the Herbert catchment			5	123 4	
Consequences					
Pollutants in the streams, rivers and estuaries of the Herbert catchment are causing significant damage to freshwater and coastal ecosystems			34	125	
Pollutants in the streams, rivers and estuaries of the Herbert catchment are causing algal blooms				123 4	5

Ranking

Rank the following sources of pollutants in terms of importance at the mouth of the Herbert River (1=greatest, 4=least).

Urban sources
Agricultural production
Mining
Aquaculture

How confident are you about this ranking?

Water quality (sediments).

	SA	A	NS	D	SD
The problem					
Soil erosion and sediment loads in the Herbert River are significantly higher than they would have been under natural conditions.		345		12	
Soil erosion and sediment loads in the upper catchment are significantly higher than they would have been under natural conditions.		123 45			
Soil erosion and sediment loads in the lower catchment are significantly higher than they would have been under natural conditions.		4		123 5	
Causes					
Removal of native vegetation in the lower catchment is a primary cause of increased sediment load		245		13	
Removal of native vegetation in the upper catchment is a primary cause of increased sediment load		123 45			
River bank collapse due to inadequate riparian zones is a primary cause of increased sediment load		145	3	2	

Erosion rates have not increased but more sediments are reaching the river system as a result of removal of substantial areas of riparian vegetation on tributaries of the Herbert river		12	35	4	
Stock concentration along water courses in upper catchment is a primary cause of increased sediment load		135	24		
Road construction and similar work is a primary cause of increased sediment load	4	135		2	
Old mining areas are a primary source of increased sediment load	1	235	4		
Impacts					
Increased sediment loads are causing accelerated sedimentation / aggradation of the river system		1345		2	
Increased sediment loads are reducing the efficiency of natural and man-made drainage systems		12345			
Sedimentation of stream beds is causing an increased number of overbank flood events		15	34	2	
The Hinchinbrook Channel and Missionary Bay are experiencing increases in sedimentation	4	135	2		

Ranking

Rank the following causes for increased sediment accession into the drainage system in terms of importance (1=greatest, 7=least).

Inadequate vegetation cover (upper catchment)
Inadequate vegetation cover (lower catchment)
River bank collapse
Stock concentration along water courses
Removal of riparian zones as sediment traps
Road construction
Erosion from mining areas

How confident are you about this ranking?

Surface water quantity - wet season

The problem	SA	A	NS	D	SD
The way in which water moves through the catchment has changed as a result of man's activities	2345	1			
Rainfall runoff from inland areas of the catchment is significantly faster than it would have been under natural conditions.		12345			
Coastal areas of the catchment are more often inundated with water and that water stays around for longer than it used to.		1235	4		
Causes					
Clearing of native vegetation for conversion to pastures increases runoff rates		12345			
Clearing of native vegetation for cane production increases runoff rates	35	124			
Clearing of native vegetation for forestry increases runoff rates		1	5	234	
Converting pasture to cane land increases runoff rates		1345		2	
The introduction of levees and other control features and unintentional interventions (eg. raised banks for the railway) have significantly altered water flows	235	4		1	
Drainage schemes in areas of expansion are having a serious impact down stream by increasing the rate of runoff	5	1234			
Laser levelling is having a serious impact down stream by increasing the rate of runoff		45	3	1	2
Increased flooding risks can primarily be attributed to siltation of the river beds.		235		14	
Consequences					
The design capacities of drainage schemes in the coastal areas of the catchment have been exceeded		1235	4		

Paddocks in the lower catchment are under water more often and for longer		123 5	4		
This leads to a decline in cane yield		123 45			
Increased flooding is causing significant land degradation			5	123 4	
Increased flooding is causing habitat destruction		4		123 5	

