Irrigation Futures

of the Goulburn Broken Catchment

Final Report 1 – Scenarios of the future: Irrigation in the Goulburn Broken Region

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Authors

Mr David Robertson, Dr Q.J. Wang, Mr Leon Soste and Mr Robert Chaffe

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Irrigation Futures of the Goulburn Broken Catchment

Final Report 1 – Scenarios of the future: Irrigation in the Goulburn Broken Region

Project Team:
Dr Q.J. Wang (Project Leader), Leon Soste (Operational Manager), David Robertson (System Analyst), Sherridan Watt (Project Support) – Department of Primary Industries and Cooperative Research Centre for Irrigation Futures

Robert Chaffe (Workshop Facilitator) – Community Engagement Network, Department of Sustainability and Environment

Governance Committee:
Ian Atkinson, Murray Chapman, Denis Flett, Phillip McGowan, Ian Moorhouse, John Pettigrew (Chair), Sonja Tymms.

Stakeholder Reference Committee:
Mark Allaway, Allen Canobie, Bruce Cumming, Steve Farrell, Peter Gibson (Chair), Colin James, Peter McCamish, Ian Moorhouse, Chris Norman, Russell Pell, Derek Poulton, Ann Roberts, Nick Roberts, Nick Ryan, Ken Sampson, Alan Sutherland, David Taylor, John Thompson, Mark Wood.

Technical Working Group:
Bruce Anderson, David Bourke, Allen Canobie, Bruce Cumming, John Dainton, Joe Demase, Peter Fitzgerald, Lyn Gunter, Shane Hall, John Laing, Peter Langley, David Lawler, Oliver Moles, Bev Phelan, Claire Pinniceard, Derek Poulton, Kevin Preece, Durham Prewett, Peter Sargent, Rien Silverstein, Katrina Tehan, Ross Wall, Gordon Weller.

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Department of Primary Industries
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Preface

We have been in drought for almost 10 years. Water trade is moving large amounts of water in and out of regions. Overseas markets wax and wane. These issues and more will continue to bring major challenges to irrigated agriculture here and elsewhere in Australia, and indeed the world.

To help us to plan for these challenges, we (as a region) commissioned the Goulburn Broken Irrigation Futures project. The aim of the project was to work with stakeholders to develop a vision and strategies for irrigated agriculture in this region over the next 30 years. That long-term planning horizon involved considerable uncertainty, so we chose to use a scenario-based approach to our planning.

This report, entitled *Scenarios of the future,* describes four plausible scenarios, developed for this project, of how the future might unfold. It explores the likely impacts of those scenarios for regional business, communities and the environment. It considers how those groups might respond to challenges and opportunities. It also explores the implications for major regional agencies associated with irrigated agriculture, and illustrates how those agencies are implementing their responses. Finally, it provides guidance on how we (as a region) might position ourselves for an uncertain future. It will become a living reference document for us in the coming years.

This work would not have been possible without significant input from a large number of irrigators, businesses, community and environment groups, and agency staff within our community. To those people, I say a sincere thank-you. I am also pleased to report that the Irrigation Futures project team has worked closely with these stakeholders at every stage. This means that we can have confidence in, and ownership of, the ideas and the recommendations contained in this report. I commend it to you.

Readers may also be interested in a companion document entitled *Regional scenario planning in practice*. This describes the processes used to formulate and explore the scenarios. Our intention was to provide a guidebook for other regions which wish to engage their communities in a similar exercise.

Planning is one thing. Implementation is another. Many people have said to me that the hard work starts now. I agree. I invite you to join with me in making these plans for our future a reality.

John Pettigrew
Chair,
Irrigation Futures of the Goulburn Broken Catchment
June 2007

Acknowledgments

The work reported in this publication was undertaken as a part of the project Irrigation Futures of the Goulburn Broken Catchment. The project was the initiative of a small group of community leaders, particularly John Dainton, Steven Mills and John Pettigrew, who had the foresight to recognise the need for the Region to plan for the long-term.

The authors would like to recognise the numerous people have contributed to this project.

The Community Engagement Network of the Department of Sustainability and Environment provided expertise in community engagement and workshop facilitation. The contributions of Selina Handley, Nicole Hunter, Fiona Smolenaars deserve particular recognition.

During 2004, over 120 members of the Regional community participated in Irrigation Futures Forums, a program of four workshops exploring the future for irrigation in the Region. These workshops laid the foundations for the output from the project.

The Technical Working Group contributed many days of their time in undertaking analysis of the scenarios and developing their implications for the Region. Members of the Technical Working Group included: Bruce Anderson, David Bourke, Allen Canobie, Bruce Cumming, John Dainton, Joe Demase, Peter Fitzgerald, Lyn Gunter, Shane Hall, John Laing, Peter Langley, David Lawler, Oliver Moles, Bev Phelan, Claire Pinniceard, Derek Poulton, Kevin Preece, Durham Prewett, Peter Sargent, Rien Silverstein, Kate Tehan, Ross Wall, and Gordon Weller.

The Stakeholder Reference Committee played an important role in ensuring the stakeholder engagement processes were inclusive. They also helped synthesise the output from the Irrigation Futures Forums. Members of the Stakeholder Reference Committee included: Mark Allaway, Allen Canobie, Alan Crouch, Bruce Cumming, Steve Farrell, Peter Gibson, John Gray, Terry Hunter, Colin James, Brigette Keeble, Tony Long, Peter McCamish, Ian Moorhouse, Chris Norman, Russell Pell, Kylie Pfeiffer, Derek Poulton, Helen Reynolds, Ann Roberts, Nick Roberts, Melva Ryan, Nick Ryan, Ken Sampson, Justin Sheed, Alan Sutherland, David Taylor, John Thompson, Mark Wood and Roger Wrigley.

The Governance Committee provided oversight of the strategic direction of the project. Members of the Governance Committee included: Ian Atkinson, Murray Chapman, Deborah Courtney, Denis Flett, Frank Greenhalgh, Richard Habgood, Brigette Keeble, Philip McGowan, Ian Moorhouse, John Pettigrew, Kylie Pfeiffer, Greg Roberts, Sonja Tymms and Mark Wood.

The project received funding and support from the Victorian Government's Department of Primary Industries and Department of Sustainability and Environment, the National Program for Sustainable Irrigation, Goulburn Broken Catchment Management Authority, Goulburn-Murray Water, the Cooperative Research Centre for Irrigation Futures and the Australian Government's National Action Plan for Salinity and Water Quality.

The authors would also like to thank the reviewers of the project and its documents. These reviewers included Dr. Nick Abel, Dr. Allan Dale, Professor Ron Johnston, Dr. John Wolfenden, and Bruce Wright.

Contents

1 Introduction

The Goulburn Broken Catchment is known as the food bowl of Australia. It covers 2.4 million hectares and has a population of around 200,000 people (Department of Sustainability and Environment 2005). Irrigated agriculture is a major business engine in the Goulburn Broken Region, producing more than $1.2 billion at the farm gate in 2001-2002 from about 280,000 hectares of irrigated agricultural land. Investment in on-farm and processing infrastructure is about A$100 million per annum (Michael Young and Associates 2001). The Region is therefore a major contributor to the state and national economies and the quality of life of consumers.

The Region faces significant challenges and opportunities. Issues such as free-trade agreements, climate change, water reform, and technological developments will have a significant influence on the future. As one of the oldest gravity irrigation systems in Australia, Goulburn-Murray Water's irrigation system needs substantial renewal of its ageing infrastructure in the next 20 years. The consequences of these pressures for the Region are highly uncertain and will include impacts on the Region's economy, environmental assets and social fabric. Therefore, it is critical that the Region develops a sound plan to strategically position itself for irrigation in the future.

Regional planning is highly challenging. In addition to the complexity of issues and high level of uncertainty, a diverse range of stakeholders has interests in the planning process and its outcomes. Enabling all stakeholders access to the planning process is important to managing their expectations and developing plans that are robust and likely to be adopted.

The Goulburn Broken Irrigation Futures project was established to assist the regional community to plan for the future. It was a regional initiative, funded by the Goulburn Broken Catchment Management Authority, Goulburn-Murray Water, Victorian Department of Primary Industries, Victorian Department of Sustainability and Environment, the National Action Plan for Salinity and Water Quality, the Cooperative Research Centre for Irrigation Futures and the National Program for Sustainable Irrigation. The project adopted a scenario planning approach in collaboration with the region's stakeholders. The project objectives were to:

- develop a shared vision for the future of irrigation in the Goulburn Broken catchment over the next 30 years;
- identify scenarios of major constraints and opportunities and of Regional response options;
- understand the social, economic and environmental consequences of various scenarios; and
- facilitate key stakeholders to build consensus on preferred Regional strategies for future irrigation.

Scenario planning is a relatively new approach to strategic planning developed and applied famously by the Royal Dutch Shell Company to

anticipate and plan profitably for the oil shocks of the 1970s (O'Brien 2000; van der Heijden 1996). Scenario planning explicitly acknowledges ambiguity and uncertainty in the strategic question by creating a set of scenarios that describe plausible, coherent pictures of alternative futures. These scenarios become a powerful tool for testing the robustness of strategies, as well as for generating new strategic options. Scenario planning also provides a useful means for organisational learning. While scenario planning has become widely used by private corporations and public organisations (O'Brien 2000), there are few examples of its application for regional planning.

The Goulburn Broken Irrigation Futures project used scenario planning in conjunction with the Regional community to explore and plan for the future of irrigation in the Region. The project was undertaken in four stages. Following an initial stage that developed the project, community perspectives on the future for irrigation were captured by an extensive stakeholder-engagement program. The third stage involved developing detailed scenarios and examining their Regional implications. The final stage involved examining the implications of the scenarios for specific issues, in collaboration with the Region's agencies and organisations. A brief summary of the activities and output for each of the stages follows.

Stage 1: Project development
Stage 1 involved scoping the detail of the project, securing funding, and establishing the governance arrangements for the project.

Stage 2: Capturing community perspectives
Through the Irrigation Futures Forums, Stage 2 engaged a wide range of stakeholders to capture perspectives on the visions, external scenarios and response options. About 120 stakeholders participated in a series of four full-day workshops held throughout the Region. Stakeholders included primary producers, major processors, business and community groups, local government and agencies responsible for land and water management. Stage 2 produced:

- aspirations for irrigated agriculture in the Region;
- 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.

Stage 3: Conducting analysis
Stage 3 involved conducting a detailed analysis of how the Region would manage the external scenarios developed in Stage 2. The assessment included both qualitative assessment and quantitative modelling of the scenarios and their impacts. A skill-based Technical Working Group comprising members of the local community and stakeholder organisations undertook the qualitative assessment. The analysis considered:

- how individuals, businesses and organisations would respond to the four external scenarios;
- the likely consequences of the external scenarios and Region's responses for the economic, community and environmental well-being of the Region; and

- the broad implications of the scenarios for the Region and strategies to address these implications.

Stage 4: Enabling changes

Stage 4 involved assisting Regional organisations and groups to build the learning from the project into their business and strategic plans. The project team worked with a number of organisations in major strategic developments in the Region, principally:

- the development of Goulburn-Murray Water's Strategic Overview of Service Needs for the Shepparton Irrigation Region;
- the five-year review of the Shepparton Irrigation Region Catchment Strategy; and
- the development of the Rural Strategy for the Campaspe, Moira and Greater Shepparton local governments.

A more-detailed summary of the project stages is provided in the Appendix, and the full project methodology is described in the companion publication to this book, *Regional scenario planning in practice: Goulburn Broken Irrigation Futures.*

The project has produced output at three levels to enable users to access material in different ways. The four *Scenarios*, which describe the evolution of plausible alternative futures for the Region, are designed to enable users to consider alternative possible futures and how they may impact on their business or organisation. The *Broad implications of the scenarios* are designed to enable users to readily identify strategies to maintain and increase the attractiveness of the Region and consider how to build those strategies into their business or organisation. The *Implications of the scenarios for specific issues* are tailored recommendations for individual organisations in the Region.

This book contains the principal Regional-level output from the Goulburn Broken Irrigation Futures project, and supporting background information, specifically the four *Scenarios* and the *Broad implications of the scenarios* for the Region as a whole. Chapter 2 introduces the Region, providing a background description of the Region's human, financial and natural resources, their current condition, and an historical perspective of how the current condition has arisen. Chapter 3 describes some of the forces that drive the Region and the possible directions that these forces may take in the future. Chapter 4 contains an overview of the four scenarios, describing how the driving forces may evolve, how the residents and organisations of the Region may respond, and the impacts of the driving forces and responses on the social, economic and environmental well-being of the Region. Chapter 5 discusses the broad implications of the scenarios for the future of the Region. It identifies strategies for the Region to protect and strengthen the features that make it attractive for investment and living. Chapter 6 concludes by summarising the key findings of the project and describing how this publication can be used by individuals, businesses and organisations in the Region to plan for the future.

2 The Goulburn Broken Region

Introduction

In looking at what the future may hold for the Region, it is useful to understand the current conditions of the Region and how these conditions came to exist. This chapter provides a perspective on the current conditions by looking at the Region's major strengths and weaknesses. Some of the historical circumstances leading to the current conditions are also discussed. The Irrigation Futures Project identified six major competency areas of the Region that summarise the strengths and weaknesses. The competency areas are Water, Land, Agribusiness, Community, Environmental Assets and Institutional Support.

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 describe the conditions of the Region and the changes that have occurred.

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 publicly-owned constructed infrastructure, whereas throughout the remainder of the Region irrigation water is predominantly diverted from water bodies.

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.

Water

Rainfall varies considerably across the catchment, with average annual totals varying from 430 mm in the far north-west of the catchment to 1,700 mm in the south-east. Inter-annual rainfall variation is also significant. Figure 3 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 1,000 mm in the south to 1,500 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 3 also illustrates the seasonality of rainfall and pan evaporation in the Region.

Pan evaporation is highly seasonal with peak rates observed during summer, while the seasonality of rainfall is lower, with monthly totals highest during the winter and spring months. This seasonality highlights the importance of irrigation to the Region.

Figure 1 Catchment management and irrigation delivery districts within the Goulburn Broken catchment.

