

IRRIGATION FUTURES OF THE GOULBURN BROKEN CATCHMENT



Milestone 4 Attachment Scenarios and Implications June 2006

**Primary Industries Research Victoria (PIRVic) - Tatura
Department of Primary Industries**

in collaboration with

**Community Engagement Network
Department of Sustainability and Environment**



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1. Introduction

Project Overview

Irrigation is a fundamental driver of the regional economy in the Goulburn Broken catchment. The regional farm-gate gross value of production from irrigated agriculture in 2000 was \$1.35 billion. Investment in on-farm and processing infrastructure is about \$100 million per annum.

However, irrigation is facing enormous challenges. As one of the oldest gravity irrigation systems in Australia, Goulburn-Murray Water's irrigation system needs substantial renewal in the next 20 years. Initiatives to increase environmental flows and potential climate changes will have major impacts on the amount of water available for irrigation. In addition, there are increasingly stringent demands for natural resources management to meet social, economic, environmental and cultural outcomes. It is obvious that the region will have to prepare for the future, if it wishes to remain prosperous.

Project Objectives

The Goulburn Broken Irrigation Futures project has been established to assist the regional community to plan for the future. It is a regional initiative, funded by the Goulburn Broken CMA (GBCMA), National Action Plan for Salinity and Water Quality (NAP), Goulburn-Murray Water (G-MW), Department of Primary Industries (DPI), Department of Sustainability and Environment (DSE), and Land and Water Australia (LWA).

The objectives of the project are to:

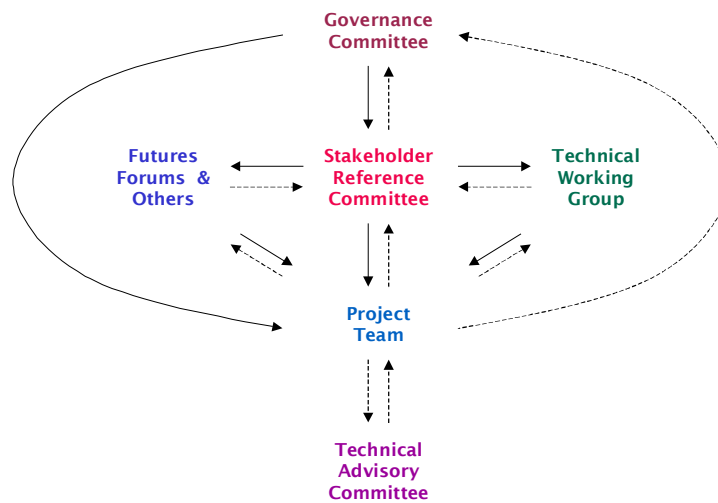
- Facilitate key stakeholders to develop a shared vision for the future of irrigation in the Goulburn Broken catchment over the next 30 years, and to identify scenarios of major constraints and opportunities and of regional response options.
- Understand the social, economic and environmental consequences of various scenarios through impact assessment that integrates the best available knowledge.
- Facilitate key stakeholders to build consensus on preferred regional options for future irrigation, and recommend regional follow-up actions.
- Develop a methodology that can be applied elsewhere in Australia for sustainable irrigation planning at a catchment scale.

Timetable

Project Stage	Timeframe
Stage 1: Project development	Jun 2003 – Dec 2003
Stage 2: Vision, scenarios and options	Jan 2004 – Dec 2004
Stage 3: Assessment of consequences	Jan 2005 – Jun 2006
Stage 4: Enabling changes	July 2006 – Jun 2007

Organisation

Project organisation, and the roles of each of the project organisational groups, are given below.



Project organisation

Roles of project organisational groups

Organisational Group	Key Roles
Governance Committee (GC)	Set broad directions Review project progress and performance Make investment decisions
Stakeholder Reference Committee (SRC)	Provide guidance on processes for wider stakeholder participation Consolidate ideas from wider stakeholders Generate confidence in the regional community
Futures Forums and Others	Provide input from the community and other key stakeholders, including contributing ideas on values and aspirations, future scenarios and regional response options.
Technical Working Group	Further develop details of ideas generated by Futures Forums Contribute knowledge and expertise to the assessment process.
Project Team	Facilitate the stakeholder participation process Provide scientific input.
Technical Advisory Committee	Provide expert advice as required

Stage 2 - Vision, Scenarios and Options

Stage 2 used an extensive program of stakeholder engagement to capture perspectives on the visions, external scenarios and response options.

About 120 stakeholders participated in a series of 4 full-day workshops held throughout the region (Echuca, Kyabram, Shepparton, Cobram, Benalla and Seymour). A diverse range of stakeholders were involved to ensure a wide spectrum of views were captured. Stakeholders included primary producers, major processors, business and community groups, local government and agencies responsible for land and water management. Input from women and young people was specifically targeted.

The outputs from the engagement process have been synthesised and documented (Output & Recommendations from the Stage 2 Community Engagement). The output from Stage 2 includes:

- Aspirations for irrigated agriculture in the region, (See Section 2)
- Four external scenarios describing alternative sets of the challenges and opportunities that the region may have to face during the next 30 years, and
- A suite of regional strategies for dealing with those challenges and opportunities.

These outputs were distributed to regional agencies and interest groups. They provide an important resource for future planning within the region.

Stage 3 - Assessment of Scenario Implications

Stage 3 involved conducting a detailed assessment of how the region would manage the alternative scenarios developed in Stage 2. The assessment considered:

- The responses of individuals, businesses, groups and organisations to the challenges and opportunities within the four scenarios developed in Stage 2,
- The likely consequences of the external scenarios and region's responses for the economic, community and environmental wellbeing of the region,
- The broad implications of the scenarios for the region and strategies to address these implications, and
- Specific implications of the scenarios for individual organisations and groups.

Stage 4 - Enabling Changes

Stage 4 will involve assisting regional organisations and groups build the learning from the project into their business and strategic plans. Three levels of output will be produced from the overall project:

- Four full scenarios describing the evolution of plausible alternative futures for the regions,
- Broad implications of the scenarios for the region describing the major strengths and weaknesses of the region, opportunities and challenges the region may face and regional strategies to realise the opportunities and manage the challenges, and
- Implications of the scenarios for specific issues that will involve in-depth analysis of particular issues and tailoring recommendations to individual organisations in the region.

The main activities of Stage 4 will be to communicate the full scenarios and broad implications widely throughout the region and to work with individual organisations and groups to develop the implications for specific issues.

About This Document

This document includes a summary of the Irrigation Futures Forum Aspirations and a snapshot of irrigation in the Goulburn-Broken Region. It gives a summary of the Stage 3 process and outputs of the Irrigation Futures project. Section 2 describes the methods and processes used for the assessment of the scenarios and the investigation of the implications of the scenarios. Sections 5 to 7 and Appendix 1 contain the outputs of the assessment of the scenarios and their implications including

- Four Scenarios describing plausible futures of irrigation in the region: the evolution of interplay between external operating environments, regional responses, and regional consequences,
- Broad implications of the scenarios for the region and strategies, and
- Specific implications of the scenarios for irrigation infrastructure planning.

The document also includes a list of the communication activities undertaken by the project team between July 2005 and June 2006 (Section 8).

2. A Summary of the Irrigation Futures Forum Aspirations

In 2035 we want the community of the Goulburn Broken Catchment to be:

- Seen as a world leader in food production (clean and green, export markets, growth)
- Efficient users of water, and have appropriate water distribution systems
- Recognised and valued as stewards of the land (proud to be farmers/irrigators, recognised for contribution to economy and community, keep natural resource condition in good shape for future generations)
- Achieving a balance between environmental, social and economic demands (industry exists in harmony with environment and community)
- A vibrant, prosperous (businesses, region, employment, eco/ag tourism, service industries) and diverse community
- A great place to live (community well-being, social networks, well-serviced, appropriate/maintained infrastructure, amenities)
- Happy people who have time for leisure
- Creating all kinds of opportunities for all (in particular young people and new farmers)
- Embracing new and existing technology
- Investing in the environment (biodiversity, healthy rivers, native vegetation, etc.)
- Continuing to have access to water resources for irrigation
- Planning strategically and making collaborative decisions (displaying community leadership, cooperation, working together as a wider community)
- Actively participating in decision making processes and implementation programs
- Managing change (preparedness, adaptability, innovation, learning culture).

3. A Snapshot of the Goulburn Broken Region

Administrative Boundaries

Within the Goulburn Broken region, several administrative agencies collect and report data describing the region. The boundaries used by these agencies to report data do not all align. The administrative boundaries introduced in this section are subsequently used to provide a snapshot of the region and the changes that have occurred over the last 10 years.

Figure 1 shows the catchment management zones and irrigation delivery areas in the Goulburn Broken region. The Goulburn Broken Catchment Management Authority administers the catchment in three regions, the Shepparton Irrigation Region, the Mid Goulburn region and the Upper Goulburn region. The boundary of the Shepparton Irrigation Region is defined by the boundaries of the irrigation delivery areas and extends beyond the boundary of the Goulburn Broken catchment to the west to include all of the Rochester Irrigation Area. In the Shepparton Irrigation Region, irrigation water is delivered primarily through constructed infrastructure, whereas throughout the remainder of the region irrigation water is predominantly diverted from water bodies.

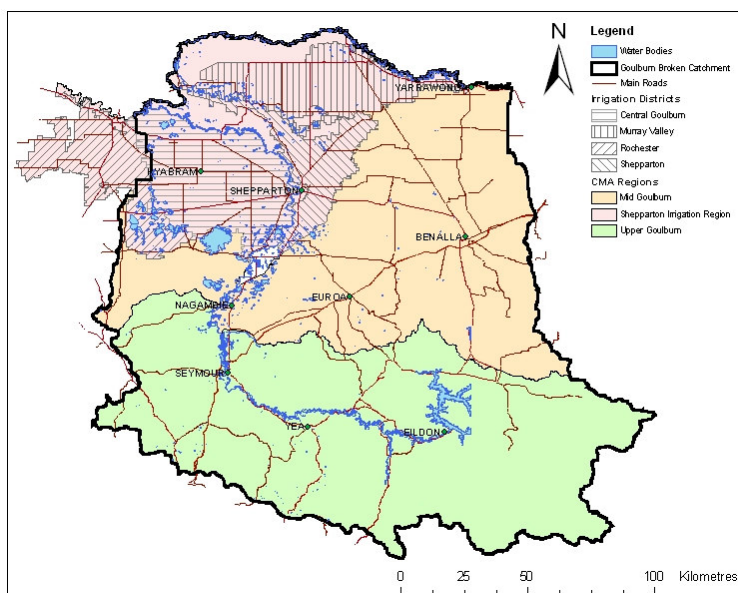


Figure 1 Catchment Management and Irrigation Delivery Districts within the Goulburn Broken Catchment.

Figure 2 shows the municipal and statistical areas for the Goulburn Region. The statistical areas are used by the Australian Bureau of Statistics and consist of several municipalities. The boundaries for both the municipalities and statistical areas do not align with catchment management boundaries. For the purposes of the information presented in this document, the North Goulburn statistical area has been equated to the Shepparton Irrigation Region, and the balance of the catchment to the South Goulburn statistical area. The combination of the North Goulburn and South Goulburn statistical areas is Goulburn Statistical Division.

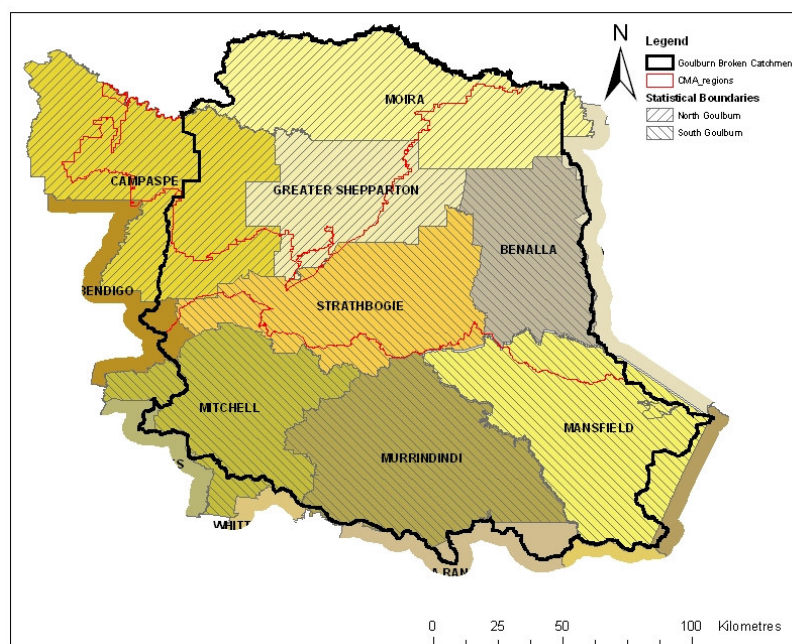


Figure 2 Municipal and Statistical Areas in the Goulburn Broken Catchment

Changes over the Last 10 years

Regional Demographics

Between 1996 and 2001, the population of the Goulburn statistical division increased from 178,000 people to 194,000 and was expected to increase to 206,000 by 2006. In the North Goulburn statistical area, the population increased from 110,000 in 1996 to 121,000 in 2001 and was expected to increase to 128,000 by 2006.

