

# IRRIGATION FUTURES OF THE GOULBURN BROKEN CATCHMENT



Milestone 4 Appendix  
Detailed Scenarios  
June 2006

**Primary Industries Research Victoria (PIR Vic) –Tatura**  
**Department of Primary Industries**  
in collaboration with  
Community Engagement Network  
Department of Sustainability and Environment



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## The National Program for Sustainable Irrigation

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## Appendix 1: Detailed Scenarios

### Scenario 1: Moving On 2005-2020

Drivers	Responses	Impacts
<b>Primary Drivers</b>		
<p>Social, Economic, Political, Technological, Ecological Drivers</p> <ul style="list-style-type: none"> <li>• <i>Climate change</i> causes a 10% decrease in annual rainfall, increases summer rainfall intensity and reduces chill hours.</li> <li>• <i>Free trade agreements</i> are signed with the United States and ASEAN</li> <li>• <i>Genetically modified organisms</i> are permitted for agriculture in Australia and are used globally. Consumers have a wide range of opinions on the acceptability of consumption of genetically modified organisms.</li> <li>• Demand for <i>rural living properties</i> and tourism increases.</li> <li>• Government water reform package reallocates some irrigation water entitlement to the environment, reduces barriers to water trade and reduces the third party effects of water trade.</li> <li>• <i>Agricultural production costs</i> escalate partly because employment in agriculture is viewed as undesirable and partly because of rising costs associated with increasing quality assurance requirements of markets.</li> <li>• Energy shortages create demand for <i>alternative energy sources</i> including biofuels.</li> <li>• Community willingness and ability to volunteer decreases due to decreasing availability of time and money and increasing regulation.</li> <li>• Governments let market forces direct outcomes and only intervene when market failure is significant. Exceptional circumstances support decreases.</li> </ul>		
<b>Our Industries</b>		
<p><i>Overall</i></p> <ul style="list-style-type: none"> <li>• Regional irrigation entitlement reduces due to inter-regional water trade and government water reform. Entitlement remaining in the region in 2020: High reliability 995 GL, Medium reliability 550 GL</li> <li>• Regional irrigation allocation reduces due to lower rainfall. 2020 Allocations: High reliability 100%, Medium reliability 0%</li> <li>• Water tariffs increase at the inflation rate</li> <li>• High demand for lifestyle properties increases the price for small blocks of land. This places pressure on farmers with low returns to sell.</li> </ul> <ul style="list-style-type: none"> <li>• Manage declining terms of trade and seasonal variability by diversifying income and reducing production costs. Small businesses that cannot adapt leave the industry.</li> <li>• Make considered choices about the adoption of genetically modified organisms and target production to meet the needs of niche and boutique markets.</li> <li>• Improve environmental credentials by complying with industry codes of practice.</li> <li>• Sell redundant assets, eg houses, to lifestylers.</li> <li>• Become highly skilled at business management including land, plant, animal and people management.</li> <li>• Campaign for strong “country of origin” labelling laws.</li> <li>• Trade irrigation water entitlement to enable business development.</li> <li>• Pump increasing volumes of groundwater.</li> </ul> <ul style="list-style-type: none"> <li>• The region continues to prosper despite global competition.</li> <li>• Businesses in larger centres prosper and become less dependent on the fortunes of agriculture.</li> </ul>		

### *Dairy*

- Demand for dairy products grows predominantly in Asian markets.
  - International production grows, particularly in Eastern Europe and South America, in response to increasing world demand for dairy products.
  - There is no change in the real price paid to farmers because demand for dairy products is fulfilled by production increases.
  - Improvements in farm efficiency do not keep pace with increasing costs causing the competitiveness of dairy production in the region to decrease.
- Increase business efficiency and effectiveness through the following: increasing the economies of scale, use of genetic modification, imported fodder, and increasing irrigation efficiency.
  - Collectively negotiate supply contracts to realise long-term price surety.
  - Increase size of drainage and effluent management systems to cope with larger rainfall events.
- Number of dairy farms decrease.
  - Milk production increases 30%.
  - Area of dairy farm land decreases 10%. Production is increasing through genetic modification, grain and fodder imports, and increasing irrigation efficiency.
  - Irrigated area decreases 5%, irrigation water use decreases 10%.

### *Horticulture*

- Free trade agreements allow the importing of fruit into Australia.
  - Global prices for horticultural products are lower than Australian prices due to lower labour costs and lower standards for chemical use in competing countries.
  - Fruit imports lower the real price for horticultural produce in the region.
  - Local production costs continue to increase, causing a decrease in the competitiveness of horticultural production in the region.
- Increase efficiency through labour and water saving technologies and practices.
  - Attract new investment, particularly vegetable growers, away from Melbourne's fringe.
  - Instigate think tanks to develop a future industry direction.
  - Manage climate change by moving to cooler areas, changing rootstock and modifying their microclimate.
- Fruit production decreases 10%, but gross value of production increases 5% due to diversification into new higher value products.
  - Growth of new industries with controlled environment systems for QA. These industries require year round access to water.
  - There is no change in irrigated area, irrigation water use decreases 5%

### *Livestock*

- As Asian countries become more affluent, global demand for meat increases.
  - Increasing global production results in no change in the real price for meat.
  - Use of genetic modification and more intensive production systems cover increasing costs, ensuring no change in competitiveness.
- Increase investment in feedlots and intensive production systems.
  - Use genetic modification technology to increase production efficiency.
  - Develop supply chain to access Asian markets.
- Production increases 20% to accommodate increased global demand.
  - Land area decreases 5% through increasing use of feedlots and intensive systems.
  - Irrigated area decreases 10%, irrigation water use decreases 10%

### *Cropping*

- The cropping industry remains highly dependent on the dairy industry.
  - Declining competitiveness of the dairy industry ensures there is no change in the real price.
  - Competitiveness increases slightly as genetic modification increases yields and reduces production costs.
  - Demand for grain for bio-fuel production is fulfilled by worldwide oversupply of grain, with little increase in demand for grain from the Goulburn-Broken region.
- Adopt genetically modified crops to increase yields.
  - Invest in technology to reduce production costs, including satellite controlled tractors.
  - Increase business flexibility by opportunistically leasing and cropping land.
- Production increases 20% to accommodate increasing demand from the dairy industry.
  - There is no change in land area.
  - Irrigated area decreases 10%, irrigation water use decreases 10%.

### *Processing*

- Cooperative processors find it difficult to raise capital to invest in processing capacity.
- Free trade agreements encourage the expansion of processing capacity where costs are lowest.
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- To enable business development, cooperative processors are sold to multinational corporations. The multinationals rationalise production facilities and invest in just-in-time processing, improve logistics and use alternative fuels.
- Improve vertical integration of production systems, increasing control of the supply chain.
- Undertake research and development into new products, particularly into health food products including pharmaceuticals and nutraceuticals.
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- Large multinational processors show less commitment to production in the region.
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### *Other*

- Water resources of the region become the focus for the expanding tourism industry.

## **Our Community and Environment**

- Owners of lifestyle properties only remain for a few years before selling up. They have an unrealistic expectation of agricultural practice eg animal welfare, less noise, less smell and less dust.
- Population of the region increases and ages due to increasing numbers of retirees relocating to the region even though there is a continuing loss of school leavers to Melbourne.
- Inter and intra regional water trade leads to irrigation infrastructure being under used in some areas and over used in others

- Increasingly engage a broad cross-section of the community in regional decision making processes.
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### *Water Supply Manager*

- The process for reconfiguring irrigation infrastructure commences. Production and lifestyle zones are recognised.
- Invest in irrigation infrastructure improvements that realise water savings. Receive support from government on the condition that efficiency gains are returned to the environment.
- Investigate implications of climate change on water availability and communicate results to industry groups to encourage adaptation.

### *Local Government*

- Encourage the development of tourism, health and education industries to diversify the rate base.
- Encourage the use of Section 173 agreements to manage 'right to farm' issues on subdivided agricultural land.

### *Catchment Manager*

- Enforce land use controls through: irrigation water use licences, land use planning processes and referrals. The controls restrict development on the flood plain, encourage irrigation on light soils and, introduce buffer areas around significant natural features and irrigation areas.
- Reserve areas of the flood plain to manage salt and nutrients during floods. Fences and levee banks along the river are removed.

### *Communities*

- Active communities create opportunities to maintain local services, eg banks, petrol stations, schools etc.
- Develop community leadership skills of young people through encouraging their involvement in sporting clubs, young farmers and other community groups.
- Lobby state and federal governments to invest in improved transport infrastructure.
- Irrigators support the CMA management of flood plains to reduce the demand for increased environmental flows.
- Support environmental education in schools and the wider community.

### *Infrastructure*

- Transport infrastructure improves with the completion of Goulburn Valley Highway from Seymour to the NSW border, and the road-rail transport interchange at Mooroopna.
- Irrigation infrastructure is rationalised to reduce maintenance and renewal costs, stranding salinity management infrastructure.
- Housing development occurs on the fringes of larger centres. The developments encroach onto agricultural land.

### *Environment*

- Extent of shallow watertables decreases due to less recharge and increased groundwater pumping, decreasing the risk of soil and wetland salinisation.
- Catchment yields are reduced due to climate variability. Environmental flow entitlement increases, due to 80:20 sales deal and water saving projects. No effects of the increased environmental flow entitlement are observed due to low water availability.
- Nutrient pollution continues to be a problem due to the intensification of agriculture, particularly the dairy industry.
- Interspecies transfer of genes from genetically modified plants creates herbicide resistant weeds, infertile native species and reduces insect populations.
- Frequency of aquatic birds breeding decreases due to wetlands receiving less water.
- Area of isolated native vegetation in agricultural land continues to decline.

