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Understanding Water Availability Farm/Food Processor Viability in the GMID – Phase 1 understanding the issues

Final Report

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Contents

1 Executive summary

This Project

The ultimate objective of this project is to develop a strategy to maximise the potential of the Goulburn Murray Irrigation District (GMID). It will focus on making the most of opportunities and mitigating the impacts of declining water availability on farm and industry viability.

This project is being undertaken for the Goulburn Broken Catchment Management Authority, through Goulburn Murray Water and a steering committee of representatives from Goulburn Broken CMA, North Central CMA, GMW and DEDJTR.

There are two phases for the project. Phase 1- this report which documents relevant issues, challenges, drivers and activities. Phase 2, which has not yet commenced, will be to develop a strategy to address the key issues.

Phase 1 is intended to also provide a resource for informing:

- the Land and Water Management Plans in the North Central and Goulburn Broken CMA regions that deal with the Goulburn Murray Irrigation District (GMID).
- The GMW Strategic Plan.
- Other stakeholders who can assist in enhancing the opportunities within the GMID.

The Region

The GMID is a major irrigation district comprising 15,000 properties. The gross value of irrigated agricultural production is around $1.4 billion per year. The main enterprises are dairy, mixed grazing and cropping farms; and horticulture. There are major food processors located in Shepparton and Echuca and the region supports a population of 170,000 people.

The region is part of the southern connected Murray Darling Basin (sMDB) and the amount of water available to the GMID is highly influenced by the water available in the sMDB and trade between industries.

In 2011 there were approximately 7,600 jobs in agriculture and a similar number in manufacturing. This is out of a total of 57,000 jobs in the GMID region. This figure has probably increased since 2011 as the 2011 was in the aftermath of the drought. The food processing industry is a major Victorian employer and its main exporter. There are sixteen dairy factories in the Region.

Economic drivers

Dairying and horticulture make up over 90% of the value of irrigated agriculture in the GMID. Ensuring the area retains sustainable competitive advantages for both is crucial for the GMID's long term future. Future agricultural economic activity depends on attracting new investors and new industries and enabling the growth and expansion of the larger properties. These properties find it difficult to expand when block sizes are small and when they are inflated by rural residential values. Therefore, land use planning is important to support existing agriculture and to ensure that there will be opportunity for expansion by retaining allotments in larger parcels and limiting subdivision in areas suited for irrigated agriculture.

It will also be important that urban growth/housing does not drive up land values beyond productive value and render it unavailable for farm expansion. The prevention of ad hoc rural living development by managing housing development on small allotments is critical in prime agricultural areas.

The implications of global market trends are that there are large opportunities for growth, but there will be continuing pressure for GMID industries to improve product quality, to invest in new technology and skills; and to improve water use efficiency. This will be in terms of tonnes of production per ML and economic value created per ML.

Competition for water in the sMDB will require the GMID to maximise its competitive advantages over other regions in the sMDB. These include climate, water quality, modernised supply (level of service), high serviced land availability, cost base, food processing, skilled workforce and proximity to market.

Water use

The GMID historical annual irrigation water usage has fallen from above 2,000 GL to around 1,400 GL.

Once horticultural growth across the sMDB is satisfied with its growth being limited by drought; a dynamic equilibrium between opportunistic users such as rice, semi-interruptible industries like dairy (where some feed substitution for GMID water[1] can occur) and non-interruptible horticulture is expected.

It is expected that this will result in GMID averaging around 1,300 GL/y water usage but varying between 400 GL/y in drought years[2] to 1,600 GL/y in wet years. Further Commonwealth water recovery, assuming another 750 GL reduction in the sMDB consumptive pool, could reduce this to 1,050 GL/y in an average year, 270 GL/y in a drought year and 1,300 GL/y in wet years.

An important change has been that in drought years the water expected to be used in the GMID is only 25% of the average year. In the past the usage would have been around 50% of the long term average. This means that irrigation farms need to continue to develop strategies to cope with years when water is short and temporary water prices are high.

The key issue is whether the region can continue to afford to fund infrastructure operation, maintenance and replacement for 600,000 ha capable of being served, when only 390,000 ha is currently irrigated and this area will be much lower in drought years.

The importance of flexibility and scale

Already, a key challenge facing irrigators is the ability to respond to a variable water supply/ water market price. This will continue to be a challenge, especially in drought years when the GMID is prone to trade water out to horticulture. But in wet and average years the GMID has the ability to expand its production and has been successful in buying water from other industries.

In some areas there has been an increase in flexibility with a transition from traditional dairy farms with a heavy reliance on grazing of perennial pastures that has a high water dependence, to farms that utilise a mix of feed sources such as cut and carry, annual/perennial pastures and feed crops, silage and holding feed stocks. Provided it is profitable this trend is likely to continue. However, there are a significant number of dairy farms in parts of the GMID where there continues to be a high reliance on perennial pastures.

Some mixed farms have moved to more dryland production, which has lower inputs, with opportunistic irrigation when water is more available and affordable. However, this transition can be difficult on small paddocks that are the legacy of ex-irrigation land. Farmers converting to dryland face substantial costs in

[1] For example dryland Mallee cereal crops cut for hay can bring in feed for GMID stock. This has effectively used rainfall from outside of the GMID to substitute for a lack of channel water.
[2] which based on the last 20 years occur approximately 2-3 years in 20.

removing redundant infrastructure to get the large paddocks and economies of scale required for profitable dryland production.

Small family farming businesses typically have less resources than larger businesses. This is due to fewer people, which limits the potential skill set, reduced borrowing capacity and less control/influence in the market. A large dependence on off farm income, or a willingness to take low income, can subsidise small farm businesses to survive, but small and medium sized businesses without access to off farm income are at risk. The trend has been that larger businesses, provided they are profitable, tend to be those with a surplus, that after meeting living costs, can continue to expand, invest in technology and survive, but they are also exposed to more risk as scale magnifies losses as well as profits.

GMW implications

Low water use in drought years will place increased pressure on GMW to operate the system in new ways that minimise losses. A more flexible GMW system may be required.

GMW water charges are higher for larger users than for those in neighbouring NSW districts, albeit that service standards differ[3], but higher charges are not a key factor limiting higher value horticulture and dairy, but may be limiting investment for attracting lower value industries, such as cropping and mixed farming.

Increasing costs associated with the water market and owning and maintaining irrigation systems is resulting in mixed farmers becoming larger and more dependent upon dryland production with opportunistic irrigation supplementing their crop mix, when the water market price is at appropriate levels.

The infrastructure costs are largely fixed. The GMID faces a quandary in that if delivery share charges were reduced for dryland then it would mean that DS charges for irrigated land would rise, which may act as a barrier for irrigation expansion and irrigation competitiveness.

Different industry and individual farm profiles imply that GMW, where it is cost effective, might consider different service offerings that are more in line with needs. For example, the GMID system might be divided, ideally by landholder choice, into blocks that:

- receive a premium service product suitable for horticulture, domestic and stock, dairy milking areas and has a high guarantee of supply in drought years.
- receive a lower charge service more aligned to mixed farms, dairy outblocks and would be a lower priority for supply in drought years.

However, this may not be easily achieved where there is a patchwork of different needs off the same supply system, which is quite often the case.

Summary of issues and challenges

Issues:

- Increasing demand for Victorian HRWS from outside of the GMID.
- Low and declining regional irrigation water use, relative to historic use and GMW system capacity.
- Exposure of irrigation industry and processing sector to less water, especially the impact in a future drought year.

[3] Eg. GMW are moving towards an on demand system.

- Increasing variability in water availability and as a result, water market price and regional use.
- Need to build flexibility to changing water availability into farming systems.
- Reliance on the dairy sector which is vulnerable due to competition from other dairy regions, tight profit margins, exposure to world market fluctuations and limited water use flexibility.
- Potential significant increase in water supply cost.
- Cost of delivery share charges and how these are shared amongst GMW customers. Charges impact low intensity (low ML/ha) and high intensity (high ML/ha) water users in different ways and depend on the historic water right that was held at unbundling. It is important that water charges be competitive for irrigation to grow in the GMID.
- Trend for increasing sub-division and purchase by rural residential landowners that contribute to the area being 'dried off'.
- Spatial variability in irrigation demand and whether there is the opportunity to develop different water service products to reflect the increasingly varied needs. For example, rural residential, horticultural, dairy and mixed farmers all have different needs.

Challenges:

- More water scarcity creates increasing need to ensure irrigation is used to generate the greatest net benefit in terms of economic, environmental and social outcomes. For this to occur there need to be signals that reflect total system (farm and off farm) water use efficiency[4]; and measures that fully account for the environmental and social effects of irrigation.
- Ensuring water conveyance losses and third party impacts of trade[5] are properly understood and accounted for.
- Increasing knowledge of the water market and providing transparency in water trading across the southern connected Murray Darling Basin, so fully informed water use / business decisions are made.
- Uncertainty with regard to future water availability in the GMID. This includes impacts from water trade and the very large impact of reducing the consumptive pool by 450 GL of Upwater[6]. This uncertainty is hampering investment in the GMID.
- Ensuring land use planning supports agricultural growth and other land use such as rural residential expansion in appropriate areas.
- Increasing flexibility and diversity of farming systems so that they are more profitable and can attract water to the area.
- Ensuring GMW service offerings best meets industry future needs and maximises the productive capacity of the land.
- Provision of serviced large land parcels for attracting and growing commercially viable and profitable irrigation businesses. This could include restructuring small blocks into more viable sized parcels.
- Managing the patchwork of different irrigation service needs off the same supply system.

[4] Including ET demands and production per ML.
[5] Third party impacts can include the environment, other irrigators whose water security may be changed, or impacts arising from land abandoned for commercial agriculture (weeds etc). It could also include the impacts on regional water charges.
[6] under the Murray Darling Basin Plan the 2,750 GL target could be increased to 3,200 GL to meet the Sustainable Diversion Limit.

Opportunities and next steps:

Phase 2 will set a vision for the Region based on the objective of maximising the potential of the Goulburn Murray Irrigation District (GMID).

It will develop a Strategy that is informed by the above issues and challenges and will facilitate a range of opportunities within the GMID that makes it a more attractive place to invest and for existing businesses to grow.

It will build on the GMID's sustainable competitive advantages that include its modernised system, low energy irrigation, low ET, top quality soils, existing supporting infrastructure, proximity to markets, processing factories, skilled workforce and other advantages. A prospectus will be developed to demonstrate and market these advantages.