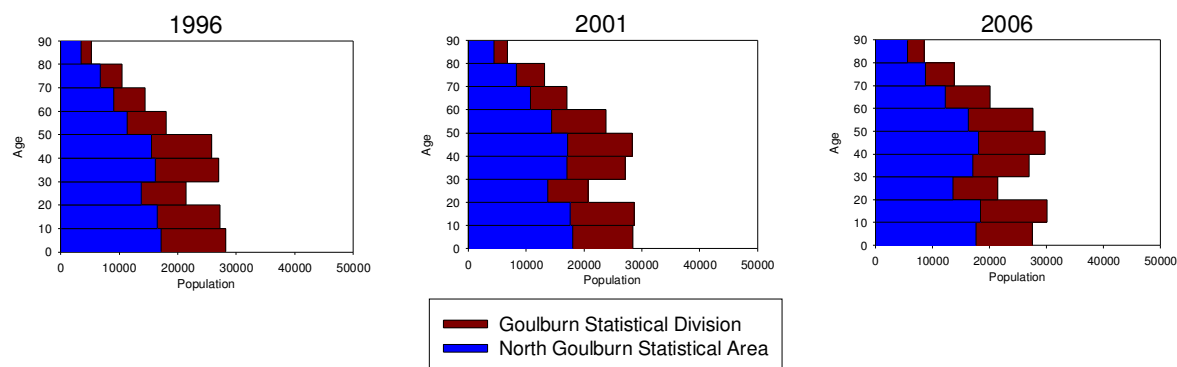


Figure 3 Population profiles for the Goulburn statistical division (Source: DSE, 2005)

Figure 3 shows the population profiles for the Goulburn statistical division for 1996, 2001 and 2006. These profiles show that the population of the region aged between 20 and 30 years is lower than the adjacent age cohorts. The profiles also show that the population aged 40 and over has increased between 1996 and 2006, with the largest increases in those aged between 40 and 60 years.

Contribution of Agriculture to the Regional Economy

Agriculture is a significant contributor to the economy of the Goulburn Region. Between 1996 and 2005, the farm gate value of agricultural production increased 42%, or approximately 4% pa, from \$1.17 billion to \$1.67 billion (Table 1). The dairy production is the largest single contributor to the economy, followed by livestock slaughter and

fruit production. All industries, with the exception the dairy and wool industries have experienced growth between 1996 and 2005. The wool industry has been influenced by demand and prices for wool decreasing internationally since 1990 (ABARE, 2006). The dairy industry in the region contracted significantly in 2002/03 due to low irrigation water availability and has been slowly recovering since.

Table 1: Farm Gate Gross Value of Production for Goulburn Statistical Division (\$ million)
Source: ABS 1996, ABS 2002, ABS 2005)

Activity	1995/96			2001/02			2004/05
	North Goulburn	South Goulburn	Goulburn Statistical Division	North Goulburn	South Goulburn	Goulburn Statistical Division	Goulburn Statistical Division
Dairying	440.8	12.5	453.4	512.2	9.4	521.6	388.6
Livestock slaughter	145.9	65.0	210.9	223.7	102.2	325.9	307.9
Fruit (not grapes)	167.7	1.6	169.2	188.2	8.1	196.2	280.2
Timber	0.0	85.6	85.6	0.0	135.8	135.8	135.80*
Hay production	49.6	12.3	61.9	64.8	16.8	81.6	184.6
Wool	15.7	33.7	49.4	16.1	38.4	54.5	49.4
Cereal Grain	41.1	10.8	51.9	74.6	15.5	90.1	104.3
Vegetables	24.2	3.7	27.9	72.3	4.3	76.6	89.6
Other	13.2	46.1	59.4	41.1	74.1	115.2	125.2
Total	898.2	271.3	1169.5	1192.9	404.5	1597.4	1665.6

* estimated

Land Use

Table 2 shows the major land uses in the Shepparton Irrigation Region. The dairy industry uses the most land, followed by fodder and grain production and livestock production. The available data suggest that the area of fodder and grain production grew between 1996/97 and 2004/05, while the area of land used by other industries decreased.

Table 2: Land use of the Shepparton Irrigation Region (ha)^
(Source: Douglass et al 1997, McAllister 2005)

Industry	1996/97	2004/05
Dairy	210,997	185,883
Horticulture	21,144	16,707
Livestock production	99,102	74,384
Fodder and grains	115,158	166,498
Lifestyle*		21,805
Total	446,401	465,277

*Category introduced in 2004/05

^Different data collection methods used

Climate

Rainfall varies considerably across the catchment, with average annual totals varying from 430 mm in the far north west of the catchment to 1700 mm in the south east. Inter-annual rainfall variation is also significant. Figure 4 illustrates the variability of rainfall for Tatura, in the north west of the catchment and Lake Eildon, in the south east. Pan evaporation is less variable than rainfall, with average annual pan evaporation varying from 1000 mm in the south to 1500 mm in the north of the catchment. Over the past decade, the region has experienced below average annual rainfall and above average pan evaporation in the majority of years.

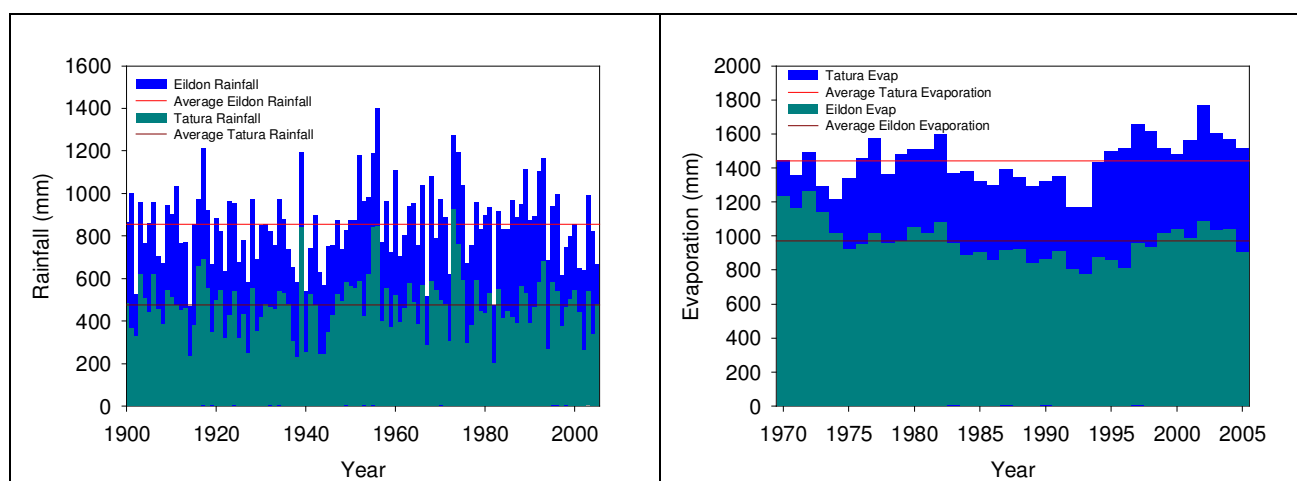


Figure 4 Historical Rainfall and Pan Evaporation for the Goulburn Broken Catchment
(Source: Bureau of Meteorology)

Irrigation Water

Irrigation water underpins the prosperity of much of the Goulburn Broken region. The historical irrigation entitlement for the Goulburn Broken region is approximately 1100 GL. Historically individual irrigators have had access to up to 200% of their entitlement when 'sales' water was available, resulting in regional use of up to 1.6 times the regional entitlement. Table 3 shows the water use by industry for the 1996/97 and 2004/05 irrigation seasons. The 1996/97 irrigation season was the most recent time when full (200%) sales allocations were available across the entire Goulburn Broken region. The majority of water (>60%) is used by the dairy industry, with livestock and fodder and grains also using large volumes.

Table 3 Irrigation Water Use, Entitlement and Allocations in the Goulburn Broken region[^]
(Source: Douglass et al 1997, McAllister 2005, Goulburn-Murray Water Annual Reports)

Industry	1996/97	2004/05
Dairy	959,821	692,038
Horticulture	70,765	62,141
Livestock production	299,362	92,720
Fodder and grains	175,860	195,538
Lifestyle*	-	47,703
Total	1,505,808	1,090,140
Entitlement	1,103,657	1,066,568
Allocation	200%	100%

* Category introduced in 2004/05

[^] Volumes of water in ML

Water trade commenced in Victoria in 1989. Figure 5 shows the volumes of temporary and permanent water trade moving into the Goulburn Broken region since 1994. Until 1999, irrigation water was traded into the Goulburn Broken region, both permanently and temporarily. Temporary trade has always resulted in water moving into the region, and volumes have always been greater than volumes of permanent trade. Since 2000, irrigation entitlement has been permanently traded out of the region, with the maximum allowable volume of permanent trade out of the region being realised in 2003/04 and 2004/05.

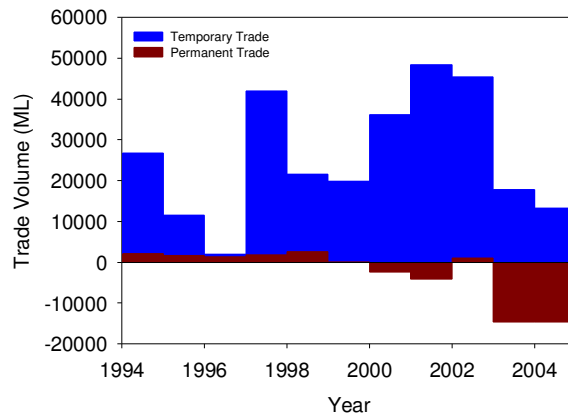


Figure 5 Water Trade into the Goulburn Broken region
(Source: Goulburn-Murray Water Annual Reports)

Salinity and Watertables

In the irrigated areas of the region, salinity and water logging is a threat to agricultural production. In the Shepparton Irrigation Region, the area of shallow water tables has been used to estimate the risk of salinity and water logging. Figure 6 shows the extent of shallow water tables in the Shepparton Irrigation Region in August 1995 and August 2005. Between 1995 and 2005 the area with a water table nearer than 2 metres to the surface has decreased from approximately 50% of the region to less than 20%. There are many possible causes of this decrease, of which low water allocations and low rainfall are major contributors

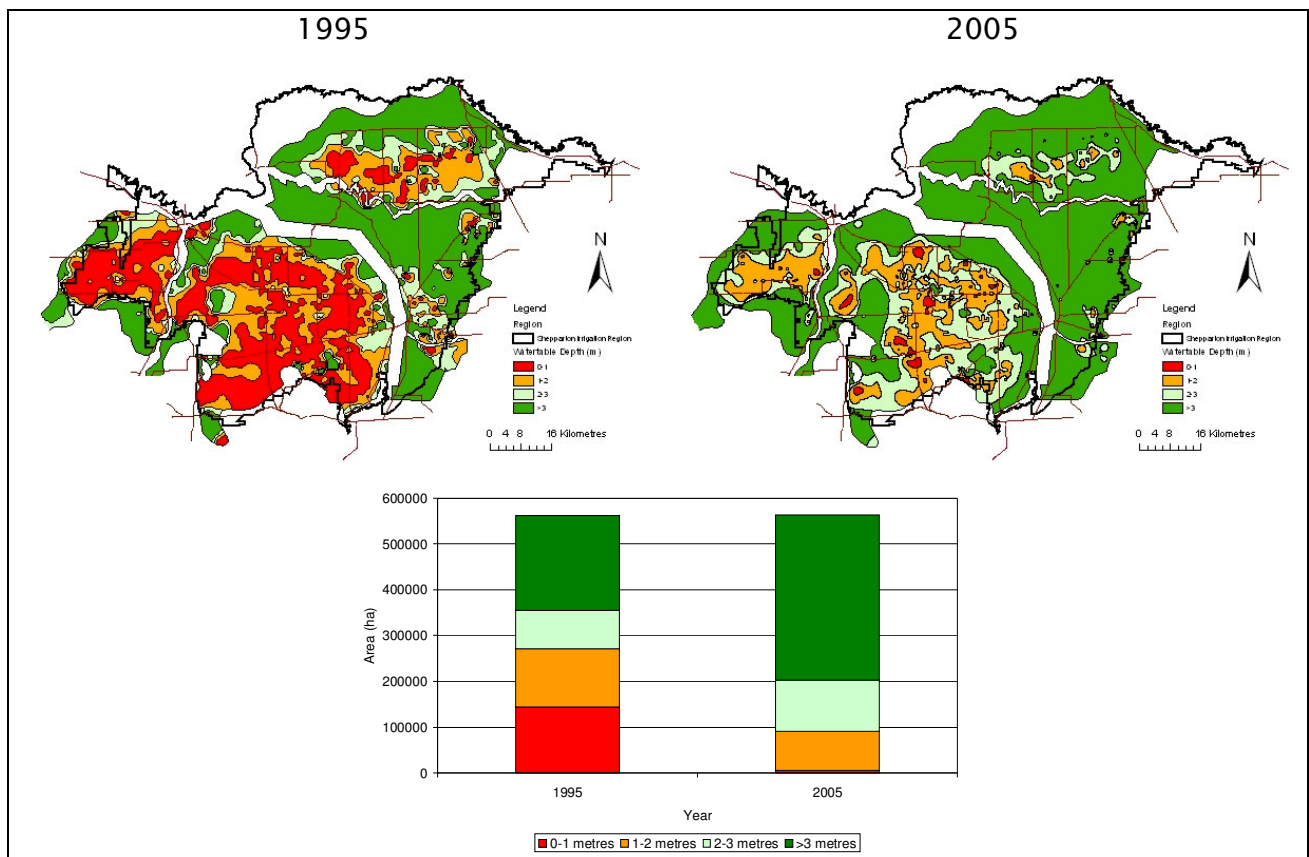


Figure 6 Watertable depths for the Shepparton Irrigation Region

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4. Stage 3 Scenario Assessment Process

Method

Four external scenarios were developed by the Irrigation Futures Forums at Stage 2 of the project. They represent a range of plausible future operating environments for the region in the next 30 years. During Stage 3, we constructed a response scenario corresponding to each of the external scenarios, describing how the players in the region may respond to the external developments and the social, economic and environmental consequences of the external factors and regional actions. We then examined the broad implications of the scenarios for the region and recommended strategies for the region to effectively deal with future opportunities and challenges. We also examined in greater depth implications of the scenarios for specific aspects of the region.

Technical Working Group

A Technical Working Group (TWG) was formed to work with the project team to undertake scenario assessment and investigate scenario implications. The TWG provided a forum for the stakeholders to contribute their significant knowledge and rich experience to this project. It also supported a largely qualitative assessment and investigation, complemented by quantitative analysis where necessary. The TWG provided inputs through a series of workshops.