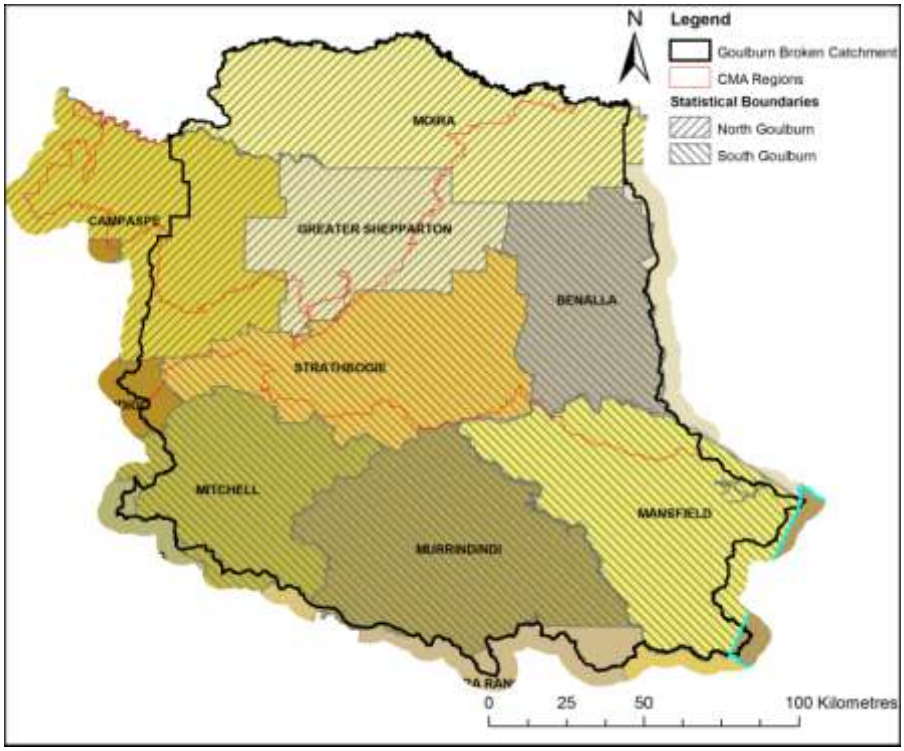


Figure 2 Municipal and statistical areas in the Goulburn Broken catchment

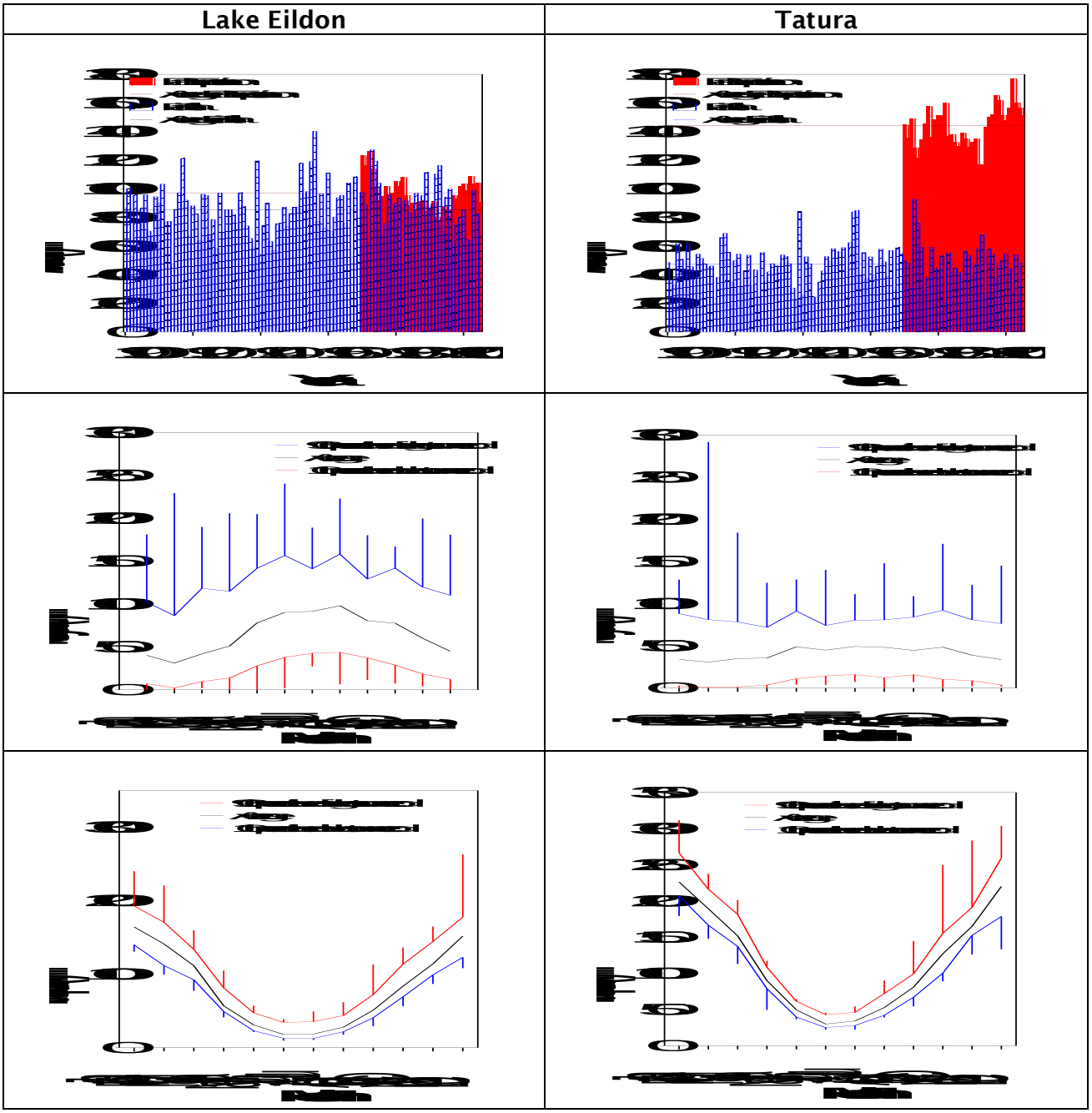


Figure 3 Historical rainfall and pan evaporation for the Goulburn Broken Catchment
(Source: Bureau of Meteorology)

Irrigation water entitlements and their associated rights are one of the Region's strengths. These entitlements were enshrined in the first legislation dealing with irrigation in 1886 and have been progressively modified to improve security for irrigators. The first irrigation entitlements were based on the area deemed to be irrigable and water was allocated *pro rata* according to its availability. In 1905, annual charges were legislated to fund the irrigation infrastructure operation and maintenance. These charges were imposed even if landholders did not use their available water, and were designed to encourage landholders to use their water entitlement regularly or sell their property to someone who would.

In 1958, following several augmentations of water supplies, including the construction of Lake Eildon, volumetric water entitlements were established. These water entitlements were also based on area of land suitable for irrigation and commanded by the supply infrastructure, but were not directly proportional to area (see Table 1). Water was allocated annually to these entitlements and any water in excess of the entitlements was made available to irrigators as a 'sales' allocation.

Table 1 Volumetric water entitlements enshrined in 1958 Water Act (Source: Rural Water Commission of Victoria 1988)

Property area	Water entitlement
0 – 16.2 ha of suitable land	5.33 ML/ha
16.2 – 40.5 ha of suitable land	86 ML plus 3.048 ML/ha for each ha in excess of 16.2 ha
40.5 ha to 89 ha of suitable and commanded land	160 ML plus 0.254 ML/ha for each ha in excess of 40.5 ha
> 89 ha of suitable and commanded land	172 ML plus 1.016 ML/ha for each ha in excess of 89 ha

The *Water Act* of 1989 enabled irrigation water entitlements to be traded between landholders, and established legal water entitlements for the environment. Amid growing concerns about changes to riverine flow regimes, in 1995 the Murray Darling Basin Commission capped the volume of water that could be diverted from rivers at 1993-1994 levels of development. The imposition of the cap had little impact on the quantity of water available in the Goulburn Broken Region because the available surface water resources were almost completely developed by 1993-1994. However, the cap has meant that further irrigation development is contingent on achieving water-use efficiencies or water trade.

Recent modification of the 1989 *Water Act* was made as a part of the 2004 water reform white paper, *Securing our water future together*. From 1 July 2007, these modifications will unbundle irrigation water entitlements into three separate parts: a share of the available water resource; a share of the water distribution capacity; and a licence to irrigate. Both the water share and capacity share will be tradeable, however the water-use licence will be linked to land parcels. 'Sales' water allocations will also convert into medium-reliability tradeable entitlements, and the historical entitlements will be labelled as high-reliability entitlements. In converting the 'sales' water into a secure tradeable entitlement, 20 percent of the available 'sales' water pool was reallocated from irrigation entitlements to an environmental entitlement. The developments of water entitlements and policies in the Region since 1989 illustrate that water resource management has moved from an expansionary phase, dominated by resource exploitation, to a mature phase, where issues of scarcity and external costs prevail.

In 2006, the Goulburn Broken catchment had water entitlements of a little under 1,100 GL. From 1 July 2007, this entitlement is expected to comprise 1,100 GL of high-reliability entitlement and approximately 530 GL of medium-reliability entitlement. Historical data suggest that full high-reliability water entitlements can nominally be delivered in 96-97 years out of every 100. Medium-reliability water entitlements have a considerably lower

reliability. Table 2 shows the use of irrigation water entitlements, by industry, for the 1996-1997 and 2004-2005 irrigation seasons. The 1996-1997 irrigation season was the most recent time when full (100%) sales allocations were available across the entire Goulburn Broken Region. The majority of water (more than 60 percent) is used by the dairy industry, with livestock and fodder and grains also using large volumes.

Table 2 Water use, entitlement and allocations in the Goulburn Broken Region^ (Source: Douglass *et al.* 1998; Goulburn-Murray Water 1997; 2005; McAllister 2005)

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 1989, following the introduction of the revised *Water Act*. Until 1994 the volume of water traded each year was relatively small, averaging less than 8,000 ML/year for all of northern Victoria (Department of Natural Resources and Environment 2001) . Since then the volume of water traded temporarily each year has increased to 15 percent of water entitlement in the Region and the volume of permanent water trade has increased to a little over two percent of water entitlement per year (Figure 4).

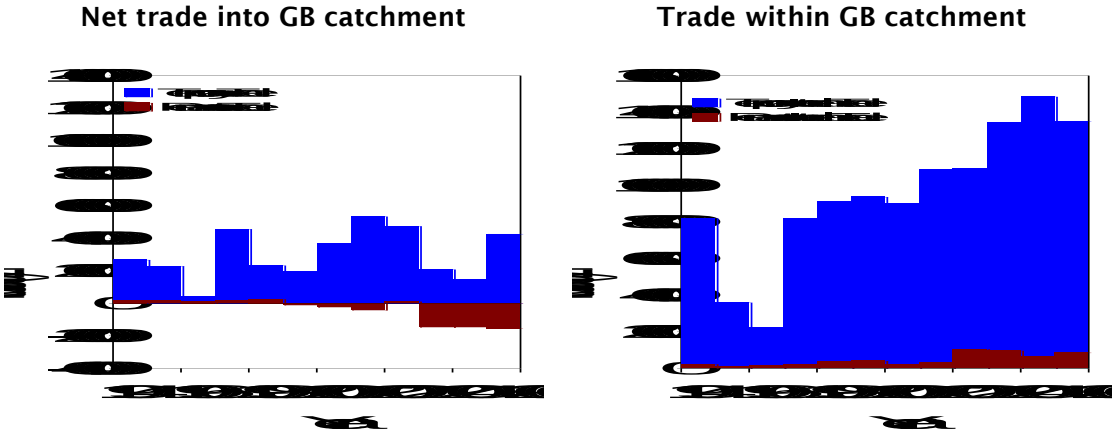


Figure 4 Water trade in the Goulburn Broken catchment (Source: Goulburn-Murray Water Annual Reports)

The majority of irrigation water used in the catchment is used in the Shepparton Irrigation Region. Most irrigation water is distributed to irrigation properties through open earthen channels. The network of channels within the Region is extensive, enabling water to be delivered to all properties. However, much of this infrastructure is ageing, and will require replacement over the next 20 years.

Land

Land in the Goulburn Valley was first formally settled in the early 1870s. Until this time, squatters in the Region had occupied large tracts of land under licence, commonly grazing sheep. Following the enactment of the *Selectors Act* in 1868, selections of up to 320 acres (130 hectares) could be made by prospective landholders. These selections were found to be too small for profitable agriculture, particularly during the drought of the late 1870s, and within 20 years only one in 10 of the original settlers remained (Barr and Cary 1992).

Introduction of the *Closer Settlement Ac*t (1904) and *Water Act* (1905) saw the development of Closer Settlement Schemes. These Schemes broke up large landholdings into small blocks suitable for intensive irrigated agriculture. The size of these blocks varied according to land use suitability, with blocks of 35 acres (14 ha) offered in areas suitable for fruit production, 20 to 100 acres (8-40 ha) for dairy production and 100-200 acres (40-80 ha) for mixed farming operations (Rutherford 1964). The development of the closer and soldier settlement schemes continued from the early 1900s until 1976, when sale of land in the Campaspe West irrigation district was finalised (Barr and Cary 1992). These blocks are the basis of land parcels used for agriculture today and continue to leave a legacy to current agricultural businesses. The mixed sizes of land parcels make the Region attractive to a wide range of agricultural businesses; however the diversity in size also constrains the ability of some agricultural businesses to grow.

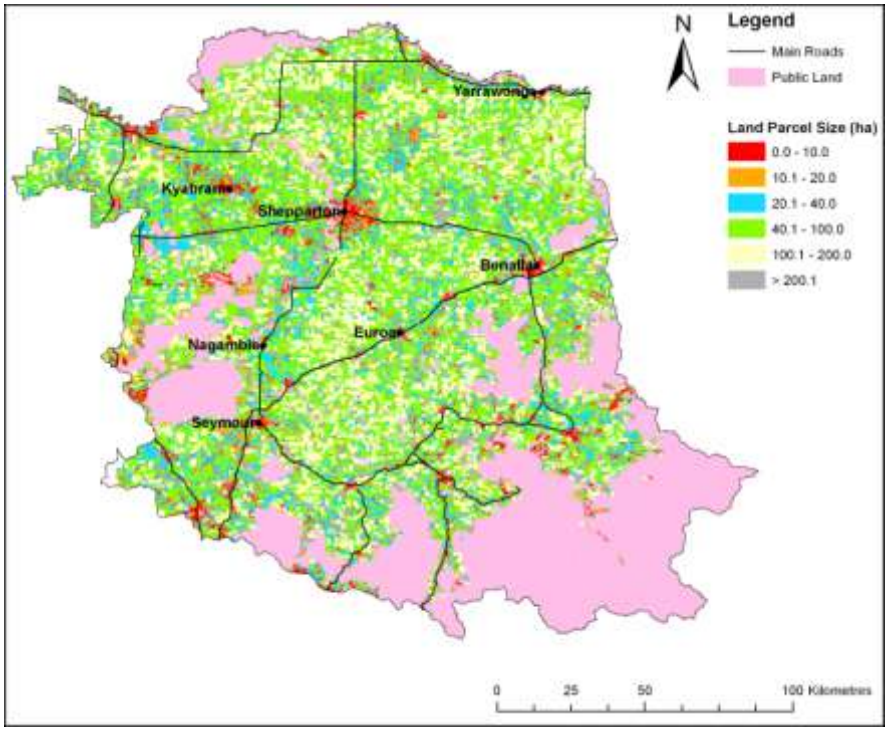


Figure 5 Land parcel size in the Goulburn-Broken catchment

The majority of irrigated agriculture in the catchment occurs in the Shepparton Irrigation Region (See Figure 1). Land use in the Shepparton Irrigation Region is diverse; however a few major agricultural industries use the majority of the land (Table 3). 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 1996-1997 and 2004-2005, while the area of land used by other industries decreased.

Table 3: Land use of the Shepparton Irrigation Region (ha)^ (Source: Douglass *et al.* 1998; McAllister 2005)

Industry	1996-1997	2004-2005
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 2004-2005

^Different data collection methods used

The Region has a wide diversity of soil types. In the irrigation area, the majority of these soils originate from sediments deposited by aeolian and riverine processes. In the higher parts of the catchment, the diversity of soils is considerably greater due to the steeper topography, greater rainfall and parent materials. Many of these soils are highly suitable for agriculture if their physical and chemical limitations, such as inherent sodicity and acidity, are carefully managed.

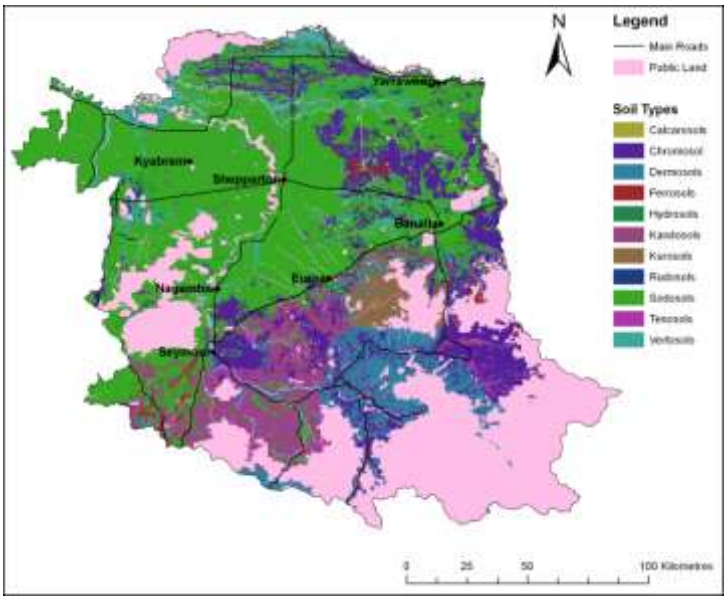


Figure 6 Soils of the Goulburn Broken catchment

Historically, salinity has been identified as a threat to agricultural production in the Region, particularly in the Shepparton Irrigation Region. First evidence of salinity problems emerged in the late 1920s following severe floods, particularly in areas of poor drainage (Barr and Cary 1992). Surface drainage programs were not seen as a priority during the initial development of irrigation infrastructure. Periodic efforts at providing surface drainage have been made, starting in the Depression of the 1930s. By the 1950s it became apparent that surface drainage alone would not provide a complete solution

to salinity and water logging problems, and investigations into the use of subsurface drainage began. In recent times, the Shepparton Irrigation Region Land and Water Management Plan has accelerated the rate of implementation of salinity management infrastructure, particularly through community surface drainage and private groundwater pumping programs. Surface and subsurface drainage is now available in many parts of the Shepparton Irrigation Region (Figure 7). A Regional watertable monitoring program was also established as a part of the Land and Water Management Plan to understand the areas at risk of salinisation. This monitoring has shown that between 1995 and 2005 the area of shallow watertable decreased substantially (Figure 7), which has been caused by several factors including the effects of management plan works, a dry climate sequence and water trade.

Increasing evidence of land salinisation throughout the Murray Darling Basin and its forecasted increases in river salinity led to the formation of the Murray Darling Basin Commission (MDBC) in the mid 1980s. To manage the emerging salinity problems, the 1988 MDBC Salinity and Drainage Strategy placed constraints on the disposal of saline drainage water to the Murray River. These constraints mean that any new drainage works installed in the Region need to be offset by salinity credits, which can be obtained by providing financial support for salinity reduction works.