### *Community*

- Regional population continues to grow, supported by new migrants continuing to move into the region to seek employment and an increased retention of young people due to the increasing availability of tertiary educational opportunities.
- Area of land used for lifestyle purposes increases 100%, while irrigation water use on these properties increases 20%.
- Unemployment remains low because the service and retail industries grow.
- Some small towns decline due to the increasing size of farms, reducing the number of people living in rural areas. The decline is first evidenced by the withdrawal of services such as banks, supermarkets and petrol stations.
- Small towns, within commuting distance of larger centres, become dormitory centres with limited services.
- Conflicts between agricultural and lifestyle values result from limited intervention by local government in land-use planning.
- Volunteer organisations decline and are progressively amalgamated to maintain service provision.
- Influence of the farming community in government decision-making decreases due to the decreasing number of people involved in agriculture and the increasing size of the urban population.

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## Scenario 1: Moving On 2020-2035

Drivers	Responses	Impacts
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### Primary Drivers

#### Social, Economic, Political, Technological, Ecological Drivers

- Water delivery *infrastructure is privatised* causing a reduction in the cross-subsidisation of infrastructure costs and an increase in water tariffs.
- *International trade* barriers continue to decrease.
- The growing middle class in *India and China become a market* for high quality agricultural produce.
- *Consumers* become increasingly affluent, health conscious and concerned for animal welfare.
- Lifecycle of *product differentiation* decreases as competitors rapidly eliminate product differentials.
- *Climate* remains drier than the historical average; but, with increasing summer rainfall intensity.
- Increasing reliance on electronic communication and trade.
- *Agricultural land prices* remain low due to historical small farm sizes that contain redundant assets.
- *Increasing work pressures* and the changing nature of work mean that time away from work is more highly valued and tends to be spent with family.

### Our Industries

#### Overall

- Regional irrigation entitlement is maintained as inter-regional water trade declines. Entitlement in the remaining region in 2035: High reliability 995 GL, Medium reliability 550 GL
- Regional irrigation allocation varies but remains lower than the long term average. 2035 Allocations: High reliability 100%, Medium reliability 25%.
- Water tariffs increase through building in a commercial rate of return and through decreasing cross-subsidisation.
- Agricultural businesses continue to invest in the region due to low land prices and reliable water.
- Develop markets and build closer relationships with customers to reduce competitors' influence.
- Increasingly rely on contractors to provide specialised services, such as quality assurance, conservation services, labour hire and product marketing
- Agricultural franchises develop to enable small agricultural businesses to exist. Franchises provide the farming system, product marketing and insurance services.
- Large agricultural businesses are increasingly managed as specialised business units.
- Wireless electronic animal control measures remove the need for fences.
- Form active industry lobby groups to influence political decisions.
- Reduce the use of groundwater for irrigation as the availability of surface water increases
- The region continues to prosper despite global competition.
- Agricultural businesses use irrigation water carefully and as a result water moves about the landscape from year to year.

#### Dairy

- Demand for dairy products in Asian markets continues to grow.
- Increasing demand causes a small increase in the real price for dairy products.
- Increases in real prices and improvements in farm efficiency result in no change in the competitiveness of dairy production in the region.



- Reduce labour requirements by automating irrigation and milk harvesting.
  - Introduce controlled feeding systems
  - Use genetic modification technology to modify cows to produce milk to meet processor requirements for the production of high-value nutraceuticals.
  - Develop business consortiums to seek private investment to fund investment in technology.
- Milk production increases 30% to fulfil increased international demand.
  - Land area decreases as farms become larger and more intensive and small farms exit.
  - Irrigated area increases 5%, while irrigation water use increases 5%.

### *Horticulture*

- Demand from India and China grows.
  - Global production grows in response to increasing demand and there is no change in real price.
  - Increases in production efficiency and product diversity ensure the competitiveness of the industry does not change.
- Increasingly use controlled environment and hydroponic technologies to provide for greater control over fruit quality.
  - Develop mechanical harvesting and pruning systems to reduce labour requirements.
- Production increases 50% to fulfil market opportunities, enabled by genetic modification technology.
  - Land area increases 50%, while irrigation water use increases 50%.

### *Livestock*

- Global demand for meat continues to increase.
  - Global production increases in response to increasing demand. No change in real price occurs.
  - Relative industry competitiveness decreases due to the prosperity of other industries, and their ability to pay for water, feed etc.
- Sell water and land to dairy and horticulture.
  - Invest in controlled feeding systems to tailor stock feeding to maximise growth efficiency.
- No change in production as increased demand is fulfilled by international competition.
  - No change in land area, however grazing is important to consumers.
  - Irrigated area increases 10%, while irrigation water use increases 10%.

### *Cropping*

- Growth in cropping industry remains highly dependent on the dairy industry.
  - There is a small growth in demand for pulses from Asia.
  - Genetic modification increases yields. The increasing availability of locally produced fodder and grain causes a decrease in the real price.
  - Increased yield potential ensures there is no change in competitiveness.
- Increase production of high protein pulses to cater for increasing international demand.
  - Use precision agricultural techniques to spatially tailor use of water, fertilisers and herbicides to crop requirements.
- Production increases 100% due to genetic modification and demand from the dairy industry.
  - Irrigated area increases 40%, while Irrigation water use increases 40%.

### *Processing*

- Intra-regional transport costs increase substantially due to deteriorating roads and increasing

volumes of product.

- Encourage pre-processing of farm products on farm to reduce transport costs

#### *Other*

- Water resources of the region become the focus for expanding the tourism industry.

### **Our Community and Environment**

- Household sizes continue to decrease, increasing the demand for residential land. Migration of people from other regions occurs due to low land prices.

#### *Water Supply Manager*

- Continue to reconfigure infrastructure, with a more commercial focus.
- Automate large sections of the delivery infrastructure to reduce labour costs.

#### *Local Government*

- Encourages lifestyle and urban development to diversify the rate base.
- Sell off under-used community assets, including sporting grounds and community halls.

#### *Catchment Manager*

- Develop an enforcement capability, being the primary environmental regulator.
- Introduce a board comprised of elected representatives and skills based appointments by government
- Produce an annual report describing the health of the catchment using a range of indicators.
- Provide incentives and support for environmental farm plans for less productive areas.

#### *Communities*

- Consolidate activities to ensure a critical mass of volunteers.

#### *Infrastructure*

- Permanent trade in entitlement within the region results in water moving closer to the main trunk channels and rivers. Irrigation infrastructure is progressively withdrawn from the extremities of the system.
- Salinity management infrastructure is stranded as irrigation infrastructure is rationalised.

#### *Environment*

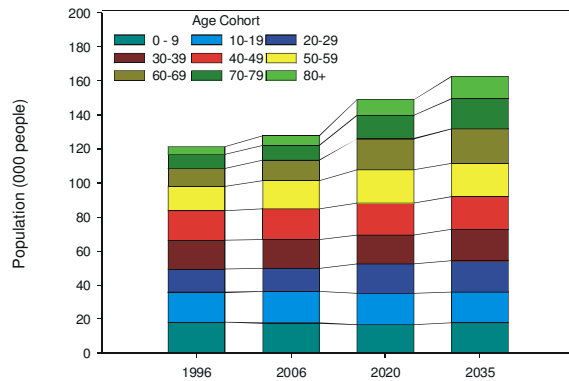
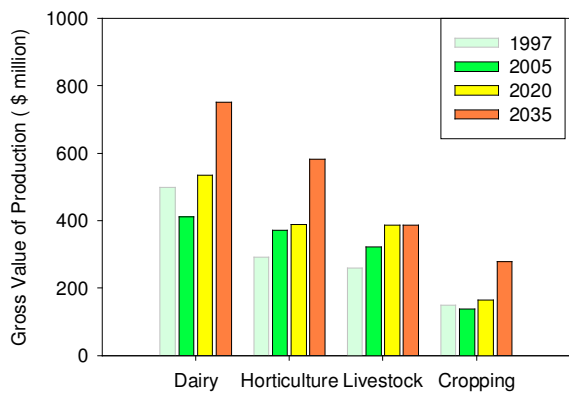
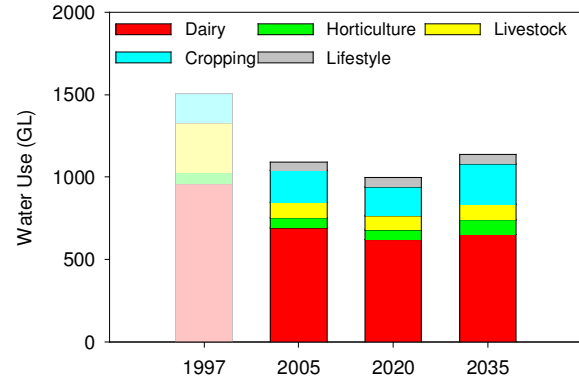
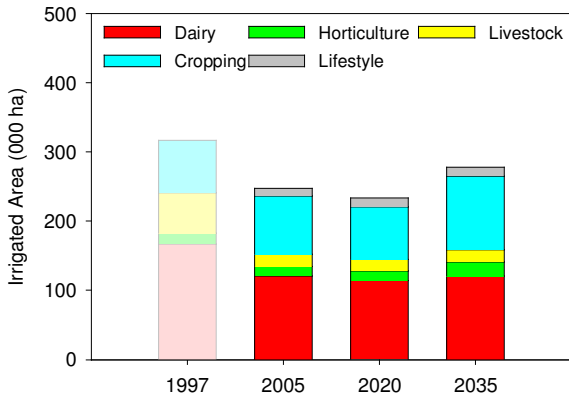
- Soil salinity problems follow water about the landscape. Floods play an important role in washing excess nutrient and salt off agricultural land.
- Environmental water entitlements are used judiciously to encourage spawning of native fish and nesting of water birds.
- Large areas of the region are revegetated resulting in corridors linking many remnant vegetation stands.
- Tensions exist over native vegetation conservation. The public are concerned with preserving what currently exists, regardless of why it exists. This means that conflict arises when management changes have impacts on biodiversity. For example, the piping of an open channel eliminates seepage that enabled a wetland or red gums to emerge and exist.
- The extent of shallow water tables increases due to increasing availability of irrigation water and lower groundwater pumping volumes, increasing the extent of soil and wetland salinisation.
- Nutrient runoff decreases as precision agricultural practices are adopted.