Constructing response scenarios

Scenario assessment was carried out through the construction of a response scenario corresponding to each of the four external scenarios developed at Stage 2. The construction began by understanding the plausible operating environment embedded in an external scenario. The TWG then described what the regional responses might be. The responses included that of individuals, businesses, groups, organisations and the community in general. Some of the underlying factors considered included the changing nature of demographics, culture and technology. The TWG then explored the consequences of the external operating environment and regional responses on the economic, community and environmental wellbeing of the region.

Broad implications of the scenarios

The TWG identified a number of major areas of regional competencies that need to be addressed for the region to be successful in the future. The areas were identified by considering what would make the region an attractive place for investment and for living. For each of the competency areas, the current strengths and weaknesses of the region were identified. The opportunities and threats presented by scenarios were analysed. Strategies were then developed for the region to realise future opportunities and manage threats, building on current strengths and addressing weaknesses.

Through the Irrigation Futures Forums, Stage 2 of the project produced a set of regional strengths and weaknesses, and also a preliminary set of regional strategies. These materials were incorporated into the final outputs of this part of the Stage 3 investigation.

Specific implications of the scenarios

The broad implications of the scenarios develop a series of regional strategies that will increase the ability of the region to prosper under a range of plausible futures. Some specific aspects of these strategies need further development to understand in greater depth and detail the issues or options available, and to increase the relevance of the strategies for particular organisations. Further development of these strategies will occur through focused investigations.

The areas for focussed investigations were identified by the TWG and by organisations indicating their willingness to be involved. The details of the focussed investigations have been developed in conjunction with the lead organisation responsible for managing the specific issue. The focussed investigations have been undertaken by the project team in collaboration with organisations in the region and supported by the TWG and by consultants when appropriate.

Implementation

Technical Working Group

The TWG was formed by seeking nominations from the Stakeholder Reference Committee (SRC) and from members of the Irrigation Futures Forums. Nominees were requested to describe their skills in a number of areas considered important for Stage 3. Forty-four nominations were received.

The project team prioritised nominations to ensure that the group incorporated a broad range of skills and experience, that it was a manageable size, and that it had representation from women and young people. The prioritised list of nominees was presented to the SRC for approval, and twenty-three people were accepted. This provided a team of local stakeholders with considerable experience across most areas of irrigated agriculture.

For the construction of the response scenarios, the TWG was separated into a Narrative Team and an Analysis Team, according to their preferred thinking style. Members of the Narrative Team preferred a right-brain style of thinking, which tends to be holistic and rely on intuition. Members of the Analysis Team preferred a left-brain thinking style, which tends to be logical and rational. For other investigations, the two teams worked as a group.

The TWG met on 18 occasions in total (team workshops and whole group workshops) during Stage 3. These were usually full-day workshops (ie 10am - 3pm). It was a demanding task, with some members attending up to 12 meetings (ie roughly one per month).

The project team supported the TWG by facilitating and contributing at the workshops, and by synthesising workshop outputs. When necessary and appropriate, the project team developed initial ideas and material, and the TWG then provided comments and suggestions.

Constructing response scenarios

Scenarios 1 and 3 were constructed by the TWG at workshops supported by the project team. Scenarios 2 and 4 were constructed by the project team and then checked by the TWG.

In constructing Scenarios 1, The Narrative Team and the Analysis Team worked in sequence. The Narrative Team came up with ideas on the plausible evolution of the interplay between external factors, regional actors and their actions. The Analysis Team would then critique the scenario ideas, and provided an assessment of the plausible regional consequences for businesses, the environment and communities.

“Taking a journey into the future” can be a challenging task. To help the teams to do so, they were initially asked to consider the last 5 years (ie 2000 – 2005), so that they could identify the important issues being carried forward into the scenario. Then, to help teams imagine that they were in the future, they were taken through a scenario internalisation process. This involved physically putting on a ‘writers cloak’, considering the key elements shaping a period within the scenario (eg the first 5 years), drawing a picture (or writing about) what it was like in that period, and then articulating their thoughts.

The Narrative Team was then asked to identify a number of ‘actors’, and to consider what they might be doing. These ‘actors’ included obvious stakeholders such as primary producers, processors, and agencies. They also included ‘actors’ such as industry associations, seasonal workers, service industries, community and environment groups, and lifestyle farmers. To further extend their thinking, team members were asked to identify young persons whom they knew, and to imagine what they might be doing within the particular time period.

The Analysis Team provided comments on the outputs from the Narrative Team. The Analysis Team was also asked to consider themselves as a consultancy group. Their consultancy brief was to produce a series of ‘State of the Region’ reports. The reports would describe the consequences for regional business, the environment, community groups and infrastructure systems, given this period within the external scenario and the actors and actions predicted by the Narrative Team.

A similar process was followed when constructing response Scenario 3. However, more focus was given to the competitiveness of future agribusinesses in the region. The Narrative Team was asked to consider themselves as the Goulburn Valley Economic Development Authority. Their role was to attract business investment into the region. They were asked to identify those regional features attractive to investors now, and the businesses that they would recommend to investors under Scenario 3. They were then asked to predict the nature of those future businesses (products, customers, competitive advantage, etc), the concerns that the scenario might create for those investors, and how those concerns might be managed.

The Analysis Team were asked to expand on the Narrative Team’s ‘wealth generating’ businesses in the region, by defining the underlying distinctive regional competencies of those businesses, and in the light of Scenario 3, consider how those businesses might evolve into the future, the new competencies required, how those competencies might come under threat, what actions the region could take to respond to the threats.

The experience and ideas gained from constructing response Scenarios 1 and 3 helped the project team to construct relatively quickly the response Scenarios 2 and 4. This helped reducing the time demand on the TWG. These scenarios were commented on and approved by the TWG.

Broad implications of the scenarios

The TWG and the project team identified six major areas of regional competencies. These were based on the distinctive competencies for agribusinesses identified by the TWG when constructing response Scenario 3 and on the consideration of regional aspirations developed by the Irrigation Futures Forums at Stage 2. These major areas of regional competencies are land, water, agribusinesses, environment, communities, and institutional support.

For each of these regional competency areas, the project team developed a list of current strengths and weaknesses of the region. These were based on the strengths and weaknesses identified by the Irrigation Futures Forums at Stage 2 and also the details of the distinctive regional competencies for agribusinesses identified by the TWG when constructing response Scenario 3.

The TWG revisited all the four scenarios and identified the major opportunities and threats that the four scenarios present to the region. They were then asked how to get the fundamentals right for the region to deal with the opportunities and threats, considering the region's strengths and weaknesses. The project team subsequently updated the preliminary regional strategies developed by the Irrigation Futures Forums at Stage 2 by incorporating the TWG ideas as well as the learnings from the focused investigations on specific implications of the scenarios.

Specific implications of the scenarios

The TWG identified a number of aspects requiring focussed investigations, including:

- Irrigation infrastructure planning
- Catchment management
- Land use planning
- Retention of young people in the region
- Development of differentiated products
- Economic impacts of change on small towns and communities

Several of these focussed investigations have commenced, while others will commence as Stage 4 of the project progresses.

Specific implications for irrigation infrastructure planning

The focussed investigation looking at the implications for irrigation infrastructure planning was initiated to coincide with the commencing of Goulburn-Murray Water's irrigation reconfiguration planning. The project team, in conjunction with a consultant and the TWG, developed a chapter providing perspectives of future irrigation for a strategic overview of service needs for the Shepparton Irrigation Region. The chapter summarised the scenarios and their implications for irrigation and recommended some issues that should be considered as part of the reconfiguration process and is included in Section 7 of this report.

One of the recommendations was to incorporate flexibility into the irrigation infrastructure configuration, design, ownership and management. To assist Goulburn-Murray Water in adopting this recommendation, further work was commissioned to investigate the options for increasing the flexibility of irrigation infrastructure. Currently a handbook for flexible irrigation technologies is being developed by consultants to

assist irrigation infrastructure designers to increase the flexibility of irrigation infrastructure.

Specific implications for catchment management

The specific implications of the scenarios for catchment management are being developed as a part of the five-year review of the Regional Catchment Strategy for the Shepparton Irrigation Region. A program of workshops was developed by the project team in collaboration with the Catchment Strategy Review team.

The first workshop involved the teams undertaking the review of the six Catchment Strategy programs. This workshop introduced scenario planning to the participants and examined the implications of one scenario for management of the catchment and individual programs. Individual programs subsequently examined the implications of the remaining scenarios with support from the project team. A second combined workshop is planned to draw together the work of the program teams and examine the implications for the Catchment Strategy as a whole.

Specific implications for land use planning

The third focused investigation, currently under development, will assess the implications of the scenarios for land-use planning and economic development. This investigation will be led by the project team in conjunction with three Local Governments (Campaspe, Greater Shepparton and Moira) and also involve water service providers, the Catchment Management Authority and State Government Departments. The process will involve two workshops. The first will introduce scenario planning and consider the implications of one scenario. The second workshop will consider implications of the remaining scenarios and identify strategies and processes to address the implications.

5. Scenarios (Summary Slides)

Introduction

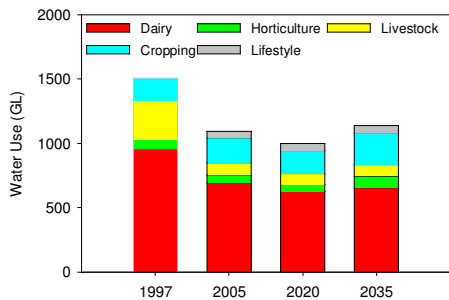
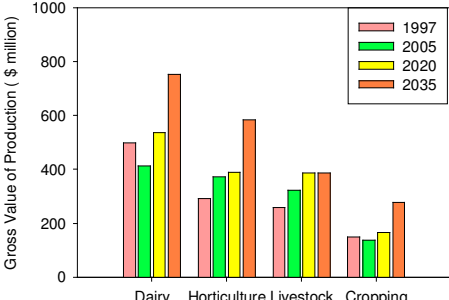
This section presents a summary of the four scenarios, describing plausible alternative futures of irrigation in the Goulburn Broken region. The four scenarios, Moving On, New Frontiers, Pendulum, and Drying Up, summarise external driving forces and the follow-on effects of those driving forces resulting from the region's response to those driving forces.

Detailed descriptions of the scenarios are presented in Appendix 1. The detailed scenarios are presented in two periods, 2005-2020 and 2020-2035. For each period the scenario is described in three main sections, *Primary Drivers*, *Our Industries* and *Our Community and Environment*. *Primary Drivers* describe the forces that influence the region but are primarily beyond the control of individuals and organisations in the region. *Our Industries* describes the specific drivers for industry in the region, how industry responds and the overall impacts of the drivers and responses on industry. The section considers industry as a whole as well as the main irrigated agricultural industries present in the region. *Our Community and Environment* describes the specific drivers for the community and environment, how individuals, agencies and community groups respond and the overall impacts of the drivers and responses on the community and environment. Responses are categorised using the responsible agency, organisation or community group.

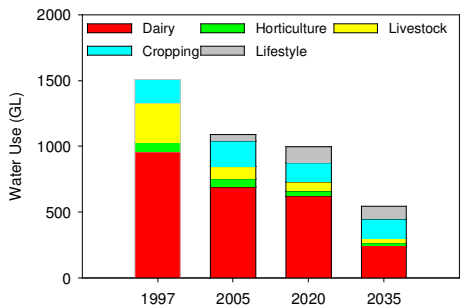
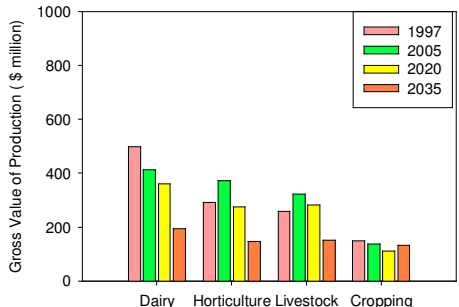
The four scenarios are not predictions of the future. They are intended to represent a range of possible opportunities and challenges that the Goulburn Broken region may face over the next 30 years. Many elements of the scenarios can be interpreted as metaphors or examples of possible events that may occur. For example, the outbreak of fire blight described in Scenario 2 has been used to depict a bio-security threat. Alternative bio-security threats such as foot and mouth disease or avian influenza could have been used. Similarly, government policies described in the scenarios should be considered as plausible, but should not be interpreted as a statement of future government policy or intent.

The scenarios are intended to stimulate discussions on strategies that organisations, agencies and individuals may take to ensure they and the region is resilient under a range of possible futures. The broad implications of the scenarios for the region are described in Section 6 of this document. Implications for specific aspects of the region are progressively being developed in collaboration with regional agencies and organisations. The specific implications for irrigation infrastructure planning are reported in Section 7 of this document. The specific implications for other aspects will be reported in subsequent publications.