Phase 2 could include a range of actions that create positive change from:

- Attracting new irrigation development and investment.
- Taking advantage of global market opportunities for irrigated agriculture by investing in product quality, new technology, skills; and systems that improve water use efficiency and farm profitability.
- Encouraging profitable dairy and horticulture to continue to provide employment opportunities both on and off farm.
- Encouraging existing and new horticulture.
- Investigating scope for diversification and new high value crops (vegetables etc)
- Supporting dairying to find new more flexible and more profitable production systems.
- Considering how GMW infrastructure and services can assist industry and attract new investment.
- Enabling existing farmers to profitably expand through water trading, sound land use planning and GMW service offering including system flexibility.
- Developing farm systems and irrigation techniques that improve water use efficiency and farm profitability.
- Consider third party impacts of water trade out of GMID eg. conveyance losses.
- Consider management of summer storms and potential for capture (eg. farm storage)
- Investigating river management/spills/ environmental interactions to improve system efficiency and pool available
- GMW cost recovery, connections program and asset infrastructure adjustment to meet different needs.
- Creating opportunities from areas of previously irrigated land becoming available for productive use.
- Land use planning and matching irrigation to land capability. This includes the irrigation technology adopted is suitable for the soil type.

These actions will be further developed in Phase 2 and where appropriate integrated within other action plans. This could include the relevant land and water management plans, local government regional development plans and the GMW Strategic Plan. Leadership, integration and coordination of roles across stakeholders with high level executive support will be key to achieving success.

2 Purpose

The objective of this project is to develop a strategy to maximise the potential of the Goulburn Murray Irrigation District (GMID). It will focus on making the most of opportunities and mitigating the impacts of declining water availability on farm and industry viability.

This project is being undertaken for the Goulburn Broken Catchment Management Authority, through Goulburn Murray Water and a steering committee of representatives from Goulburn Broken CMA, North Central CMA, GMW and DEDJTR.

There are two phases for the project.

Phase 1 (this report) - to document relevant issues, challenges, drivers and activities. The outcome of Phase 1 will be a report on issues that need to be addressed.

Phase 2 (not included in this report) - will build on stage 1 to develop a strategy to address the key issues. Phase 2, Strategy development, has not yet commenced.

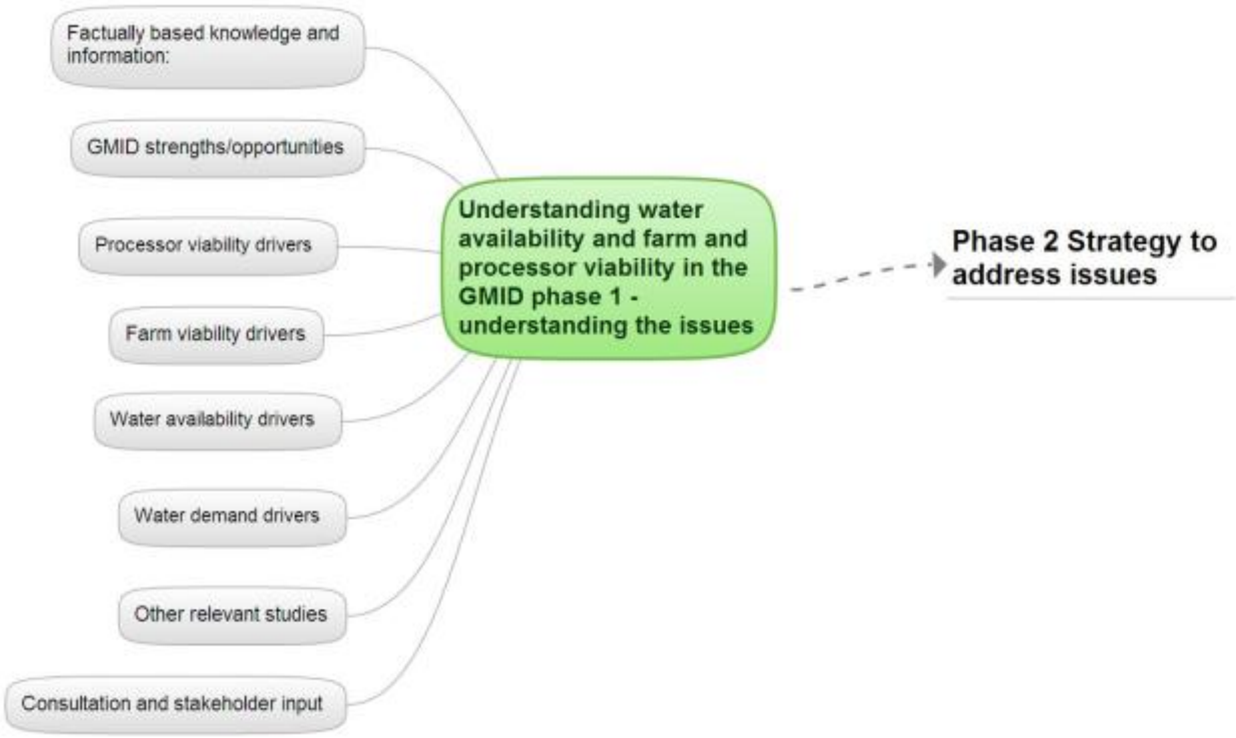

Figure 2-1: Phase 1 Issues diagram

Further information

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3 Regional overview

3.1 The Region

The project is focused on the Goulburn Murray Irrigation District (GMID) as shown in the map below.

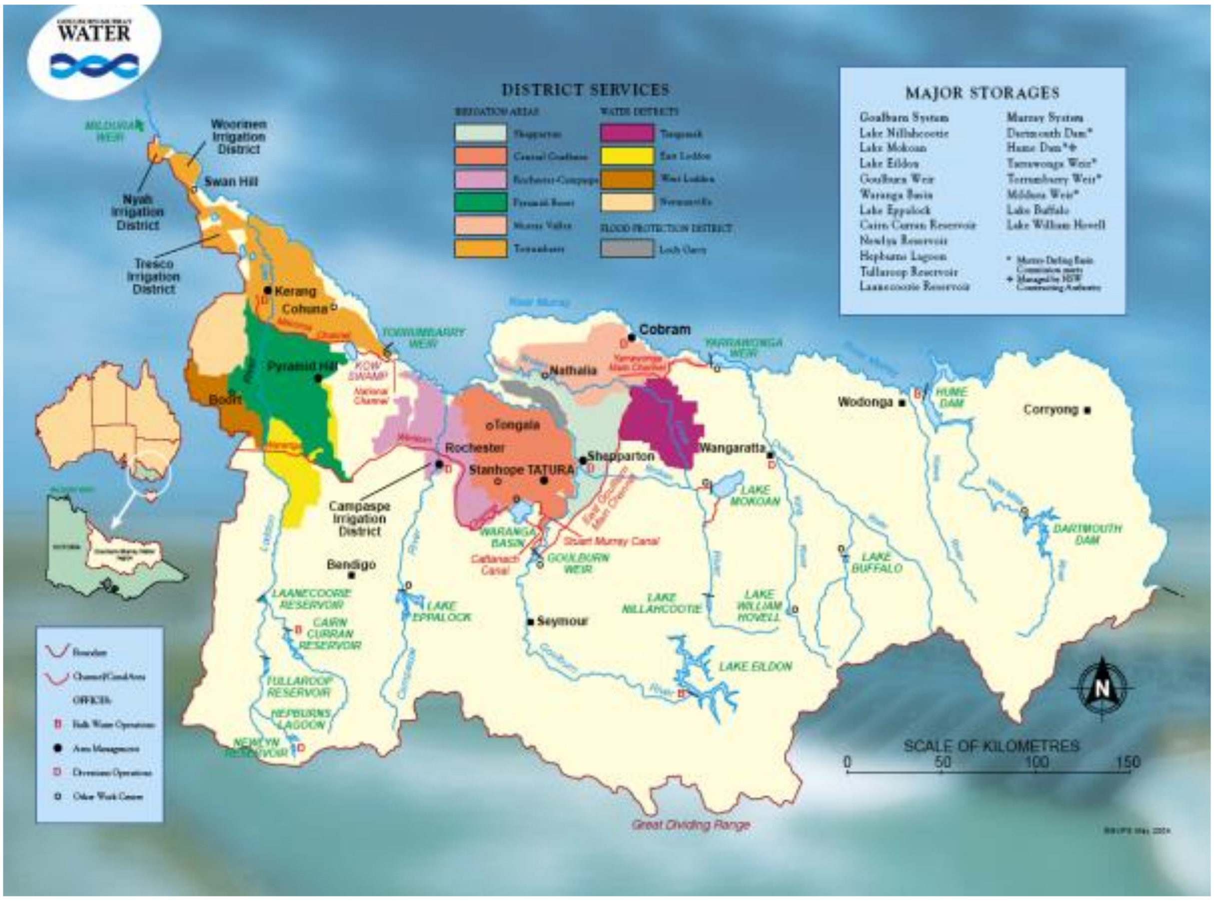


Figure 3-1: Goulburn Murray Irrigation District (source: G-MW)

The Goulburn Murray Irrigation District (GMID) is a major irrigation district comprising 15,000 properties over 9000 Km^2. The gross value of agricultural production is around $1.4 billion per year. The main enterprises are dairy, mixed grazing and cropping farms; and horticulture. There are major food processors located in Shepparton and Echuca and the region supports a population of 170,000 people.

GMID irrigators are generally supplied by gravity from a GMW supply channel. The GMID incorporates the Shepparton, Central Goulburn, Rochester, Loddon Valley, Murray Valley and Torrumbarry Irrigation Areas. The GMID irrigation infrastructure is generally 60-80 years old and consists of 6,300 km of channels, 900 km of pipes and 3,000 km of drains. Many of the control structures are being modernised as part of the $2 billion GMW Connections Project.

As of July 2015 there was 978 GL of High Reliability Water Shares (HRWS) held in the GMID. There is also an additional 825 GL of "Non- water user", which is not tied to a land parcel. (GMW 2016) and is mostly environmental holdings (See Section 5.1 for more information on water ownership).

The region is part of the southern connected Murray Darling Basin (sMDB) and the amount of water available to the GMID is highly influenced by the water available in the sMDB and trade between industries.