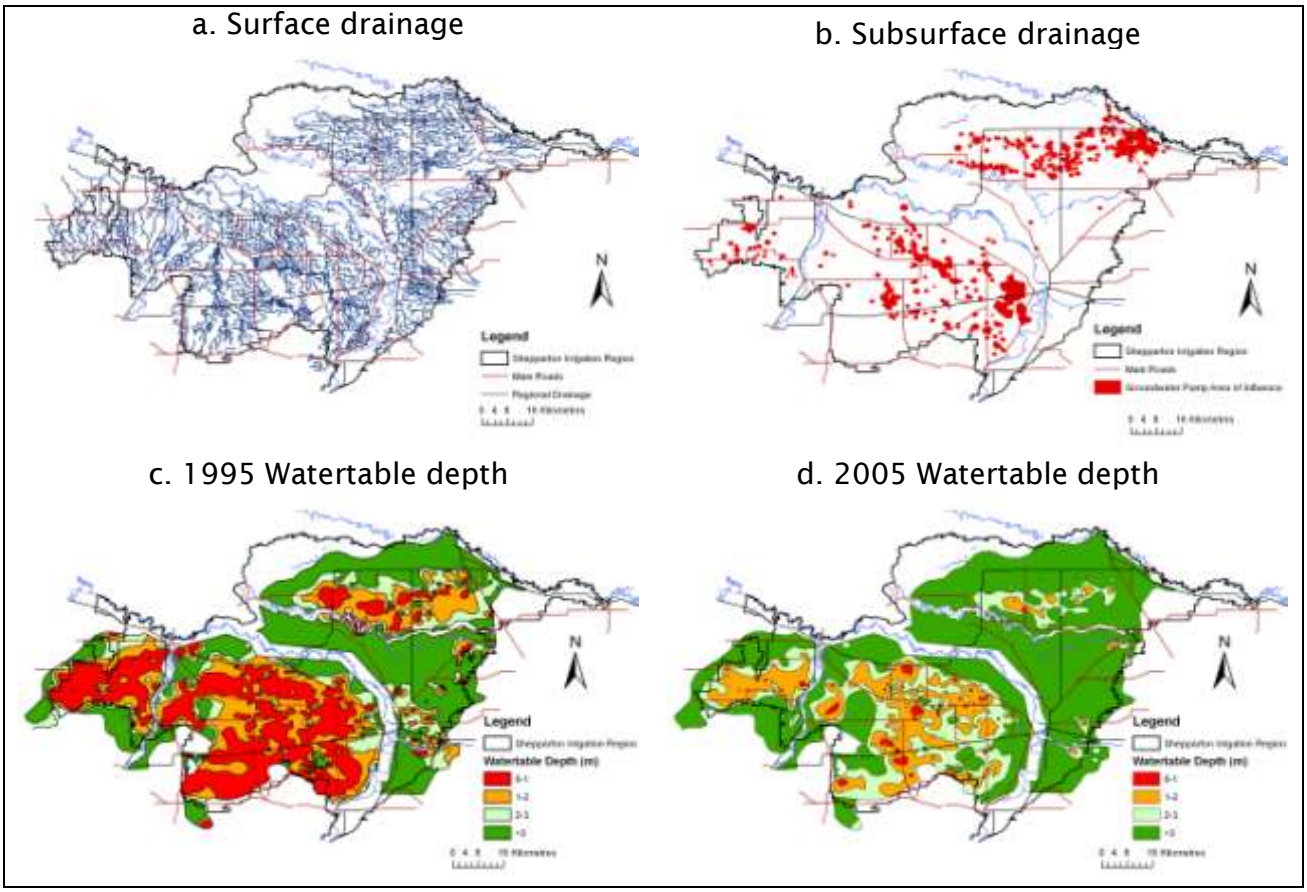


Figure 7 Salinity and drainage in the Shepparton IrrigationRegion

Agribusiness

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 percent, or approximately four percent per annum, from $1.17 billion to $1.67 billion (Table 4). Dairy production is the largest single contributor to the Regional 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, 2005). The dairy industry in the Region contracted significantly in 2002-2003 due to low irrigation water availability and has been slowly recovering since.

Table 4 Farm-gate gross value of production for Goulburn Region ($million)
(Source: Australian Bureau of Statistics 1996; 2001; 2005b)

	1995-96			2000-01			2004-05
Activity	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	135.8*
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**

Synergies exist between many of the agricultural industries in the Region. For example, the dairy industry relies heavily on the hay and grain production within the Region. However, the agricultural industries primarily produce commodities and therefore have little control over the prices they receive.

The scale of many of the Region's agricultural industries has enabled the growth of manufacturing industries in the Region. These manufacturing industries also make a substantial contribution to the economy of the Region (Table 5). The largest contribution is by the food and beverage manufacturing industries that process agricultural products. The size of the agricultural production and processing industries in the Region has also attracted a wide range of service industries, including machinery and metal manufacturers.

Table 5 Contribution of manufacturing industries to Regional economy in 2001-2002
(Source: Australian Bureau of Statistics 2005a)

Manufacturing industries	Number of locations	Sales Income ($ million)
Food, beverage and tobacco	140	2924.7
Textile, clothing, footwear and leather	90	89.2
Wood and paper product	100	135.8
Printing, publishing and recorded media	89	56.6
Petroleum, coal, chemical and associated product	45	29.4
Non-metallic mineral product	73	45.2
Metal product	277	312.7
Machinery and equipment	214	110.7
Other manufacturing	163	54
Total manufacturing	**1191**	**3758.3**

Community

The strength and diversity of the Regional community supports the development and adaptation of the Region. 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. The population density, particularly in the North Goulburn statistical area, has enabled a wide range of community and commercial facilities to develop in the Region.

Figure 8 shows the population profiles for the Goulburn statistical division for 1996, 2001 and 2006. These profiles show that the population aged between 20 and 30 years is considerably lower than the adjacent age cohorts. This occurs due to the limited availability of educational opportunities in the Region. A large number of young people leave the Region to seek education and employment. The profiles also show that the population aged 40 and over has increased between 1996 and 2006, with the largest increases in the age cohorts between 40 and 60 years old.

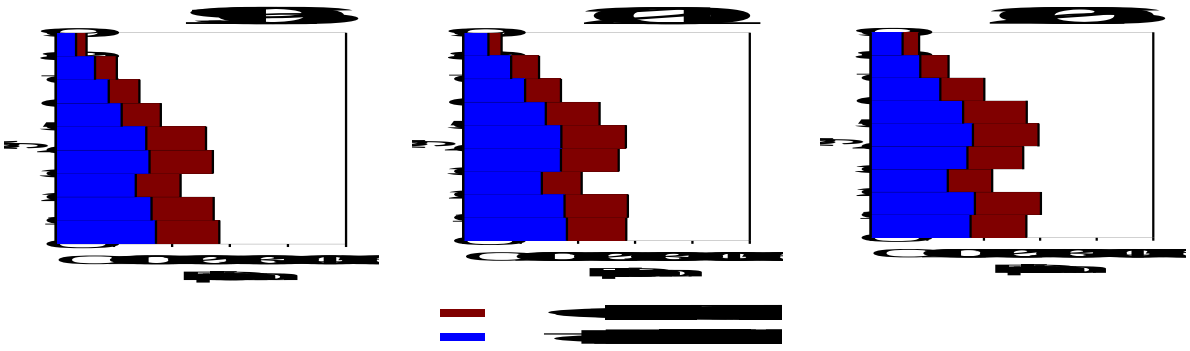


Figure 8 Population profiles for the Goulburn statistical division
(Source: Department of Sustainability and Environment 2005)

The Goulburn Broken Region is culturally diverse. While only 10 percent of the population was born outside Australia (Figure 9), over 23 percent of the population have at least one of their parents born overseas (Australian Bureau of Statistics 2002). This cultural diversity has attracted new migrants to the Region who have brought new ideas with them. This has helped the Region develop a strong culture of innovation.

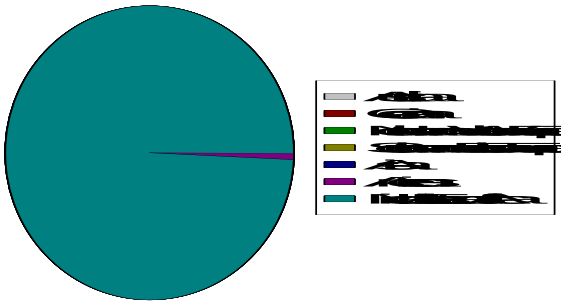


Figure 9 Birthplace of population in Goulburn statistical division (Source: Department of Sustainability and Environment 2005)

The Region's community is active and generous with their time and money. A recent survey of Victorian communities found that levels of voluntary activity and participation in organised community groups in the Region were higher than the state wide average (Department for Victorian Communities 2005).

Institutional support

The Region has a wide range of institutions that encourage and support the development of the Region. The Region's industries and professions are well organised. A network of active industry and professional associations provides a public voice for agricultural industries and supports industry development activities.

Numerous state and federal government agencies have a presence within the Region and many of these agencies have active programs to support the Region. These programs include research and extension activities to support agricultural industries and a narrow range of educational opportunities. Ten local governments support the communities of the Region. These local governments are strong and actively encourage the development of the Region. All of these agencies are relatively mature and work together co-operatively, providing certainty for investment.

Environmental assets

The Region has a wide variety of environmental assets. While large areas of the Region have been cleared, some parts are well vegetated, particularly riparian areas and the upper catchment (Figure 10). These parts of the landscape are aesthetically attractive for tourists and lifestyle residents. The Region has a large number of wetlands and waterways, many of which have environmental water entitlements; however these allocations are relatively small in comparison to the entitlements of agricultural production.

Much of the Region's community is concerned about their local environment. This is demonstrated through involvement in Landcare and other environmental organisations. The area of influence of Landcare groups currently covers the vast majority of the private land within the catchment (Figure 10).

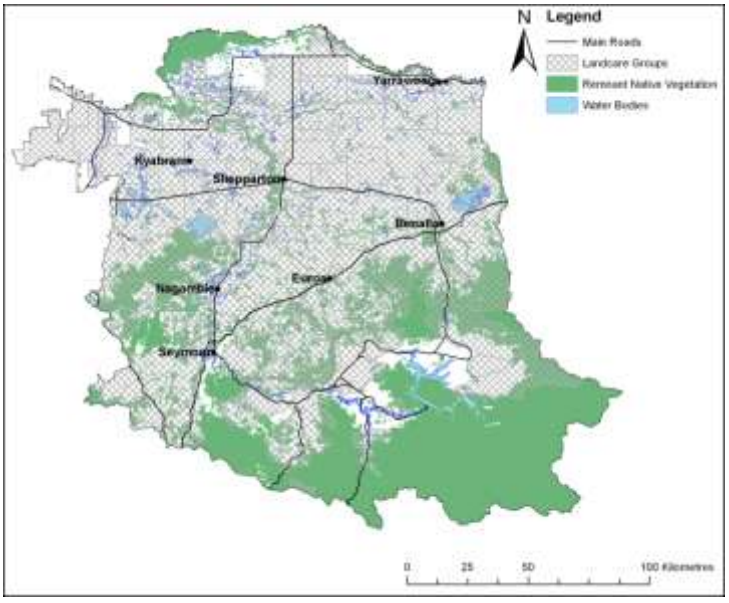


Figure 10 Extent of remnant native vegetation and Landcare groups in the Region

Community Aspirations

During Stage 2 of the project, the Irrigation Futures Forums defined their aspirations for the Region. The forums desired that, in 2035, the community of the Goulburn Broken Region would 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, co-operation, working together as a wider community)
- Actively participating in decision making processes and implementation programs
- Managing change (preparedness, adaptability, innovation, learning culture).

3 Understanding the drivers for change

There are many forces that influence the businesses and organisations in the Region. In looking at the future it is useful to understand how some of those forces have influenced the Region in the past and how they may evolve in the future. This chapter explores some of the forces that were identified as important drivers for the Region in the future and examines how they may evolve. The drivers covered include the major social, economic, political, technological and environmental factors and their interactions.

Pressure on agriculture

In recent history, agricultural businesses have been suffering declining terms of trade. Prices received for products have been trending downward in real terms (adjusted for inflation). For example, Figure 11 shows that the price received by dairy farmers has decreased, in real terms, from 55 cents per litre in 1960 to 30 cents per litre in 2005. Production costs, on the other hand, have tended to remain static, or increase. Figure 11 also illustrates the long-term changes in the cost for some typical farm production inputs. The combination of decreasing prices received and static, or increasing, costs cause agricultural businesses to become decreasingly profitable.

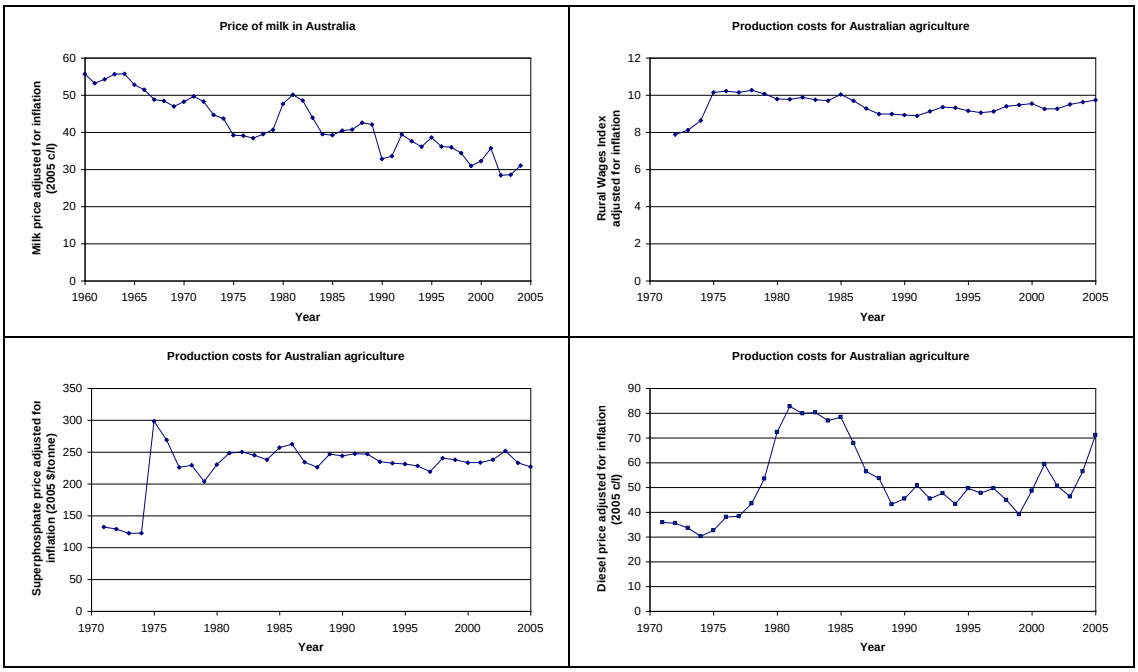


Figure 11 Historical milk prices and production costs. (Source: ABARE 2005)

Historically, agricultural industries have a propensity to adapt to cost pressures by increasing business productivity, producing more, using fewer resources or both, and generating higher valued products. This has enabled the total economic profit of agricultural industries to increase or remain steady, in real terms, for many years.

Dairy farming systems, for example, have adapted to declining terms of trade using a number of strategies. Between 1960 and 2005, milk production per cow has increased from less than 2,000 litres to nearly 5,000 litres per year, which has been achieved through improved herd genetics, pasture management and supplementary feeding. Over the same period, the number

of farms has decreased and the average herd sizes have increased. Enlargement of farms has been supported by increases in farm labour efficiency, particularly in milk harvesting, and has enabled the industry to spread fixed overhead costs over a larger base.

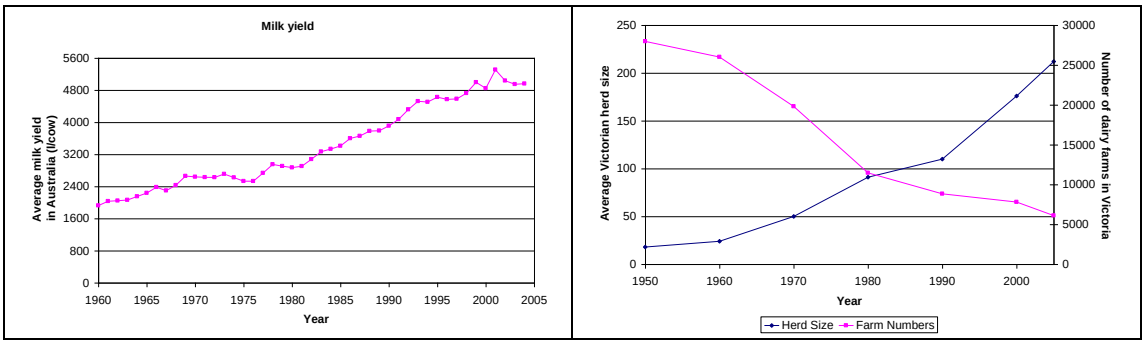


Figure 12 Historical productivity improvements. (Source: ABARE 2005; Jackson 1998)

Future productivity improvements in agricultural industries are likely to continue. On farms, these improvements are likely to arise from the use of new technologies that enable increases in product yield or price, or reductions in inputs, including labour, water and fertiliser. In processing industries, productivity improvements will result in higher value products and reduced production costs.

In the dairy industry, Garcia and Fulkerson (2005) suggest improvements in productivity will arise in three main areas: increasing forage production per unit area; increasing the efficiency of milk production per cow; and increasing labour efficiency through the use of technology. For example, currently the Swedish dairy industry averages 6,700 litres per cow per year, approximately 35 percent higher than Australian yields, and examples of individual cows yielding 13,000 litres have been reported. This suggests the efficiency of milk production per cow in the Australian herd can be improved through genetic selection and feeding regimes. Likewise, emerging technologies such as robotic milking have the potential to significantly improve labour efficiencies on dairy farms. These improvements may cause fundamental changes to the structure of dairy farming systems, but will enable the industry to exist into the future.

Agricultural productivity improvements and their impact on communities

Agriculture and associated manufacturing industries have historically been the major source of employment in the Region. The increasing productivity of agricultural industries has reduced the number of farms and reduced manual labour requirements through the adoption of new technology. This effectively reduces the number of people employed directly by agriculture.