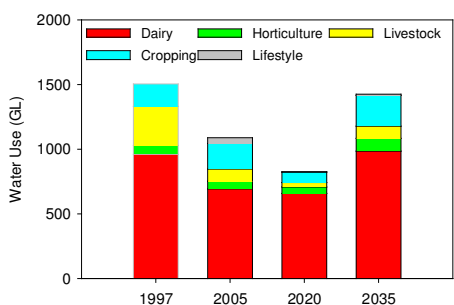
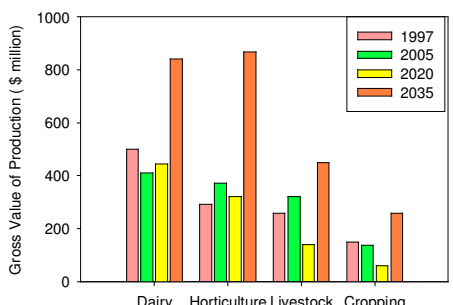
Scenario 1: Moving On

Primary Drivers 2005-2020 • Freer international trade • Increasing agricultural production costs • Genetically modified organisms permitted • Rural living and tourism • Climate change • Energy shortages • Decreasing volunteerism • Governments favour markets and individual responsibility	Follow-on Effects • Agriculture - Fewer, larger and more efficient farms - Adapt to cost pressures - Increased value of production - Multinational control of processing • Lifestyle properties - Small increase • Irrigation infrastructure reconfiguration • Decline of small towns • Region prospers																																																							
Primary Drivers 2020-2035 • International trade opportunities improve • Consumer concern for health and animal welfare • Competitive marketing environment • Electronic communication and trade • Water delivery infrastructure privatised • Dry climate • Low land prices • Highly valued leisure time	Follow-on Effects • Agriculture - Traditional industries - Highly controlled - Increased value of production • Land and environment management tension • Rationalised infrastructure • Decreased influence of agriculture • Lower salinity risk																																																							
Water Use  The chart shows a general decline in water use over time. Dairy is the largest user in 1997, but its share decreases significantly by 2035. Horticulture and Livestock show a steady increase in water use. Cropping and Lifestyle remain relatively stable but show a slight downward trend. <table><tr><th>Year</th><th>Dairy</th><th>Horticulture</th><th>Livestock</th><th>Cropping</th><th>Lifestyle</th></tr><tr><td>1997</td><td>1000</td><td>100</td><td>400</td><td>400</td><td>100</td></tr><tr><td>2005</td><td>750</td><td>150</td><td>300</td><td>300</td><td>100</td></tr><tr><td>2020</td><td>650</td><td>200</td><td>350</td><td>250</td><td>100</td></tr><tr><td>2035</td><td>600</td><td>250</td><td>400</td><td>200</td><td>100</td></tr></table>	Year	Dairy	Horticulture	Livestock	Cropping	Lifestyle	1997	1000	100	400	400	100	2005	750	150	300	300	100	2020	650	200	350	250	100	2035	600	250	400	200	100	Value of Production  The chart shows that the gross value of production for all sectors increases over time. Dairy and Horticulture show the most significant growth, with Dairy reaching nearly 800 million by 2035. Livestock and Cropping also show steady increases, with Livestock reaching 400 million and Cropping reaching 300 million by 2035. <table><tr><th>Sector</th><th>1997</th><th>2005</th><th>2020</th><th>2035</th></tr><tr><td>Dairy</td><td>500</td><td>450</td><td>550</td><td>750</td></tr><tr><td>Horticulture</td><td>300</td><td>350</td><td>400</td><td>600</td></tr><tr><td>Livestock</td><td>250</td><td>300</td><td>350</td><td>400</td></tr><tr><td>Cropping</td><td>150</td><td>180</td><td>200</td><td>300</td></tr></table>	Sector	1997	2005	2020	2035	Dairy	500	450	550	750	Horticulture	300	350	400	600	Livestock	250	300	350	400	Cropping	150	180	200	300
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Livestock	250	300	350	400																																																				
Cropping	150	180	200	300																																																				

Scenario 2: New Frontiers

Primary Drivers 2005-2020 • Demand for rural lifestyle properties • Improved communication technologies • Regulation of agricultural practice • Freer international trade, but loss of markets • Price of oil doubles • More water reform • Drier climate • Fireblight outbreak	Follow-on Effects • Agriculture - Fewer, larger and more efficient farms - Highly focused on production - Lower value of production - Regulated practice • Lifestyle residents - Buy land and water, increasing its value - Demand aesthetically pleasing environments - Bring money, ideas and energy into region - Strongly influence local agencies																																																							
Primary Drivers 2020-2035 • Laboratory-based food production • Genetically modified organisms permitted • All agricultural production subsidies removed • Climate dries further • Removal of barrages at mouth of Murray River • Government purchase of agricultural land for environmental purposes	Follow-on Effects • Agriculture - Traditional industries decline substantially - Cropping industry expands as feedstock for laboratory-based food and biofuel production - Irrigation water trades out of region • Limits on salt disposal to Murray river lifted • Decreases salinity risk • Population continues to grow • Region continues to be prosperous																																																							
Water Use  <table><caption>Estimated Water Use (GL)</caption><thead><tr><th>Year</th><th>Dairy</th><th>Horticulture</th><th>Livestock</th><th>Cropping</th><th>Lifestyle</th></tr></thead><tbody><tr><td>1997</td><td>1000</td><td>50</td><td>100</td><td>200</td><td>100</td></tr><tr><td>2005</td><td>700</td><td>50</td><td>50</td><td>200</td><td>100</td></tr><tr><td>2020</td><td>600</td><td>50</td><td>50</td><td>200</td><td>100</td></tr><tr><td>2035</td><td>300</td><td>50</td><td>50</td><td>200</td><td>100</td></tr></tbody></table>	Year	Dairy	Horticulture	Livestock	Cropping	Lifestyle	1997	1000	50	100	200	100	2005	700	50	50	200	100	2020	600	50	50	200	100	2035	300	50	50	200	100	Value of Production  <table><caption>Estimated Gross Value of Production (\$ million)</caption><thead><tr><th>Sector</th><th>1997</th><th>2005</th><th>2020</th><th>2035</th></tr></thead><tbody><tr><td>Dairy</td><td>500</td><td>400</td><td>350</td><td>200</td></tr><tr><td>Horticulture</td><td>300</td><td>350</td><td>250</td><td>150</td></tr><tr><td>Livestock</td><td>250</td><td>300</td><td>250</td><td>150</td></tr><tr><td>Cropping</td><td>150</td><td>150</td><td>150</td><td>250</td></tr></tbody></table>	Sector	1997	2005	2020	2035	Dairy	500	400	350	200	Horticulture	300	350	250	150	Livestock	250	300	250	150	Cropping	150	150	150	250
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Cropping	150	150	150	250																																																				

Scenario 3: Pendulum

Primary Drivers 2005-2020 • Large water purchase for the environment • Land and infrastructure restructure • Environmental credit markets • Energy shortage • Freer trade, multinational takeovers • Genetically modified organisms prohibited • Increase in interest rates • Rural resentment of urban attitudes	Follow-on Effects • Agriculture - Large dryland farms - Decrease in confidence - Lower value of production • Contraction of irrigation infrastructure • Decreased salinity risk • Improved environmental health • Decline of rural communities																																																							
Primary Drivers 2020-2035 • Auction of water entitlement • Irrigation infrastructure rebuilt • High rainfall • Weaker Australian dollar • Genetically modified organisms prohibited • Consumer concern about genetically modified foods	Follow-on Effects • Agriculture - Expansion of irrigated agriculture - Increased diversity of production - Value of production increases substantially • Planned redevelopment of irrigation • Labour shortage • Increased salinity risk • Region is highly prosperous																																																							
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Scenario 4: Drying Up

Primary Drivers 2005-2020

- Major recession in USA
- Unemployment increases nationally
- Australian dollar appreciates
- Freer trade and highly competitive marketplace
- Genetically modified organisms prohibited
- Severe drought
- Decreasing egalitarianism

Follow-on Effects

- Agriculture
 - Sale of assets to make ends meet
 - Rely on government assistance
 - Very low value of production
- Decline of infrastructure
- Environmental decline
- Fractious community

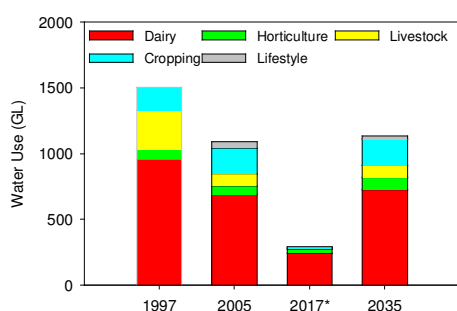
Primary Drivers 2020-2035

- Global economic growth
- New world order
- Agricultural production subsidies eliminated
- Consumer demand for health and natural foods
- Genetically modified organisms prohibited
- Governments assist rural revival
- Above average rainfall

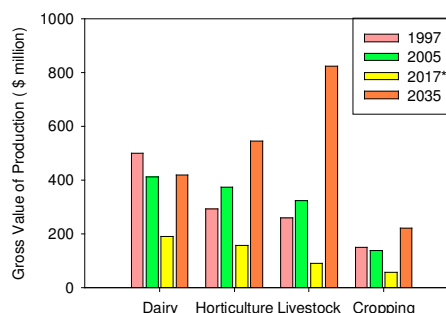
Follow-on Effects

- Agriculture
 - Cautious expansion and intensification
 - Greenfield development
 - Value of production increases substantially
- Labour shortage
- Changed nature of community
- Environmental recovery
- Region regains prosperity

Water Use



Value of Production



6. Broad Implications of the Scenarios

Introduction

This section considers the broad implications of the four scenarios, developed through the Irrigation Futures project, for the region as a whole. The broad implications are structured around the areas of major regional competencies. Regional competencies are those features that make the region attractive for investment and for living.

The major areas of regional competencies are:

- Land for Agricultural Production,
- Water for Agricultural Production,
- Agribusinesses,
- Communities,
- Environment Assets, and
- Institutional Support.

For each of the major regional competency areas, the current strengths and weaknesses of the region and the future opportunities and threats that the scenarios present to the competencies are outlined. Strategies are proposed that build on the current competencies to realise the opportunities and manage the threats.

The strategies are underpinned by three key principles that describe the role of the regional organisations and community groups. These key principles are:

1. The region will initiate and coordinate actions to attain sound social and institutional arrangements and physical infrastructure, so that entrepreneurship and innovation will flourish, and environment and community wellbeing will be protected and enhanced.
2. The region will involve active participation of the community in decision making to effectively utilise local knowledge and take into account a diversity of views, so that decisions will be robust and owned by the community.
3. The region will build strong adaptive capability, continually monitor, learn, innovate and make adaptive changes to manage future uncertainties, so that the region will embrace opportunities and challenges when they arise.

This section provides a preliminary account of the broad implications of the scenarios and will be improved as the project progresses. Improvements to the content of this material will be made as the focussed investigations progress during Stage 4 of the project. The readability and structure of this material will also be improved.

Land for Agricultural Production

Current Strengths and Weaknesses

Agricultural production creates significant economic wealth for the Goulburn Broken region. The land of the region has a number of strengths and weaknesses, which include:

- The region has an abundance of good agricultural land available for use.

- The relief is relatively low, particularly within the lower and middle parts of the catchment, ensuring that land is accessible for agricultural production.
- A wide range of soil types exist throughout the region, which are suitable for a diverse range of crops and land uses.
- The land is in relatively good condition, with low levels of soil degradation, for example salinity and acidity.
- A large proportion of the land, particularly within the Shepparton Irrigation Region, is serviced by drainage and salinity control infrastructure.
- The size of land parcels is diverse, making the region attractive to a wide range of agricultural businesses. The diversity in size of land parcels also constrains the ability of some agricultural businesses to grow.

Future Opportunities and Threats

The scenarios suggest that a number of opportunities and threats that may influence the suitability of land for agricultural production in the future. These opportunities and threats include:

- Decreasing terms of trade place pressure on agricultural businesses requiring increases in business scale, require increases in farm sizes to maintain viability.
- Demand for lifestyle properties and urban development may increase the price of land and decrease its availability for agricultural production. Increasing numbers of new entrants may cause conflicts over acceptable land use and management practices.
- Restructuring of land parcels may be both possible and desirable under some conditions.
- The vulnerability of land to degradation, such as salinity, sodicity and acidity, may increase or decrease.
- Rationalisation of irrigation infrastructure will retire some land from irrigation, reducing the land available for irrigated production.

Strategies

- Investigate options for flexible land amalgamation and subdivision, including managing redundant assets, to enhance the adaptive capability of the region to respond to future land use changes.
- Develop sound land use zoning to manage the interfaces between production, urban, rural living, environmental and industrial uses of land and ensure land is available for all uses at acceptable prices.
- Further investigate the role and feasibility of prime irrigation development and re-development zones in attracting investment to the region.
- Investigate options for land retirement from irrigation or from agricultural production, based on land capability, and opportunities for enhancing the environment.

Water for Agricultural Production

Current Strengths and Weaknesses

The majority of the region's income from agricultural production comes from irrigated agriculture. The major strengths and weaknesses of the region's water supply are:

- Water entitlements and associated rights are well established.
- Robust markets for water enable temporary and permanent trading of entitlements.
- Irrigation water entitlements have high reliability in areas served by reservoirs, but low reliability in unregulated areas.
- The surface water supply is of high quality and groundwater is generally of relatively low salinity, but poor quality in some areas.
- Water tariffs and market prices are modest.
- In many areas the condition of irrigation distribution infrastructure is degrading as it nears the end of its design life.
- Irrigation infrastructure is distributed widely across the region. This enables irrigation water to be delivered to all irrigation properties within the region, but also means that more infrastructure exists than is required to deliver the region's water entitlement.

Future Opportunities and Threats

The scenarios suggest that a number of opportunities and threats that may influence the region's water supply and distribution infrastructure in the future. These opportunities and threats include:

- Climate change and variability may radically change the amount of water available to the region.
- Government policies may cause changes to the allocation and pricing of water in the region.
- Water trade may result in large volumes of water trading into or out of the region, or redistribution of water within the region.
- Irrigation infrastructure may be reconfigured or restructured by governments, water supply authorities or private companies.
- New technologies may emerge that increase water delivery efficiency or reduce the need for irrigation water in the region.
- Changes in land use may alter the demand for irrigation water or service requirements of irrigation distribution infrastructure.
- Irrigation infrastructure may be privatised and sold to investment companies or irrigator cooperatives.
- The quality of surface or groundwater may deteriorate due to salinity or other degradation processes.

Strategies

- Explore potential effects of water reform and other driving forces on the region and ways to manage these potential effects.

- Value the ability of irrigation infrastructure to adapt to future changes in land and water uses, and adopt flexible technologies and management processes where appropriate.
- Develop a sound plan for water pricing and associated services to ensure the viability of irrigation delivery services and ability of irrigation enterprises to adapt to changes, and to balance short term and long term needs.
- Periodically review water allocation policy such as water allocation to different users and level of reliability of water products.
- Review the service requirements of irrigation water users to ensure services provided meet their needs.
- Undertake irrigation infrastructure planning in conjunction with environmental and land use planning to ensure infrastructure complements current and future land uses.
- Actively lobby governments to influence water policy decisions.