Figure 3-2: southern connected Murray Darling Basin (source: MDBA)

3.2 Demographics and population

The Goulburn Murray Irrigation District (GMID) encompasses five municipalities (Swan Hill, Loddon, Gannawarra, Campaspe, Greater Shepparton, and Moira) and twelve major towns/cities, the GMID had an estimated regional population of 173,000 in 2015. The issue of community impact of declining water availability was explored in detail in Community Impacts of the Basin Plan (EBC 2011) and the more recent Socio-Economic Impact of the Basin Plan on the GMID (RMCG 2016), which found that:

- Total available water use has been reduced by over 300GL - that is a 20% reduction.
- The dairy sector has carried the majority of that reduction down by 234GL to a volume of 891GL in an average year.
- That reduction is equivalent to future lost annual production with a farm-gate value of $200 million/yr.
- As a consequence dairy processing has seen a fall of $360 million/yr in output value.
- Mixed farming has lost annual turnover of a further $25 million/yr at the farm gate.
- Taken together this has resulted in a reduction in the value of production across the GMID of $580M/yr and the loss of 1,000 jobs across the region (this being temporarily offset by some 700 jobs associated with capital works for infrastructure upgrades).
- Any further reduction as part of a future implementation strategy for the Basin Plan will undermine the viability of the GMID.

Since 2006 the GMID experienced growth in the Shepparton and Moira areas, but declines in Gannawarra and Loddon. These declines relate to the drought, reduced water availability and a continuing trend of rural de-population in agricultural dependent regions. This is also related to mechanisation and economies of scale as farms get larger to remain competitive. The regions experiencing population growth usually relate to increases in regions less dependent on agriculture.

3.3 Employment

Agriculture employment declined from 2006 to 2011, particularly in the dairy industry, but food processing employment did not. Data in Appendix 3 shows there were approximately 7,600 jobs in agriculture and a similar number in manufacturing. This is out of a total of 57,000 jobs in the GMID region, which remained steady as increases in other sectors offset the decline in agriculture. Employment in agriculture has probably increased since 2011, as that year was in the aftermath of several years of drought with low production.

Employment in the region is highly dependent upon irrigation especially in the dairy and horticultural industries, which support substantial regional processing jobs. In the western half of the GMID, there is a less diversified economy and farm jobs are a more important part of the local employment picture.

4 Agricultural production in the GMID

4.1 Economic significance

The Goulburn–Murray region is the country's largest irrigation district. It produces more of Australia's fruit and dairy produce than any other region, as well as significant general horticulture and mixed farming. Irrigated agriculture generates an estimated $1.4 billion. There is also additional production from unirrigated land in the region.

Total agricultural production including dryland is expected to be $2.1 billion, which is 18% of the States GVAP of $11.6 billion in 2012/13 (ABARES 2015). The food processing industry in the Goulburn–Murray region is a major Victorian employer and its main exporter. There are sixteen dairy factories in the Region.

Table 4-1: Estimated GMID Contemporary land, water and GVIAP by industry[7]

Industry & GVIAP/ML	% irrigated land area	Ha	% water use	GL water use	% GVIAP	GMID GVIAP $ Value
Horticulture[8] $5,603/ML	5%	21,000	7%	92	36%	$514 M - $800M with packing
Mixed crops $480/ML	15%	59,000	10%	141	5%	$68 M
Mixed non-dairy pastures $345/ML	18%	72,000	12%	171	4%	$59 M
Estimated rural residential $345/ML	8%	31,000	5%	73	2%	$25 M
Dairy $802/ML	53%	208,000	66%	935	53%	$749 M
Total irrigated	100%	391,000	100%	1,412	100%	$1,415 M

The area serviced by the GMID system for irrigation is much larger and was reported to be 561,927 ha on 803,771 ha of properties by GMW in the irrigated farm census of 1997. (GMW 1988). This suggests that 30% of the area laid out for irrigation in 1997 is now not irrigated.

[7] based on ABS 2012/13 $/ML & ML/ha and 2012 to 2015 water availability
[8] Includes perennial and annual horticultural crops. Annual crops include tomatoes and vegetables and are estimated to generate $120 M using 20 GL on 4,000 ha or $6,000/ML GVIAP. (Processing tomatoes approx. 2,000 ha, 10 GL and generates $20 M/y).

Table 4-2 below provides similar information for the sMDB. This indicates that the GMID is around 43% of the irrigated area, 31% of the water use and 27% of the GVIAP in the sMDB. However, this will vary from year to year depending on water allocation.

Table 4-2: Estimated sMDB Contemporary land, water and GVIAP by industry[9]

Industry & GVIAP/ML	% irrigated land area	Ha	% water use	GL water use	% GVIAP	GVIAP $ Value
Horticulture $2,930/ML	19%	174,000	24%	1086	65%	$3,185 M
Mixed crops $480/ML	18%	157,000	10%	453	4%	$149 M
Mixed non-dairy pastures $345/ML	20%	181,000	10%	433	4%	$59 M
Cotton $503/ML	2%	19,000	4%	181	2%	$91 M
Rice $210/ml	10%	91,000	25%	1149	5%	$242 M
Dairy $811/ML	30%	272,000	27%	1,223	20%	$992 M
Total irrigated	100%	894,000	100%	4,526	100%	$4,877 M
% in GMID	43%	391,000	31%	1,412	29%	$1,415 M

4.2 Size distribution of GMID customers

Across all agriculture the major industries continue to be chasing increased scale and water use efficiency. To attract new investment, it will be important that the GMID can offer the ability to achieve this scale.

In horticulture, this tends to be in the form of higher density plantings rather than increased area, particularly as orchards are moving to more fresh market varieties. Mixed farms are looking for scale in paddock size so that they can compete with dryland operations and use the same machinery as dryland farms; they are trending to 1,000 ha plus. Dairy farms are heading for 1,000 cow plus units on large 260 ha blocks sometimes with cut and carry systems. This compares with the traditional dairying areas with multiple small blocks of 32-68 ha, which are now becoming more rural residential areas.

Therefore, the areas that were traditionally high irrigation intensity are becoming less attractive, due to small block size and competition from rural residential buyers. Larger commercial farms are looking for the larger 260 ha blocks, which were traditionally low irrigation intensity areas. This has implications for water services and the attractiveness for agricultural investment in different parts of the GMID.

Like all forms of agriculture, the GMID has experienced

- growth in the number of rural residential properties that are supported by off farm income,

[9] based on ABS 2012/13 $/ML & ML/ha and 2012 to 2015 water availability

- growth in larger properties, that have the cash flow to expand
- a reduction in medium sized properties, that find it difficult to fund expansion.

With reduced water availability this trend is accelerated as there are more small scale dryland blocks that are usually only attractive for rural residential buyers. There is expected to be future growth in rural residential as block sizes become too small for commercial irrigation and the relative price of a house in town increases versus a block with a rural house. These properties sometimes are used for commercial agriculture, particularly if the owner is involved in agricultural contracting. But many of the blocks become horse properties or unproductive. It is estimated that

- Small farms (<50 ML/y water use) now represent approximately 60% of the number of GMID customers. They represent a small proportion of the total water use, and a very low proportion of the agricultural economic activity. The growth in rural residential is particularly strong in areas close to towns and in particular Echuca, Swan Hill, Kerang, Bendigo and Shepparton where off farm employment is available.
- Medium sized properties (50 to 500 ML/y) make up around 30% of the number of customers and use around 25% of the water. There can be social implications associated with the reduction in middle sized family owned properties.
- Larger properties using more than 500 ML are probably around 10 to 15% of the number of properties, but use around 70% of the water use. Meeting the future needs of these properties will be important for the competitiveness of the GMID.

The future economic activity depends on growth and expansion of the larger properties. These find it difficult when block sizes are small and when they are inflated by rural residential values.

Larger farm businesses as defined by having a gross farm income (value of production) of $1 million/year or over, are more likely to expand. This is because with average cost control they are more likely to have a cash surplus, after they have met their living costs or owner's salary, to invest in expansion either through additional land, water or investment in new production systems. Based on average GVIAP per ML and per ha these properties tend to be:

- Horticulture users with more than 200 ML/y use and 40 ha of horticulture
- Dairy farms with more than 1,000 ML/y use and 300 ha of irrigated land
- Mixed farms with more than 2,000 ML/y use and 600 ha of irrigated land.

The number of properties that match this definition is relatively small, but they make up a large proportion of water use and value of production.

4.3 Land use planning

Land use planning is important to support existing agriculture and ensure that there will be opportunity for expansion by retaining allotments in larger parcels and limiting subdivision.

It will also be important that urban growth/housing does not drive up land values beyond productive value and render it unavailable for farm expansion. The prevention of ad hoc rural living development by managing housing development on small allotments is critical.

Restricting urban expansion into high value agricultural areas; and preventing land use conflicts by ensuring that there are buffers between urban (and urban-type) development and agricultural areas is important.