Alternative sources of employment have emerged in providing services to agricultural businesses and in other industries. These service businesses require skilled workers and are typically based in the Region's larger centres. Employees of service businesses have greater freedom in their place of residence than those directly employed by agriculture. Some of these people are attracted to living in larger centres close to their place of employment, while others choose to live in smaller towns, where property prices are generally lower.

Those who live in smaller towns tend to treat their place of residence as a dormitory. This means that they not only commute to work away from their place of residence, but also tend to shop and form social networks in larger centres. As a result, many of the businesses and services in smaller towns receive less custom. As levels of custom decline below critical thresholds, businesses close and services are progressively withdrawn. Small towns without critical services, such as banks, supermarkets and petrol stations, are less attractive to new residents and businesses. Therefore, in the longer term, these small towns are likely to stagnate or decline.

Barr *et al* (2005) describe how such a decline has occurred in the grain growing areas of the Mallee, with the population of some areas declining by as much as 40 percent in 40 years. In irrigation areas, such trends are yet to emerge in the available statistics. The population of most small towns in the Shepparton IrrigationRegion has, in general, grown slightly or remained static over the past 20 years, while also ageing (Department of Sustainability and Environment 2004). Anecdotal evidence suggests that services are being slowly withdrawn from many small towns in the Region, unless the community actively intervenes. For example, Lockington, Tongala and Nathalia communities have established community banking facilities to ensure that services continue to be provided in their towns. This suggests that improvements in agricultural productivity are beginning to have an effect on small towns in the Region and further productivity improvements may causes further decline.

Climate variability and change

Irrigated agriculture in the Region is dependent on a reliable source of water and highly suitable climatic conditions. The Region's climate is highly variable between years, particularly rainfall and stream flows, but also temperatures and related phenomena such as frosts. Variability in annual flows of the Goulburn River is one of the lowest in the Murray Darling Basin, but still ranges between 20 and 220 percent of average (Murray Darling Basin Commission 2005). To manage the variability in rainfall and stream flow, substantial storages are required to provide reliable water supplies. Farming systems have also been developed that are suited to the climatic conditions.

Historically, extreme events have had significant impacts on agriculture in the Region. Water logging associated with flood events in the 1930s, 1956 and 1973 caused a large proportion of fruit trees in the Region to die (ACIL Australia 1983; Cockroft 1965). Likewise, unseasonal frosts in 2002 and 2006 caused large losses of fruit production. For the dairy industry, extremely dry conditions and exceptionally low water allocations in 2003 caused the first decline in milk production in over 20 years (ABARE 2005). These extreme events have caused significant loss of income and hardship in the Region, particularly for those who were under-prepared for such occurrences.

Climate changes associated with the enhanced greenhouse effect may also pose a threat to the suitability of the Region's climate for irrigated agriculture. Predictions of climate change in the Region vary considerably. The general consensus is that average rainfall will decline, average temperatures will increase and the number of frost days will decrease, while the occurrence of extreme events such as droughts and floods will increase. The range of predicted changes in annual rainfall for 2030 extends from a three percent increase to a 15 percent decrease, accompanied by a

temperature increases of 0.3˚ to 1.6˚ C (Anonymous 2004). Jones *et al* (2002) investigated the impact of these predicted climate changes on stream flow, finding average runoff will decrease between 0 to 30 percent by 2030.

In the upper catchment, average annual rainfall for the 10 years to 2005 is 12 percent below long-term (100-year) average, while stream flows are 25-35 percent below the long-term (50-year) average. While the average rainfall for the 10 years to 2005 is low, it is not the lowest on record. Over this period, agricultural industries have been able to adapt and continue to increase productivity. This suggests that existing agricultural industries may be capable of surviving the predicted changes in average conditions for the next 30 years. However, when natural climate variability is added to changes in average conditions, circumstances considerably worse than those historically observed are foreseeable. The ability of agricultural industries to cope with extreme events under a changed climate is unknown and may be limited, particularly if the severity of extreme events is worse than historical observations.

As the climate changes, agricultural industries will continue to adapt, drawing on lessons from previous experience provided that changes are not rapid. Year-to-year variability and the occurrence of extreme events are likely to remain a substantial challenge to agricultural production in the Region. Industries in the Region will need to strengthen strategies to manage climate variability and extreme events to remain in business over the long-term.

Lifestyle 'farmers' - a threat or opportunity?

Improvements in transport and increasing professional employment in Regional centres have created additional demand for lifestyle properties. Future improvements in communication technologies may enable regional residents to telecommute to workplaces throughout the world and therefore create additional demand for lifestyle properties. Lifestyle properties can be considered as land used for a variety of purposes, but the landowners are not dependent on agricultural production for their primary source of income. These properties may be used as hobby farms, weekenders, bush retreats, or some form of commercial agricultural production.

Lifestyle properties can be seen as a threat to landowners whose primary income source is from agricultural production. Purchasers of lifestyle properties can afford to pay higher prices for land, because they are not reliant on income from agricultural production alone to pay for the land and do not necessarily require the same return on investment. Therefore, land prices may increase to levels above those agricultural businesses can afford. However, for those selling their land, purchases by lifestyle residents increase the return they obtain for their asset.

Owners of lifestyle properties may also have expectations of the environment in which they choose to live. Their expectations of the acceptability of land management and animal welfare practices and amenity of rural areas may not necessarily concur with traditional agricultural practice. Issues relating to tillage, chemical usage, crop-protection measures, hours of work and animal management all may be sources of potential conflict. Agricultural producers, on the other hand, may expect owners of lifestyle properties to manage their land to agronomic standards, and control weeds and pest animals. The differing expectations of rural amenity of lifestyle residents

and agricultural producers has the potential to cause conflict between neighbours and with regulatory authorities (Barr *et al.* 2005).

New lifestyle residents may also be beneficial to rural communities. Aslin (2006) describes a number of positive contributions that lifestyle residents can make to rural communities. The establishment of rural lifestyle properties will bring new people into the Region with new ideas and energy. Involving these new residents in community groups has the potential to strengthen and reinvigorate local communities. Owners of rural lifestyle properties are not reliant on agricultural production for income. Therefore, service businesses in the Region will be less vulnerable to downturns in agricultural industries and the Regional economy will be more resilient.

New lifestyle residents will have the ability to purchase rural land at relatively high prices, however they may not have the skills to manage the land. This may create opportunities for agricultural producers to creatively manage their capital. By establishing land-management agreements with new lifestyle landowners, agricultural producers may be able to reduce capital invested in land and use that capital for further developing their business.

Increasing numbers of residents within the Region can also influence the provision of infrastructure and services. With a greater population density, the cost of providing infrastructure and services will be spread over a greater number of people/businesses and may potentially be lower. A high population density will also be attractive to infrastructure and service providers when establishing new services.

Lifestyle residents will present the Region with both opportunities and challenges. Considered regional planning can contribute to managing these challenges and opportunities. The expectations of both agricultural producers and lifestyle residents of each other and their practices will also contribute to the overall outcome.

The future of food

Food production consumes large quantities of the world's resources. For example, UNESCO estimates that 86 percent of the water consumed globally is used by agriculture, much of which is in the production of food. The production of protein-based food, such as meat, is relatively inefficient. It has been estimated that 2 to 15 kilograms of plant food are required to produce 1 kilogram of meat, and that 40 to 50 percent of the world's cereal harvest is used to produce feed for animals.

The quantity of protein consumed in a diet has been related to affluence of a society. Projections of increasing world population and affluence have stimulated the development of alternative methods of producing high protein foods, as far back as the 1960s. Soy-based products, such as tofu, have long been known as an alternative source of protein. To increase their popularity, a range of soy-based products has been developed, including textured protein products that are design to look and taste like meat. More recently, methods to commercially produce fungus-based protein products have been developed. Mycoprotein, produced in large fermentation vessels, forms the basis of the meat substitute, Quorn, which is commercially available in many parts of the world (Wiebe 2004). The production of both soy- and fungus-based protein sources uses fewer resources than the production of meat, and they are therefore seen as foods of the future.

Research into the production of meat in a laboratory has been receiving significant attention in recent times. However, such an idea is not new. In 1912, Nobel Prize laureate Alexis Carrel demonstrated that it was possible to produce animal flesh in a laboratory by growing tissue from a chicken's heart. He managed to keep the heart tissue actively growing until his death in 1934 (Heselmans 2005). In the past 10 years, several research consortia have been attempting to develop production methods that will produce commercial meat products. Researchers have already produced animal muscle tissue up to 0.5 cm thick in a laboratory on a non-commercial scale, which they claim can be used as a basis for minced meat products. The expectation is that commercial products will be possible within 10 to15 years (Edelman *et al.* 2005; Heselmans 2005; Wolfson 2002).

Milk products are an important alternative source of non-meat protein. However, the dairy industry is not immune from substitute products. Substitutes for dairy products have existed for some time. For example margarine, a substitute for butter, has been commercially produced since the 1870s, but only relatively recently has it become a significant competitor. Likewise, soymilk has existed for some time, but has not become a significant competitor in western markets due to taste and quality issues. Current research is attempting to overcome these issues and make soymilk more attractive to consumers. A significant proportion of Australia's dairy product is used as ingredients for other food products, including whey protein and milk powder. The role of many of these dairy ingredients can be readily substituted with alternative products.

While alternative high protein foods may emerge as commodity foods, a market for authentic food is likely to remain. This market is likely to remain a small niche and command high prices. Demand for such products can be seen in today's market places where traditional foods command very high price, for example Waygu beef wholesaling for greater than $120 per kilogram.

"Functional foods" and "nutraceuticals" are another food trend that is also emerging. "Functional foods" are foods that may provide a health benefit beyond basic nutrition, while "nutraceuticals" are foods that specifically aid in the prevention or treatment of diseases or disorders (Kalra 2003). Some of these products have enhanced levels of nutrients or functional components, through manufacturing or product selection, while other products use the natural levels of nutrients or functional components as a marketing tool. Considerable research is occurring into methods to enhance levels of nutrients and the development of markets for "functional food" and "nutraceuticals" products. The development of markets for such foods may influence agricultural production through requirements for specialised production systems. Genetic engineering of plants and animals may also result in enhanced levels of functional components and nutrients in food products.

The nature of food has the potential to change radically in the future. Increasing production costs of traditional agriculture, particularly in the production of protein-based food, will make highly controlled factory production increasingly viable. These factory production systems will need some form of input or feedstock. Agriculture may have a place in providing all or some of these inputs, but alternatives to agricultural production may also exist.

Political (r)evolutions

Government policies change over time in response to changes in governments and changes in societal attitudes and values. Significant changes in policies generally occur over relatively long periods, although rapid changes also occur. Some of these policy changes have major impacts on the way people live and work, while others serve to change the attitudes of society.

Historically there are numerous examples of government policy changes that have significantly changed the direction of society.

Since World War II government economic policies have undergone dramatic changes. During the 1950s and 1960s governments sought to minimise unemployment and avoid recessions by managing their spending to ensure that the productive capacity of the economy remained in relative balance with the demand for goods and services.

Since the 1970s government economic policies have increasingly sought to maintain inflation at a low and steady level primarily through control of interest rates. To manage the economy in this fashion, governments have needed to deregulate the economy by, for example, floating the currency and removing import tariffs. This has meant that market forces, rather than governments, increasingly determine levels of employment and as a result wages.

A follow-on effect of this change in macro-economic policy has been the emergence of "economic rationalism" and micro-economic reform policies. This led to the large scale privatisation of government-controlled services such as electricity, telecommunications and banking, to encourage competition and efficiency improvements. Changes to the national economic policy generally influence society over the long term and as a result the full effects of the changes started in the 1970s are yet to emerge.

Government environmental policy in Australia is still in its relative infancy and has been evolving since the first *Environment Protection (Impact of Proposals) Act* was enacted in 1974. That act was developed following a wide range of protests in the late 1960s against developments that had impacts on locally and nationally significant environmental assets. These protests were in response to issues such as the proposed flooding of Lake Pedder and the clearing of undeveloped bushland, near Sydney, for housing development. Until relatively recently, environmental policies had focussed on the protection and conservation of remaining pristine environmental assets. In more recent times, understanding of the value of non-pristine environmental assets and the ecosystem services they provide has developed. Government environmental policies have evolved to consider how these non-pristine environmental assets can be enhanced and restored to protect and improve the range and quality of the ecosystem services they provide.

On some environmental issues, changes in government policies have been relatively rapid. Australia signed the *Montreal Protocol on Substances That Deplete the Ozone Layer* in 1987 and had completed the majority of its obligations by 1995. Government policies influencing the allocation of natural resources can also change quite rapidly. For example, recent changes to forest policy in Victoria saw a 30 percent reduction in logging across the state within three years of its announcement.

Government policies frequently change in both the tools used in their implementation and underlying intent. These policy changes occur in response to numerous stimuli including changes in societal values and attitudes, the availability of resources and the evolution of knowledge. Changes in government policies are difficult to predict and have the potential to change significantly the way people live and work in the Region.

Living in a global market place

The market for agricultural produce is global. The few barriers that Australia has to agricultural imports are related to bio-security, and therefore prices for agricultural produce in Australia reflect the global price. Global prices for agricultural products are subject to variation in the long and short term.

Short-term price fluctuations are primarily related to the supply of agricultural produce, which can vary with production conditions throughout the world. For example, extreme climatic events can decimate production in some parts of the world and reduce the availability of some agricultural commodities. Recent examples include cyclones in northern Australia during 2006 reduced the supply of bananas and increased domestic prices by 400 percent, while dry conditions in the United States and Australia in 2002 and 2003 caused wheat availability to decline and international prices to increase 25 percent (ABARE 2005).

Numerous factors influence the long-term prices for agricultural produce, including the emergence and disappearance of new agricultural producing nations and the outcomes of bilateral and global trade negotiations. Many such changes have occurred historically. For example, until 1973 when Britain joined the European Economic Community, former colonies had preferential access to British markets. For Australian agriculture this meant guaranteed markets for produce, in particular butter and apples. After 1973, Australian producers needed to find new markets to replace the loss of British markets. However, significant rationalisation of both horticultural and dairy industries occurred, with extensive 'tree pull' schemes to assist horticulturalists to exit the industry.

There are many uncertainties in the direction of agricultural produce markets in the future. For example, the role of China in global agricultural markets is highly uncertain. Agriculture in China has undergone significant development over the past 20 years. Large investments have been made in developing agricultural industries that maximise the benefits of China's large labour supply, while also achieving the objective of grain self-sufficiency. As a result, fruit production in China has increased from 11 million tonnes in 1985 to 153 million tonnes in 2005, at a compound rate of 14 percent per annum. Over the same period, production of other agricultural products increased by no more than 3 percent per annum. The value of agricultural exports grew from US$6.5 billion in 1989 to nearly US$25 billion in 2004 at a little over 9 percent per annum (ABARE 2006).

Continued growth of this magnitude could have a considerable impact on the global trade of agricultural products and, in particular, Australian agricultural producers. The greatest growth in China's agricultural industries has been the production of fruit and vegetables. The size of the labour force in China means that it can produce fruit and vegetables relatively cheaply, and therefore any further growth in production can be readily exported and will potentially lower international prices. Lower prices for export products may

result in a decline in profitability of Australian producers and put some out of business.

However, China may not be able to sustain such growth in agricultural production. While agricultural exports have been growing, so too have agricultural imports, which reached approximately US$16 billion in 2004. Agriculture in China faces several challenges. Only 15 percent of land in China is arable and a considerable proportion of that land is under threat from desertification and urban and industrial development. It is estimated that 6.6 percent of arable land in China was lost in the past 10 years.

Much of the growth in China's agricultural production has been due to expansion of irrigation. However, China is facing water shortages in many of its agricultural areas, and therefore further growth in agricultural productivity is likely to be limited. On top of current water shortages, it is expected that by 2030 China will need to increase its water supplies by between 130,000 and 230,000 GL per year to meet expected demand. While these water resources exist in China, their distribution is such that the water is not available where urban and agricultural development has been greatest. While large-scale engineering projects are under way to divert water from areas of excess in the south to areas or shortage in the north, these projects will take many years to complete. Therefore, the growth in agricultural production in China may slow and with a population that continues to increase, China may present export opportunities for Australian agricultural producers.

The previous discussion highlights some of the implications of China's development for global agricultural produce markets. A similar discussion could equally apply to many other agricultural producers around the world. The development of agriculture in many South American countries and its effects on global markets is uncertain. World Trade Organisation negotiations may also reduce production subsidies in Europe and the United States which would likewise radically change global agricultural markets. The volatility and uncertainty of international agricultural markets could provide both opportunities and challenges to Australian producers. Agricultural producers will need to be prepared for fluctuations in prices and both the loss and emergence of markets.

Technological development

The past 15 years have seen the evolution and convergence of numerous technologies that have made significant changes to the nature of work and leisure. Many everyday technologies, including digital television and cameras, internet access, anti-lock (ABS) brakes and air bags in cars, hybrid vehicles and precision agriculture, simply did not exist 15 years ago. The rate of technological developments in recent history is likely to continue into the future. There are a number of areas where future developments have the potential to significantly change the way people live and interact.