Agribusinesses

Current Strengths and Weaknesses

Agribusinesses are the engine room of agricultural production in the region. The current strengths and weaknesses of agribusiness in the region are:

- A wide range of agricultural businesses exist, ensuring the region is not dependent on the fortunes of a single industry and synergies exist between businesses.
- There is a critical mass of agribusinesses for most of the commodity groups in the region, encouraging processors and secondary industries to invest.
- A wide range of service and value adding businesses exist in the region to support agribusiness.
- The majority of agribusinesses are producing commodities and are therefore not able to influence the price they receive for their produce.
- Agribusinesses in the region have a history of entrepreneurship and innovation, remaining at the leading edge of technological developments.
- Agricultural industries in the region are adaptable to a range of market and climatic pressures.
- The region and agricultural businesses within the region have a reputation for agricultural production, but do not necessarily capitalise its reputation in product marketing.
- The region is located relatively close to markets and has good transport infrastructure to transport product to markets.

Future Opportunities and Threats

The scenarios suggest that a number of opportunities and threat that may influence the region's agribusinesses in the future. These opportunities and threats include:

- The availability of labour in the region will be influenced by many factors and will influence the viability of agribusinesses. It is likely that labour will increasingly need to be highly skilled.

- New entrants into agribusiness will bring new ideas and energy into agribusiness in the region and be more open to change.
- Periods when times are difficult for individual industries and the region as a whole are likely. Retaining a critical mass within industries and the region will be crucial to the continuation of agribusinesses in the region.
- Climate change may influence the viability of agribusinesses through reductions in winter chill hours, decreases in water availability and increases in summer temperatures and changes to the seasonality of rainfall.
- International markets are changeable, and commodity producers in the region are vulnerable to such changes.
- The marketing environment may become increasingly competitive, increasing the need for business skills in the management of agribusinesses.
- Up to date information may become increasingly valuable in decision making for agricultural businesses. Without access to current information, businesses may become increasingly isolated.
- The value of agricultural products is likely to increasingly come from value adding to farm output. For agribusinesses to stay viable, they may increasingly need to have a share in value adding and supply chain, improving vertical integration.
- New crops may provide opportunity to further diversify agricultural businesses.
- New technologies for agricultural production, communication etc, may reduce production costs, improve efficiencies or provide new ways for doing business.
- Competition for land with other uses may change its availability or price such that agricultural production can not compete.
- Production costs may rise significantly through increases in the costs of inputs such as fuel, labour, water, etc.
- The region is vulnerable to biosecurity threats, such as fire blight and anthrax.

Strategies

- Promote a positive image of careers in the agricultural industry, through positive stories in media and involvement in schools, targeting the values and aspirations of the next generation.
- Create opportunities for new entrants into agribusiness through developing career paths within businesses and financial pathways to business ownership, such as succession planning.
- Maintain active and high quality programs for agricultural research, development and education.
- Research market potential and production systems for emerging and new products and market niches.
- Value and support diversity in businesses, agriculture enterprises, farming systems and products in the region.
- Investigate options for structural change in the agricultural businesses, including the development of businesses using private or public capital and investment in value adding and supply chain development to assist with wealth creation.
- Provide support to irrigators so that they understand and adapt to the implementation of new government policies, in particular, new water policy.

- Build the business and technical skills of agricultural business owners, managers and technicians through training in a range of areas.
- Develop strategies to ensure the resilience of the region is maintained through tough times, including preservation of core industry requirements such as seed, stock and processing capability, by bringing resources into the region and enabling restructure.
- Encourage migration into the region from within Australia and overseas to enhance the availability of labour and skills and bring new energy and ideas into the region.
- Improve the efficiency of water use at individual and regional scales through use of technology, improved operator skill and business composition.
- Actively lobby all levels of government to provide strong support and policy certainty for agribusiness to ensure continued investment in the region.

Communities

Current Strengths and Weaknesses

The ability of the region to adapt to changes has been supported by the strengths of the regional communities. The strengths and weaknesses of the regional communities are:

- The region has a wide range of community groups that are active.
- The region has a long history of migration, which has brought new ideas and products to the region as well as a source of labour.
- Communities within the region are adaptable and have the capacity to change and reinvent themselves.
- The people of the region are generous with their time and money.
- The density of the population is high enabling a wide range of commercial facilities to exist in the region.
- A limited range of tertiary education opportunities are available in the region.
- A large proportion of young people leave the region to seek employment and educational opportunities.

Future Opportunities and Threats

The scenarios suggest that a number of opportunities and threats that may influence the region's communities in the future. These opportunities and threats include:

- Small towns and community groups may decline due to a number of causes.
- Controversial issues cause divisions and conflicts within the region's communities.
- Rising fuel costs may reduce the ability of individuals to contribute to community groups.
- Facilities for community activities may diminish as small towns and community groups decline.
- Technology developments may improve community connection through improved communication or transport systems, but may also cause some people to be more isolated.
- New entrants to the region may bring in new ideas and energy for community groups.

- The creation of employment opportunities that complement agricultural production and the provision of community support services, such as kindergartens etc, may assist in attracting new entrants to the region.
- An ageing population may provide a pool of volunteers for community groups, but may also place pressure on community facilities, such as hospitals etc.
- Active community groups require and assist in the development of strong leadership. Decline of community groups may also decrease the strength of leadership in the region.
- Lifestyle residents may enable the region to grow and reduce the dependence on the fortunes of agriculture.

Strategies

- Continually rejuvenate membership and processes of community groups and community involvement in organisations.
- Recognise and value community leaders, particularly those independent of agencies and support their development through a variety of programs.
- Facilitate community groups to discuss significant issues related to natural resources management, to explore cultural values and build strong community networks.
- Continually support community groups to take initiatives in natural resources management and celebrate their achievements.
- Actively promote, to people living both inside and outside the region, the benefits of irrigated agriculture and the opportunities that the region can offer.
- Provide support for individuals to recognise and adapt to changes.
- Actively seek support and opportunity for upgrading transport, energy and communications infrastructure, developing major regional centres, and expanding tertiary education and research facilities.
- Encourage the settlement of new residents, including lifestyle residents, to bring new ideas and money and diversify the economy of the region.

Environmental Assets

Current Strengths and Weaknesses

The region has a wide variety of environmental assets. The strengths and weaknesses of these environmental assets include:

- Parts of the landscape are aesthetically attractive for tourist and lifestyle residents.
- Large areas of the region have been cleared, but some parts, for example riparian zones and parts of the upper catchment, are well vegetated.
- Water is allocated to environmental use through the environmental reserve, through recent water reforms. However the volume of the environmental reserve is relatively small in comparison to the allocation of water to agricultural production,
- Knowledge of environmental systems and processes is in its infancy.
- The community demonstrates its concern about their local environment through involvement in LandCare and other environmental programs.

Future Opportunities and Threats

The scenarios suggest that a number of opportunities and threats that may influence the region's environmental assets in the future. These opportunities and threats include:

- Extended periods of drought and adverse climatic conditions.
- Irrigation transfer flows may result in unseasonal high river levels.
- Increased scarcity of water may place pressure on the use of environmental water allocations.
- Changes in the political environment may provide increases or decreases in environmental flow allocations.
- Defining and communicating clear and measurable objectives for environmental flows may reduce community and political pressures on environmental allocations.
- Trade between agricultural and environmental water users may provide inter-annual flexibility in water use.
- Conditions may exist where the salinity of waterways in the region may increase or decrease, which potentially has flow-on effects for both terrestrial and aquatic biodiversity.
- The creation of markets for environmental services may provide an opportunity for concentration, enhancement or establishment of environmental assets.
- The retirement of land from irrigation or agriculture may provide opportunities to develop new or enhance existing environmental assets.
- New entrants to the region and lifestyle residents may have the ability and desire to invest in environmental asset protection or enhancement.
- Redevelopment of infrastructure may provide opportunities to protect and enhance environmental assets, but may also threaten environmental assets.

Strategies

- Develop a vision of significant environmental areas and corridors for protection and enhancement, so that other land use and infrastructure planning complements the environmental vision and that tourism potential is enhanced.
- Encourage landowners to integrate environmental features, such as native vegetation, animal sanctuaries and wetlands, with agricultural production systems and rural living properties.
- Set out clear standards for environmental and natural resource management through water use licences, and through responsible land ownership guidelines to manage potential conflicts between adjoining land uses.
- Manage river flows, including the environmental water reserve, soundly to maximise the environmental benefit.
- Manage tensions between environmental and other needs and desires and develop new innovative ways for people to work together.
- Investigate the nature and requirements of environmental assets under changing climatic, and other, conditions.
- Create environmental programs that are adaptable to and capitalise on changing conditions, for example climate, politics, prosperity.

Institutional Support

Current Strengths and Weaknesses

The region has a wide range of institutions that encourage and support the development of the region. The strengths and weaknesses of the region's institutional support are:

- A network of active industry associations that provide a public voice for agricultural industries and support industry development activities.
- Many state government agencies have a local presence and active programs to support the region.
- Local governments in the region are strong and support the development of the region.
- The region has several educational institutions, but these have a relatively narrow focus.
- The region has several research and development facilities that support the development of agricultural industries.
- The institutional arrangements in the region are mature, providing certainty for investment.
- Institutions in the region work together cooperatively.

Future Opportunities and Threats

The scenarios suggest that a number of opportunities and threats that may influence the region's institutional support in the future. These opportunities and threats include:

- The future is uncertain, and large and rapid change will occur. Institutions will need to be prepared to support the region under a range of possible eventualities.
- The region may experience tough times, which will place pressure on institutions to provide support to individuals and organisations within the region.
- The diversity of views may increase as agriculture diversifies, new lifestyle residents enter the region and the region becomes less reliant on agricultural production.
- Communication, between institutions and the community, will be vital during periods of change. Technology developments may assist in with communication, but may also isolate parts of the community who do not adopt technology.

Strategies

- Develop a framework for regional adaptive management to continually monitor, learn, innovate and make adaptive changes to manage future uncertainties, so that the region will embrace opportunities and challenges when they arise.
- Review current mechanisms for knowledge generation, accumulation, communication and use, and examine ways for improvement, to ensure regional and organisational knowledge is retained in the region and transferred within and between generations, and new ideas and knowledge are available and utilised.
- Continually promote a culture of regional cooperation among organisations, sharing information and coordinating decision making.

- Maintain effective communication between organisations, community leaders and the community, to ensure strong community input to regional decision making and government policy formulation.
- Develop systems to support the region through tough times, by taking leadership and coordinating the actions of organisations.
- Encourage the active participation of the community in decision making to effectively utilise local knowledge and take into account a diversity of views, so that decisions will be robust and owned by the community.
- Provide leadership and support in implementing the recommended strategies under all of the regional competency areas.

7. Specific Implications of the Scenarios

The document included in this Section is a chapter developed by the Irrigation Futures Project as its contribution to the Goulburn-Murray Water's strategic overview of service needs for the Shepparton Irrigation Region. It summarises the scenarios and their implications for irrigation infrastructure planning.

One of the recommendations was to incorporate flexibility into the irrigation infrastructure configuration, design, ownership and management. To assist Goulburn-Murray Water in adopting this recommendation, further work was commissioned to investigate the options for increasing the flexibility of irrigation infrastructure. Currently a handbook for flexible irrigation technologies is being developed by consultants to assist irrigation infrastructure designers to increase the flexibility of irrigation infrastructure.

Perspectives of Future Irrigation

Prepared by

David Robertson, QJ Wang, Leon Soste, Robert Chaffe and Clive Lyle
on behalf of

Goulburn Broken Irrigation Futures Project

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Scenario 1: Moving On

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Scenario 3: Pendulum

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Introduction

It is critical that irrigation infrastructure planning considers the needs of future irrigated agriculture. However, it is difficult to predict the future for irrigated agriculture as it will be influenced by many uncertain factors. Scenario planning is an approach to deal with the uncertainty by considering a plausible range of futures, so that the planned irrigation infrastructure will be able to service the needs of the future.

This section contains four scenarios, describing alternative plausible futures for irrigated agriculture in the Goulburn Broken catchment, and their implications for irrigation water supply. Although the scenarios have been developed for the Goulburn Broken catchment, they are also relevant to other irrigation regions in northern Victoria.

The four scenarios, Moving On, New Frontiers, Pendulum, and Drying Up, summarise the external driving forces, the region's response to those driving forces and the regional impacts that follow. The impacts focus on those factors relevant to irrigation infrastructure planning.

The four scenarios are not predictions of the future. They are intended to represent a range of possible opportunities and challenges that the Goulburn Broken catchment may face over the next 30 years. Many elements of the scenarios can be interpreted as metaphors or examples of possible events that may occur. For example, the outbreak of fire blight described in Scenario 2 has been used to depict a bio-security threat. Alternative bio-security threats such as foot and mouth disease or avian influenza could have been used. Similarly, government policies described in the scenarios should be considered as plausible, but should not be interpreted as a statement of future government policy or intent.

The four scenarios have been developed by the Goulburn Broken Irrigation Futures project. The project is a community initiative aiming to develop a shared vision for irrigated agriculture in the region. The project engaged the regional community and other key stakeholders through a series of 4 workshops held at 6 locations throughout the catchment. These workshops looked at the community's aspirations, the possible evolution of external driving forces in the future, and strategies to achieve the aspirations. The outputs of the workshops were developed further by a Technical Working Group to assess implications of the external driving forces and regional strategies.

Each scenario is presented in two forms: a summary and a more detailed description. The scenario summary provides a snapshot of the driving forces, regional impacts and implications for the distribution of water, along with illustrative graphs of land use, irrigated area, water use and farm gate gross value of production for the Shepparton Irrigation Region. The detailed scenario description contains additional information about the driving forces and impacts on different irrigation-dependent industry groups.