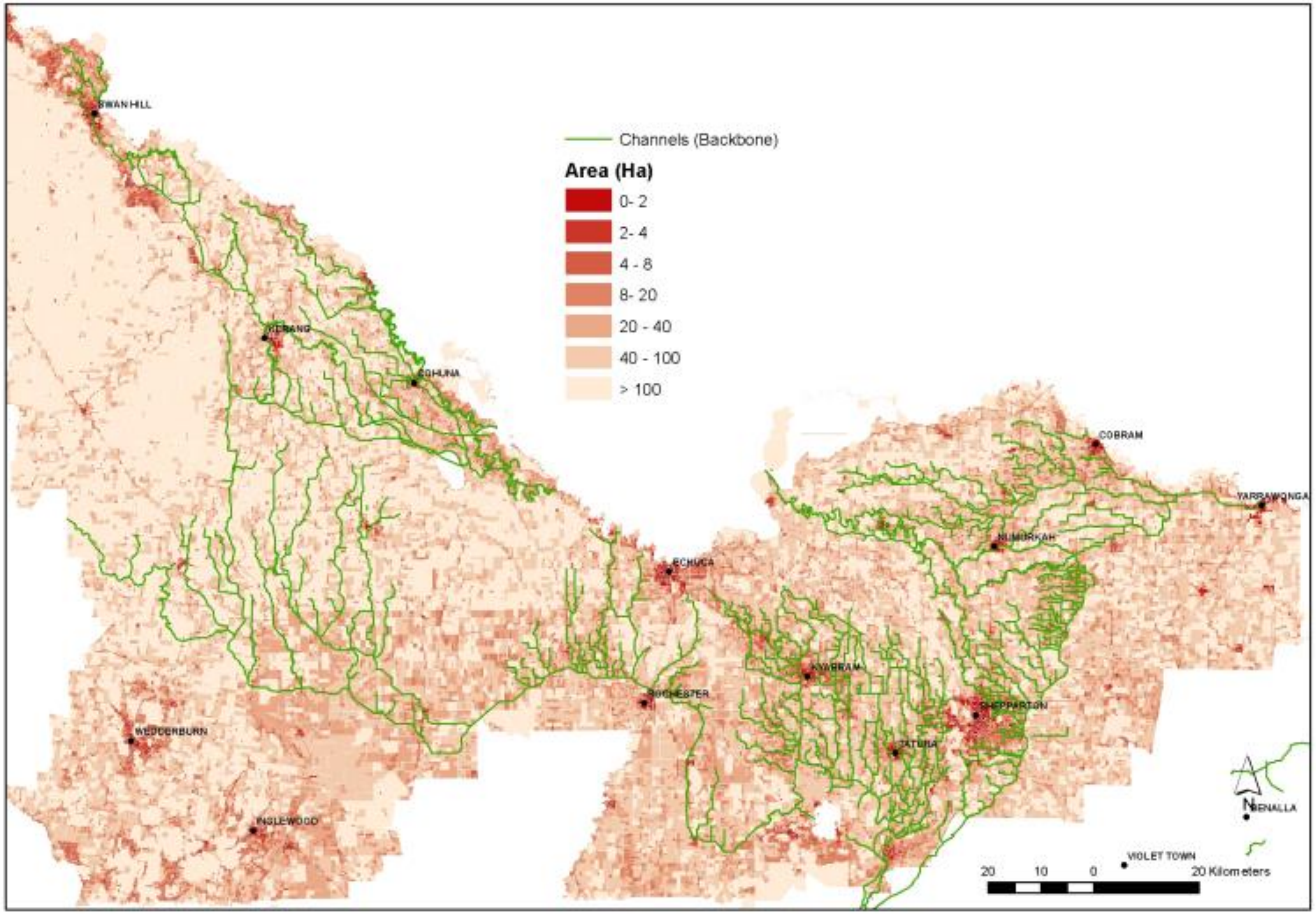
This is particularly true for modern irrigation operations as they occur 24 hours a day, seven days a week and may produce odour and noise.

Infrastructure will need to provide flow rates and service levels that are suitable for irrigators that want to expand. Especially horticultural expansion, and dairy expansion. This includes expansion into traditional mixed farming areas where block sizes are generally larger and larger scale units can be achieved.

Figure 14-7 illustrates the size distribution of land parcels in the GMID.

A similar map for the GMID showing suitable soil types for high value development and irrigation supply capacity would be a useful resource that could be used to encourage new irrigation investment in the GMID. This could update earlier work completed on prime development zones, environmental risks (CSIRO traffic light map) and the GMW Atlas.

Figure 4-1: Size distribution of land parcels in the GMID.(supplied by DEDJTR, 2016)



4.4 Irrigation industry prospects and the GMID.

4.4.1 Scan of global drivers that may impact on demand for irrigated produce.

The Agricultural White Paper (Agricultural Competitiveness White Paper 2015) notes:-

- Asian markets provide fast-growing markets, with the Organisation for Economic Co-operation and Development (OECD) predicting Asia could account for 66 per cent of the world's middle class by 2030, up from around 30 per cent today.
- The North Asian Free Trade Agreements (FTAs) with Japan, China and Korea has provided opportunities for export. There are additional agreements being negotiated to liberalise trade, which may provide further opportunities.
- Around two-thirds of all Australian agricultural produce is exported. Much of this is to bulk commodity markets where competition is intense. To stay competitive and to increase the value of exports, Australian farmers must be given the best possible chance of also capturing high-value premium markets.
- Australia currently feeds around 60 million people globally each year. It produces around 1 per cent of the value of agricultural production globally, but is among the top 10 agricultural exporting countries in the world (WTO 2014).

ABARES have undertaken scenario analysis on global food production and prices to 2050. (ABARES Conference paper 13.6 2013). This analysis concludes: -

- Depending on the assumptions, world agrifood prices are projected to be 11.5 per cent higher in 2050 compared with 2007 (in 2007 US dollars). But much of this increase had already occurred to 2013 due to global shortages.
- Price rises are driven by stronger demand from increasing incomes and population
- Constraints such as land availability and rainfall deficiency are likely to affect productivity increases.
- The price increase is projected to be lower when
  - trade is liberalised
  - there are additional increases in productivity growth rates
  - if first-generation biofuels in the United States and European Union are reduced; (especially for cereal prices).
- Australia is well located to take advantage of the opportunities that higher food consumption will provide but this will require growth in productivity and more targeting of consumer needs especially in Asia.
- Industries will need to target more diversified markets and market segments where there is greatest potential for value adding. Competitive advantages could include, safe, low pest, environmentally sound, animal friendly products; products with a low carbon footprint.

The CSIRO (Eady 2015) in a report on megatrends impacting Australian Agriculture identify a bright future for Australian agriculture, with diverse opportunity that is driven by:-

- Global growth in demand for food and fibre products.
- Income growth in Asia will see diets diversify, protein consumption rise and niche markets for boutique foods becoming mainstream markets.
- New technologies to reduce costs, improve product quality, manage risk and make supply chains operate more efficient.

- A knowledgeable customer, who is more demanding. Provenance, ethics, sustainability and health benefits, will be both a challenge and an opportunity.
- Climate change, globalisation and environment change posing risks to both supply chains and production.

The implications of these megatrends are that there will be continuing pressure to:-

- Improve product quality for export
- Invest in new technology and skills
- Improve water use efficiency.

In general, Australian agricultural industries are aware of these drivers and are investing considerable resources to maximise their opportunities for growth.

Figure 4-2 Megatrends impacting on Australian agriculture (Eady 2015)

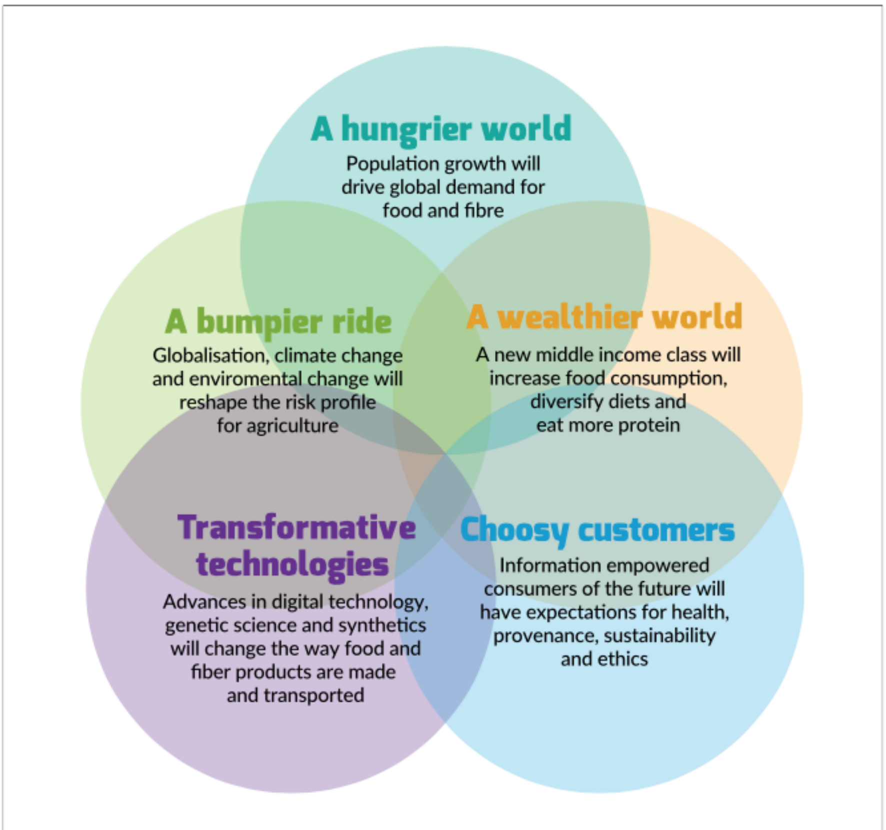


Figure 1: Megatrends impacting Australian rural industries.

4.4.2 GMID prospects within the sMDB

The prospects of the GMID are underpinned by the competitiveness of dairy and horticulture in a global environment and the ability to pay for water amongst the other industries within the sMDB.

Dairy is the GMID's biggest water user and also underpins many mixed farms who produce feed for the dairy industry. Rabobank (Michael Harvey, Rabobank 2016) in a presentation to Murray Dairy on the global dairy market in August 2016 advised:-

- World prices have been low (<$USD 3,000/t) for the last 23 months, which is deeper and longer than other downturns since 2008.
- Rebalance is required to improve process and this depends on Europe reducing supply and global stocks clearing.
- Recovery will occur as all producer countries are not receiving prices above their cost of production. But it is some time off and it will be gradual. The current downturn will extend into 2016/17.
- Untapped dairy demand in Asia means milk pricing will get substantially better in the medium term
- Australia debt levels / flexible production systems suggests most producers can weather the cycle. "*Our analysis shows that average Victorian farm debt levels (in terms of debt per kilogram of milk solids) are now 20 per cent below the historic highs of 2008/09*," [10]

This suggests that once the current downturn is over, dairying in the GMID can continue to be a major industry. In recent years, dairying in the GMID has purchased water from NSW. Nevertheless, rice and cotton may be able to compete when dairy prices are low and cropping prices are high. But over the long term the dairy industry is expected to be able to out compete these industries for high reliability water.

Given that average water availability in the sMDB is currently more than 4,500 GL/y dairy's average long term share of 27% or 1,200 GL/y is likely to remain affordable for dairy. However, this volume (if not the %) may be reduced if there are further reductions to the total consumptive pool, and there are likely to be major contraction of irrigation in the drought year. This is discussed further in Section 4.4.

Over the long-term horticulture, which uses around 1,100 GL/y, is the dairy industry's major competitor for water. However, horticulture is unlikely to expand by more than around 1,400 GL in the sMDB. This is 60% of all the water available in a drought year when there is only 2,300 GL available in the sMDB (includes around 500 GL of groundwater). Horticulture is unlikely to be able to grow more than this due to the "stickiness[11]" of water held in other industries.