Biotechnology has the potential to significantly change agriculture, particularly through genetic engineering technologies. Genetically modified (GM) crops have existed for some time. The first genetically modified crop, a variety of tomato that was designed to be more resistant to rotting, was first sold in 1992. Since that time a large number of varieties of GM crops have been grown throughout the world, including rice, soybeans, canola, cotton and corn. These GM crop varieties have been created to produce higher yields, be resistant to pests, survive in harsher environments, use lower inputs or deliver health benefits to consumers, and so have the potential to

increase the productivity of agricultural production. On the other hand, many concerns have been expressed about the potential social, economic and environmental consequences of GM crops. Many of these concerns are related to the lack of knowledge about aspects of GM crops that are not related to production. These concerns include the impacts on human health and possible transfers of modified genetic material between species, and have the potential to influence the marketability of GM products. Governments have regulated the use of GM crops to manage the potential consequences of their use. The possible use and consequences of GM crops is highly uncertain and their adoption may present both opportunities and risks to agricultural production.

Technology related to energy production and use may also influence agriculture. Globally, costs for traditional energy sources are likely to increase due to increasing competition for fossil fuel resources and internalising the externalities associated with pollution, particularly carbon dioxide emissions. As energy costs rise, alternative technologies become an increasingly economic prospect. These technologies include solar, wind and nuclear power for the generation of electricity and biofuels for transport industries. Agricultural areas have the potential to contribute to these energy sources, particularly in the production of biofuels, such as ethanol and biodiesel, but also in the provision of land for wind turbines and solar power stations. The production of biofuels may create opportunities and challenges for different agricultural industries. Grain growers will have new markets for their product, while grain users, such as the dairy and livestock producers, will have an additional industry to compete with for fresh grain. However, grain users may also have alternative products as feed that are byproducts of the biofuel industry.

Information and communications technology has rapidly developed in recent times and has the potential to continue to do so. In 1965, the founder of Intel predicted that the complexity of computer chip components, and therefore computing power, would double every two years. This doubling of computing power has happened, on average, since that time, and is expected to do so for some time into the future. In parallel, other related information technology, such as computer memory and disk storage, has also been developing at an exponential rate. Historically, the use of these technological developments has been rapid in applications for which there is a substantial market. For example, Bluetooth technology, flash memory and GPS technologies have spread rapidly into consumer products. However, the use of information technologies has been relatively slow in agricultural industries, where markets are relatively small. Many of these technologies offer potential to reduce costs and improve resource-use efficiency on farms, through automation of repetitive tasks, such as controlling irrigation systems and milking, and detailed monitoring of production systems. The application of current technologies has the possibility of redefining farming and the nature of agricultural employment. Future technological developments will continue to create possibilities for agriculture, however it will be up to agricultural producers to recognise these possibilities and ensure the benefits are realised.

Technology will continue to develop at a rapid rate. These technological developments will present agriculture with both opportunities and challenges. To remain competitive, agricultural producers will need to seek

to capitalise on the opportunities and carefully manage risks when adopting new technology.

4 The Scenarios

Scenario 1 Moving on

Note: Graphic designer to give the appearance of newspaper article

Northern Irrigator

13 March 2026

by Les Watchem, Business Editor

Tariffs charged to irrigators in the Goulburn Broken Region are to be increased by an average of 27percent next season as Goulburn Broken Water Infrastructure Pty Ltd seeks to restore profitability after five years of below-average rainfalls and record low river flows.

Goulburn Broken Water Infrastructure, the winning tenderer to take control of Goulburn Broken irrigation water delivery infrastructure when it was privatised in 2020, undertook as part of its bid not to increase charges by more than the consumer price index for five years.

The five years of Goulburn Broken Water Infrastructure's control has coincided with extended drought in southern and eastern Australia, almost certainly an indication of future low flows because of climate change.

While increased efficiencies have reduced the impact of reduced water availability on many irrigators, the reduced water availability has significant impact on Goulburn Broken Water Infrastructure's bottom line, with losses recorded in two of the past five years.

"We cannot continue to provide irrigation water to landholders without this increase in charges," Goulburn Broken Water Infrastructure Managing Director Hugh Inkum said. "Our company simply cannot continue to trade if it is going to make losses every year."

Mr Inkum said fees had to increase to a level which both allowed urgent investment in refurbishment works and underpinned a return on capital for investors in Goulburn Broken Water Infrastructure.

"There has been inadequate investment in repairs, maintenance and refurbishment for decades and unless we can get the money to spend on urgent maintenance the irrigation system will collapse," he said.

The secretary of the Goulburn Broken Irrigators Association, Will Gudheart, said the new charges would add to the pressure driving irrigators off the land. "Families are being broken up as they lose their livelihoods and homes because of these increases in charges," he said. "Our members face global competition for their products; they simply can't pay these outrageous prices for water.

"Goulburn Broken Water Infrastructure should be stripped of its monopoly over water infrastructure in the Region. Otherwise virtually every irrigator in the district will be simply forced off their land.

2005-2020: The cost-price squeeze continues to drive the development of agriculture. The signing of bilateral free trade agreements offers respite for industries that are internationally competitive, but hastens the decline in profitability of industries that focus on protected domestic markets. Expanding market opportunities in Asia and the United States relieve price pressures for the dairy industry, while international imports of processed products threaten the viability of the horticultural industry. Demand for biofuels and alternative energy sources create new opportunities for agriculture.

Climate changes become increasingly evident. Annual rainfall totals decline, while the intensity of rainfall events during summer increases. Average temperatures continue to rise causing a decrease in the number of chill hours. Changes in both rainfall and temperatures severely impact the yield and quality of horticultural products.

The demand for residential properties in aesthetically attractive areas moves inland as the affordability of costal properties decreases. Inland waterways increasingly become a focus for tourism.

Governments show preference for market forces to direct outcomes and intervene only when market failure is significant. As a result, exceptional circumstances support from government decreases.

Agriculture continues to adapt to declining terms of trade. Agribusinesses increase production efficiencies by becoming larger and using new technologies. Smaller farms that find it difficult to adapt exit their industries. The number of dairy farms decreases from about 2,000 in 2005 to 1,200 in 2020, while average herd sizes increase from 250 to 480 cows. The value of agricultural production continues to increase for all industries, which attracts takeovers of the Region's processing facilities by multinational corporations.

Small towns within the Region slowly decline as the demand for labour decreases. The small increase in the number of lifestyle residents cannot prevent the closure of banks, supermarkets and petrol stations in small towns. Communities demonstrate less willingness to participate in voluntary activities. Services dependent on volunteers, such as fire brigades and sporting clubs, are progressively disbanded or amalgamated.

Irrigation infrastructure within the Region is reconfigured to manage the effects of water trade. Infrastructure is rationalised in some areas and enhanced in others.

2020-2035: International trade opportunities improve as trade barriers continue to be removed and opportunities for markets in Asia expand. The marketing environment is highly competitive, with product differentials changing rapidly. Consumers are increasingly concerned for their own health and for the welfare of animals. International trade is enhanced by improvements in electronic communication technology that enables rapid trade.

Irrigation water delivery infrastructure is privatised. The new owners increase water tariffs and further rationalise infrastructure to obtain a commercial return on their investment. The Region continues to remain attractive to agribusiness investors due to relatively low land prices and the availability of irrigation water.

The climate remains drier than the long-term average, with summer rainfall occurring in intense events. The drier climate reduces the risk posed by salinity to agricultural production and infrastructure in the Region.

Traditional agricultural industries continue to exist in the Region. To maintain their competitiveness, agricultural businesses develop highly controlled production systems that enable them to increase production and reduce waste. The dairy industry increasingly uses controlled rationing and automatic milking systems to increase productivity, while horticultural producers use hydroponic and controlled environment technologies. The number of agricultural businesses continues to decrease due to the large financial investment required for highly controlled production systems. The total value of agricultural production continues to increase.

Individual landholders have primary responsibility for land management. Tension arises between landholders when adjoining land uses are incompatible, or when neighbours perceive land management practices as inappropriate. Conflict also arises over environmental management, particularly in understanding the distinction between natural and anthropogenic features.

The influence of agriculture on governments and in the community decreases, as the number of people involved in agricultural production decreases.

The community places a high value on leisure time. Location-based community groups, with fixed meeting times, are forced to consolidate their activities. Electronic communities of interest flourish due to their flexible participation arrangements.

Throughout this scenario, the Region remains economically prosperous, with low unemployment. The population continues to grow steadily, with an increasing proportion aged over 50. Environmental impacts of agriculture are minimised though the use of technology.

Scenario 2 – New frontiers

Note: Graphic Designer to create Goulburn Valley Dairy Pty Ltd letterhead

6 July 2026

Dear Shareholder

I am pleased to be able to inform you that New Century Food Manufacturers Ltd has formally offered $6.50 for every ordinary share in Goulburn Valley Dairy Pty Ltd.

The Board of Goulburn Valley Dairy Pty Ltd has carefully considered this offer, and decided to recommend to shareholders that they accept it.

You will be aware of the difficult trading conditions experienced by Goulburn Valley Dairy in recent years. It is true that in the early years of the 21st Century Goulburn Valley Dairy was able to expand as small landholders found it increasingly difficult to comply with increasing government regulation. The efficiencies of our modern production systems underpinned profitable production of quality milk and milk products and enabled us to acquire dairy land with water entitlements. The capital value of Goulburn Valley Dairy grew and we were able to pay generous dividends through this period.

However, the past five years have proved increasingly difficult for Goulburn Valley Dairy and, as you well know, share value has dropped as we have experienced successive annual losses. As I said in my last half-year profit warning, the rise of laboratory production systems for food has decimated the market for the natural milk and milk products of Goulburn Valley Dairy. Laboratory-based companies are able to produce low-cost milk-like products from grain that have proved acceptable to the consumer. The niche markets which remain for natural milk and milk products are insufficient for the production levels necessary to sustain our factory and infrastructure systems profitably.

The offer by New Century Food Manufacturers Ltd remains open until 15 September, and is conditional on New Century Foods receiving offers of 90 percent of Goulburn Valley Dairy shares by that date. I and other members of the Board urge you to accept this offer, which values Goulburn Valley shares 30 percent above the last sale on the day before the offer was made. If the takeover is not successful, your Board will have no alternative but to break up the assets of the Goulburn Valley Dairy Ltd and offer them for sale separately.

Yours sincerely

Planz Phaled

Chairman

2005 – 2020: 3G and 4G communications technologies radically alter the nature of work, enabling workers to telecommute to workplaces throughout the world. Many people seek to establish home offices on small blocks of land close to essential services, in areas of pleasing amenity, such as near waterways and forested areas. In the Goulburn Valley, properties adjacent to rivers and streams are in high demand.

Urban communities and new lifestyle residents are politically influential and express concerns for the environment, animal welfare, personal health and food safety. Governments respond by increasing regulation on all industries and creating zones of industrial agriculture. Agricultural industries have restrictions placed on the location and nature of developments. Agricultural practices, such as harvesting, spraying and tillage, are also tightly controlled to ensure the levels of amenity desired by lifestyle residents are achieved.

Free trade agreements are signed with a number of international trade partners, providing agriculture with new markets. However, Australia loses markets in the Middle East due to our alliance with the United States and our continuing involvement with conflicts. Middle Eastern conflicts also cause oil prices to continue to increase.

Governments introduce a new wave of water reform. Barriers to interstate water trade are removed and environmental flow entitlements increased. Irrigators are provided with an opportunity to exchange medium-reliability entitlements for high-reliability at an appropriate exchange rate. The availability of water remains relatively low as the climate remains drier than the historical average.

Agricultural businesses in the Region struggle to adapt to the increasingly tight business environment. Compliance with regulation increases production costs substantially. Many small farms leave the industry as only large and highly efficient businesses can afford to comply with regulations. These farms are highly focused on production and have little time or money to invest in environmental improvements. The pome fruit industry is decimated by an outbreak of fire blight. Overall, the farm-gate value of agricultural production in the Region declines, led by the decline of both the dairy and horticultural industries.

Lifestyle residents purchase increasing amounts of land and water in the Region; the value of both land and water rapidly escalates. The owners of some agricultural businesses fund their retirement through the sale of their properties to new lifestyle residents. The influx of lifestyle residents brings new sources of income, ideas and energy into the Region. Schools prosper and a range of vibrant community groups contributes to the Region. These lifestyle residents have a strong influence on local agencies and authorities.

The Region continues to remain prosperous. The strength of the Regional economy is less dependent on the fortunes of agriculture.

2020-2035: Technological developments enable laboratory-based food production systems that cheaply create sophisticated foods from basic carbohydrates. To assist in lowering the cost of raw ingredients, such as grains and pulses, governments permit the use of genetically modified organisms for agriculture. In view of the changed nature of agricultural production, the World Trade Organization agrees to remove all agricultural production subsidies. A limited number of affluent consumers continue to

demand authentic food products. However it becomes increasingly difficult to supply authentic food products that are free of modified genetics.

Continuing conflict in the Middle East encourages Australia to invest in biofuel production to secure energy supplies, particularly for the transport industry.

The climate continues to become drier, reducing irrigation water availability. The barrages at the mouth of the Murray River are removed to improve the health of the river, freeing up water entitlement for irrigators and the environment and lifting the limits on salt disposal from the Region.

Urban and lifestyle residents are unsatisfied with environmental outcomes achieved through regulation of agricultural practice and encourage governments to purchase agricultural land for environmental purposes. Land is purchased to create buffer zones between industrial agriculture and lifestyle zones, while agricultural zones are further divided to create areas free of modified genetic material.

Agriculture production in the Region changes significantly. The traditional dairy and horticultural industries experience a major contraction due to their replacement by laboratory-produced foods. A boutique authentic food industry enables some dairy and horticultural producers to survive. Cropping industries expand to support the production of laboratory food and biofuel industries. The limited availability of large land parcels suitable for cropping within the traditional irrigation areas causes large volumes of water to be traded out of the Region to southern New South Wales and north-western Victoria.

The risk posed by salinity decreases as regional watertables drop due to dry climatic conditions and lower irrigation water use in the catchment. The area of native vegetation in the Region increases through the development of buffer zones.

Throughout the scenario the population of the Region grows strongly with the influx of lifestyle residents. Community groups are strengthened by new membership, particularly new retirees who have time to volunteer. The Region continues to be prosperous, with a decreased reliance on agriculture.

Scenario 3: Pendulum

Note: Graphic designer to give appearance of newspaper article

Goulburn Broken Express

27 January 2030

Victorian Premier Jo Baker described the record 200 new Australians naturalised in an Australian Day ceremony at Shepparton yesterday as the lifeblood of economic growth in regional Victoria.

These new Australians, combined with the many Australian-born people who have moved from interstate to work in the Goulburn Broken Region, have underpinned the renaissance of irrigated agriculture and the strength of the Victorian economy, he said in a speech at the naturalisation ceremony.

"The joint decision of the Victorian and federal governments in the early 2020s to reallocate water entitlements from the environmental reserve is a proven success, with agricultural products from the Goulburn Broken Region finding new markets across Asia," he said.

"I am proud that my Government has been able to reverse the long period of economic hardship in Goulburn Broken, boosting agricultural output to create the jobs which attracted these welcome migrants to our shores," he said.

While also welcoming the new migrants, Opposition Leader Michael Warne suggested the return to better than average rainfalls over recent years and the floating of China's currency on the open market did more to stimulate the Goulburn Broken economy than any polices of the Government. "Next, the Premier will be claiming credit for the weather and for China joining the global economy," he said.

2005-2020: Federal and state elections deliver the balance of political power to green parties. Governments purchase 1,500 GL of irrigation water entitlement from Victoria and remove all institutional barriers to interstate water trade. To manage the social impacts associated with the withdrawal of irrigation water, governments also support the restructuring of irrigation infrastructure and properties. Irrigation infrastructure is withdrawn from some parts of the Region, while land that is retired from irrigation is resumed, amalgamated and resold as dryland farms.

Following the ratification of the Kyoto Protocol and subsequent agreements, governments establish markets to enable the trade of environmental credits and services, starting with carbon, but later extending to biodiversity. These markets provide agricultural businesses with opportunities to diversify into new markets and products. The planting of native vegetation becomes a commercially attractive investment.

Global demand for fossil fuels begins to exceed available supplies, causing energy prices to rise. The production of biofuels becomes an increasingly economic prospect providing additional possibilities for the cropping industry.

The loss of water from the Region causes the area of irrigated agriculture in the Region to decrease substantially. The number of businesses supporting agriculture also contracts. Confidence in all agricultural industries declines resulting in reduced investment on farms. Remaining agricultural businesses improve their risk management by adopting a more flexible approach to managing their land and assets, and seeking long-term supply contracts. Processors invest in the development of differentiated products to increase profitability and carefully protect their intellectual property. The value of agricultural production in the Region declines, particularly in the livestock and cropping industries.

The health of the environment in the Region improves substantially. Recreational fishermen report increasing catches of native species and the Region becomes a focal point for ornithologists from throughout Australia. The withdrawal of irrigation water causes regional watertables to decline and the risk of salinity throughout the Region to decrease.

Divisions between residents of rural and urban areas intensify as rural communities resent ill-informed attitudes of urban communities, particularly toward the environment. The prosperity of the Region declines and many shops in the towns close. Population growth slows to a minimum as young people leave the Region to seek employment elsewhere.