The scenarios are intended to stimulate discussions on strategic approaches to irrigation infrastructure planning including reconfiguration by considering what the future may hold and how the region can ensure it is robust under a range of possible futures. Further work looking at the implications of the scenarios for environmental management and the community will be reported in subsequent publications.

Scenario Presentation

Scenario Summary

Impacts

Describes a summary of regional scale consequences of the scenario including some economic, environmental and social impacts

Driving Forces

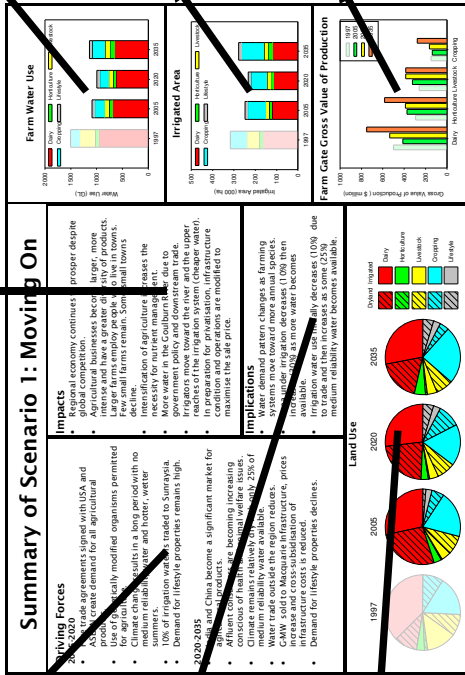
Describes a summary of the main factors influencing the region during the scenario.

Implications

Describes the implications of the scenario for the distribution of irrigation water.

Land Use

Illustrates the changes in land use within irrigated properties by the Shepparton Irrigation Region over the period of the scenario.



Farm Water Use
Illustrates the changes in farm water use by industry for the Shepparton Irrigation Region over the period of the scenario.

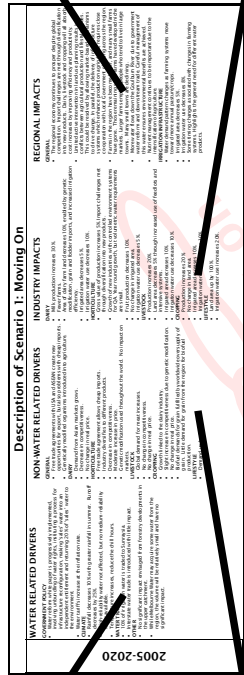
Irrigated Area
Illustrates the changes in the area of land which is irrigated in a particular year by industry for the Shepparton Irrigation Region over the period of the scenario.

Farm Gate Gross Value of Production
Illustrates the changes in the farm gate gross value of production for the Shepparton Irrigation Region by industry over the period of the scenario in 2005 dollars.

Scenario Description

Water Related Drivers

Describes the driving forces related to the availability of water, including forces related to government policy, climate and water trade.



Regional Impacts
Describes some of the consequences of the scenario, in terms of some social, economic and environmental impacts. Specific impacts for irrigation infrastructure are also described.

Non-Water Related Drivers

Describes the non-water related driving forces and how they influence each of the major industries within the region. Price changes are real changes in price and do not include the effect of inflation.

Industry Impacts
Describes the impacts of the combination of water and non-water related driving forces on the major industries within the region. Impacts are described for each industry as a whole and do not necessarily reflect the impact on individuals within each industry.

Learning from the Scenarios

The four scenarios presented in this section describe alternative plausible futures for irrigated agriculture in the region and their implications on future irrigation water supply. Some of the drivers are common to all scenarios. For example, the emergence of new economic powers such as China and India providing both threats and opportunities for our industries. Other drivers diverge markedly, resulting in very different scenarios.

Scenario 1 “Moving on” depicts a steadily changing operating environment for the region. The industries in the region evolve successfully in response to international business conditions and moderate climate variability. In Scenario 2 “New Frontiers”, agricultural production in the region declines over time because of a number of unfavourable conditions, most notably, the rise in synthetic food production. However, there is a sharp increase in the number of people who live in rural areas and work remotely, bringing a new and significant income stream to the region. Scenario 3 “Pendulum” describes how large shifts in water policy can dramatically change the face of the region. Scenario 4 “Drying up” highlights the vulnerability of the region to global economic recession and natural disasters such as drought.

The four scenarios represent four very different futures, as highlighted by the graphs below. Even though they are not predictions of the future, they provide useful test beds for examining the effectiveness of management strategies under a range of conditions. In the context of irrigation infrastructure planning, the four scenarios highlight a number of important issues.

Flexibility of irrigation infrastructure

There is great uncertainty in the size of the irrigated area and the amount of water use in the future. There may be periods of rapid contraction and expansion of irrigation. Thus there is a need to build flexibility into irrigation infrastructure, so that it is adaptable to future demands. Flexibility may be achieved through innovative system configurations, flexible distribution technologies, a mix of infrastructure ownership, and improved management systems.

Irrigation service level requirements

One of themes that emerged strongly from the scenarios is that the competitiveness of the agricultural industries in the region will depend on generating and marketing differentiated products. The industries are thus likely to demand greater levels of service in water supply than today. On the other hand, service requirements for water use on lifestyle properties are likely to be quite varied. Water supply to lifestyle properties may become more significant in the future as indicated by Scenario 2 “New Frontiers”.

Integration with land use and environmental planning

The scenarios describe significant changes in land use over the next 30 years, within and between agricultural, lifestyle and environmental uses. These land use changes can radically alter the viability and requirements of irrigation infrastructure. Irrigation infrastructure planning needs to be closely linked with land use and environmental planning. This calls for a collaborative approach to planning by agencies, industry groups and the community.

Social and economic responsibility

The scenarios highlight the complexity of issues surrounding irrigation and the importance of involving stakeholders, including the community, in decision making. Changes to irrigation infrastructure and irrigation business viability can potentially have wide social consequences. Equity and social adjustment need to be carefully managed during periods of infrastructure change. Likewise, financial planning for infrastructure needs to make provision for industry down turns.

Large shifts in government policy on water can dramatically change the face of the region, as indicated by Scenario 3 “Pendulum”. It is critical that the region actively influences all levels of government so that regional concerns and issues are addressed in policy development.

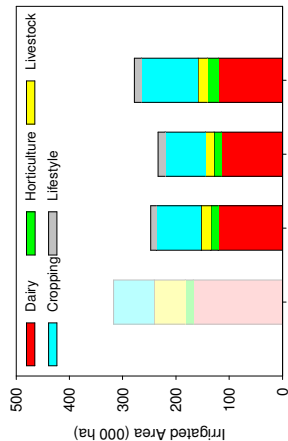
Planning for changes

The scenarios also point to some of the potential weaknesses of the region. For example, the relatively small size of irrigated land parcels makes the region uncompetitive when the market demands large-scale production systems, as indicated in Scenario 2 “New Frontiers”. Significant restructuring will be required to overcome some of these weaknesses, but it should be done under the right conditions so that changes can be made smoothly. The scenarios suggest that there are only a limited number of windows of opportunity for large-scale restructuring. In Scenario 3 “Pendulum” for example, government may be lobbied to assist in land amalgamation during periods of major water policy shifts. To seize these opportunities, there is a need for having plans and options prepared in anticipation of future conditions.

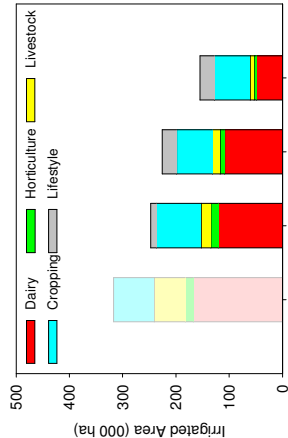
The issues highlighted above represent the learnings from the scenarios by the Goulburn Broken Irrigation Futures Project. The scenarios are intended to stimulate discussions on strategic approaches to irrigation infrastructure planning including reconfiguration. Therefore, readers are encouraged to use the scenarios to develop their own thoughts and ideas.

Comparing the Scenarios - Irrigated Area

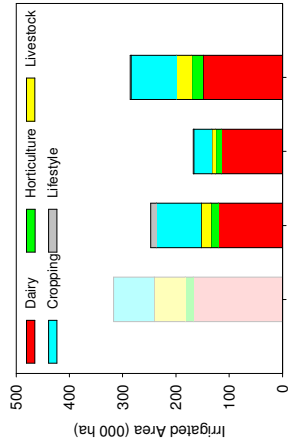
Scenario 1: Moving On



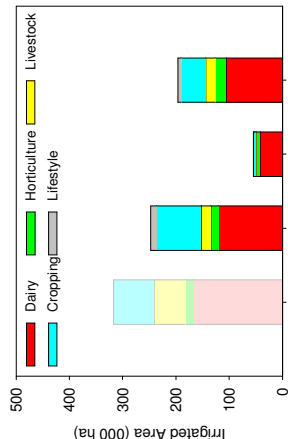
Scenario 2: New Frontiers



Scenario 3: Pendulum



Scenario 4: Drying Up



Summary of Scenario 1: Moving On

Driving Forces

2005-2020

- Free trade agreements signed with USA and ASEAN create demand for all agricultural products.
- Use of genetically modified organisms permitted for agriculture.
- Climate change results in a long period with no medium reliability water and hotter, wetter summers.
- 10% of irrigation water is traded to Sunraysia.
- Demand for lifestyle properties remains high.

2020-2035

- India and China become a significant market for agricultural products.
- Affluent consumers are becoming increasing conscious of health and animal welfare issues.
- Climate remains relatively dry with only 25% of medium reliability water available.
- Water trade outside the region reduces.
- G-MW sold to Macquarie Infrastructure, prices increase and cross-subsidisation of infrastructure costs is reduced.
- Demand for lifestyle properties declines.

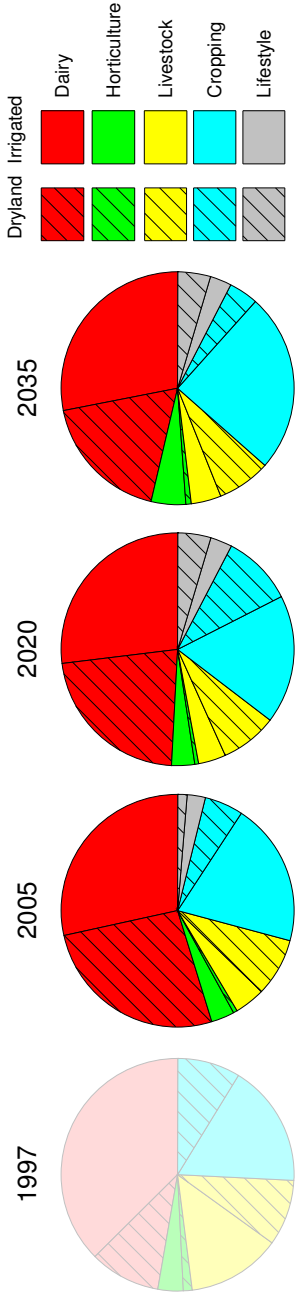
Impacts

- Regional economy continues to prosper despite global competition.
- Agricultural businesses become larger, more intense and have a greater diversity of products. Larger farms employ people who live in towns. Few small farms remain. Some small towns decline.
- Intensification of agriculture increases the necessity for nutrient management.
- More water in the Goulburn River due to government policy and downstream trade.
- Irrigators move toward the river and the upper reaches of the irrigation system (cheaper water).
- In preparation for privatisation, infrastructure condition and operations are modified to maximise the sale price.

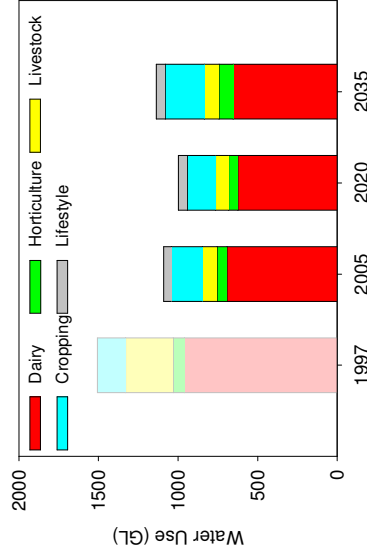
Implications

- Water demand pattern changes as farming systems move toward more annual species.
- Area under irrigation decreases (10%) then increases (30%) as more water becomes available.
- Irrigation water use initially decreases (10%) due to trade and then increases as some (25%) medium reliability water becomes available.