Surface water quantity - dry season

The problem	SA	A	NS	D	SD
Base flows in some areas in the river and stream systems are significantly reduced from their natural levels		134	2	5	
Causes					
Increased runoff rates during the wet season mean that less water is stored in the catchment through into the dry season		124		35	
Extraction of water for irrigation from the river during the wet season means that less water is stored in the catchment through into the dry season		4		123 5	
Consequences					
Some wetland areas are becoming drier as a result of inadequate recharge during drier periods		12	4	35	
Reduced base flows in the dry season are causing increased habitat destruction		3	14	25	
Reduced base flows are having an ecological impact - for example on fish breeding		13	4	25	
Changes in the timing of water flow may cause acid sulphate soil problems to occur in the Herbert		35	2	14	

Ground water

The problem	SA	A	NS	D	SD
Ground water resources in some areas within the Herbert catchment are becoming depleted		3	4	125	
Causes					
Excessive pumping of ground water in some areas for irrigation is having an impact on ground water levels.		34		125	
Alteration of drainage characteristics of catchment is leading to more runoff and less deep penetration to recharge ground water		234		15	
Consequences					
Reduction in ground water means that the baseflow in streams in the dry season has dropped		234		15	
Reduction in ground water means that the baseflow in the main river in the dry season has dropped		34		125	

Appendix 2 : Semi structured interview questions

1. Presentation of the issue

I'd like to talk in more detail about one particular issue - soil erosion in the Herbert and what happens to soil from paddocks in both the upper and lower catchments once it is washed off the paddock and into the stream system.

There seems to be considerable disagreement about how widespread this type of erosion is in the catchment and what its consequences are.

In particular :

i) What are the factors that determine whether significant soil erosion will occur as a result of rainfall? Why?
ii) What factors determine how much sediment enters the river system? Why?
iii) What happens to eroded soil once it enters the stream system?

Appendix 3 : Scenario selection by individuals

(supported by use of an A0 sized map showing a fictitious catchment in north Queensland in some detail)

Having looked at your opinions on the issues and the basis for some of these I'd like to briefly look at the implications they have for decision making.

I would like to present three plans for cane expansion in a fictitious catchment and ask you which you would favour and, more importantly, your justifications for favouring that plan.

Details
A mill (in the town) shown requires an increased throughput to remain economically viable.

Two areas for expansion have been identified - Eastern Block and Western Block.

Expansion has been agreed for one of the two sites - the question is which?

The Eastern Block would require drainage of the small wetland area.

The Western Block could be converted without drainage.

However, extensive drainage taking water from this area completely would increase land use suitability from 3 to 2 for most of the area.

Scenarios
Scenario 1 : Convert Eastern Block.
Scenario 2 : Convert Western Block without drainage scheme
Scenario 3 : Convert Western Block with a drainage scheme.

Appendix 4 : Group-based scenario discussion

Cane Expansion in the Milltown Catchment

The Milltown catchment is somewhere in north Queensland. Cane has been grown in the area for many years, however the management of the catchment's sugar mill (situated in Milltown) feels that it has to increase production in order to remain nationally and internationally competitive. Two areas have been identified as being suitable for expansion - The Common on the eastern side of the catchment, formerly Crown Reserve land but now under leasehold to Milltown Council, and The Station, part of a freehold grazing property on the western side of the catchment.

Conversion of The Common would require some drainage works. Conversion of The Station could be done without a drainage scheme. However, a major drainage scheme has been proposed which would increase the land use suitability for cane of most of The Station from 3 to 2. This would involve a major drain running up through the lowland rainforest area to the south of Milltown and then across the southern edge of the town to the sea.

The Milltown catchment is typical of many in north Queensland. Flooding and drainage, water supply for irrigation in the dry season, water quality, acid sulphate soils, soil erosion and the sedimentation of river systems are all actual or potential problems. Habitat management and protection are also significant issues with rapidly declining lowland rainforest and wetland areas. Two high-profile and endangered animal species are found in the catchment.

We would like you as a group to discuss the ways to try to meet the sugar mill's needs for increased through-put and the industry's desire to produce more cane in the Milltown Catchment. In making your recommendation (as a group) think as broadly as possible about options for the catchment. Whatever you recommend, we are particularly interested in the reasons for your recommendation and the issues that you feel needed to be considered in reaching your conclusion.