2020 –2035: A conservative federal government, concerned with reinvigorating regional economies, perceives that increased environmental flows are not worth the economic cost. The federal government assumes control over the management of water and reallocates water entitlements from the environmental reserve, auctioning entitlements on the open market. Proceeds of the auction are used to rebuild and rehabilitate irrigation infrastructure in partnership with irrigator co-operatives.

The Region experiences an extended period of higher than average rainfall. Floods occur in successive years, inundating large parts of the landscape, and enabling full irrigation allocations for the first time in many years.

After many years of economic reforms, China floats its currency on the open market. The value of the Australian dollar weakens considerably. Australian agricultural products become increasingly competitive in all Asian markets.

Internationally, consumers become increasingly concerned about the perceived side effects of genetically modified foods on human health. Australian governments retain a ban on the use of genetically modified organisms in agriculture. The ban creates many new export opportunities for producers.

Agriculture within the Region goes through a renaissance. Irrigated production expands throughout the Region, including the middle and upper parts of the catchment. The expansion is carefully planned so that irrigation occurs only in areas that are most suitable, using the most appropriate technologies. Agricultural producers use a diverse range of production systems and create a variety of products as industries target different market niches. Boutique cheese factories and pick-your-own horticultural producers emerge to cater for domestic markets.

The redevelopment of irrigated agriculture in the Region creates an abundance of employment opportunities. Low population growth between 2005 and 2020 results in shortages of labour, slowing the pace of development. International and domestic migrants are attracted to the Region by the possibility of making their fortune in an expanding economy.

While environmental controls for managing the offsite impact of irrigated agriculture are strongly enforced, increasing irrigation intensity and above-average rainfall result in rising regional watertables and increasing salinity risks. Wetter than average conditions enable terrestrial and riparian vegetation to thrive and aquatic biodiversity to prosper. Native fauna slowly colonise revegetated areas, as do introduced pests.

The Region slowly regains its former prosperity.

Scenario 4: Drying up

Note: Graphic designer to give appearance of a letter

The Manager
Big Bank Corp
Melbourne
Victoria

Dear Sir

I refer to your letter of 20 April 2019 threatening to foreclose and as mortgagee in possession auction my property in the Goulburn Broken Region.

I acknowledge that I have not been able to make scheduled mortgage payments for more than a year now, and that the debt is mounting. However, I suggest that you are much more likely to recover the debt in full by allowing me to continue to work the property than by foreclosing and auctioning.

The extended drought which is the primary cause of my inability to make mortgage payments at this time has also dramatically reduced the value of the property. After record low rainfalls and five consecutive years of irrigation allocations far below 100 percent I, like other farmers in the district, have had to scale back production. Recent sales in the Region demonstrate that an auction at this time would attract only a minute proportion of the underlying value of the property, and much less than the debt.

However, domestic demand remains strong for the high-quality fresh fruit which I produced very successfully for many years prior to the current drought, and which I can produce again as soon as rainfall patterns return to normal.

You will be aware that the Government has recognised the unusual nature and extreme hardship of the current situation by introducing a moratorium on the payment of irrigation infrastructure charges. I ask that you, too, recognise the unusual nature of the current situation by allowing further delay on interest payments. History gives us assurance that normal rainfall patterns will return. At that time, with full allocations of the irrigation entitlements I hold, I could resume normal mortgage repayments ensuring your bank recovers the debt in full.

Yours sincerely

Joseph Carmody

2005 - 2012: A major recession in the United States of America causes the value of the US dollar to decline. US agricultural products become increasingly attractive in international markets and encroach on traditional Australian markets for dairy, meat and grain products. China begins to control international export markets for labour intensive and high value

horticultural products, while importing land intensive, bulk agricultural commodities.

Agricultural producers in the Region lose many of their export markets and experience increasing competition in domestic markets. These industries seek market niches that enable them to maintain viability. Horticultural industries focus on high quality fresh fruit for the domestic market, while the dairy industry attempts to capitalise on markets for value added products, such as “nutraceuticals”.

2013 - 2020: The Region experiences an extended period of severe drought. Record low rainfall over many years sees irrigation allocations below 100 percent for 5 consecutive years, with the lowest allocation of 30 percent.

Governments remain willing to support and provide financial assistance to communities experiencing exceptional hardship. Across the wider community the sense of egalitarianism declines with people less willing to help out those in need. However, local communities are drawn together to battle through the adverse conditions.

Agricultural producers experience extreme hardship. Initially, all producers scale back production to meet their available water. As the drought continues, many producers are forced to sell assets to make ends meet, while others rely on government assistance to put food on the table. Agricultural production in the Region is decimated. Many producers leave the industry, some of those leave willingly, while others are forced off the land by banks foreclosing.

Governments introduce a moratorium on the payment of irrigation infrastructure charges to reduce the financial burden on agricultural producers. Irrigation infrastructure rapidly deteriorates as investment in maintenance and redevelopment is put on hold.

Low rainfall and surface water availability causes the Regional watertable to decline throughout the Region. Tributaries of the Goulburn River dry up completely and minimum environmental flows are not delivered for two consecutive years. Populations of fish and aquatic birds decline and recreational activities, including fishing, are restricted to minimise damage to ecosystems.

Regional population growth drops to zero as young people leave the Region to seek employment elsewhere. Divisions exist within the community between those with wealth and employment and those without.

2020 - 2035: The global economy experiences a period of strong growth. Many Asian and South American countries become increasingly affluent as the balance of wealth across the globe becomes more uniform. Increased global affluence enables the World Trade Organization to agree to remove all agricultural production subsidies.

International and domestic consumers increasingly demand food with credence values, particularly those offering health benefits and produce using natural genetic stock. The Australian government ban on genetically modified organisms ensures local producers have a competitive advantage in international markets. Governments provide assistance to rural communities to rebuild and take advantage of market opportunities, by investing in infrastructure to support agricultural production.

Conditions for agricultural production improve substantially. Above average rainfall allows full allocations of high-reliability irrigation entitlements and some allocations of medium-reliability entitlements.

Agricultural industries cautiously expand and intensify production systems. Many producers choose to invest in greenfield developments in preference to redeveloping in areas with a legacy of poor quality infrastructure. Private and public companies invest in agricultural businesses on the expectation of long-term growth and profitability. The livestock industry is particularly successful at expanding production to capture new market opportunities, due to its relatively low capital requirements. The value of production of all agricultural industries grows substantially.

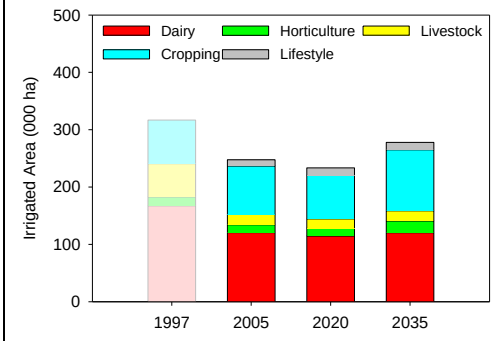
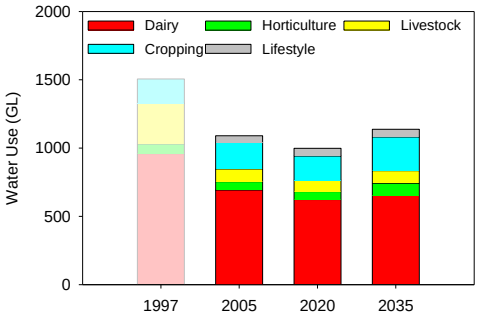
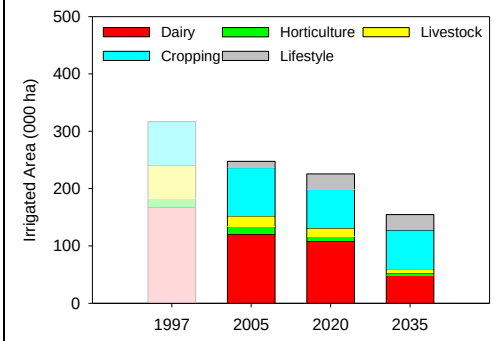
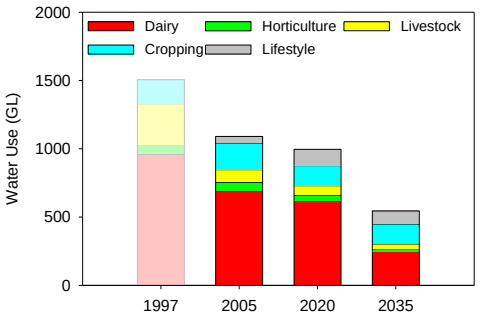
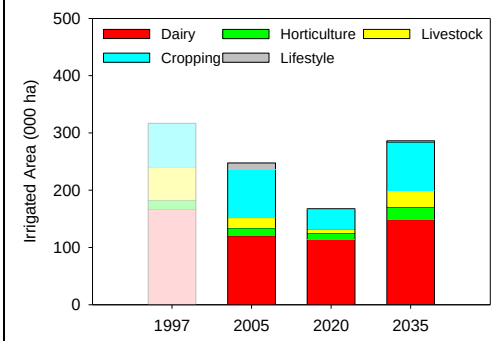
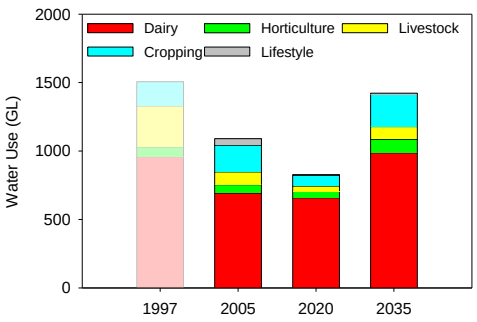
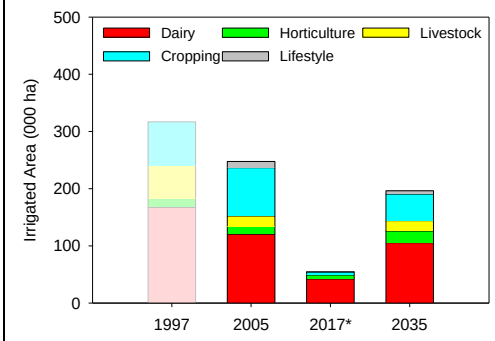
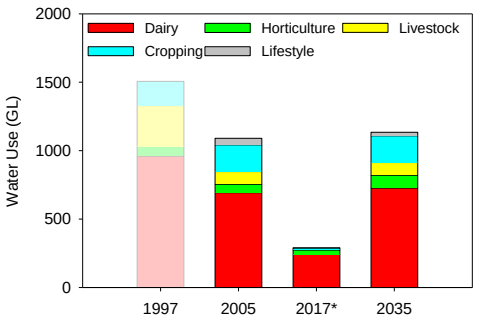
As agricultural industries expand, labour is in short supply. Governments facilitate and support the importation of guest workers to fill shortages of manual labourers. Population growth in the Region is very low due to the continued decline in the number of young people.

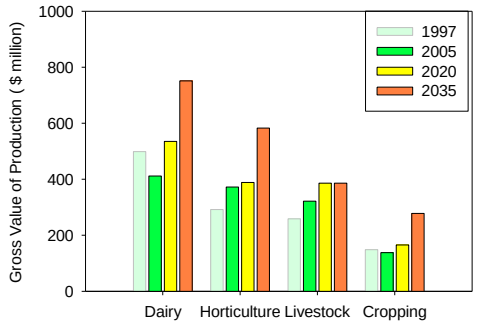
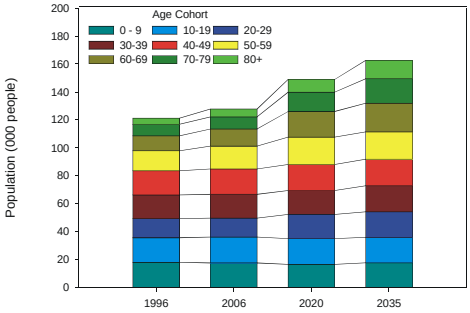
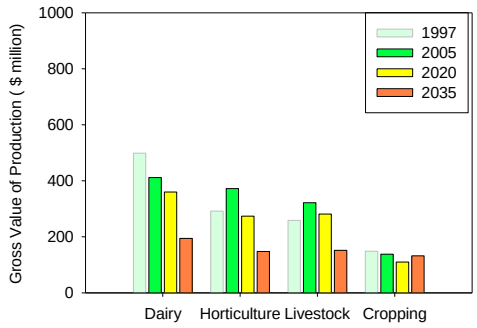
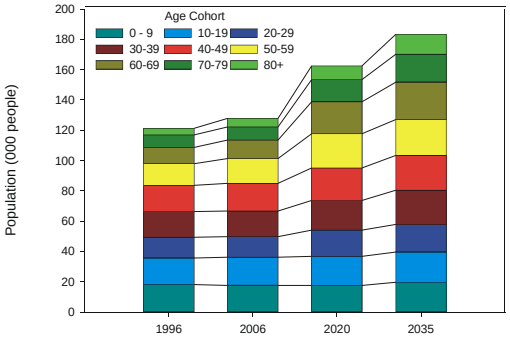
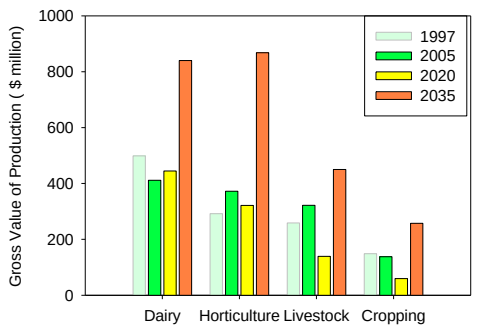
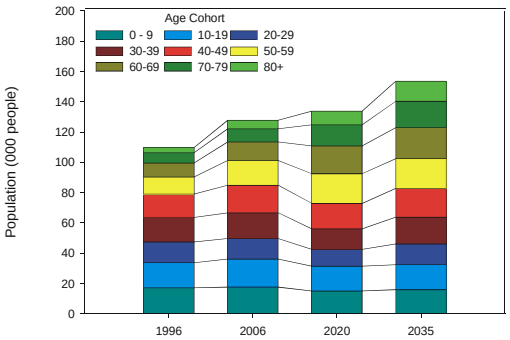
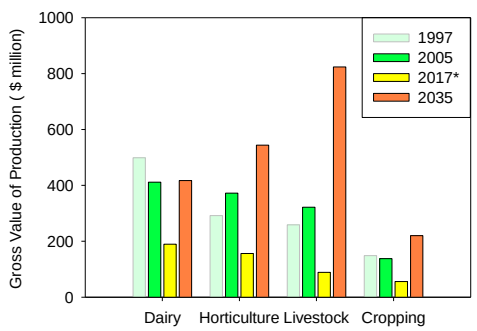
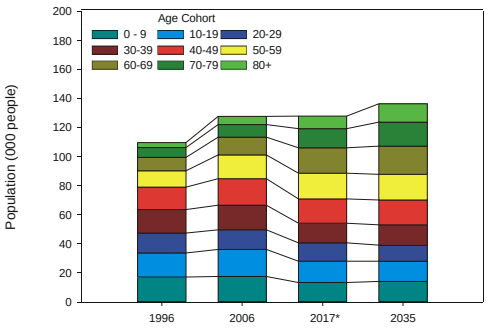
Communities fundamentally change. Developments in communication technologies cause the evolution of a new culture and set of social skills. Communities are formed around interests rather than locations. Many guest workers retain their links with their communities of origin rather than becoming involved in the Region.