GMID horticulture is a relatively small water user of the GMID (<10%) and is only 10% of the total horticultural water use in the sMDB. However, it generates a very high return per ML. The GMID has a competitive advantage for pome and stone fruit with its soils, climate, water security, updated delivery system, price of land, infrastructure, transport links, skilled people, and reputation for clean and safe produce. All these competitive advantages need to be maintained and enhanced to ensure horticulture continues to grow in the region. Investment in large scale horticultural tree crops (particularly nuts) is choosing to locate in the Mallee Region, partly because of the flexibility and control provided by being a private diverter and for the dry autumn required for nut harvesting. The opportunity for all year round supply and an on demand system within the GMID may help change this equation, particularly as the costs for private diversion are increasing as there are fewer blocks within an economic distance from the River Murray. However, this may require a more flexible service offering from GMW and a more proactive approach in attracting the large scale corporate investor.

[10] https://www.rabobank.com.au/media-releases/2016/160707-australian-dairy-well-positioned-to-ride-out-stormy-weather/ accessed 23/8/16

[11] Some water is unable to be traded (e.g. groundwater and zone restrictions e.g. Barmah choke) and some water holders will not choose to trade.

The key competitive advantages for the GMID versus other areas in the sMDB are:-

- Soils, - excellent for low energy and low cost gravity irrigation systems. Also highly flexible for a range of crops. They are especially well suited for pasture, feed crops, pome and stone fruit.
- Climate, - lower ET demand[12] and higher rainfall than other areas in the sMDB means that pasture can be grown at lower water use per ha (more t of dry matter per ML of irrigation) than any other irrigation area in the sMDB. The climate is also highly suited for pome and stone fruit, with chilling hours in winter. There is a lower risk of extreme temperatures than other parts of the sMDB, which can cause crop losses through sunburn and wind damage.
- Water security- Victorian GMID product has much higher security than NSW and less river conveyance losses compared to downstream use. However, this advantage is not recognised in current water trading rules.
- Water quality – lower salinity risks and salt slugs than downstream areas, which can cause production impacts.
- Updated delivery system – capable of close to on demand supply, which means that irrigation can be scheduled to meet optimum demand. Although supply systems are also being upgraded in other areas of the sMDB with Colleambally, private diversion areas, the Riverland CIT and parts of LMW also offer a close to on demand system.
- Land availability – there is a lot of land that is currently unirrigated that is serviced by the GMW supply system. This also occurs in NSW, but is becoming more difficult in the Victorian Mallee region as suitable land within a cost-effective distance to the river is reducing.
- Infrastructure, for example, road access, subsurface and surface drainage services.
- Transport links, proximity to market especially to the Melbourne Sydney corridor.
- Food processing investment. Milk factories, fruit processing factories and transport hubs.
- Skilled people and partnerships, with a pool of skilled people and organisations in the region
- Low cost base for setting up irrigation in the region versus large capital needed for private diversion.
- Access to research through DEDJTR, and university campuses in the Region.

One disadvantage for some areas is flooding risk, however this is minimised by extensive drainage networks. High watertables that have been a problem in the GMID are also a diminishing risk.

Evidence of the strengths of these advantages is that there in most years when there is average to above average allocations the GMID has been a net importer of 200 to 300 GL of water through water trade. But this has only partly offset some of the loss of water shares in the region due to the buy back[13] and trade to horticulture.

[12] See Appendix for more information on GMID evapotranspiration versus other regions.
[13] Government purchase of water to meet environmental targets and achieve sustainable diversion limits (SDLs) under the Murray Darling Basin Plan.

5 Past, present and future water use

5.1 Current water ownership

Ownership of water has changed over time. The water market trends report analysed this from 2001 to 2015 (Tim Cummins & Associates 2016) indicates the scale of these changes with a 40% reduction in HRWS owned in the GMID.

However, this is partially offset by some HRWS which has been transferred to the not tied to land category. In total 175 GL was in this category, some of which will be owned by parties outside of the GMID.

Table 5-1 Change in water ownership (Tim Cummins & Associates 2016)

Water owner	Location		High-reliability water share volume (GL)		% change
			30 June 2001	30 June 2015	
Irrigator	LMW diverters		203	216	6%
	LMW districts		189	125	-34%
	GMW diverters		243	164	-32%
	GMW districts	Torrumbarry	378	234	-38%
		Loddon Valley	230	124	-46%
		Rochester/Campaspe	208	113	-46%
		Central Goulburn	391	237	-39%
		Shepparton	181	117	-35%
		Murray Valley	259	167	-35%
		GMID Subtotal	**1,648**	**992**	**-40%**
	Not tied to land		0	175	N/A
Water corporation	Not tied to land		0	62	N/A
Environment	Not tied to land		0	605	N/A
TOTAL			**2,283**	**2,338**	**2%**

Notes on table

1. The volumes reported for Torrumbarry include water shares in the Nyah, Tresco and Woorinen irrigation districts.
2. The user group 'Water corporation' includes water shares owned by Victorian urban and rural water corporations. Note that any interstate water corporations that may own Victorian water shares cannot be easily identified and would be classified as 'Private – not tied to land'. It is assumed that these are not tied to land, however there may be some water shares linked.
3. Volumes at 30 June 2001 reflect the volume of water rights held (since water shares had not yet been introduced).

5.2 GMID trend in water use

The GMID potentially serves an irrigation area of around 600,000 ha, of which 390,000 ha is currently irrigated.

A key determinant of the area of irrigated land is the volume of irrigation water available to irrigators. Through water trade, buy backs, climate and water reform the volume available has declined substantially since 1989. Figure **5-1** below shows water delivered in the Goulburn Murray Irrigation District (GMID) since 1984/5.

There has been a decline in water allocation percentages and entitlement volumes. Some of it due to the 80/20 sales deal and a range of other reforms such as the reserve policy, the introduction of carryover and overall, for a range of factors, irrigation usage has fallen. 2012/13 usage was unusual as it showed a rise in usage that was associated with a change in the “carry over” rules (that changed the volume of water carried forward from one season to the next). In this year many irrigators diminished their carry over water as new restrictions on the amount of that could be carried over were applied.

Figure **5-1** shows that thirty years ago around 2,000 GL/y was delivered to the GMID. In recent years (post drought) deliveries with 100% allocation of HRWS have been around 1,250 GL/y and the amount of entitlement (high reliability water shares) held by irrigators in the GMID is now only around 1,000 GL having reduced from 1,500 GL in 2007 (Goulburn Murray Water. 2013).

The reasons for the lower deliveries include water buyback, the introduction of carry over, a more conservative water reserve, entitlement reform and net trade out of the GMID.

In recent years’ water use in the GMID has been supplemented by 200-300 GL of net trade in from NSW plus groundwater usage. However, net trade inwards can only occur when there are significant allocations of NSW general security.

Figure 5-2 shows this a map of the spatial distribution of water use reduction. Except for the de-commissioning of the Campaspe irrigation district there is no pattern in where the reduction has occurred.

Table 5-2 shows the water use for each district and across Northern Victoria for a number of years since 2004/5.

A key issue is whether the region can continue to afford to fund infrastructure operation, maintenance and replacement for a 600,000 ha footprint, when only 390,000 ha is currently used and this area may be much lower in drought years.

Figure 5-1 - GL/y water deliveries in the GMID

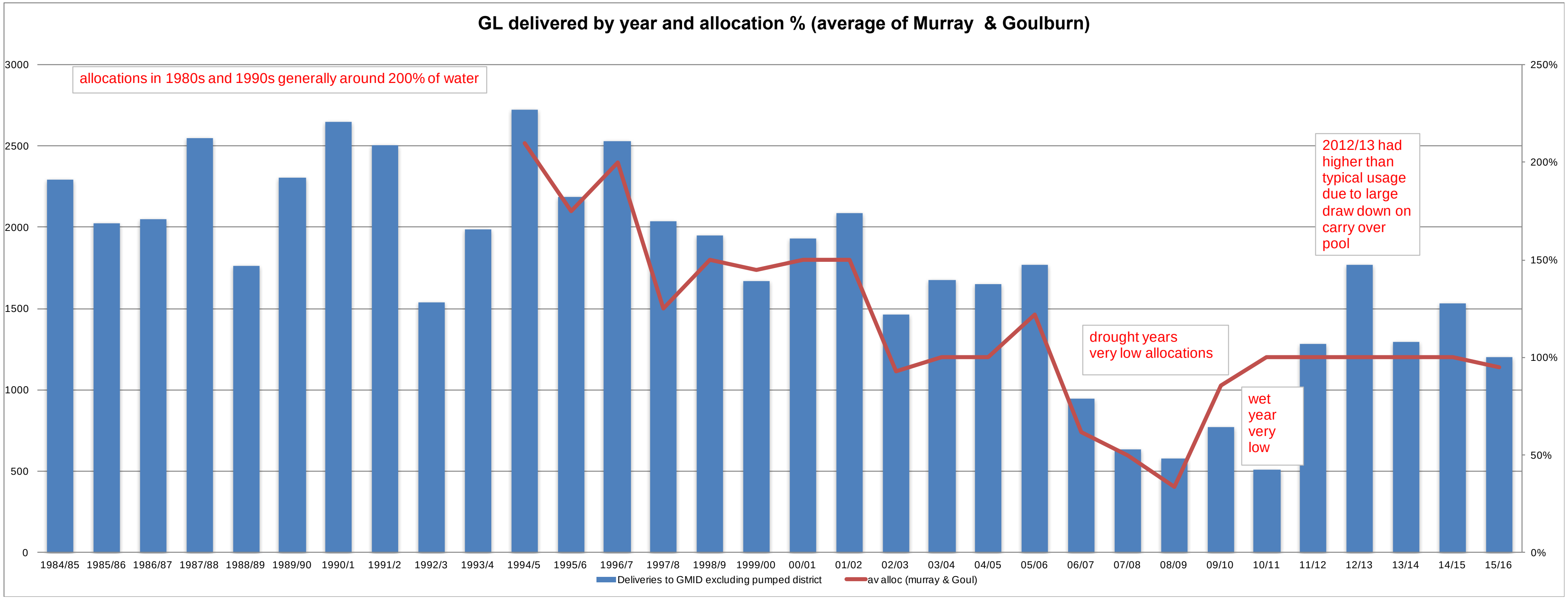


Figure 5-2 - Spatial change in water use in the GMID 2003/4 to 2011/12 (source: Victorian Water Register)