### *Community*

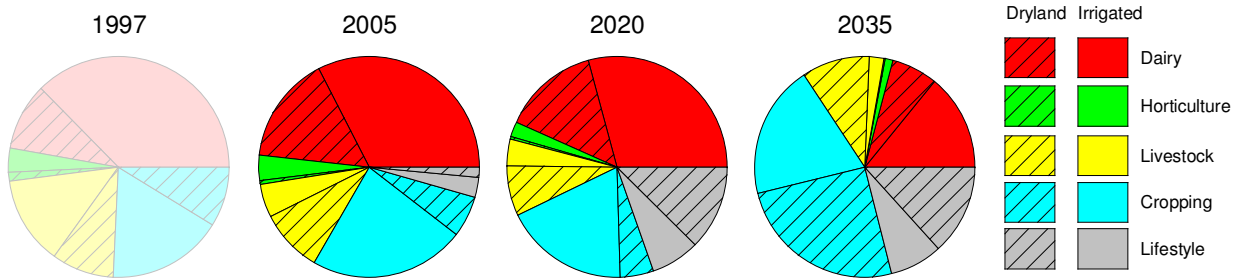
- Regional population increases as new migrants continue to move into the region to seek employment. Young people are increasingly retained in the region by increasing educational and employment opportunities.
- Unemployment remains low as the prosperity of the region sustains continuing growth in employment. Very few labouring jobs exist with a large number of people employed as specialised technicians.
- Urban areas continue to expand as the population continues to increase. Larger towns grow at the expense of smaller communities. The area of land used for lifestyle purposes does not change, nor does the volume of irrigation water used.
- Ageing population places pressure on aged care facilities.
- Conflicts between agricultural and lifestyle land uses continue, due to the frequent turnover of the owning of lifestyle properties.
- Voluntary community groups become increasingly interest-based rather than location-based. Amateur sporting clubs decline due to declining voluntary activity and decreasing population in smaller towns.
- Agricultural industries influence political decisions through lobby groups.

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## Scenario 1: Illustrative Graphs



## Land Use



## Scenario 2: New Frontiers 2005-2020

### Drivers

### Responses

### Impacts

#### Primary Drivers

##### Social, Economic, Political, Technological, Ecological Drivers

- *Free trade agreements* are signed with USA and ASEAN, but Middle East *trading partners are lost* due to the alliance with USA.
- Significant increase in *demand for rural lifestyle properties* and rural tourism causes rural land prices to increase.
- Urban communities become *increasingly affluent* and have increased concern for the environment, personal health and food safety. Government responds to community concerns and demands by *increasing regulation* on agricultural development and practices.
- *Genetically modified organisms* are prohibited for agriculture in Australia.
- *Cost of oil* doubles causing an international recession.
- The high price of oil causes *substantial increases in transport costs*.
- *Government water reform* increases environmental flow entitlement through a deal, which allows medium-reliability water entitlement to be exchanged for high-reliability water entitlement.
- *Government water reform* allows for interstate water trade to occur.
- *Climate* remains drier than long-term average, causing *bushfires* throughout large parts of south eastern Australia.
- *Ageing population* creates high demand for aged and health care workers. This demand decreases the number of workers available for other industries. The increasing number of retirees creates a pool of *willing volunteers* for community activities.
- *Communications technologies* rapidly improve in rural areas as rural lifestyle property owners demand high service levels.

#### Our Industries

##### Overall

- Regional irrigation entitlement changes due to a government deal to secure water for the environment and water trade out of the region. Entitlement in the region in 2020: High reliability 1050 GL, Medium reliability 0 GL
- Regional irrigation allocation reduces due to a lower than average rainfall and a decrease in run-off due to bushfires. 2020 Allocations: High reliability 95%, Medium reliability 0%
- Water tariffs increase at the inflation rate.
- Market value of irrigation water increases due to low water allocations.
- Manufactured fertiliser prices increase substantially as the price for oil increases.
- Build lifestyle properties and residents into their businesses through: leasing redundant houses to new lifestyle residents and tourists, targeting production to emerging niche tourist markets and leasing lifestyle properties for productive purposes.
- Many farmers leave their industries due to decreasing competitiveness, particularly those farmers with small margins.
- Small properties in aesthetically pleasing areas and surrounding towns are sold as rural lifestyle blocks.
- Lobby governments to reduce regulation of agricultural practice, apply similar conditions to other land uses and control lifestyle development.
- Become highly skilled at business management including land, plant, animal and people management.
- Banks broker deals for new industry entrants, encouraging them to set up in low risk locations.
- Increase use of groundwater in response to low water availability and higher market value.
- Declining prosperity of agricultural production causes many businesses to sell out to rural lifestyle developers.

- Lifestyle development increasingly underpins the economic base of the region. Lifestyle development creates an increasing demand for service industries.
- There is a contraction of most industries due to declining exports.

### *Dairy*

- International demand for dairy products decreases due to the international recession. Demand for Australian products decreases further due to loss of middle eastern markets.
  - Decreasing demand for dairy products causes a decrease in the real price.
  - Increases in production efficiency do not keep pace with decreases in prices and increases in production costs causing the competitiveness of the dairy industry in the region to decrease.
- Invest in technology to improve efficiencies, reduce operating costs, maintain competitiveness, and meet government regulations.
  - Reduce production costs by increasing reliance on their own pasture base.
  - Increase business size by purchasing neighbouring properties.
  - Purchase irrigation water from NSW farmers.
  - Investigate the use of biodigesters and methane as sources of energy.
- Decrease in competitiveness of the dairy industry causes many producers to exit the industry. Those who remain cannot increase regional production to historical levels.
  - Milk production decreases 5%
  - Irrigated area decreases 10%, irrigation water use decreases 10%.

### *Horticulture*

- Free trade agreements allow importation of fruit into Australia.
  - Fire blight outbreak cripples pome fruit industry.
  - Import quarantine restrictions on pome fruit are lifted. This causes a large decrease in the real price for pome fruit.
  - Marketing of other horticultural products using a clean and green image causes a small increase in real prices.
  - Price increases of non-pome fruit production increases the competitiveness of horticultural production in the region.
- Remove and burn fire blight infected pome trees.
  - Increasingly grow short rotation fruit and vegetable crops to minimise long-term capital commitment.
  - Use increased government regulation to substantiate clean and green production credentials.
  - Develop speciality niche products and production systems catering for tourist market.
  - Purchase irrigation water from NSW farmers.
- Widespread infection of pome fruit trees with fireblight causes fruit production to decrease 75%.
  - Increases in prices for other fruit and vegetables encourage increases in production by 20%.
  - Irrigated area decreases 40% as fireblight infected pome fruit trees are removed, irrigation water use decreases 40%.

### *Livestock*

- International demand for Australian meat decreases due to loss of Middle Eastern Markets.
  - Lower demand causes a decrease in real price for meat.
  - Improvements in production efficiency ensure competitiveness remains unchanged.
- Sell water to owners of lifestyle properties to supplement income.
  - Increasingly adopt dryland production systems and seek second income off farm.
- Shortage of water reduces the production potential of the livestock industry.

- Production decreases 5%.
- Irrigated area decreases 20%, irrigation water use decreases 25%..

### *Cropping*

- Demand reduces slightly due to decreasing competitiveness of the dairy industry.
- Reducing demand causes a moderate decrease in price.
- Declining demand and prices causes competitiveness to decrease.
- Sell water temporarily to provide an income source in a time of water shortage.
- Increasingly adopt dryland production systems.
- Investigate viability of biofuel production.
- Decreasing demand for product and a shortage of water causes production to decrease 5%.
- Conversion to dryland production systems causes the irrigated area to decrease 20%.
- Irrigation water use decreases 25%.

### *Processing*

- Free trade agreements result in lower profit margins for our processing industries. Free trade agreements allow imports to increase. There is a loss of international market share and increasing production costs.
- Invest in product development to maximise returns from markets.
- Purchase raw product from lowest price producer, predominantly from overseas producers in the horticultural industry.
- Reduce expenditure on maintenance of processing facilities.
- Rationalise transport systems and improve linkages to reduce transport costs.

### *Other*

- The number and diversity of service and tourism businesses increases substantially to cater for new lifestyle residents.
- Service industries for new lifestyle residents grow rapidly.

## **Our Community and Environment**

- Communication technology improvements enable major changes in the way professional work is undertaken.
- Demand for rural living properties is high as professionals seek aesthetically pleasing locations for their home-offices.
- Owners of rural lifestyle properties seek irrigation water entitlements to maintain the aesthetics of their properties and support the few stock they keep.

- Rely heavily on central government to provide direction.

### *Water Supply Manager*

- Invest in channel automation technology to reduce labour costs and water losses.
- Increase the range of service levels, including pressurised supply, available to cater for demands of lifestyle customers.
- Introduce pricing differentials related to service levels.

### *Local Government*

- Encourage tourism and lifestyle developments to diversify economic base.
- Use government regulations to define acceptable agricultural practice and allow interspersed land uses.
- Allow decisions to be strongly influenced by lifestyle residents.

### *Catchment Manager*

- Encourage owners of rural lifestyle properties to plant native vegetation.
- Enforce government regulations relating to the environmental impact of agriculture, including management of runoff, weeds etc.

### *Communities*

- Run pro-active programs to engage new and existing residents to encourage them to contribute to debate and become involved in the community.

### *Infrastructure*

- Irrigation infrastructure is withdrawn from some areas and enhanced in other areas at the request of irrigators.
- Communication infrastructure is substantially upgraded to meet demands of lifestyle residents. High-speed wireless broadband is available throughout the region.