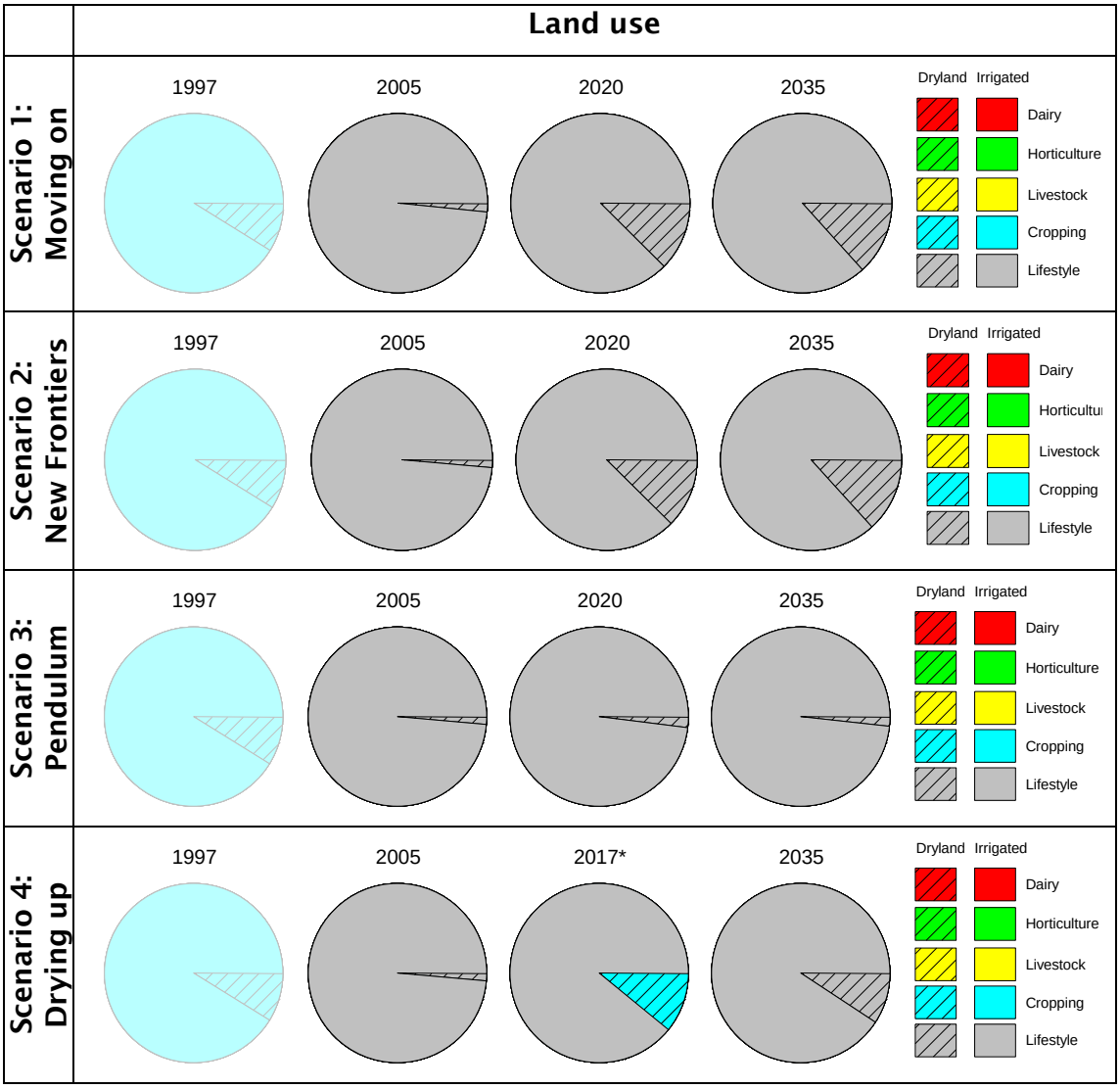
Wetter climate and increasing irrigation allocations cause the regional watertable to rise and the risk of soil and wetland salinisation to increase. Flows in the Murray and Goulburn Rivers increase allowing fish and aquatic bird populations to recover. The improving prosperity of agricultural producers and market signals encourages investment in improved land and environmental management.

Little by little, the prosperity of the Region slowly recovers.

Projections for the Shepparton Irrigation Region

	Irrigated area	Water use
Scenario 1: Moving on		
Scenario 2: New frontiers		
Scenario 3: Pendulum		
Scenario 4: Drying up		

	Farm-gate gross value of production	Population
Scenario 1: Moving on		
Scenario 2: New frontiers		
Scenario 3: Pendulum		
Scenario 4: Drying up		



* Scenario 4 projections are for 2017 and 2035, rather than 2020 and 2035 as with other scenarios

5 Implications of the scenarios

The four scenarios represent four very different futures. They present the Region with some significant challenges and opportunities. The implications of the scenarios for the Region were assessed by considering the impact of each individual scenario and all the scenarios collectively, on the major areas of Regional competencies. The Regional competencies are those features that make the Region attractive for investment and for living. These Regional competency areas include land and water for agricultural production, agribusinesses, communities, environmental assets, and institutional support.

This chapter identifies some of the current strengths and weaknesses of the Region in each of the competency areas and discusses the challenges and opportunities posed by the scenarios for these areas. Strategies that will protect and strengthen each of the competency areas are subsequently described.

Land and water for agricultural production

Irrigation water supply infrastructure

The Region has an extensive network of irrigation water supply infrastructure that has the ability to deliver water to the vast majority of properties in the Region. However, much of this infrastructure is degrading and nearing the end of its design life. The scenarios highlight that water availability for irrigation may change significantly in the future due to variability and change in climate as well as potential changes in water policy. Water trade may also affect the amount of water used in the Region and its spatial distribution. Therefore, there is great uncertainty in the size and location of the irrigated area and amount of water used in the future. There may even 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.

Examples of flexible distribution technologies are lay-flat pipes and other short life infrastructure, portable outlets, in-channel and off-channel storage, system mothballing, making provisions for the possibility of future system expansion, and staged development of infrastructure. These technologies can be used in combination with long-term quality assets to create distribution systems that are highly adaptable to future needs. A handbook of technologies for flexible infrastructure has been prepared.

Irrigation supply service level requirements

One of the themes that emerges strongly from the scenarios is that the competitiveness of the agricultural industries in the Region will depend on generating differentiated products. These high-value 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”. This suggests individual channels will need to deliver a range of service levels. Where a range of service levels is needed on a single channel, infrastructure and management systems may need to consider operational

flexibility, which may include oversizing channel capacity or real-time control systems. However, opportunities to tailor service provision may occur where aggregations of common service requirements exist.

Irrigation drainage infrastructure and management

The Region is relatively well served by drainage and salinity control infrastructure. The scenarios suggest that this infrastructure and its management will also need to adapt to future changes in irrigated area, land use and water management practice. Given the rapid changes that are occurring in the irrigation scene currently, there is merit in delaying the construction of major high value assets such as evaporation basins as long as possible. Irrigation reconfiguration planning, and infrastructure planning in general, must integrate surface and subsurface drainage with supply infrastructure. As land and water management changes, there should be ongoing review of surface and subsurface drainage needs and design and service standards. There is a strong need to investigate technologies and management practices for increasing flexibility in surface and subsurface drainage systems, so that the systems are adaptable to future conditions. For example, some of the existing subsurface drainage works may be decommissioned and mothballed. They may be recommissioned at some time in the future when demand for subsurface drainage increases.

Water management on farms

The scenarios depict how farming enterprises and systems today may change significantly in the future. Whole farm planning, one of the key strategies in the catchment to assist irrigators to improve water management, may need to evolve significantly in the future. It may shift from its current focus on farm and irrigation layout to dealing with more strategic issues such as enterprise and system changes and flexibility, use of new water products and services, and environmental management systems. Whole farm planning may also evolve to the planning for groups of farms, to interface with irrigation infrastructure planning. There may also be a greater role for providing knowledge and information support for improving the efficiency of water use.

Integrated land use planning

The Region has an abundance of good quality land, most of which is currently used for agricultural production. The land contains a wide range of soil types and parcel sizes, which makes it attractive to a diverse array of land uses. The scenarios describe significant changes in land uses over the next 30 years, within and between agricultural, lifestyle and environmental uses.

There is a need for a collaborative approach to land use planning by agencies, industry groups and the community, to manage potential conflicts and bring about complementarity. It is critical to develop sound land use zoning to manage the interfaces between production, urban, rural living, environmental and industrial uses of land and to ensure land is available for all uses at acceptable prices. For example, the Region needs appropriate accommodation for new residents, including lifestyle residents, to encourage them to settle and bring new ideas and income streams to the Region. On the other hand, the settlement of new residents needs to ensure that affordability of agricultural land is not adversely affected. To ensure

agricultural land is adaptable to future changes in enterprises and farming systems, options should be investigated to enable flexible amalgamation and subdivision of land parcels and to manage redundant assets.

Agribusiness

Developing the agricultural workforce

Agricultural industries have a range of labour requirements, including skilled, semi-skilled and unskilled workers. Many agricultural businesses have difficulty in finding the labour required for many reasons. Agriculture is often portrayed as a career with little future and many potential agricultural employees are turned away by the lack of clear career paths. The scenarios suggest that there will be times when agricultural industries are vibrant and highly profitable, needing an increasing number of employees. During these times shortages of labour may limit the Region's ability to capitalise on the buoyancy of agriculture.

Promoting a positive image of agriculture may encourage future generations to pursue agricultural careers. The promotion of agricultural careers will need to target the values and aspirations of the next generation, for example the desire to use cutting-edge technology, and may include positive media stories and involvement of agricultural industries in school programs. Encouraging migration, from both overseas and other parts of Australia, may also assist in increasing the availability of labour in the Region. Attracting migrants to the Region will enhance the availability of labour, but will also bring new energy, skills and ideas into the Region. Opportunities also need to be created to ensure new entrants to agribusiness are able to pursue a rewarding career. These opportunities may include establishing clear career paths within existing agricultural businesses and creating financial pathways to business ownership, including succession planning.

Developing agricultural products and markets

The scenarios suggest that maintaining competitive agricultural industries in an international marketplace is likely to be challenging. Terms of trade may continue to decline for agricultural businesses as free trade agreements come into force and other countries develop the capacity to export agricultural products. The scenarios also describe a range of possible circumstances where the fortunes of individual industries, business structures or products may rapidly decline or improve, due to changes in climatic, market or other conditions. In Scenario 2, for example, an outbreak of fire blight decimates the pome fruit industry, which currently provides a significant proportion of the Region's horticultural income.

Maintaining vibrant agricultural industries in the Region will mean that they will need to maintain a competitive advantage in the international marketplace. Competitive advantage can be maintained by either producing products at a low cost or by differentiating product offerings from the competition, and necessitates that producers remain ahead of market trends. This will require continual development and innovation in products, production systems and market niches supported by high quality research and development programs that generate and capture new knowledge. Possible differentiated product niches that the Region can develop include "nutraceutical" and health food markets.

In addition to the development of new knowledge, agricultural industries need to ensure that individual businesses are aware of the emerging technologies and market trends. To maintain business competitiveness, high-quality education and extension programs are required to ensure agricultural business understand how to use the new technologies and market information.

For the Region to maintain vibrant agricultural industries it is also necessary to maintain a diversity of business and agricultural enterprises. A diversity of enterprises will ensure that it can retain a level of prosperity through downturns in individual industries and capture the opportunities that emerge. Encouraging new and innovative agricultural enterprises to establish in the Region and providing them with appropriate support may further develop diversity of agricultural industries.

Developing flexible and robust agribusiness structures

Agricultural businesses in the Region will be subject to a range of pressures, including declining terms of trade, disease outbreaks, increasing regulation and changing climatic conditions. For example, the introduction of free trade agreements, particularly in Scenarios 1 and 4, may place substantial pressure on the profitability of some industries and cause agricultural enterprises to rethink the way they do business.

Agricultural businesses will be able to manage these challenges and opportunities using a range of strategies. Declining terms of trade may be overcome by increasing the scale of farm business or investing in technology to lower operating costs. Alternatively, agricultural businesses may develop or invest in the development of value adding or supply chains. This will increase the vertical integration of the industry, may reduce costs in the supply chain and may assist in creating additional wealth for the agribusiness owner. These strategies may radically alter the structure of agricultural industries and will most likely require the injection of additional capital into agribusinesses, which may be raised using innovative public or private financing arrangements.

To withstand fluctuations in markets, climate and other influences on agriculture, businesses need to build flexibility into business structures. This flexibility may include diversifying their income stream to insure against a downturn in a particular product, or owning land in different areas to manage threats posed by climatic conditions. Flexibility may also be built into business structures by creating financial or other (such as hay or water) reserves during good times to minimise the effects of tough times.

Undertaking these strategies will increase the sophistication of technological and business systems used by agribusinesses. These systems will need managers, operators and technical support staff who have highly developed technical skills. Therefore agribusinesses will need to build and maintain advanced technical and business skills in their owners, managers and employees. The building and renewal of these technical and business skills will require continued investment in training in a range of areas.

Actively maintaining access to resources

Irrigated agriculture is the major driver of the Region's economy and makes a substantial contribution to the state and national economies. However, in making this contribution, agriculture in the Region (particularly irrigated agriculture) uses a wide range of natural resources. The scenarios suggest

that the scarcity of these resources, particularly water and fossil fuels, may increase due to competition with other sectors and climate change. The expectations of agricultural product markets and the wider community may also place pressure on the use of natural resources for agricultural production. In the second half of Scenario 4, for example, consumers demand food with credence values, which may include minimal environmental impact.

The increasing scarcity of natural resources suggests that the efficiency of resource use, particularly the use of water, may need to increase within the Region. Efficiency gains may be possible to achieve within individual businesses and at the regional scale. Opportunities for improving resource use efficiency include the use of technology, improved operator skill and changes to business composition.

The contribution of irrigated agriculture to the Regional and state economy and the quality of life of consumers is not necessarily well understood by all members of the community. They may therefore be willing to curtail its resource use. This suggests that communities and organisations with an interest in irrigated agriculture need to actively promote its benefits to people living both inside and outside the Region. Maintaining a high level of awareness of the importance of irrigation may help reduce community pressures to impose increased constraints and restrictions on irrigation industries.

Communities

Maintaining active community organisations

The Region has a large number of active community groups that undertake a wide range of activities. The activities of these community groups make a substantial contribution to the vibrancy of the Region and the achievement of regional management objectives. Leaders of the Region's community groups also play an important role in representing the views of the wider community to the agencies and organisations inside and outside the Region. Commonly, these community leaders make personal and financial sacrifices to undertake their community leadership role.

The scenarios suggest that these community groups could be very different in the future, through necessity or evolution. Community groups may decline due to a number of reasons, including decreasing population in small towns, changing individual priorities, emerging communication technologies and increasing work pressures. During these times, community leaders may also be less willing to make sacrifices, particularly when business conditions are tight. However, there is also the chance that community groups may flourish as an increasing number of retirees or new entrants to the Region become involved. The scenarios also suggest there is a risk that community leaders are perceived to become too close to the Region's agencies and are viewed as their advocates.

To ensure the sustained prosperity of community groups, continual rejuvenation of both membership and processes is necessary. This may entail encouraging new people to participate or undertaking activities that inspire members and provide them with a fresh perspective on the group's activities. Similar principles also apply to the Region's organisations that have some form of community involvement. It is also important to recognise the contributions and activities of community groups. Agencies in the

Region need to continually support initiatives of community groups and encourage them to celebrate their achievements.

To maintain the willingness of community members to take positions of leadership, the Region needs to recognise and value its community leaders, particularly those who are independent of the Region's agencies. Support can be provided to assist the development of community leaders through the provision of training and networking opportunities.

Encouraging development of Regional community infrastructure

A wide range of transport, energy and communications infrastructure currently serves the Region. The availability of high-quality infrastructure can influence the decisions made by current and potential residents to live and invest in the Region. For example, the Region loses a large proportion of young people because it cannot provide the educational opportunities they desire.

The scenarios describe numerous developments in technology and infrastructure that may improve the connection of communities within and beyond the Region and attract new residents and investment. For example, in Scenario 2, 3G and 4G communications technologies enable workers to easily telecommute to workplaces throughout the world. However, the ability to use these technologies relies on having access to the infrastructure within the Region, which will require investment by governments or large corporations. The scenarios suggest that some smaller regional communities may decline and with them the number and quality of community facilities. Local access to high quality education and research facilities is also likely to become increasingly important in maintaining the competitiveness of the Region's businesses and in retaining young people in the Region.

This implies that the Region needs to actively seek support and opportunities to upgrade infrastructure and develop regional centres. Encouraging universities and research institutions to establish themselves is particularly important if the loss of young people from the Region is to be reduced.

Actively lobbying governments

Governments make decisions that can have considerable consequences for the Region. Some policy changes can cause uncertainty, reduce the confidence of agribusiness operators and investors, and decrease the level of agribusiness investment. Other policy changes can provide certainty and encourage investment in the Region. For example, the purchase of water by government in Scenario 3 decreases the confidence of agribusiness in the Region. Supportive government policies, such as those in the second half of Scenario 4, encourage the re-establishment of agriculture in the Region.

This suggests that the Region's community needs to actively lobby all levels of government to ensure that policies support the continued development of the Region, and that policies adversely affecting agricultural industries have adequate transitional arrangements to allow businesses to adapt. For example, if irrigators believe that the current water allocations need to be reviewed in light of recent dry conditions and with a view to increase their ability to manage risk through using carry-over, they need to present their case to local members of parliament and the appropriate minister.

Environmental assets

Vision for the environment

A wide variety of environmental assets makes parts of the Region aesthetically appealing and attracts tourists to the Region. Currently, the protection of environmental assets is managed on a case by case basis, typically at the time when developments are proposed. This means that the planning of land use, infrastructure and farm developments is difficult. The valuation and management of these assets can be a source of potential conflict, particularly when protagonists have different aspirations for environmental assets and different understanding of systems.

The scenarios suggest that the environmental assets of the Region may come under pressure from a range of sources, including development pressures (for example the settlement of an increasing number of lifestyle residents in Scenario 2) and inadequate management, which may be caused by the declining terms of trade in agricultural industries. The scenarios also describe circumstances where conflicts over environmental assets may arise.

To assist with planning and managing development, the Region needs to develop a vision of significant environmental corridors for protection and enhancement. Such a vision would provide landholders and land use and infrastructure planners with some degree of certainty and the opportunity to develop plans that complement the vision. Involving the community in the development of such vision may help manage future conflicts over the value of environmental assets by sharing knowledge and understanding about the environmental systems and providing a forum for debate of environmental aspirations.

Encouraging environmental management on farms

The vast majority of land in the Region is privately owned and many of the Region's environmental assets are located on this land. The management of private land is currently the responsibility of the landowner and is subject to very few conditions or restrictions. Therefore, to improve the environmental assets in the Region the willing participation of landowners will be required.