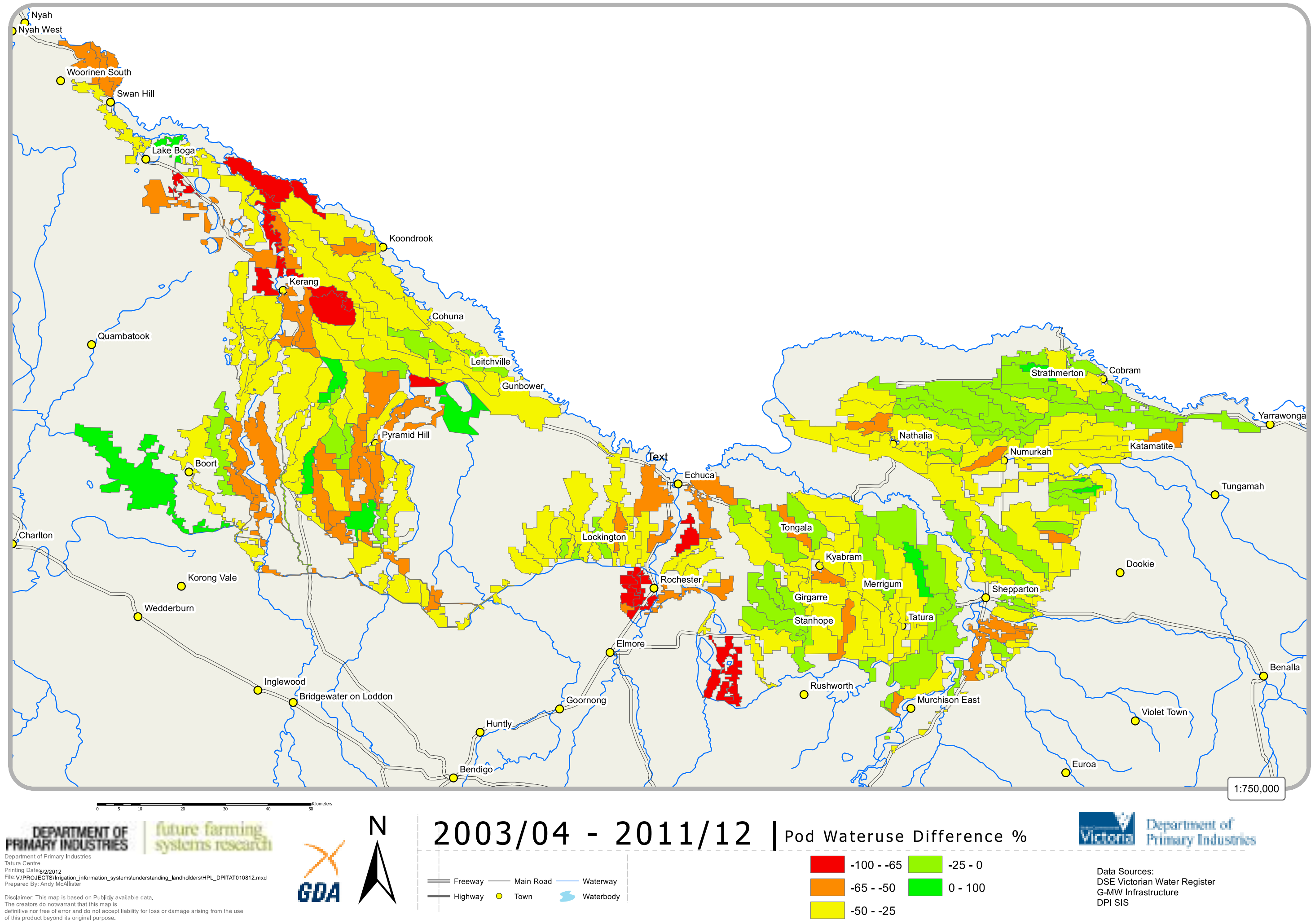


Table 5-2 Change in annual water use (Tim Cummins & Associates 2016)

User group	Use location		Annual water use (GL)								% change from 2004-05 to 2014-15
			2004-05	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	
Irrigator	GMW districts	Central Goulburn	389	140	171	121	289	414	313	347	-11%
		Shepparton	157	64	72	42	103	163	127	128	-19%
		Rochester	199	58	84	52	153	215	163	173	-13%
		Pyramid-Boort	222	70	100	44	152	234	164	204	-8%
		Campaspe	10	3	0	3	11	1	2	1	-88%
		Murray Valley	283	92	127	92	209	302	222	227	-20%
		Torrumbarry	405	112	173	130	332	423	304	348	-14%
		Nyah, Tresco & Woorinen	20	17	17	10	18	23	21	23	12%
		GMW districts subtotal (GMID)	***1,686***	***555***	***745***	***495***	***1,267***	***1,776***	***1,316***	***1,450***	***-14%***
	GMW diverters		133	43	33	19	59	104	89	91	-32%
	LMW districts	Robinvale, Red Cliffs, Merbein	86	60	56	33	66	73	64	63	-27%
		First Mildura Irrigation District	50	30	30	13	28	39	34	33	-34%
		LMW districts subtotal	136	90	87	46	94	113	98	96	-30%
	LMW diverters		196	236	270	190	310	408	354	397	103%
	Irrigator subtotal		2,150	924	1,135	751	1,731	2,402	1,857	2,033	-5%
Water corporation	Not specified		unknown	79	111	64	73	74	70	73	N/A
Environment	Not specified		unknown	25	41	224	315	334	659	512	N/A
TOTAL for Northern Victoria			2,150	1,028	1,287	1,038	2,118	2,810	2,587	2,618	22%

5.3 Future water use

Water use in the GMID is likely to continue to decline through a combination of:

- Further water recovery to meet Basin Plan sustainable diversion limits.
- Water trade to horticulture
- Climate change

The impacts of each of these are discussed below.

Water recovery

The adoption of sustainable diversion limits (SDL) under the Basin Plan has resulted in substantial buy back of entitlement and infrastructure improvements to reduce losses. There is still some water recovery remaining and Table 5-3 shows the volume remaining at 30th September 2016[1] to meet the 2,750 GL target[2].

Table 5-3 Water recovery to meet Basin Plan SDLs at 30/9/2016

Catchment	Recovery Target GL/y	Recovered GL/y	Remaining GL/y
MDB	2,750	1,996	754
sMDB connected	2,289	1,651	638
Victoria	1,075	823	252

The Basin Plan- GMID socio-economic impact assessment (RMCG 2016) identified that the average reduction in overall available water use across the GMID from the Basin Plan over the last four years has been around 300 GL/year, with the largest proportion of that reduction coming from the dairy sector, with a reduction of around 220 GL/yr. The reduction of 300 GL/yr in irrigation production is equivalent to a farm-gate value of around $225M, with flow-on effects for dairy processing and the regional economy. Input:output modelling estimated that the reduction to-date has seen a loss of 1,000 jobs across the GMID, with half in irrigation and half in the wider regional economy. This has been offset by 700 jobs created by the capital injection from irrigation modernisation. Most of the extra jobs have been created in the Shepparton region so the offsetting benefits have been far less in the west of the GMID.

It is unclear how much of the water recovery remaining to meet the SDLs will ultimately come from the GMID consumptive pool rather than from other areas or be delivered from infrastructure savings and environmental works that create SDL offsets.

There is also the possibility of an additional 450 GL of “Upwater” water recovery that if it were to proceed would further reduce water availability (if there is a 3,200 GL of water recovery rather than 2,750 GL in the MDB). This additional water recovery is contingent upon there being no socio-economic impact.

Farm infrastructure improvements delivered by On Farm Efficiency Programs may also be having an impact on the future size of the irrigated area. Government funding for upgrades in return for a share of the

[1] http://www.mdba.gov.au/sites/default/files/docs/environmental-water-recovery-estimates-as-at-30-september-2016-details.pdf

[2] The 2,750 can go down to 2,100 if SDL offsets work to the maximum, but then may be increased if there are further ‘efficiency projects’ to 3,200 GL (this increase is known as “Upwater”)

water savings are resulting in a net loss of water entitlement. This is entitlement that has been used to cover farm losses, and so has not reduced the current area, but in the future could have been used for additional consumptive use if the infrastructure upgrade had been privately funded so that all the water savings were fully retained on-farm.

This means that the irrigation footprint for a given irrigation allocation volume is shrinking and there is likely to be more unirrigated land. Add to this the trend for increasing sub-division and purchase by rural residential landowners, there are additional factors that contribute to the area being ‘dried off’.

Water trade to horticulture

There is increasing demand of around 250 to 350 GL/y of additional demand from water purchasers in the Mallee horticultural areas for new development and maturing plantations in NSW, Victoria and South Australia. This may also continue the long-term net trade of water out of the GMID, which paused during the drought period.

By way of illustration across the Victorian Murray-Mallee region the irrigable area expanded by 33,310 hectares, an 84% increase from 39,705 hectares in 1997 to 73,015 hectares in 2015. Most of this expansion occurred between 1997 and 2009, with only 8% occurring after 2009 (SunRise 21 2011). However, there has been a recent resurgence in demand, particularly for almond plantations.

Water use in the Victorian Mallee is now approaching 500 GL per year compared to 300 GL/y in the early 1990s with most of this additional demand sourced from water traded out of the GMID. The 500 GL/y usage is set to expand with maturation of recently planted tree crops and may approach 600 to 700 GL/y.

In terms of the sMDB, horticultural water use is expected to grow and its growth will then be limited by the water accessible in a drought to around 1,400 GL/y. This is currently 1,100 GL/y, but was only 800 -900 GL/y at the turn of the century. It is possible for growth to exceed the 1,400 GL/y, but the next severe drought would force a costly and painful contraction as some areas of horticulture dry off.

Demand for additional water, which paused in the drought as areas were dried off, appears now to be re-starting with demand for almonds increasing. This is being driven by global markets and increasing water scarcity in California, which is a major global producer. Future horticultural expansion is likely to be purchased as High Reliability Water Shares or allocations (temporary trade) from the GMID. This is because in low allocation years the GMID is the only major non-horticultural district that has access to the high security water, which, as demonstrated in the last drought, will be sought after by horticulture.