### *Environment*

- Environmental flow entitlements increase, however the volume of water in the river does not increase due to low water availability.
- Extent of shallow watertables decreases in broad acre agricultural areas, due to increased groundwater pumping, increased irrigation efficiency and low rainfall. Water tables in rural lifestyle areas remain high as inexperienced irrigators have low irrigation efficiency.
- Extent of soil and wetland salinisation risk decreases as watertables fall.
- Extent of native vegetation on rural lifestyle areas increases as lifestyle residents invest in environmental improvements eg planting trees.
- Pest, plant and animal management on broad acre properties decreases as agricultural industries become less profitable and landowners decrease investment in environmental improvements and protection.
- Nutrient runoff from the region decreases as irrigation efficiencies improve and manufactured fertiliser use decreases.



### *Community*

- Regional population grows strongly due to the increase in number of lifestyle residents. Youth leave the region to pursue educational and employment opportunities. Young families and retirees move into the region.
- Area of land used for lifestyle purposes increases 350%, while irrigation water use on these properties increases 150%. Lifestyle development predominantly occurs on the fringes of towns.
- Unemployment remains low in the region. The focus of employment opportunities changes toward service provision to the tourism industry and lifestyle residents.
- Available workforce increases due to new lifestyle residents.
- Diversity of community facilities is retained throughout the region as the presence of these services attracts new lifestyle residents.
- Under-planned lifestyle developments cause tension between agricultural production and lifestyle values.
- Interaction between neighbouring communities decreases because technology development and infrastructure advances result in the development of large dispersed communities.
- There is a marked decline in the influence of the agricultural community on central government.
- Voluntary groups prosper as increasing number of retirees provide time and energy.
- New lifestyle residents bring new ideas and energy to the community, increasing its vibrancy.

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## Scenario 2: New Frontiers 2020-2035

### Drivers

### Responses

### Impacts

#### Primary Drivers

##### Social, Economic, Political, Technological, Ecological Drivers

- Barrages at the mouth of the Murray River are removed. The removal has large water savings and increases salt disposal entitlements.
- Government purchase of agricultural land to provide wildlife corridors and wetlands throughout the state.
- World Trade Organisation agrees to remove all *agricultural production subsidies*.
- *Genetically modified organisms* are permitted for agricultural production.
- Technological development enables *laboratory-based food production* from basic carbohydrates.
- Internationally, affluent consumers demand high quality real food that has credence values including environmental friendly and ethical production.
- *Climate* dries further.
- Governments strengthen *regulation* on acceptable agricultural practice.
- *Oil substitution* occurs (electricity, fuel cells, biofuels). Energy costs increase slightly.

#### Our Industries

##### Overall

- Regional irrigation entitlement reduces due to significant water trade out of the region. Entitlement in the region in 2035: High reliability 550 GL, Medium reliability 0 GL
- Regional irrigation allocation reduces due to lower than average rainfall and a decrease in run-off due to bushfires. 2035 Allocations: High reliability 95%, Medium reliability 0%.
- Water tariffs increase as there is less water in the region to fund infrastructure.
- Many producers sell water on the national market. The sale allows them to leave their industry with a large superannuation.
- Sell land to government for wildlife corridors.
- Some producers develop real food production and marketing systems, which target niche affluent markets both within Australia and internationally.
- Form active industry coordination and lobby groups, who campaign for strong product labelling laws to distinguish between synthetic and real food.
- Invest in genetic modification technology to ensure a share of profits from technology is retained in the region.
- Increase mechanisation to reduce production costs.
- There is a significant decline in agricultural economic activity due to loss of markets and use of laboratory based food production.
- Most industries undergo a major contraction, while areas under cropping are maintained.
- Small and difficult to manage land parcels limit the ability of the region to respond to changes in markets and to remain competitive.

##### Dairy

- Substantial decrease in demand for real milk due to cheaper laboratory-made product.
- Small niche market for real milk exists.
- Global supply of real milk contracts as demand declines.
- Real milk commands a higher price than laboratory-made product. However, real milk price increases a small amount over time.
- Decreasing demand for real milk and increasing costs of production causes a large decrease in the competitiveness of the dairy industry.
- Adopt low cost pasture-based production systems to reduce dependence on grain and bought

in fodder.

- Form small cooperative processors to cater for niche real food and tourism markets.

- Decreasing competitiveness causes many farmers to leave the industry.
- Milk production decreases 50%.
- Irrigated area decreases 55% and irrigation water use decreases 60% as farmers sell irrigation water to other users.

### *Horticulture*

- There is a substantial decrease in demand for real fruit and vegetables due to cheaper laboratory-made products.
- Small niche markets for real fruit and vegetables exist.
- Global supply of real fruit and vegetables contracts as demand declines.
- Real fruit and vegetables command a higher price than laboratory-made product. However, the real fruit and vegetable price increases a small amount over time.
- Decreasing demand for real fruit and vegetables and increasing costs of production cause a large decrease in the competitiveness of the horticultural industry.

- Develop pick-your-own production systems to cater for tourism market.
- Invest in controlled environment production systems, such as hydroponics, to cater for market demanding high quality real food.

- Decreasing competitiveness causes many growers to leave the industry.
- Fruit and vegetable production decreases 50%.
- Irrigated area decreases 50%, while irrigation water use decreases 50%.

### *Livestock*

- There is a substantial decrease in demand for real meat due to cheaper laboratory-made products.
- Small niche market for real meat exists.
- Global supply of real meat contracts as demand declines.
- Real meat commands a higher price than the laboratory-made product, The real meat price increases a small amount over time.
- Decreasing demand for real meat and increasing costs of production cause a large decrease in competitiveness of the livestock industry.

- Increasingly use dryland production systems and reduce the intensity of production.
- Diversify production system to include increasing numbers of sheep and goats
- Develop markets to maximise return from low impact production systems.

- Decreased competitiveness causes many farmers to leave the industry.
- Production decreases 50%.
- Irrigated area decreases 50%, while irrigation water use decreases 50%.

### *Cropping*

- Demand for grain increases as a raw feedstock for synthetic food and bio-fuel.
- Global supply of grain cannot keep up with increasing demand.
- Shortage of grain causes a large increase in price.
- Price increases cause the cropping industry competitiveness to increase substantially.

- Expand production using irrigated winter cropping to maximise efficiency of water use.
- Expand significantly dryland production of grain.
- Adopt genetically modified organisms to increase yield and to provide the synthetic food production industry with the required composition.
- Produce grain for production of biofuel.

- Land parcel size and land price limits the ability of the cropping industry to achieve economies of scale in the region. Expansion of cropping occurs in other regions.
- There is no change in production.
- There is no change in irrigated area, and no change in irrigation water use.

### *Processing*

- Synthetic food technology makes existing food processing technology redundant without significant capital investment
- Sell processing facilities to multinationals.
- Invest in synthetic food production capability
- Food processing industry is maintained in the region.

## **Our Community and Environment**

- Demand for rural lifestyle properties plateaus.
- Changes in the nature of work allows increased time for recreation and leisure.

- Develop production zones for genetically modified organisms and for real food. This supports industry development and protects environmental assets.
- Government purchases land as buffer zones between production zones and environmental assets.

### *Water Supply Manager*

- Withdraw irrigation infrastructure as water moves out of district.
- Provide 'stranded' irrigators with alternative supply sources or relocation support.

### *Local Government*

- Withdraw community assets and facilities to larger centres.
- Continue to rely on government to regulate on acceptable agricultural practice to govern land use.

### *Catchment Manager*

- Manage buffer zones between production and environmental zones in conjunction with the community.
- Enforce government regulations on acceptable agricultural practice through agricultural production licenses.

### *Communities*

- Run pro-active programs to engage new and existing residents to encourage them to contribute to debate and to be involved in the community.

### *Infrastructure*

- New niche production systems create demand for year round supply of water.
- There is a large, unplanned movement of water out of the region. The movement creates a financial pressure on the remaining irrigators to pay for the infrastructure.
- Public transport services within and to the region improve and are increasingly used due to rising fuel costs.

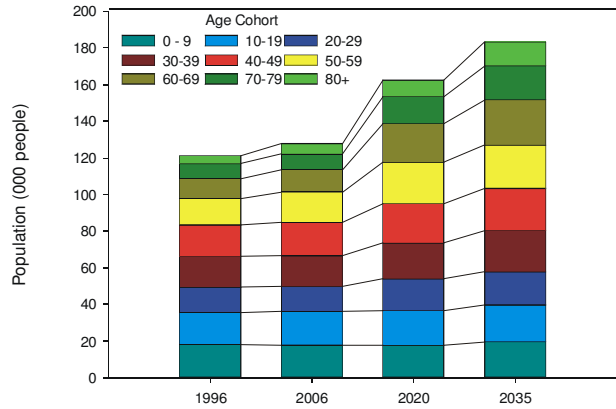
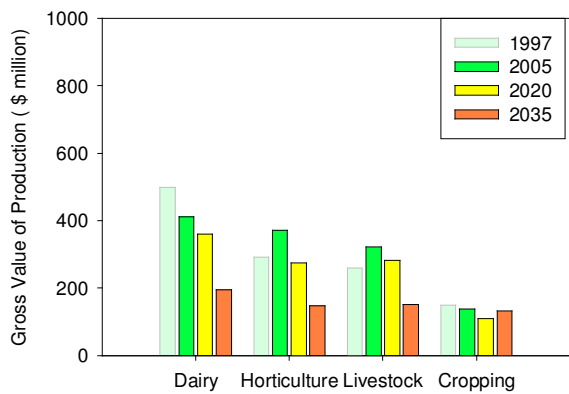
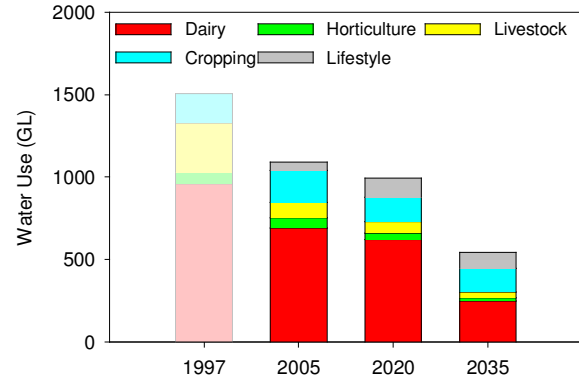
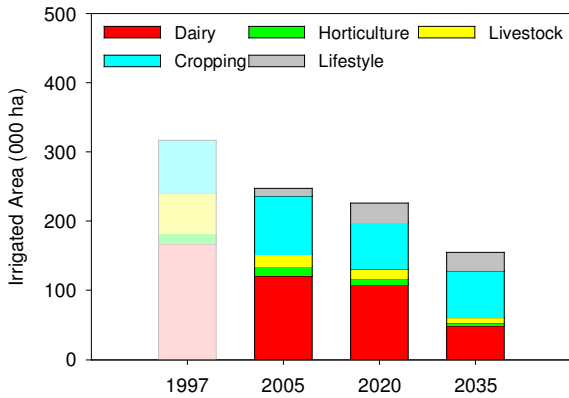
### *Environment*