The scenarios describe conditions where the presence of well managed environmental assets and features on agricultural properties may provide a marketing advantage when credence values influence consumers' purchasing decisions. The scenarios also describe circumstances where the management of private land becomes a source of tension between neighbouring landowners. For example, in Scenario 1 conflict arises between owners of lifestyle properties and commercial agribusinesses over the acceptability of land management practices, such as weed management.

The community articulated that they aspire to be recognised and valued stewards of the land. This suggests that they would like to improve the condition of environmental features on their land and their environmental credentials. Therefore, landowners should be encouraged and supported to integrate environmental features, such as native vegetation, animal sanctuaries and wetlands, with agricultural production systems and rural living properties. Guidelines for responsible land ownership may be established to identify the expectations and opportunities for landowners to improve their environmental management and minimise the potential for conflict.

Environmental water reserve

In recent times, environmental water allocations have received significant political, media and scientific interest, resulting in increased environmental water entitlements. The scenarios describe conditions when the full environmental flow entitlements are not available, for example during the first period of Scenario 4, where any allocation will need to be used judiciously. Scenario 3 also illustrates a situation where the benefits of additional environmental flows do not meet expectations, and therefore water is reallocated to commercial use. Scenario 2 also describes conditions when large quantities of water are traded out of the Region. The delivery of this water to other regions may result in unseasonally high river levels and impact on the environmental condition of the rivers. River - particularly environmental - flows will therefore need to be soundly managed to maximise the environmental benefits. If carefully managed, it may be possible to achieve environmental benefits from normal river operations as well as from the use of environmental water allocations.

Regional adaptive environmental management

The Region has a wide range of environmental management programs that seek to achieve a range of environmental outcomes by influencing the management practices of landowners and organisations. Many of the environmental outcomes relate current and proposed conditions to an historical benchmark, for example many native vegetation studies relate the current extent of vegetation communities to the extent before 1788.

The scenarios suggest that future conditions may mean that returning to such historical benchmarks may never be possible. For example, the majority of scenarios describe a decline in rainfall and increases in temperatures over the next 30 years. These climate changes are likely to influence river flows, fire regimes and the many other determinants of ecological community compositions. The scenarios also describe conditions where landowners and organisations may be unwilling or unable to adopt the desired management practices due to political, climatic or economic conditions. For example, during the first half of Scenario 4 landowner interest in installing surface drainage to reduce water logging is likely to be limited due to prevailing drought conditions and depressed product markets.

These factors suggest that environmental managers need to investigate the nature and requirements of environmental assets under changing conditions. Investigation of the impacts of climate change is particularly important for practices that influence land management in the long term, for example revegetation using the appropriate native species.

The variability in the willingness of landowners and organisations to adopt particular management practices suggests that environmental programs need to be adaptable to changing conditions. Adaptability may be built into environmental programs by developing systems that can rapidly scale up during favourable conditions and down-size during difficult times, or by developing the capability of staff to work across a range of programs.

Institutional support

Supporting communities during tough times and times of change

Periods of tough times and change are inevitable. Historically, the Region has experienced many changes and periods of tough times that have been

the result of political, market, and climatic pressures. For example, times have been experienced when prices for agricultural products have been very low and when periods of drought or flood have made production conditions very difficult and caused losses of stock and orchards.

The scenarios describe a range of conditions where significant change is imposed on the Region. For example, the effects of government policy changes are highlighted in Scenario 3 where the quantity of water available for agriculture is reduced substantially by one government and substantially increased several years later by another. The scenarios also describe conditions that create hardship for the Region's residents. For example, Scenario 4 describes the loss of international markets for agricultural products followed by an extended period of severe drought. These tough times can potentially influence the productivity of the Region in the long term as well as the short term, through the loss of core industry requirements, such as seed, stock and processing capability.

People in the Region need to be able to recognise and understand the changes that are occurring to enable them to adapt adequately. This suggests that the Region needs to provide support to individuals to recognise and adapt to changes that occur. Support from the Region's organisations may include providing regular information bulletins on significant issues for the agribusinesses in the Region, such as international market and climatic trends, case studies on how individuals have adapted to change, and training and advisory services to assist people to interpret how the information relates to their business. Support to understand and adapt to changes in government policies also needs to be provided by agricultural industry organisations and governments. In the Goulburn Broken Region this is particularly important for changes in water policy because of the high dependence of many agribusinesses on irrigation.

To ensure the Region is resilient through such periods of hardship, strategies are required for agricultural businesses and industries to ensure the core productive capacity of agricultural industries is preserved. These strategies may include taking leadership to draw resources into the Region, co-ordinating the actions of organisations so support is easily accessible, enabling business restructure or establishing financial or other reserves in anticipation of tough times.

Regional framework for adaptive management

The scenarios highlight that, as the future unfolds, the Region may be confronted with a range of possible conditions. These conditions may present opportunities for the Region to grow and develop, or challenge the economic, environmental or social foundation of the Region. The opportunities and challenges may slowly evolve, such as the trend for increasing farm sizes causing a decline in demand for agricultural properties in the Region (Scenario 2), or emerge rapidly, such as the changes in water policy described in Scenario 3. The future prosperity of the Region relies upon embracing the opportunities and challenges as they are presented.

Long-term planning is required for many issues. For example, irrigated agriculture in the Goulburn Broken Region depends on sound land and water management at a catchment scale. The complexity and uncertainty of the land and water systems and their drivers requires critical assumptions to be made when management strategies are developed. As the future unfolds,

the validity and robustness of these assumptions needs to be assessed in the light of new data and information.

The uncertainties that the future holds suggest the Region's agencies need to establish a framework for adaptive regional management. The framework would need to include processes to

- continually detect and monitor emerging issues, indicators of change and new management options
- continually learn from monitoring data to improve understanding of the systems within the Region
- make adaptive changes to management practices to manage emerging issues and future uncertainties.

To assess the robustness of management strategies, there is a need to have a systematic research program for monitoring, evaluation and review, integrated with the implementation of the strategies. The research program becomes part of a deliberate adaptive management process. The core of the research program is to identify critical assumptions on how management strategies lead to management outcomes, carefully design a monitoring scheme, use a sound scientific method to analyse the monitored data to test the assumptions, and understand the implications of the analysis results on management strategies. The research program is also to synthesise other research results outside the catchment and understand whether they shed any light on the critical assumptions being tested at the catchment.

Knowledge management

A considerable body of knowledge about the Region exists. While some of this knowledge is documented, much of it is stored in the minds of the people who live and work in the Region. This knowledge includes understanding of the biophysical system as well as the people and organisational systems within the Region.

Scenarios suggest there will be times when large numbers of people may leave the Region. For example, in Scenario 4 people seek employment outside the Region when agricultural industries are not profitable. As people leave the Region, the knowledge base of the Region may be reduced, and therefore it is important to ensure that the Region shares and exchanges knowledge. The scenarios also suggest there will also be conditions that have not been previously experienced. For example, Scenario 4 describes an extended period of drought that is worse than anything previously experienced. The effects of these conditions may be mitigated if knowledge gained from previous similar experiences can be used. These circumstances will also enable the knowledge to be generated about the human and biophysical responses to extreme conditions. Exceptional circumstances do not recur frequently, and therefore, it is necessary to ensure knowledge of exceptional conditions is transferred between and within generations.

As new technologies develop and systems become increasingly sophisticated, the continued development of knowledge will be increasingly important and may be critical to the continued profitability of the Region's industries. The Region will therefore need to continue to generate new knowledge about its agricultural systems and communicate this information to maintain industry competitiveness.

The Region needs to review the current mechanisms for knowledge generation, accumulation, communication and use, and examine ways for improvement. The aim should be to ensure that regional and organisational knowledge is retained in the Region and transferred within and between generations, and that new ideas and knowledge are created and used.

Regional communication, co-operation and decision making

The organisations, agencies and the community in the Region have a long history of working together co-operatively, extending back to the development of the salinity management strategy in the 1980s. Many governments and regional organisations have involved community leaders in their decision making processes to represent and express the views of the wider community, and to provide local knowledge. Co-operative working relationships between the Region's agencies and communities may become increasingly important in the future as the issues and challenges facing the Region become more complex. For example, in several of the scenarios, land use planning becomes increasingly complex, needing to consider the interactions between infrastructure provision, an increasing diversity of land uses and the needs of the environment. The scenarios also suggest that the range of community views may increase as land uses and agricultural businesses diversify. For example, the influx of lifestyle residents described in Scenario 2 results in an increasing range of views on acceptable land-management practices.

The growing complexity of issues facing the Region will mean that the Region's organisations and agencies will need to increasingly share information and co-ordinate their decision making to ensure issues are managed in an holistic manner. This suggests that all organisations and agencies in the Region need to continually promote a culture of regional co-operation. Regional co-operation is dependent on maintaining strong communication links between the organisations and agencies so they understand one another's objectives and directions and can achieve synergies in their activities.

An increasingly diverse community will mean that community involvement in decision making processes becomes more important. The organisations in the Region should therefore encourage active community participation in decision making processes, which will ensure that decisions are robust and engender community confidence and ownership. Enabling community involvement in decision making processes necessitates effective communication within the Region. Strong communication within the Region will make sure that the community's views are made known to the Region's agencies, and that the community understands the issues facing the Region's agencies. Measures to foster improved communication may include facilitated community discussions of natural resource issues to explore cultural values and attitudes toward the Region's natural assets. These discussions may also promote the development and strengthening of community networks.

6 What we have learnt and where to from here?

Key findings

The Goulburn Broken Region has historically made an important contribution to the nation. This contribution has been supported by the Region's many strengths, including the quality of the land and water resources, resilient agribusinesses, vibrant community and a wide range of institutional support. Many factors influence the success of the Region, and as the future unfolds the Region may be confronted with substantial changes in these factors. Through the four scenarios, this publication has highlighted some of the possibilities that the future may hold for the Region. These possibilities may provide opportunity for the Region to prosper, but may also challenge the environmental, economic and social foundations on which the Region is built.

Looking across all the scenarios illustrates that there is a very high level of uncertainty about what the future may hold. This suggests that individuals, businesses and organisations in the Region need to be flexible and adaptable. Flexibility is about building into systems the ability to respond quickly and smoothly to the challenges and opportunities that arise. Flexibility may be built into systems through innovative use of technology, infrastructure, organisational structures, financial arrangements, and management systems. Adaptability is about building on system flexibility and operationally recognising and understanding the changes that are occurring within the Region and, once change has been identified, consciously making informed choices about the future. The changes that need to be considered include changes to the social, economic, political, technological and ecological conditions and the fundamental assumptions that underpin activities.

This publication is not a solution, but it provides a first step for the Region's individuals, businesses and organisations to consider what the future may hold and what actions can be taken now to ensure that the Region's aspirations are met. The strategies described in Chapter 5 are a starting point for individuals, businesses and organisations to consider as they build plans for the future. The Region's organisations need to continue to engage in strategic conversations. Moreover, these strategic conversations need to be established as part of the organisational culture of the Region to ensure continual consideration and awareness of emerging trends and their impact on the Region's strategy. The Region's community needs to be a part of these strategic conversations to fully utilise the community's knowledge and ensure ownership of the process and outcomes.

How can this book be used?

This publication can be useful to assist individuals, businesses and organisations in the Region to develop strategic plans for the future. The publication can be used in several ways.

Individuals and businesses

Individuals and businesses can use this publication in their own planning. A process for using the publication may involve the following steps. Individuals may like to seek professional advice and support to help them through the process.

1. Write down the personal or business objectives that you are seeking to achieve.
2. Read each scenario and note down the answers to the following questions:
   If this scenario happened:
   a. What impact would the scenario have on your business or career, lifestyle and community?
   b. What changes would you need to make to your business or career, lifestyle and community activities?
3. Given that any of the scenarios may happen:
   a. What changes do you need to make to your business or career plan?
   b. What changes do you need to make to your lifestyle?
   c. What changes need to be made in your community? How can you make a difference?
4. Prepare an action plan considering:
   a. What needs to be done?
   b. Who will do it?
   c. When will they do it?
   d. When will it be completed?

Organisations

Individual organisations may use this publication to look at the implications of the scenarios. Organisations can use this publication in several ways.

In the development of plans for the future, an organisation may use the following steps. This exercise is best undertaken by a group of people to create a shared understanding of future and the plans of the organisation.

1. Construct a list of the outcomes that your organisation is seeking to achieve.
2. Carefully read each of the scenarios and note down answers to the following questions:
   a. What are the major opportunities and challenges the scenario presents for your organisation to achieve its outcomes?
   b. What are some of the ways that your organisation might manage these challenges and opportunities?
3. Looking across all scenarios:
   a. Collate all the identified challenges and opportunities and management strategies from all four scenarios.
   b. Identify strategies for your organisation that will be robust in dealing with all four scenarios.

4. Prepare an action plan considering:
    a. What needs to be done?
    b. Who will do it?
    c. When will they do it?
    d. When will it be completed?
    e. How will you know if your actions have been effective?

The scenarios can also be used to assess proposals and ideas presented to organisations. For this purpose, proposals could be examined in terms of their performance under the four scenarios to see how robust the proposal is under a range of conditions.

The Region

The establishment of a Regional forum to continue to plan for the future will be highly valuable to the Region. This Regional forum would enable organisations and businesses to collectively examine issues of strategic importance and consider their implications for the future of the Region. Businesses and organisations in the Region would then be able to develop plans that complement each other and achieve synergies. Goulburn-Murray Water has commenced an investigation of how such a Regional forum could be established to support strategic planning for their business. Expanding the scope of this forum to include other organisations would provide significant benefits to the Region.

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Appendix: Scenario planning for irrigation in the Goulburn Broken catchment: A summary of project method

PROJECT THEMES	PROJECT STAGES			
	Stage 1: Project development	Stage 2: Capturing community perspectives	Stage 3: Conducting analysis	Stage 4: Enabling change
Project planning and initiation	*Project Team* • Scoping project concept • Securing funding • Planning project • Establishing Governance Committee (GC) • Establishing Stakeholder Reference Committee (SRC)	*Project Team* • Developing stakeholder participation plan • Arranging independent review of the stakeholder participation plan • Establishing Irrigation Futures Forums (IFF)	*Project Team* • Developing scenario assessment plan • Arranging independent review of the scenario assessment plan • Establishing Technical Working Group (TWG)	*Project Team* • Developing adoption plan • Establishing stakeholder working groups
Hindsight, Insight		*Irrigation Futures Forums* Learning from the past • Constructing "history walls" • Understanding drivers of the past • Drawing key learnings • Exploring community aspiration • Writing letter to self from future • Drawing aspirations from the letters *Project Team* • Synthesising community aspirations • Finalising the community aspirations with IFF and SRC	*Technical Working Group* • Suggesting dimensions (indicators) of the community aspirations	
Foresight: Future scenarios		*Irrigation Futures Forums* • Extending drivers from hindsight • Constructing "future walls" *Stakeholder Reference Committee* • Synthesising key drivers • Extracting storylines from the 28 IFF scenarios • Assembling storylines to construct four external scenarios of next 30 years *Project Team* • Interviewing senior managers of food processing companies and leading thinkers • Completing the four external scenarios • Finalising the scenarios with IFF and SRC	*Technical Working Group* • Understanding external scenarios • Exploring Regional responses and consequences • Constructing full scenarios *Project Team* • Scenario modelling: land use, irrigated area and water use, farm gate gross value of production, and population • Checking modelling results with TWG and SRC • Finalising full scenarios with TWG and SRC	
Broad implications		*Irrigation Futures Forums* • Putting forward ideas on Regional response options	*Technical Working Group* • Identifying Regional competency areas • Understanding scenario challenges	*Project Team* • Developing with DPI CAS a scenario work kit for take-up by extension team in

		Project Team • Synthesising the ideas to a preliminary set of Regional strategies • Finalising the preliminary strategies with SRC and IFF	and opportunities • Developing strategies under each competency area *Project Team* • Synthesising TWG and IFF strategies • Incorporating results from investigations of specific implications (next Theme) • Finalising broad implications with SRC • Writing a Scenario Book to document driver analyses, scenarios and broad implications as well as methodology of Regional scenario planning	adoption work beyond project completion • Running workshops for a range of stakeholder groups to explore scenario implications for them • Briefing a range of people on project outputs and learnings
Specific implications			*Technical Working Group* • Identifying priority areas for investigations of specific implications *Goulburn Broken Catchment Management Authority* • Identifying subsurface drainage requirements under each scenario *Project Team* • Identifying Regional business support needs for developing differentiated products	*Goulburn Broken Catchment Management Authority and Project Team* • Exploring scenario implications for catchment management • Developing a framework for R&D to support adaptive management *Goulburn-Murray Water and Project Team* • Exploring scenario implications for irrigation infrastructure • Developing a handbook for flexible technologies for irrigation supply infrastructure *Local Governments and Project Team* • Linking project learnings with Rural Strategy development process
Project communication and evaluation	*Project Team* • Developing project communication and evaluation plans • Communicating with a wide range of people on the planned project to raise awareness and get feedback	*Project Team* • Communicating project progress and results with a wide range of stakeholder groups through briefings, presentations and media • Organising Speakers Day • Arranging review of Irrigation Futures Forums process	*Project Team* • Communicating project progress and results with a wide range of stakeholder groups through briefings, presentations and media • Arranging independent review of Technical Working Group process	*Project Team* • Undertaking a range of communication activities (all above) • Arranging independent review of the project