However, this is approaching a limit as horticulture cannot expand greater than the volume available in a drought year. If it does, then there are large costs to itself in that drought year. This is not to say that expansion beyond this limit cannot happen, but if it does then there are large consequences. This is discussed further in section 5.6.3.

Climate change projections

The latest CSIRO projections for Climate change (Timbal. 2015), indicate that the Murray cluster region may experience:

- Higher temperatures
- Hotter and more frequent hot days.
- Less rainfall in the cool season,
- No rainfall changes in the warm season
- Increased intensity of heavy rainfall events, more time in drought
- Increased evaporation rates, and reduced soil moisture.

This suggests that on average we can expect lower volumes harvested by water storages and more time in drought. Increased evapotranspiration infers more demand per ha and the area irrigated for a given volume will decrease.

Therefore, climate change will result in a smaller irrigation footprint and more unirrigated areas.

To account for this future scenarios have assumed inflows of 75% of the long-term average as being a future “typical year” in Section 5.7. This is similar to the average inflows of the last twenty years.

5.4 Impact of declining water availability on the water market price

An industry’s water use is determined by its capacity to use water to generate a profit and provide a return on capital. Industry profitability is influenced by its costs, including the water market cost of buying or owning water.

The market price of water is related to the water available in the sMDB. Figure 5-3 shows Murray average temporary water price in a year against total sMDB water allocated volume in that year (excluding groundwater and smaller valleys). High value horticulture sets the price when water is short and low value rice when water is plentiful.

To estimate the impact of water recovery on the consumptive pool price the graph shows the impact of a 20% reduction[3] in the consumptive pool on price as an estimate of the impact of the Basin Plan on water prices that have occurred.

It shows in drought years water prices rise by around $158/ML due to lower water availability, while in wet years it is around $32/ML. The average year results in a $66/ML price increase.

This is a substantial additional cost to water users in the sMDB and the GMID, especially those who rely on the temporary market.

[3] (this approximates the transfer in consumptive water to date from the transfer of entitlements to the Commonwealth)

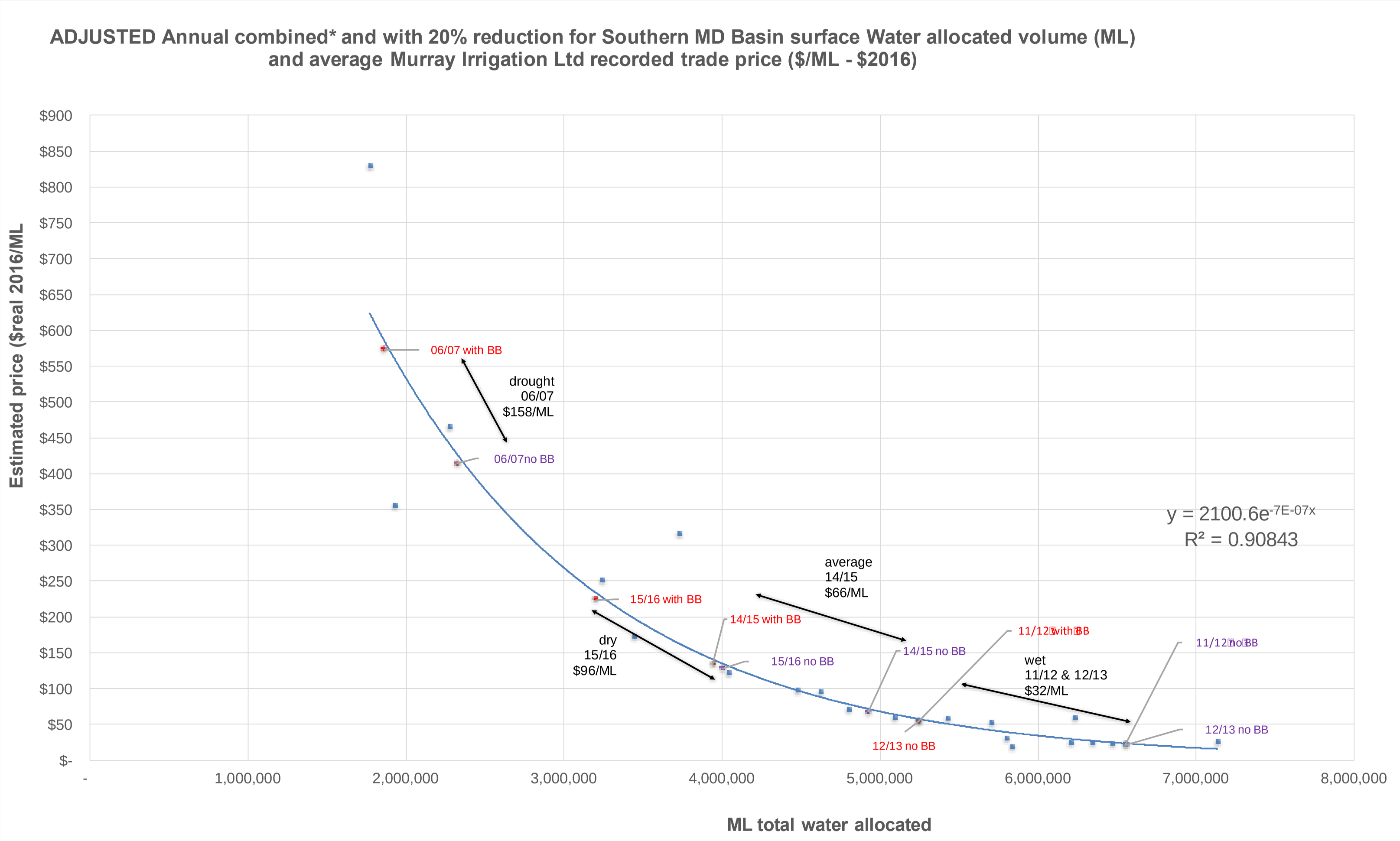


Figure 5-3 Price versus volume in sMDB pool

NOTES: Combined Volume of announced allocation three states: Murray, Murrumbidgee Goulburn Rivers but excluding NSW unreg and Supp water at end-of-season 1995-2016. Water allocation Prices are the seasonal average paid on MIL exchange and are indexed to March 2016, Disconnected markets, Government suspension of allocations etc in some seasons are not considered. The red points in the graph are based on a correlation value of 1- i.e. they are the theoretical prices per ML based on a repeat of the same allocation with 20% of available water removed form irrigator-pool. The blue points reflect actual average price and volume available based on available water being progressively transferred to State and Comm E water accounts commencing with a 1% reduction in 2004/5. Carry over volumes are excluded, but will impact prices, particularly early in the season. Groundwater access is not included. In wet seasons there is some substitution of ground water for river water. Combined environmental water recovery targets are higher than 20% of diversions, however recovery in shared-scheme conveyance water (NVIRP, PIIOP) will not impact water available to irrigators. This data set has been compiled from Murray Irrigation Limited's Water Exchange, as it is a better reflection of the true market price as unlike water register data it is unlikely to include any non-arm's length trades. (i.e. trade at reduced values between families or between neighbours as part of another exchange such as hay contracting etc).

5.5 Understanding the change in historic use

This section provides some analysis of water use trends and industry usage across GMID and other regions in the southern connected Murray Darling Basin (sMDB). Table 5-4 provides a conceptual history of periods and water use in the sMDB (RMCG 2016).The key point of this table is to illustrate that the historic drivers of water price and availability were different. This meant that the GMID enjoyed much higher water availability, which is no longer available.

Table 5-4 Periods and water use trends

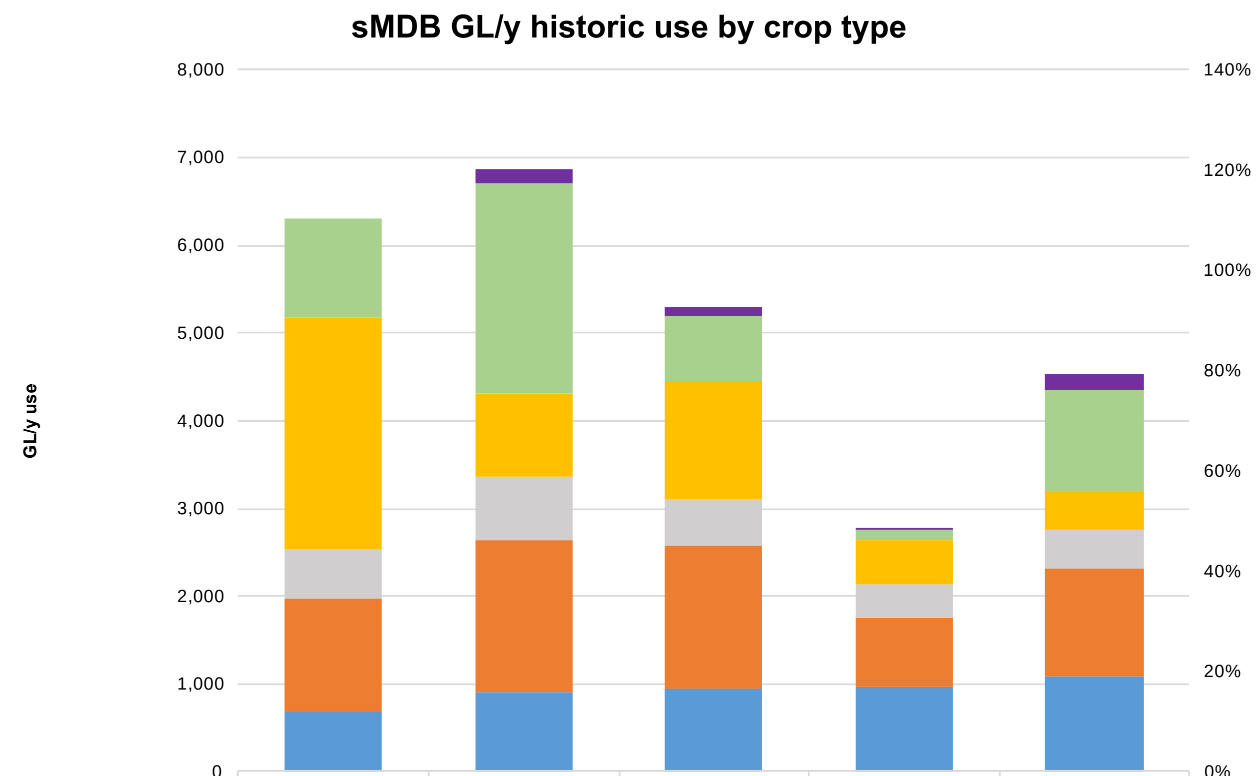
Period	Description	Key events	Southern Basin water available	GMID water available	Industry trends
1970-1985	Dams & growth, generally unlimited water	Growth in diversions, emergence of salinity, disconnected floodplains, wet period. New dams also constructed (Dartmouth)	Growing to 6,300 GL/y	2,100 GL/y	Expansion especially mixed & annual cropping
1985-2001	Cap & trade, salinity management	1987- temporary water trade introduced 1991 – permanent water trade introduced 1997 – Murray Darling Basin Cap on growth in diversions commenced to 1995 levels. 1998 – interstate trade introduced NSW carryover introduced	6,900 GL/y	2000 GL/y	Contraction of mixed farming, expansion of dairy. Rice expansion. (Dairy and rice peaked) Wine grape boom in Mallee
2001 to 2016	drought, buybacks and commodity price cycles	National Water Initiative, The Living Murray, The Basin Plan, NVIRP, GMW Connections Program, Farm Water Program. 2005 – 2% limit on permanent trade out of irrigation districts increased to 4% 2007 – water unbundled from land, introduction of WULs, AUL, Delivery shares, Carry over introduced in Vic. 2009 – 10% limit on non-water user (disassociated water shares that are held independently from a water use license) removed. Buy backs commence 2010 – spillable water accounts introduced 2012 - adoption of Murray Darling Basin Plan 2014 - 4% limit on permanent trade out of irrigation districts removed	4,600 GL/y (post drought recovery)	1,500 GL/y	Wine industry collapse. Almond industry growth. Rice industry collapses in drought. Dairy purchases temp. water from NSW and substitutes bought in feed for water. Improvements in farm efficiency. t/ML
2016 - onwards	A new equilibrium with less water	Implementation of SDLs, Implementation of Connections Program, Farm Water Program	4,526 GL/y	1,400 GL/y	Horticulture expands to its maximum limit (drought year)