- Large areas of land are reserved for environmental purposes, including flood management, biodiversity conservation and for buffer zones.
- Extent of shallow water table decreases further as irrigation area contracts due to water trade out of the region.
- Extent of problem weeds increases as land that is not irrigated and too difficult to manage for dryland cropping is less intensively managed.
- Extent of native vegetation increases as lifestyle residents on rural lifestyle properties invest in environmental protection and enhancement

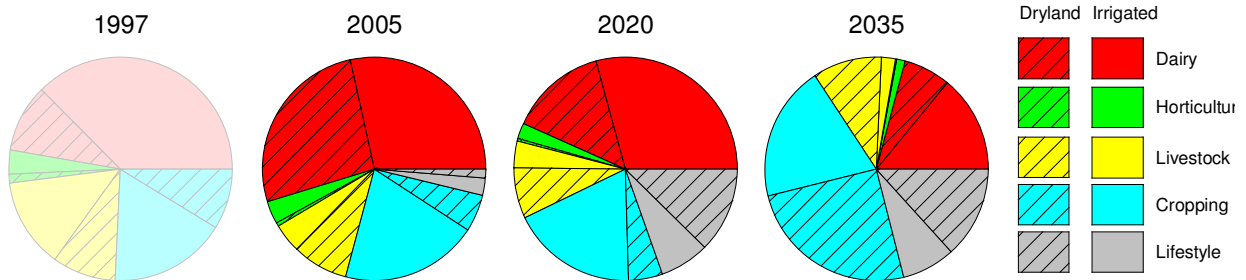
### *Community*

- Population of the region continues to increase, with growth focused along corridors surrounding major arterial roads. Young people make up a smaller proportion of the population.
- Area of land used for lifestyle purposes does not change in irrigated area, while irrigation water use decreases 20%.
- Unemployment remains low, with a large portion of the workforce employed as professionals or in service industries supporting professionals and lifestyle residents.
- Demand for low skilled labour reduces, and is replaced by demand for highly skilled labour.
- Agricultural employment is focussed on niche farms.
- Community services and facilities are retracted to major centres.
- Larger towns and increasing use of electronic communication create an increased sense of anonymity.
- Increasing leisure time creates opportunities for community activity. However, increasing regulation, particularly OHS and public liability, and the increasing size of town populations decrease the community's willingness to participate.
- Influence is expressed through interest groups, eg. fishing clubs, Landcare, etc.

## Scenario 2: Illustrative Graphs



## Land Use



## Scenario 3: Pendulum 2005-2020

Drivers	Responses	Impacts
<b>Primary Drivers</b>		
<p>Social, Economic, Political, Technological, Ecological Drivers</p> <ul style="list-style-type: none"> <li>• <i>Green ideals</i> dominate the political landscape.</li> <li>• Major government <i>water reform</i> package is announced for the purchase of 1 500 GL of irrigation water entitlement from Victoria for the environment. Government policy removes barriers to interstate water trade and reduces the third party effects of water trade.</li> <li>• Government sponsors <i>land and infrastructure restructuring</i> program, to support water reform adjustment.</li> <li>• <i>Environmental credit</i> trading markets are established.</li> <li>• <i>Climate</i> remains drier than the historical average, with increasing summer rainfall intensity.</li> <li>• <i>Energy shortages</i> cause large increases in energy costs and large demand for biofuels.</li> <li>• The government signs <i>free trade agreements</i> with the United States and ASEAN.</li> <li>• <i>Multinational corporations</i> take over Australian manufacturing operations to benefit from free trade agreements.</li> <li>• <i>Genetically modified organisms</i> are prohibited for agriculture in Australia.</li> <li>• Large increases in <i>interest rates</i> cause a decline in demand for rural living properties.</li> <li>• Rural communities increasingly resent ill-informed attitudes of urban communities.</li> </ul>		
<b>Our Industries</b>		
<p><i>Overall</i></p> <ul style="list-style-type: none"> <li>• Regional irrigation entitlement is reduced due to government purchase of water. Entitlement in the remaining region in 2020: High reliability 828 GL, Medium reliability 0 GL</li> <li>• Regional irrigation allocation is reduced due to lower rainfall. 2020 Allocations: High reliability 100%, Medium reliability 0%</li> <li>• Water tariffs remain constant as infrastructure is restructured to reduce maintenance costs.</li> </ul> <ul style="list-style-type: none"> <li>• Improve risk management particularly toward water. This includes using shorter crop rotations, adopting water saving technology and planning for variation in water supply.</li> <li>• Take a more flexible approach to asset and land management.</li> <li>• Encourage new entrants to diversify product base. These new entrants bring new ideas and, new bring business practices.</li> <li>• Hold industry focussed public forums for strategic planning and identifying change.</li> <li>• Many farmers take the opportunity offered through government water purchases and land restructuring to leave farming.</li> <li>• Dryland farms generate income by planting native vegetation for carbon credits.</li> </ul> <ul style="list-style-type: none"> <li>• Confidence in agricultural production decreases.</li> <li>• Many irrigators have a large influx of capital through the sale of water to the government.</li> </ul>		
<p><i>Dairy</i></p> <ul style="list-style-type: none"> <li>• Demand for dairy products in Asian markets grow.</li> <li>• International production cannot keep pace with increasing demand, resulting in a small increase in the real price for dairy products.</li> <li>• Increases in production costs cause the competitiveness of dairy production in the region to remain constant.</li> </ul> <ul style="list-style-type: none"> <li>• Decrease dependence on irrigation water through more efficient water use and increasing use of brought in feed.</li> <li>• Strengthen marketing capability.</li> <li>• Increase the value of product by developing differentiated products and protecting intellectual property.</li> </ul>		

- Secure long term supply contracts for reliability of price and supply.
- Number of dairy farms decreases.
- Milk production remains constant because of the availability of water for the dairy industry.
- The cropping industry produces grain, which is used by the dairy industry.
- Area of dairy farm land remains constant as the remaining dairy farms expand their land holdings.
- Irrigated area decreases 5%, and irrigation water use decreases 5%, as very few dairy farmers sell irrigation water to the government.

### *Horticulture*

- Free trade agreements allow importation of fruit into Australia.
- Imported fruit, particularly for processing, is cheaper than locally grown product.
- Production costs continue to increase causing a decrease in the competitiveness of horticultural production in the region.
- Increase production of vegetables.
- Focus on production for the domestic market.
- Growers increase specialisation and produce fewer types and varieties of fruit.
- Invest in product development to differentiate export products.
- Fruit production decreases 30%, due to lack of competitiveness of the industry.
- There is a growth of new industries with controlled environment systems for QA, requiring year round access to water.
- Irrigated area decreases 20% as non-competitive fruit trees are removed, while irrigation water use decreases 20%.

### *Livestock*

- As Asian countries become more affluent, global demand for meat increases.
- Increasing global production does not match increasing demand, resulting in a small increase in real price.
- Increases in production costs are equal to price increases, resulting in the competitiveness of livestock production to remain constant.
- Strengthen export markets by increasing diversity of production, eg goat meat.
- Attract a fish and sea food industry supplying the domestic market.
- Production decreases 60% due to the reduction in water entitlement.
- There is no change in land area as farming systems convert to dryland production.
- Irrigated area decreases 60% and irrigation water use decreases 60%, as water is sold to government.

### *Cropping*

- The cropping industry remains dependent on the dairy industry. However, demand for grain as a feedstock for bio-fuel production increases.
- Increasing demand from both the dairy and energy industries causes a small increase in real price.
- Increases in price are greater than increases in production costs, ensuring increasing competitiveness of the cropping industry in the region.
- Concentrate on fodder production to support the local dairy industry.
- Specialisation of production and harvest systems to link with dairy industry needs.
- Production decreases 60% due to the reduction in water entitlement.
- Land area increases 15%, taking over former horticultural and lifestyle properties.



- Irrigated area decreases 60% and irrigation water use decreases 60%.

### *Processing*

- Decreasing availability of raw products reduces the ability of processing facilities to maintain economic utilisation.
- Multinational processors rationalise processing facilities.
- Invest in product development and differentiation through small-scale cooperatives.
- Large multinational processors show less commitment to production in the region.

### *Other*

- Water trading and speculation industries emerge as water becomes scarce.

## **Our Community and Environment**

- Rise in interest rates decreases the demand for lifestyle properties in the region.

- Land restructuring program, using land resumption and auction, involves local government, water authority and catchment management authority. The program redefines irrigation areas using land use principles - Losers are compensated.
- Build the capacity of the regional community to engage in strategic planning, thereby providing opportunities and developing skills within the community.
- Encourage new business investment in the region.