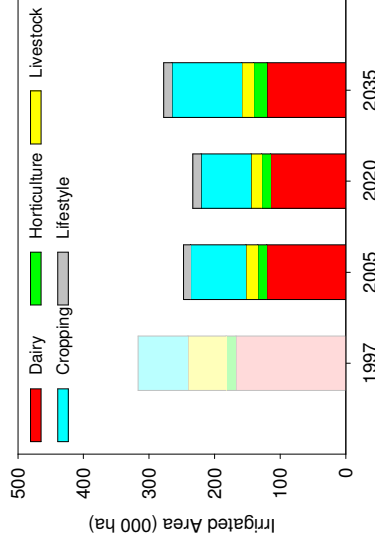
Land Use



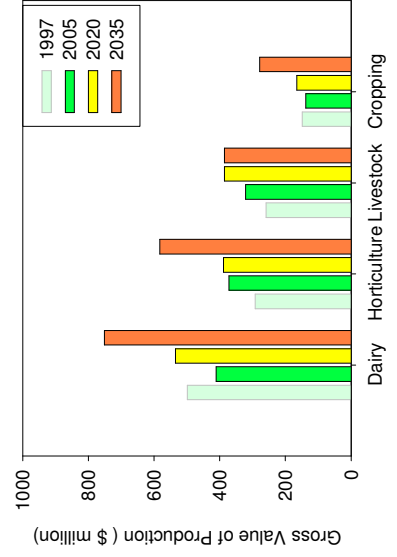
Farm Water Use



Irrigated Area



Farm Gate Gross Value of Production



Description of Scenario 1: Moving On

2005-2020	WATER RELATED DRIVERS			NON-WATER RELATED DRIVERS		INDUSTRY IMPACTS		REGIONAL IMPACTS
	GOVERNMENT POLICY - Water reform white paper is progressively implemented, involving unbundling of water rights, instituting a process for infrastructure reconfiguration, making 'sales' water into an independent entitlement and returning 20% of 'sales' water to the environment. - Water tariffs increase at the inflation rate. CLIMATE - Rainfall decreases 10% with greater rainfall in summer. Runoff decreases by 25%. - High-reliability water not affected, but no medium-reliability water available. - Temperature increases, reduce the Chill hours. WATER TRADE 10% of irrigation water is traded to Sunraysia. - Interstate water trade is introduced with little impact. OTHER - No significant impact envisaged from forestry developments in the upper catchment. - While Melbourne Water may acquire some water from the region, the volume will be relatively small and have no significant impact.			GENERAL - Free trade agreements with USA and ASEAN create new opportunities for export, but also problems with cheap imports. DAIRY - Genetically modified organisms introduced into agriculture. - Demand from Asian markets grows. - Decrease in competitiveness. - No change in real price. HORTICULTURE - Free trade agreement allows cheap imports. - Industry diversifies to different products. - Decrease in competitiveness. - Moderate increase in price. - Genetic modification used throughout the world. No impact on markets. LIVESTOCK - Global demand for meat increases. - No change in competitiveness. - No change in real price. CROPPING - Growth linked to the dairy industry. - Slight increase in competitiveness due to genetic modification. - No change in real price. - Biofuel demands for grain fulfilled by worldwide oversupply of grain. Little demand for grain from the region for biofuel production. LIFESTYLE - Demand up by 100%.		DAIRY - Milk production increases 30%. - Fewer farms. - Area of dairy farm land decreases 10%, enabled by genetic modification, grain and fodder imports, and increased irrigation efficiency. - Irrigated area decreases 5%. HORTICULTURE - Gross value of production increases 5%. Import challenges met through diversification into new products. - Growth of new industries with controlled environment systems for QA. Year round growth, but volumetric water requirements are small. - Fruit production decreases 10%. - No change in irrigated area. - Irrigation water use decreases 5%. LIVESTOCK - Production increases 20%. - Land area decreases 5% through increased use of feedlots and intensive systems. - Irrigated area decreases 10%. - Irrigation water use decreases 10%. CROPPING - Production Increases 20%. - No change in land area. - Irrigated area decreases 10%. - Irrigation water use decreases 10%. LIFESTYLE - Land area up by 100%. - Irrigation water use increases 20%.		
				GENERAL - The regional economy continues to prosper despite global competition. Import challenges are met through diversification into new products. Dairy, livestock and cropping will all absorb cost increases by improving efficiency and productivity. - Limited active intervention in land-use planning results in conflicts between agricultural production and lifestyle values. This could be resolved by allowing market-based mechanisms to drive change. In parallel, the delivery of infrastructure systems which enhance production agriculture, requires close co-operation with Local Government planning across the region. Farms in the region have become larger, and many small farms have gone. Those remaining small farms have developed niche markets. Larger farms employ people who tend to live in large towns. Many small towns are declining. - More water flows down the Goulburn River due to government water reform and downstream trade. Careful management of this water ensures environmental benefits are achieved. - Nutrient management continues to be important due to the intensification of agriculture. IRRIGATION INFRASTRUCTURE - Water demand pattern changes as farming systems move toward more annual pasture/crops. - Irrigated area decreases 5%. - Irrigation water use decreases 8%. - Some timing changes associated with changes in farming systems. Highlights the general need for different water products.				

2020-2035	WATER RELATED DRIVERS			NON-WATER RELATED DRIVERS		INDUSTRY IMPACTS		REGIONAL IMPACTS
	GOVERNMENT POLICY - G-MW sold to Macquarie Infrastructure. - Cross-subsidisation of infrastructure costs decreases as a result of privatisation. Water tariffs increase to build in a commercial profit and through decreased cross-subsidation. CLIMATE - Climate remains drier than historical average. Summer rainfall more intense. - All high-reliability and 25% of medium-reliability water available. WATER TRADE - More internal trade and trade closer to main trunk channels. - Trade outside the region reduces as limits to available land and water delivery capacity are reached. OTHER - Demand for water from Melbourne continues to have little impact.			GENERAL - China and India grow as a market for agricultural produce. - Consumers become increasingly affluent and health conscious. DAIRY - Demand from Asian markets continues. - No change in competitiveness. - Small increase in price. HORTICULTURE - Export growth to China and India. - No change in competitiveness. - No change in price. LIVESTOCK - Global demand for meat continues. - Slight decrease in competitiveness. - No change in price. CROPPING - Growth linked to the dairy industry. - No change in competitiveness. - Moderate decrease in price fodder used locally. LIFESTYLE - Demand flattens.		DAIRY - Milk production increases 30%. Increase in production of high-value nutraceuticals. - Land area decreases, as farms become larger and more intense, and small farms exit. - Irrigated area increases 5%. - Irrigation water use increases 5%. HORTICULTURE - Production increases 50% due to GM and market opportunities. - Land area increases 50%. - Growth of controlled environment production continues. - Irrigation water use increases 50%. LIVESTOCK - No change in production. - No change in land area, however grazing is important to consumers. - Irrigated area increases 10%. - Irrigation water use increases 10%. CROPPING - Production increases 100% due to genetic modification and increases in land and water use. - Irrigated area increases 40%. - Irrigation water use increases 40%. LIFESTYLE - No change in land area. - No change in irrigation water use.		
				GENERAL - Water price increases do not hurt major industries because new owners need to maintain their customer base. - Increases in water tariffs are greater at the 'bottom' of the system. Irrigators move toward the river and the upper reaches of the irrigation system where water tariffs are lower. - Competitiveness of all enterprises decreases due to increase in water price, although impact reduced by increased technology, systems and management. - Privatisation and take-up of local distribution networks by farmer groups provides greater grower flexibility to respond to market changes. However, it also requires the working together of those grower groups to be effective. IRRIGATION INFRASTRUCTURE - Irrigated area increases 20% as more water is available - Irrigation water use increases 15%, due to the availability of medium reliability water. - Irrigation water use increases In preparation for privatisation, infrastructure condition & operations are managed to maximise the sale price.				

Summary of Scenario 2: New Frontiers

Driving Forces

- 2005-2020**
- Free trade agreements signed with USA and ASEAN create demand for all agricultural products. Middle East trading partners lost due to our alliance with United States.
 - Large increase in lifestyle developments.
 - Genetically modified organisms prohibited.
 - Community concern for the environment increases.
 - Environmental flow entitlement increased through deal with medium reliability entitlement.
 - Climate change results in long period with high reliability allocation of less than 100%.
 - 15% of irrigation water is traded out of the region to Sunraysia and Northeast Victoria.

2020-2035

- International free trade is introduced.
- Fireblight and regulation cause a major decline in agricultural production across all industries.
- Synthetic food production significantly reduces the demand for naturally produced foods including dairy, horticultural and meat products, but substantially increases demand for grain.
- Demand for lifestyle properties plateaus.
- Genetically modified organisms allowed.

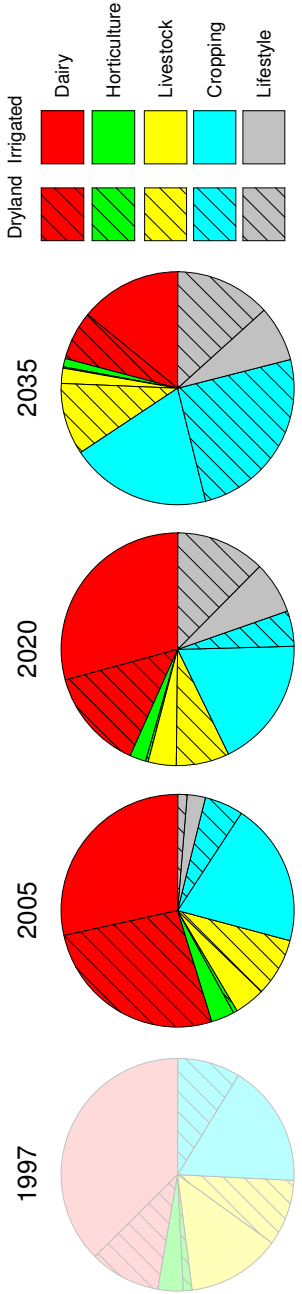
Impacts

- Initially, a small decline in agricultural activity occurs due to the loss of markets. Followed by a substantial decline due to synthetic food production. Niche agricultural industries on some small properties cater for the health food market.
- Demand for grain causes increase in annual cropping. Large quantities of water trades to New South Wales where grain production is more efficient due to larger land parcel sizes. Water trade increases infrastructure costs for remaining irrigators.
- Regional economy is maintained by new lifestyle development. Lifestyle development is unplanned causing conflicts between agricultural production and lifestyle values.
- Land is reserved for environmental purposes.

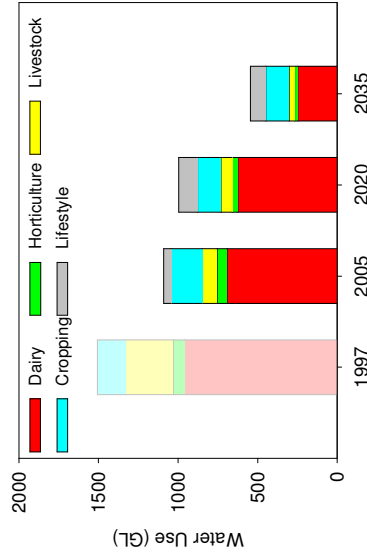
Implications

- Major contraction in most irrigated agricultural industries.
- Area under irrigation and irrigation water use decreases substantially (45%) due to water trade.
- Best areas for irrigation may change according to market demand for products and land availability.

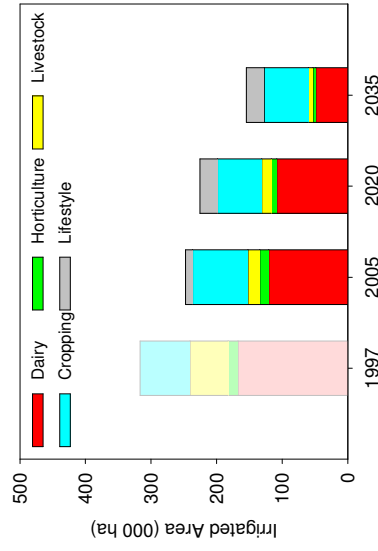
Land Use



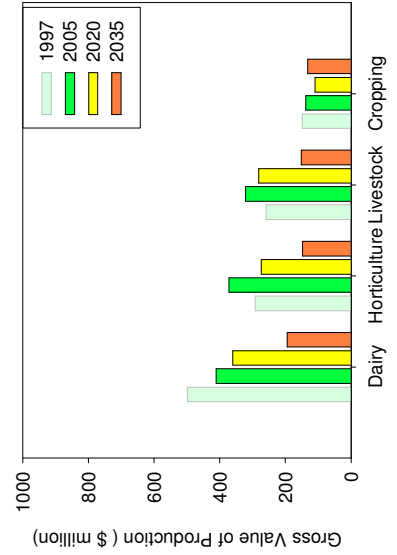
Farm Water Use



Irrigated Area



Farm Gate Gross Value of Production



Irrigation Futures Project - Milestone Report 4 Attachment

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Summary of Scenario 3: Pendulum

Driving Forces

- 2005-2020
 - Free trade agreements signed with USA and ASEAN create demand for all agricultural products.
 - Multinationals take over food processing plants.
 - Genetically modified organisms prohibited.
 - High energy costs create demand for biofuels.
 - Government returns 3500 GL of environmental water to Murray River. Victoria contributes 1500 GL through buy back of all medium reliability and 30% of high reliability water, at premium prices. Some water trades into Goulburn Valley from NSW.
 - Water buy back coupled with government purchase, amalgamation and auction of land.

2020-2035

- Chinese Yuan floated and China grows as a market for agricultural products.
- Genetically modified free status becomes a marketing advantage.
- Government reverses policy and returns water to agriculture by auction. Proceeds of auction fund development of distribution infrastructure which is transferred to irrigator cooperatives.
- Wet climate sequence causes floods.

Impacts

- Initially the regional economy declines as water is returned to the environment. Unemployment rises considerably as demand for service industries decreases.
- Perception of little additional benefit resulting from water being returned to the environment.
- Subsequently, the economy booms as international market conditions improve and policy reversal means more water is available for agriculture.
- Labour shortages occur.
- Planned adjustment of land and water resources allows infrastructure costs to be managed and leads to an improved match between land capability and use.
- Increased rainfall and floods lead to a re-emergence of water logging and salinity problems.

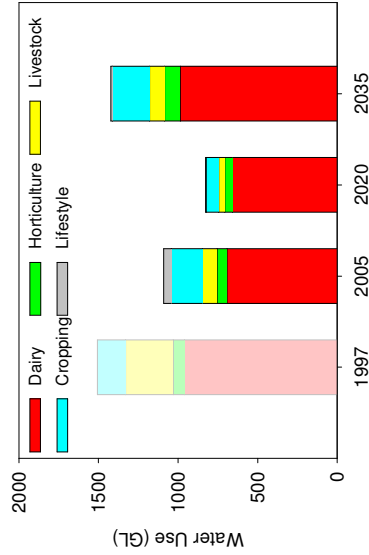
Implications

- Changes in government policy enable large changes in irrigated area and water use to be planned.