### *Water Supply Manager*

- Promote realistic reliability of water supply.
- Further discriminate water costs, identifying differential costs to individual properties.
- Provide different levels of service for different costs.
- Rationalise distribution infrastructure in conjunction with government purchase of irrigation water and land restructuring, The process encourages the movement of water away from less productive areas.
- Improve management of the total water resource; and give consideration to interactions between surface and groundwater.

### *Local Government*

- Strengthen and enforce planning zones, which define agricultural production zones and concentrate hobby farm development around towns.
- Develop long-term strategic plans that have community ownership.

### *Catchment Manager*

- Lead the process to identify zones for alternative land use, eg environmental and tourism purposes.
- Encourage the planting of indigenous vegetation for carbon credits.

### *Communities*

- Increase communication between community groups and regional agencies through community group leaders engaging with each other.
- Lobby political parties and the urban community to return water to agriculture to rebuild the rural economy.

### *Infrastructure*

- Irrigation infrastructure contracts significantly, reducing water distribution costs.
- Goulburn Valley Highway duplication is not completed.
- Rail services to the region improve resulting in the availability of high frequency and high speed passenger and freight services.

### *Environment*

- Extent of shallow watertables decreases considerably across the region due to improved irrigation efficiency.
- Extent of soil and wetland salinisation risk decreases as watertables fall, decreasing the need for salt disposal from the region.
- Environmental flow entitlement increases considerably, due to a government buy back of irrigation entitlements. The increased environmental flow entitlement results in small improvements to river health, particularly on the vegetation on the flood plain and native fish and bird populations.
- Quality of water in the Murray River improves due to decreased salt disposal and increased environmental flows.
- Land amalgamation program ensures properties remain a viable size and pest plants and animals are adequately managed.
- Large areas of the region are revegetated resulting in corridors linking many remnant vegetation stands.

### *Community*

- Population growth in the region slows as people seek employment and education elsewhere. Population of young people decreases, while retirees are less inclined to leave the region.
- Area of land used for lifestyle purposes decreases 50%, while irrigation water use on these properties decreases 90%.
- Unemployment in the region increases due to a decline in agricultural, processing and service industries.
- Small towns in the region decline rapidly as farms become larger and the rural population and workforce reduce.
- Animosity exists between those who sell water to government and those who do not.
- Voluntary activity in the region declines as population growth slows and the population ages.

-

## Scenario 3: Pendulum 2020-2035

Drivers	Responses	Impacts
<b>Primary Drivers</b>		
<p>Social, Economic, Political, Technological, Ecological Drivers</p> <ul style="list-style-type: none"> <li>• <i>Water resources management</i> becomes a federal responsibility.</li> <li>• Conservative federal government perceives that <i>environmental flows</i> are not worth the economic cost and reallocates water to economic use. 3000GL of <i>water is auctioned</i> in the Murray basin. Most of the water is purchased for agricultural and tourism businesses.</li> <li>• <i>The Government rebuilds and rehabilitates Irrigation infrastructure</i> in partnership with irrigator-owned water distribution companies.</li> <li>• <i>Climate</i> returns to a wet period with several seasons of above average rainfall and frequent floods.</li> <li>• China floats its <i>currency</i>, which strengthens against the Australian dollar. The stronger Chinese currency increases the attractiveness of Australian agricultural products.</li> <li>• Australia retains a ban on the use of <i>genetically modified organisms</i> in agricultural production.</li> <li>• Internationally, <i>consumer concern</i> arises over the possible human health side effects of genetically modified foods.</li> </ul>		
<b>Our Industries</b>		
<p><i>Overall</i></p> <ul style="list-style-type: none"> <li>• Regional irrigation entitlement increases due to the government auction of water. Entitlement in the remaining region in 2035: High reliability 1160 GL, Medium reliability 276 GL</li> <li>• Regional irrigation allocation increases considerably because of above average rainfall. 2035 Allocations: High reliability 100%, Medium reliability 100%.</li> <li>• Water tariffs increase to fund the expansion of the irrigation system.</li> </ul> <ul style="list-style-type: none"> <li>• Number of boutique providers with direct customer outlets increases to reduce the influence of multinational companies.</li> <li>• Seek capital investment from superannuation funds and private investors to expand and develop businesses.</li> </ul> <ul style="list-style-type: none"> <li>• Regional economy booms as investment in agriculture and irrigation infrastructure expands rapidly.</li> </ul>		
<p><i>Dairy</i></p> <ul style="list-style-type: none"> <li>• Demand from Asian markets grows as their populations become more affluent.</li> <li>• Increasing demand for dairy products is not met by increases in global production. This causes international prices to increase. A Decrease in the value of the Australian dollar and genetically modified free status causes a large increase in the real price for dairy products in Australia.</li> <li>• Rises in price increase the competitiveness of dairy production in the region.</li> </ul> <ul style="list-style-type: none"> <li>• Multinationals control brands.</li> <li>• The number of boutique cheese factories increases.</li> <li>• There is an expansion using pasture base to minimise capital outlay.</li> </ul> <ul style="list-style-type: none"> <li>• Milk production increases 40%.</li> <li>• Land area increases 10%.</li> <li>• Irrigated area increases 30%, while irrigation water use increases 50% .</li> </ul>		

### *Horticulture*

- Demand from China and India grows as their populations become more affluent and the Chinese currency strengthens.
  - Increasing demand for horticultural product is not met by increases in global production.
  - Decrease in the value of the Australian dollar and the genetically modified free status causes a large increase in the real price for horticultural products.
  - Price increases are greater than increases in production costs, increasing the competitiveness of the horticultural industry.
- Boutique pick your own industry emerges
  - Use of hydroponics increases.
  - There is a reluctance to invest in volatile market
- Production increases 100%.
  - Irrigated area increases 100% and irrigation water use increases 100%.

### *Livestock*

- Global demand for meat increases.
  - Increasing global demand is matched by increasing production. Genetically modified free status ensures a small increase in real price.
  - Price increases are greater than increases in production costs. As a result the competitiveness of livestock production in the region increases.
- There is an increased use of feedlots.
  - Large numbers of high quality replacement stock are bred using selective breeding from the high quality GM free gene pool.
  - Australia's quarantine status is maintained.
  - Fish and seafood production emerges.
- Production increases 200%.
  - Irrigated area increases 300%, and irrigation water use increases 150%.

### *Cropping*

- There is a small increase in demand as demand for grain for biofuel production increases, though demand for grain for the dairy industry declines due to increasing availability of irrigation water.
  - There is a small increase in price due to increasing demand.
  - Increase in price is equivalent to increases in production costs leaving the competitiveness of the cropping industry unchanged.
- The industry diversifies.
  - Grain is produced for biofuels – biodiesel and ethanol.
  - High protein, high quality grain is produced for human consumption
  - Stockfeed production remains an important part of business.
- Production increases 300%.
  - Irrigated area increases 150%, and irrigation water use increases 200%.

### *Processing*

- Genetic modification free status and the lower value of the Australian dollar increases the value of locally processed product.
- Control of processing facilities by multinational companies increases.
  - Invest in upgrading processing facilities to maximise benefits of expanding opportunities.

## Our Community and Environment

- Demand for rural living properties does not increase

### *Water Supply Manager*

- Manage remaining irrigation infrastructure in competition with irrigator-owned cooperatives
- Infrastructure expansion is planned, focusing on land suitability for irrigation development.

### *Local Government*

- Encourage urban development on town fringes away from production zones.

### *Catchment Manager*

- Enforce environmental controls on expanding irrigation areas.
- Provide advice on drainage to new developments but provide no financial support.

### *Infrastructure*

- There is an expansion of privately owned irrigation infrastructure

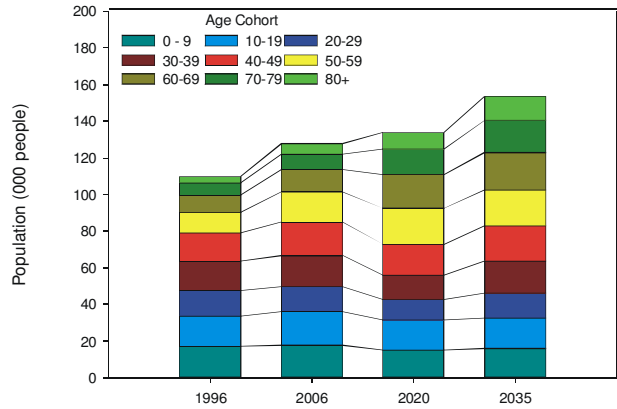
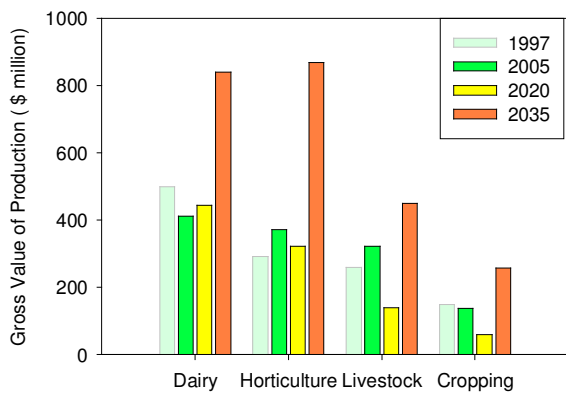
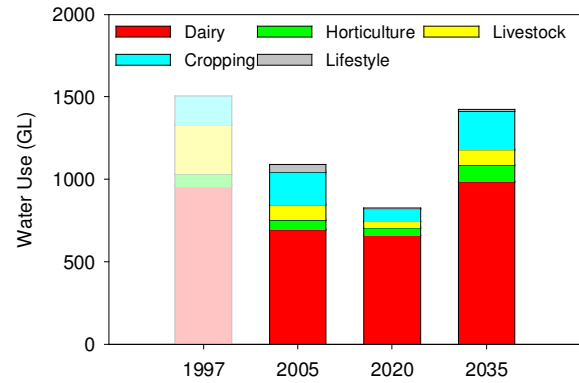
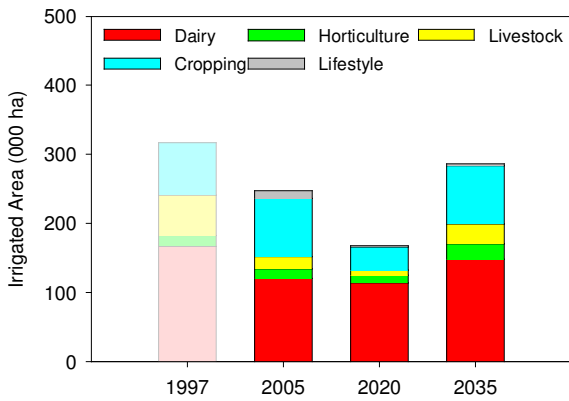
### *Environment*

- Extent of shallow water tables increases due to increasing availability of irrigation water and above average rainfall.
- Water logging and salinity problems emerge as the area affected by shallow water tables increases.
- Above average rainfall causes river flows to remain high, and flooding occurs.
- Riparian vegetation thrives.
- Large areas of the region are revegetated resulting in corridors linking many remnant vegetation stands. Native fauna species colonise revegetated areas, as do introduced pests.