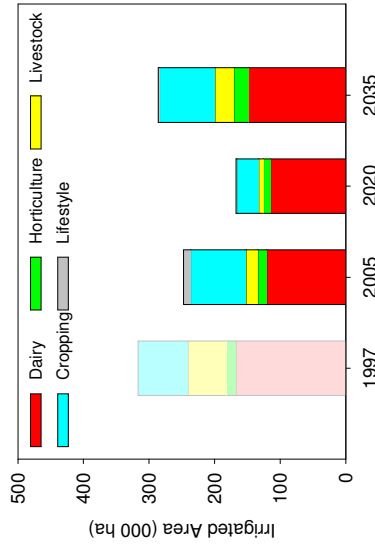
Land Use



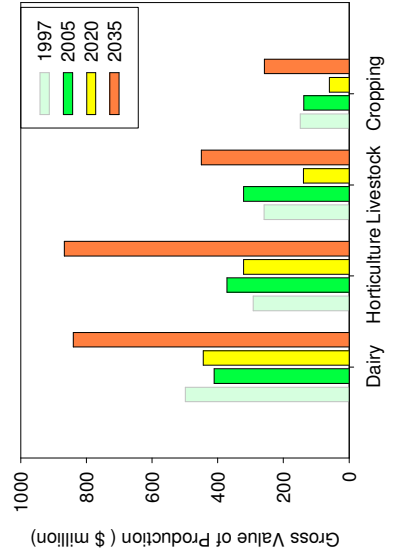
Farm Water Use



Irrigated Area



Farm Gate Gross Value of Production



Description of Scenario 3: Pendulum

2007-2020	WATER RELATED DRIVERS	NON-WATER RELATED DRIVERS	INDUSTRY IMPACTS	REGIONAL IMPACTS
	GOVERNMENT POLICY - Water reform white paper is progressively implemented, involving unbundling of water rights, instituting a process for infrastructure reconfiguration, making 'sales' water into an independent entitlement and returning 20% of 'sales' water to the environment. - New government policy introduced to return and additional 3000 GL returned to Murray River, of which Victoria contributes 1250 GL (50% of C-MW entitlement). - Government buys back all medium reliability water entitlement and 30% of the high reliability water entitlement at premium prices. - Government initiates land restructuring program, resuming land, restructuring land boundaries and auctioning dryland properties. - Irrigation system is restructured in conjunction with land restructuring, resulting in some water savings and no change in water tariffs. CLIMATE - Rainfall remains slightly drier than 'normal'. WATER TRADE - Sunraysia purchases NSW water. - Interstate water trade result in water flowing from NSW to the region (5%).	GENERAL - Free trade agreements with USA and ASEAN create new opportunities for export, but also problems with cheap imports. - Multi-nationals corporations take over processing facilities in the region. - Use of genetically modified organisms prohibited. - Large increase in energy costs and interest rates. DAIRY - Opportunity for export to Asian markets grows. - Small increase in price. - No change in competitiveness. HORTICULTURE - Free trade agreement allows cheap imports. - Small decrease in price. - Decrease in competitiveness. LIVESTOCK - Global demand for meat increases. - Small increase in price. - No change in competitiveness. CROPPING - Growth linked to the dairy industry. - Increase in demand for bio-fuel feedstock. - Small increase in price. - Small increase in competitiveness. LIFESTYLE - Demand declines, and some return to Melbourne.	DAIRY - No change in milk production as water remains in dairy and horticulture. - Fewer farms. - Land area remains constant. - Irrigated area decreases 5%. - Irrigation water use decreases 5%. HORTICULTURE - Production decreases 30% due to lack of competitiveness. - Irrigated area decreases 20%. - Irrigation water use decreases 20%. LIVESTOCK - Production decreases 60%. - Irrigated area decreases 60%. - Irrigation water use decreases 60%. CROPPING - Production decreases 60%. - Irrigated area decreases 60%. - Irrigation water use decreases 60%. LIFESTYLE - Land area decreases 50%. - Irrigation water use decreases 90% (sold into market).	GENERAL - A rapid planned decline in irrigation occurs, causing significant adverse economic impacts to both agricultural and service industries. - Remaining dairy, livestock and cropping producers manage adverse conditions by growth in efficiency and scale. - Niche industries and glasshouse production increase, but remain small in terms of overall water use and regional value of production. - Unemployment increases due to the decline in agriculture and service industries. - Significantly more water in the Goulburn and Murray Rivers results in little additional perceived environmental benefits, given the significant economic impacts. - Planned re-adjustment of land leads to better matching between land capability and use. IRRIGATION INFRASTRUCTURE - Farming systems will move toward more dryland pasture and crops. - Irrigated area decrease 30%. - Irrigation water use decreases 25%.

2020-2035	WATER RELATED DRIVERS	NON-WATER RELATED DRIVERS	INDUSTRY IMPACTS	REGIONAL IMPACTS
	GOVERNMENT POLICY - Water resources management becomes a Federal responsibility. - Lack of perceived benefits from environmental flows. - Water reallocated to economic use. 3000GL of water auctioned and sold mostly to agriculture and tourism in NSW, Vic and SA. - Agriculture in region purchases water entitlements equivalent to 2005 levels of high reliability water and 50% of medium reliability water. - Government uses funds to build and rehabilitate irrigation infrastructure, in partnership with irrigator-owned water distribution companies. Land suitability and infrastructure condition drive investment in infrastructure. - Water tariffs rise to meet debt. CLIMATE - Several seasons of above average rainfall, with floods occurring. - Groundwater and salinity problems emerge. WATER TRADE - Permanent and temporary trading of water occurs at low prices.	GENERAL - China floats its currency, which strengthens against the Australian dollar. - China and India grow as markets for agricultural products. - Multi-national corporations owning processing facilities exploit their position. - Australia's genetically modified free status becomes a competitive advantage. DAIRY - Export to Asian markets expand. - Demand increases. - Large increase in price. - Increase in competitiveness due to genetically modified free status. HORTICULTURE - Exports to China and India grow. - Demand increases. - Large increase in price. - Increase in competitiveness due to genetically modified free status. LIVESTOCK - Global demand for meat increases. - Small increase in price. - Increase in competitiveness due to genetically modified free status. CROPPING - Increase in demand linked to growth in the dairy industry. - Small increase in price. - No change in competitiveness. LIFESTYLE - No demand as a result of land use planning rules.	DAIRY - Milk production increases 40%. - Land area increases 10%. - Irrigated area increases 30%. - Multi-national water use increases 50%. HORTICULTURE - Production increases 100%. - Irrigated area increases 100%. - Irrigation water use increases 100%. LIVESTOCK - Production increases 200%. - Irrigated area increases 300%. - Irrigation water use increases 150%. CROPPING - Production increases 300%. - Irrigated area increases 150%. - Irrigation water use increases 200%. LIFESTYLE - No change in land area. - Irrigation water use increases 1000%.	GENERAL - Reversed water policy and market conditions produce a rapid planned expansion of irrigated agriculture. - Regional economy booms on the back of expansion of agriculture and investment in irrigation infrastructure. Labour is in short supply. - Periods of above average rainfall and floods lead to salinity and water-logging problems emerging. IRRIGATION INFRASTRUCTURE - Rapid increase in area irrigated and water delivery. - Irrigated areas increases 70%. - Irrigation water use increases 70%. 'New water' targeted to best areas.

Summary of Scenario 4: Drying Up

Driving Forces

2005-2020

- Financial crisis in the United States creates a global recession that reduces international trade considerably between 2009 and 2012.
- As global economy recovers, China begins to export high value horticultural products and import cheaper bulk commodities.
- Australian dollar strengthens making agricultural products expensive to overseas purchasers.
- Use of genetically modified organisms prohibited.
- Drought commences in 2012 lasting until 2020.
- High reliability irrigation water allocations between 2015 and 2020 are 80%, 50%, 30%, 90%, 100%.

2020-2035

- International export markets recover.
- International and domestic markets demand healthy food.
- Genetically modified free status becomes a marketing advantage.
- Government assists restructure and redevelopment of agriculture with focus on health food, environmental sustainability and animal welfare.
- Climate becomes wetter and enables medium reliability allocation of 25%

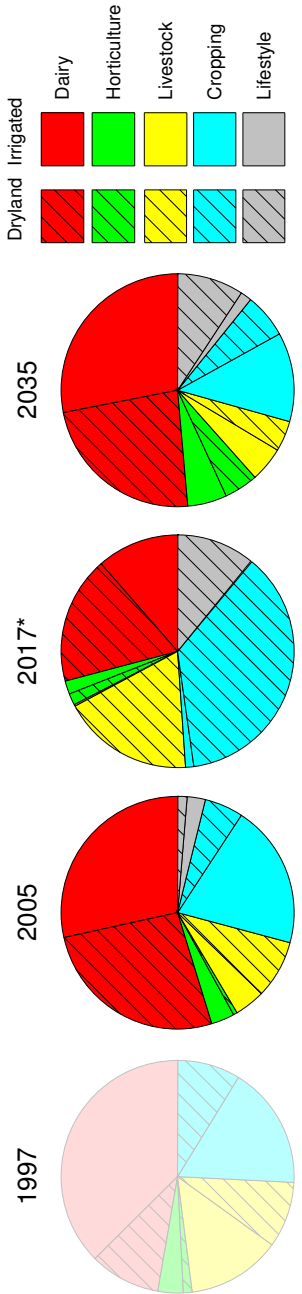
Impacts

- Initially, all agricultural industries and the regional economy is decimated by international market collapse and prolonged drought. The population is stable because employment opportunities are poor elsewhere.
- Unemployment is very high.
- Irrigators unable to pay for costs of infrastructure maintenance.
- Subsequently, regional economy booms as international markets grow and water availability increases. Growth of agricultural industries is constrained by land parcel size.
- Drought increases the frequency of severe bushfires.

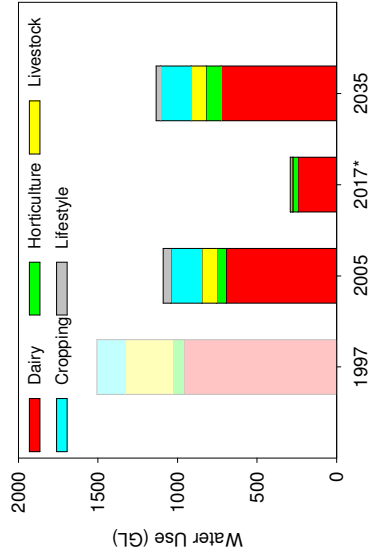
Implications

- Initially, a large decrease in irrigation water use and area irrigated as drought decreases allocations, followed by a large increase in irrigated area and water use as the drought subsides.
- Water returns along existing irrigation infrastructure as no restructuring occurred during drought.
- Infrastructure declines during times of little maintenance.

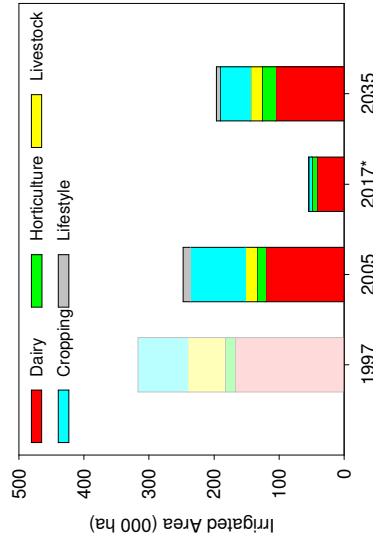
Land Use



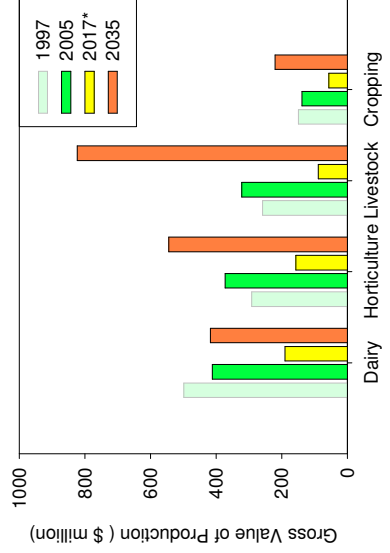
Farm Water Use



Irrigated Area



Farm Gate Gross Value of Production



* Graphics depict 2017 drought conditions with high reliability water allocation of 30%.

Irrigation Futures Project - Milestone Report 4 Attachment

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8. Communication Activities July 2005 – June 2006

The project team has presented the following written and oral reports during Stage 3B.

Milestone Reports

- Irrigation Futures of the Goulburn Broken Catchment: Milestone 4 Report, DPI Tatura, June 2006.

Governance Committee

- Progress Report, 8 November 2005
- Completion of Stage 3 requirements, 2 May 2006

Stakeholder Reference Committee

- Progress Report, 9 December 2005
- Progress Report, 23 June 2006

Technical Working Group

- 14 Workshops between July 2005 – June 2006

Briefings for Stakeholder Groups

- Campaspe Shire Council, 12 July 2005
- Kyabram Dairy Centre & ACIAR, 15 July 2005
- Moira Shire Council, 18 July 2005
- Goulburn Broken CMA, 20 July 2005
- SIRIC Reporting Day, 29 July 2005
- University of Melbourne Science and Citizenship project, 1 Feb 2006
- Murray Valley Water Service Committee, 23 February 2006
- CRCIF Project review, 17 March 2006
- Tim Thelander AFFA, 22 March 2006
- Land and Water Australia, 22 March 2006
- Water Interest group, Campaspe Shire, 19 April 2006
- North East CMA Board, 21 April 2006
- State Minister for Agriculture, 9 May 2006
- AFFA, 17 May 2006
- Regional Catchment Strategy workshop, 18 May 2006
- Economic Development Managers, CoGS, Moira and Campaspe Shires, 1 June 06
- SIRIC Reporting Day, 14 June 2006

Conference Papers Presented

- Linking Research and Extension – Bendigo, 7 September 2005
- ANCID - Mildura, 24-26 October 2005
- International Symposium on Water Resources Management – Beijing, October 2005
- ABARE Outlook Conference - Canberra, 1 March 2006
- APEN Conference - Beechworth, 6 March 2006

Articles / Newsletters

- Information updates to Irrigation Futures Forum members, Sept 05 & May 06

Other presentations

- Invited Speakers Day, Professor Jonathan West & Dr Peter Ellyard: 14 September 2005