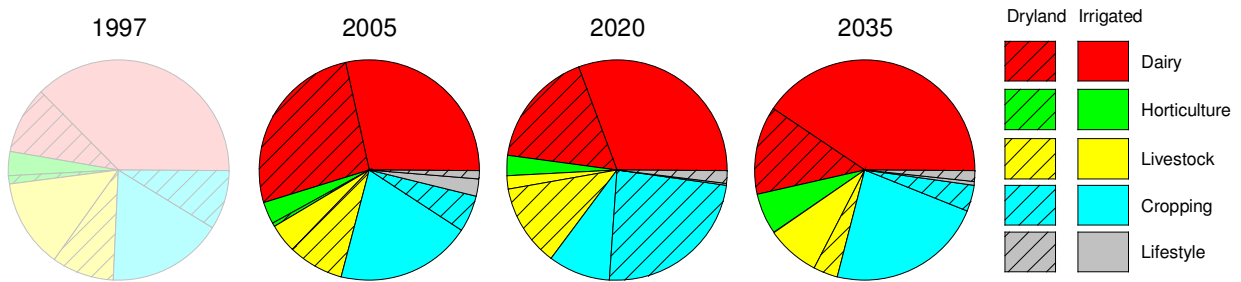
### *Community*

- The region's population grows strongly as the improving prospects for agriculture attract to the region migrants who are seeking employment.
- Area of land used for lifestyle purposes does not change. Irrigation water use on these properties increases 1000%, but remains a very small proportion of the total available water.
- Unemployment is low and labour shortages exist in many fields.
- Large expansion of housing developments around the fringes of larger towns.

### Scenario 3: Illustrative Graphs



### Land Use



## Scenario 4: Drying Up 2005-2020

### Drivers

### Responses

### Impacts

Impacts described in the first period of Scenario 4 are at 2017

#### Primary Drivers

##### Social, Economic, Political, Technological, Ecological Drivers

- Free trade agreements are signed with the USA and ASEAN.
- *Genetically modified organisms* are prohibited for food production.
- Financial crisis in the USA causes a *recession* between 2009 and 2012. The USA dries up as a market.
- The value of the *US dollar depreciates*, increasing the value of the Australian dollar.
- National *unemployment increases* as Australian industry becomes less competitive.
- *Severe drought* conditions occur between 2012 and 2020.
- China begins to *export high value horticultural products* and import lower value bulk commodities.
- Political will exists to *support communities* experiencing extreme hardship.
- *Egalitarianism* decreases across the wider community, but adverse conditions draw *local communities together*.

#### Our Industries

##### Overall

- Regional irrigation entitlement reduces slightly, due to water traded out of the region. Entitlement remaining in the region in 2020: High reliability 995 GL, Medium reliability 550 GL
- Regional irrigation allocation is reduced considerably by prolonged drought. Lowest allocation is received in 2017: High reliability 30%, Medium reliability 0%. Rain returns to restore 2020 allocations to: High reliability 100%, Medium reliability 0%.
- Urban water authorities purchase temporary water from irrigators to supplement supplies.
- The Essential Services Commission maintains water tariffs constant.
- Scale back production to manage reduced availability of water, becoming highly efficient.
- Drought and adverse market conditions cause many farmers to leave the industry. Some farmers leave voluntarily and some are forced to leave by banks foreclosing.
- Lobby federal and state governments for drought assistance.
- Hold industry forums to boost industry confidence and to share knowledge of how to cope with adverse conditions.
- Seek alternative income sources including off farm income.
- Sell assets to pay the bills.
- Pump large quantities of groundwater to supplement water supply.
- Focus on short term survival, creating a dynamic and aggressive business environment.
- Trade in properties increases
- All agricultural enterprises and the regional economy are decimated due to loss of international markets coupled with prolonged drought.
- Farmers, particularly those on small blocks, sell water as they become less viable. Then they sell land, which now has little value, generally to lifestylers, thereby decreasing the effectiveness of agriculture.

##### Dairy

- Global demand for dairy products declines.
- Decline in the value of the US dollar increases competitiveness of US producers enabling them to increase production and dominate the international markets.

- Decreasing demand and increasing production in the US causes a small decrease in the price for dairy products.
- Decreasing global demand and lower prices causes a decrease in the competitiveness of dairy production in the region.
- Scale back production systems to minimise production costs.
- Rely on irrigated fodder crops rather than imported feed to maintain breeding stock.
- Purchase water to irrigate fodder crops.
- Some farms sell off excess cows to abattoirs to supplement income.
- Small properties sell water and go into hibernation mode.
- Number of dairy farms decreases considerably.
- Milk production decreases 50%.
- Irrigated area decreases 65% and irrigation water use decreases 65%.

### *Horticulture*

- Global demand for horticultural produce remains largely steady, although consumers tend to purchase lowest cost product.
- Global supply increases as China begins to export horticultural products and US producers become more competitive on the global market.
- Increasing global supply causes a moderate decrease in the global price for horticultural products.
- Increasing production costs and lower global prices cause a large decrease in the competitiveness of the horticultural industry in the region, particularly in export focussed industries.
- Focus on producing fresh fruit and vegetables for local markets.
- Remove varieties grown primarily for the processing industry, as they are unable to compete with production in China.
- Purchase water to ensure orchards survive dry conditions.
- Production decreases 50% due to lack of competitiveness and drought.
- Irrigated area decreases 50%, and irrigation water use decreases 50%.

### *Livestock*

- Global demand for meat remains strong.
- US producers become increasingly competitive on the global market and increase their production.
- Global prices remain constant but the increasing value of the Australian dollar causes a small decrease in the price of meat in Australia.
- Lower meat prices cause the competitiveness of livestock industries in the region to decrease.
- Move to dryland and intensive production systems and seek off farm income.
- Sell water to provide income.
- Production decreases 70%.
- Irrigated area decreases 95%, and irrigation water use decreases 95%.

### *Cropping*

- Decreasing fortunes of the dairy industry cause a decrease in demand for grain and fodder in the region.
- Grain and fodder supplies, and hence prices, are highly dependent on seasonal conditions. Drought conditions cause large increases in prices.
- Decreasing demand and increasing production costs causes the competitiveness of the cropping industry in the region to decrease.



- Move to dryland production systems and seek off farm income.
- Lease land from dairy and livestock producers to grow grain and fodder.
- Sell water to provide income.
- Grow grain for the production of biofuel.

- Production decreases 70%.
- Irrigated area decreases 95%, and irrigation water use decreases 95%.

### *Processing*

- International market conditions place pressure on the profitability of processing.
- Dry conditions reduce the availability of raw product for processing.
- Rationalise facilities.
- Provide support in sourcing farm inputs, eg water and fodder, for suppliers at low cost.
- Import raw product from overseas to enable processing plants to continue operating.
- One export-oriented processor for each industry remains in the region.

### *Other*

- Decline in service industries due to little primary production to sustain them.

## **Our Community and Environment**

### *Water Supply Manager*

- As the drought begins to reduce the profitability of agriculture, a moratorium is declared on water tariffs.
- Reduce asset maintenance as income and water use decrease.

### *Local Government*

- Provide rate relief.
- Organise community activities to boost morale

### *Catchment Manager*

- Restrict water related recreational activities to minimise damage to ecosystems and to minimise the chances for human injury to occur.

### *Communities*

- Lobby all governments to provide direction and support for agricultural industries.

### *Infrastructure*

- There is major community discontent over water fees paid during the drought.
- GMW loses a major part of its income and receives a cash injection from the government to continue.
- Infrastructure declines markedly due to a lack of maintenance and investment.

### *Environment*

- Drought conditions cause the extent of watertables in the region to decline substantially.
- Tributaries of the Goulburn River dry up completely.
- Minimum environmental flow is not delivered in 2016 and 2017 resulting in a substantial decline in fish numbers.
- Increases in the frequency of bushfires in the region are caused by drought conditions.
- Native aquatic bird numbers decline due to long-term lower river levels restricting breeding.
- Prevalence of weeds increases due to decreased ability of farmers to afford to manage them.

### *Community*

- Population remains stable in the region as people seek employment elsewhere.
- Area of land used for lifestyle purposes increases 150% as small agricultural land parcels become more affordable than houses in urban areas. Irrigation water use on these properties decreases 95%.
- Drought causes high unemployment in the region, and people who remain in the region are prepared to accept any employment to 'stay alive'.
- Technology developments increase unemployment in service and processing industries.
- Social divisions occur between those with wealth, employment etc and those without.
- Interpersonal skills decline due to increased use of technology.
- Small communities draw together to help each other.
- Tensions continue to exist over land use values.
- Local community groups work together and encourage participation in community activities to give support and boost morale.
- Influence of the rural community on government increases as the evidence of rural hardship becomes more prominent.

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## Scenario 4: Drying Up 2020-2035

### Drivers

### Responses

### Impacts

#### Primary Drivers

##### Social, Economic, Political, Technological, Ecological Drivers

- *Global economy* experiences a period of extended growth following the US recession, with a more even balance of wealth across the globe. Affluence of many Asian and South American countries increases.
- Improvements to the global economy enable the World Trade Organisation to agree to remove all *agricultural production subsidies*.
- International and domestic *consumers demand* for health and natural foods.
- Australian ban on *genetically modified organisms* is a marketing advantage.
- *Governments are assisting* rural communities and provide support to accelerate the growth of agricultural production. In order to access international markets there is a strong focus on health food, environmental sustainability and animal welfare.
- Environmental water allocation is maintained.
- *Climate* is slightly wetter than the long-term average.

#### Our Industries

##### Overall

- Regional irrigation entitlement reduces slightly due to water trading out of the region. Entitlement remaining in the region in 2035: High reliability 995 GL, Medium reliability 550 GL
- Regional irrigation allocation is reduced considerably by prolonged drought. 2035 allocations: High reliability 100%, Medium reliability 25%.
- Water tariffs increase at the inflation rate.
- Attract private sector investment, eg superannuation funds, on the expectation of long term growth and profitability in the agricultural sector.
- Maintain attitudes toward efficiency of water use as people are reluctant to return to wasteful practices.
- Having experienced financial hardship, our industries manage expenditure very carefully.
- Increase flexibility and just-in-time delivery.
- Increasingly use robotics to minimise labour requirements.
- Import guest workers to undertake manual tasks.
- Regional economy booms as irrigated agriculture expands due to increasing availability of water and the government providing assistance to agriculture.
- Limited land restructuring during drought constrains growth.
- Disposable incomes increase in the region.
- International interdependence on industries increases as a result of changing social structures and real-time feed back from global customer base.

##### Dairy

- Global demand for dairy products increases as consumers become increasingly affluent.
- Increases in global supply of dairy products do not keep up with increasing demand.
- Global shortage of dairy products and genetically modified free status cause a moderate increase in the price for Australian dairy products.
- Increasing prices increase the competitiveness of dairy production in the region.
- Slowly increase production and carefully manage business risks.
- Lease and purchase additional land to expand production
- Farms minimise capital investment, due to low availability of capital and reluctance of private investors to invest in dairy production.

- Milk production increases 90%.
- Irrigated area increases 150%, and irrigation water use increases 200%.

### *Horticulture*

- Global demand for horticultural products increases, as consumers become increasingly affluent.
  - Increases in global supply of horticultural products do not keep up with increasing demand.
  - Global shortage of horticultural products and genetically modified free status cause a moderate increase in the price for Australian horticultural products.
  - Price rises increase the competitiveness of horticultural production in the region.
- New investment in the region occurs on greenfield sites in the mid and upper catchment areas adjacent to waterways.
  - Small properties on margins of towns become lifestyle and niche farms.
- Production increases 200%.
  - Irrigated area increases 200% and irrigation water use increases 200%.

### *Livestock*

- Global demand for meat products increases as consumers become increasingly affluent.
  - Increases in global supply of meat products do not keep up with increasing demand.
  - Global shortage of meat products and genetically modified free status cause a moderate increase in the price for Australian meat products.
  - Increasing prices increase the competitiveness of meat production in the region.
- Attract new private investment and rapidly expand production.
  - Expand free range production on irrigated pastures.
  - Continue development of feedlots, using private investment, for the export market.
- Production increases 700%.
  - Irrigated area increases and water use increases 1900%.

### *Cropping*

- Demand for grain and fodder increases as the dairy industry expands and international markets seek grain that is free of genetic modification.
  - Genetically modified free status causes a moderate increase in the price for Australian grain products.
  - Price rises increase the competitiveness of the cropping industry in the region.
- Develop international markets for grain free of genetic modification.
  - Use local genetics to develop high protein legumes and grains for expanding markets in Asia and South America.
  - Increase use of summer cropping to meet market demands.
- Production increases 240%.
  - Irrigated area increases 1000%, and water use increases 1900%.

### *Processing*

- Demand for processed product increases as does the availability of raw product for processing.
- Invest in developing and rehabilitating processing capability.
  - Use technology to build linkages between consumers and producers, eg microdots in packaging that contain product history and scope for feedback to producers and processors.

- Develop products tailored to newly affluent countries.

## **Our Community and Environment**

- Government support for agricultural development limits development of rural residential properties.
- Demand for rural residential properties rapidly declines as the economy improves and employment in the cities becomes more attractive.

- Selection of greenfield sites, land parcel restructuring and local government zoning is based on soils and access to infrastructure.
- Facilitate and support the importation of guest workers to fill a shortage of manual labour.

### *Water Supply Manager*

- Invests in rehabilitating degraded infrastructure and developing greenfield sites.

### *Local Government*

- Initiate strong land use planning to assist the redevelopment of agriculture.
- Encourages consolidation of lifestyle properties around town margins.

### *Catchment Manager*

- Conservation and environmental improvement works are undertaken to enhance the market advantage of the areas genetic modification free status.

### *Infrastructure*

- Rapid increase in the area irrigated and the volume of water that is being delivered.
- Delivery system follows the existing infrastructure pattern.

### *Environment*

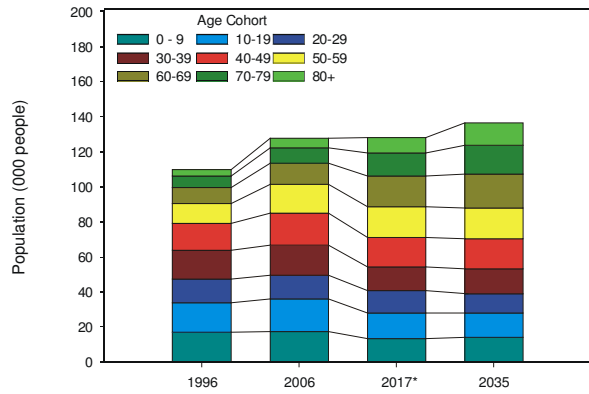
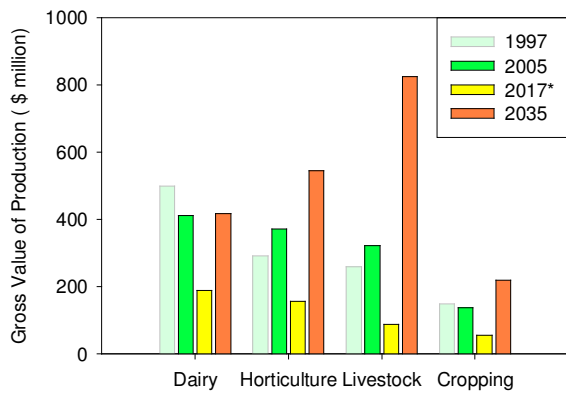
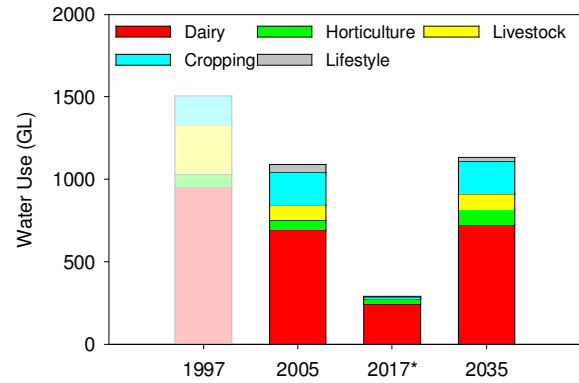
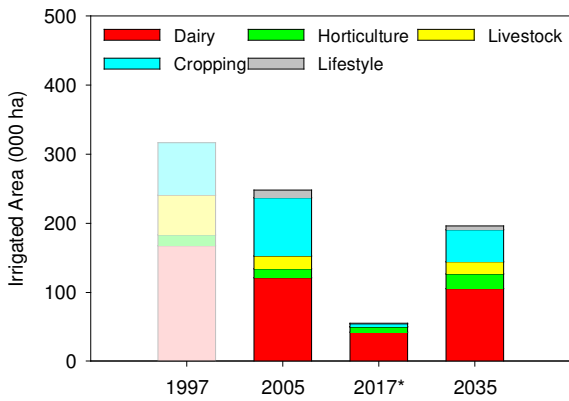
- Flows in the Murray and Goulburn Rivers increase due to a wetter climate.
- Wetter climate and increasing availability of irrigation water causes the extent of shallow water tables to increase.
- Extent of soil and wetland salinisation risk increases as the area of shallow water table increases.
- Improving prosperity of agricultural production results in investment in improved land and environmental management. The investment in improved land and environmental management decreases the extent of pest plants and animals.
- Increasing the intensity of production systems reducing the need for land for agriculture. This results in an increase in land available for biodiversity.

### *Community*

- Population growth in the region slows. The population and the proportion of young people in the region decreases.
- Area of land used for lifestyle purposes remains stable, whilst the irrigated area and irrigation water use both increase 1000%. However, the overall volume of water used for lifestyle purposes remains relatively small.
- Labour is in short supply and unemployment is low. Employment opportunities in the service industries increase substantially.
- Technology developments cause a new set of social skills and culture.
- Face to face communication decreases due to technology improvements.
- Community influence is exerted through electronic means.
- Generation Y look to maximise their own individual comfort and therefore are unwilling to contribute to community activity.

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## Scenario 4: Illustrative Graphs



## Land Use