5.6 Historic use and the dynamic equilibrium

5.6.1 Southern Murray Darling Basin

This section looks at trends in the sMDB. The data on water use of major crop types corresponding to the conceptual history above is shown in Figure 5-4. The 2016 onwards period is covered later in this report in Section 5.7 on future scenarios.

Figure 5-4 sMDB historic water use



	1985 15 year no trade	1986/2001 15 year cap & trade	2002/2006 dry	2007/2010 drought	2012/2015 recovery
Cotton GL	-	149	106	28	181
Rice GL	1,123	2,414	757	119	1,149
Pastures non-dairy GL	2,642	929	1,344	492	433
Other crops GL	567	730	530	389	453
Dairy GL	1,275	1,739	1,613	778	1,223
Horticulture GL	693	902	955	972	1,086
Total GL	6,300	6,862	5,304	2,778	4,526
long term inflows %	115%	108%	61%	35%	75%

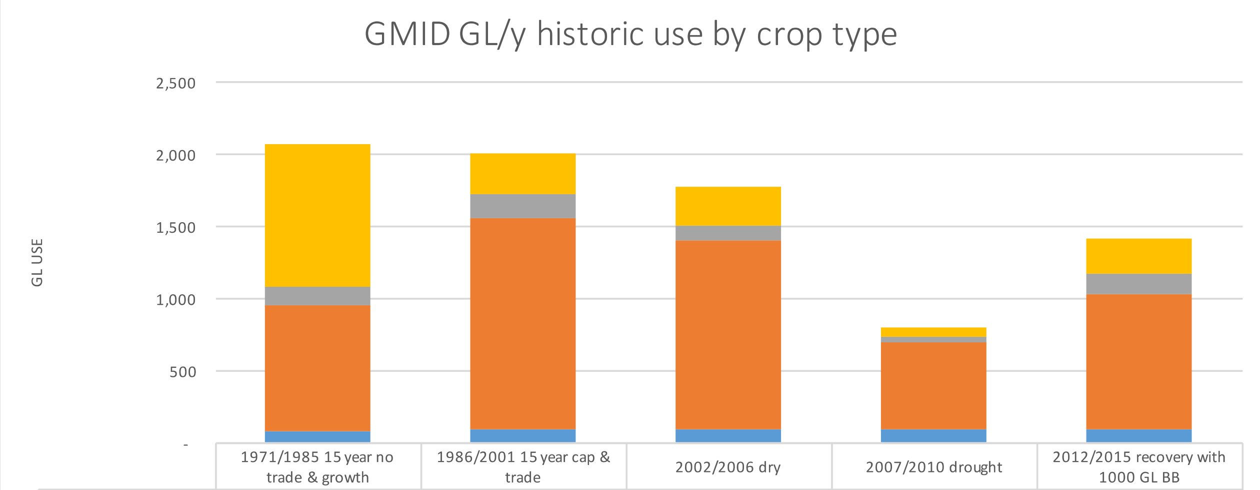
Notes. The 2001 to 2016 period is divided into the three bars on the right hand side showing the 2002-2006 years of dry, 2007 to 2010 years of extreme drought and then the 2012/15 recovery period.

5.6.2 GMID

This section examines how these trends have applied to the GMID Water use figures are shown below. Horticulture is a lower proportion of use in the GMID than the sMDB, but has increased. Non-dairy pastures have decreased use. There have been a number of key reasons for less water in the GMID to date and they are

i. The ongoing development of horticultural expansion in the Southern Connected Basin
ii. Climate change / drought and
iii. Buyback

iv. other water reforms (carry over, reserve policy, The Living Murray 80/20 sales deal)



	1971/1985 15 year no trade & growth	1986/2001 15 year cap & trade	2002/2006 dry	2007/2010 drought	2012/2015 recovery with 1000 GL BB
Pastures non-dairy GL	987	283	260	72	245
Other crops GL	124	160	106	40	141
Dairy GL	870	1,468	1,309	595	935
Horticulture GL	83	90	94	96	92
Total inc. g.water GL	2,063	2,001	1,769	804	1,412
long term inflows %	115%	108%	61%	35%	75%

Figure 5-5 GMID historic water use

5.6.3 The dynamic equilibrium in the sMDB

The responses of each industry now form a dynamic equilibrium, with:-

- opportunistic croppers expand and retract their water use in response to changing water price/availability;
- rice expands and contracts with changing water availability,
- dairy choosing to substitute bought in feed for home grown feed from irrigation and vice versa, depending on water price. When water price is attractive it buys water from lower value users such as rice.
- horticulture ensuring its water supply in dry years by buying water in drought years from dairy
- industries using carryover to secure future years supplies

The new equilibrium matches the following responses by the mix of industries in order of low allocation to high allocation years:

1. Perennial horticulture requires water every year and thus will develop based on the most secure supply. **The total size of horticulture will be capped at the total water available in a drought year.** Horticultural water use has grown significantly since the last drought due to the maturation of new almond plantings.
2. The dairy industry has some ability to expand and to contract but only within some limits and therefore is best suited to water that is available in most years. Dairy has also been able to buy additional water, mostly from NSW rice, when it is available[4].

[4] There can be trade restrictions placed on trade out of NSW, See section 7.3

3. The rice industry (and annual irrigated crops such as cereals/cotton/maize) is more interruptible and can quickly expand and contract water use to take advantage of medium- wet years
4. The low value livestock production based on broad pasture-based mixed farming can utilise large amounts of water (though often not very efficiently) when it is readily available. These industries will generally only be able to afford lower cost irrigation layouts.
5. All industries will store or carryover surplus water for future use

It is important to recognise that variability in the Australian climate determines that there is a large difference between the upper limit of horticulture and average availability. This means that there will be always be a mix of enterprises and the highest value agriculture will not be the only industry that survives.

There is a risk of horticulture “over shooting” its maximum limit could occur if there is a long period without low water allocations. A drought sequence would then result in a high cost to the perennial horticultural industry; there would be drying off and it would retract to a smaller level[5].

The future for irrigation in the GMID will depend on its competitiveness in the declining consumptive pool.

An estimate of impact of changing the future water availability in sMDB where there is dynamic equilibrium between industries is described below.

5.7 Future water use scenarios with dynamic equilibrium

Based on the above established behaviour of “the new equilibrium” the following scenarios have been developed. They allow for only small variation in horticultural use and large fluctuations in other industries per water availability/price. They also include an allowance for carry over to be accumulated in wet years. There are three climate scenarios shown to represent:

- Drought (39% inflows of average inflows) 2,328 GL. Allocations greater than this occur approximately 17 out of 20 years based on the last 20 years.
- Typical (75% of average inflows) 4,526 GL this is drier than the long-term average but may be more representative of future average); Allocations greater than this occur 13 years out of 20 years.
- Wet conditions (123% of average inflows) 5,762 GL. Allocations greater than this occur approximately 8 years out of 20 years.

These are applied to the following SDL outcomes:

- Base case - No further reduction in consumptive pool across the sMDB to meet SDLs and growth of horticulture occurs to reach a maximum limit of 1,400 GL/y usage in an average year and relatively constant use across the three climate scenarios.
- Scenario 1- 300 GL reduction. This reflects 350 GL of offsets against the 650 GL SDL reduction that is remaining to reach 2,750 GL; and
- Scenario 2 -750 GL reduction includes the 300 GL above plus 450 GL of “Upwater”.

[5] The impacts of the effect of the last drought are still visible in the older horticultural districts of Sunraysia.

Note Scenarios 1 and 2 assume 350 GL of offsets are achieved. But recent advice is that there could be up to 415 GL of offsets available, which would change Scenario 1 to a 235 GL reduction and Scenario 2 to a 685 GL reduction. This would increase the consumptive pool for the sMDB and GMID relative to the scenarios evaluated below. However, as the final volume for offsets is still being developed a more conservative 350 GL of offsets has been assumed.

Figure 5-6 illustrates how little water in the sMDB will be available for non-horticulture in the next drought.

Figure 5-9 provides the same estimate applied to the GMID and the impact on the ha irrigated. Average use in the GMID is expected to be 1,300 GL for a typical year, which after 70 GL of groundwater use is marginally higher[6] than the forecast deliveries assumed in the 2016-2020 Water Plan. (GMW 2015); which are shown below.

Table 5-5: GMID estimated future annual deliveries

GMID future deliveries from Water Plan (GL)	
2016/17	1,160
2017/18	1,150
2018/19	1,130
2019/20	1,126

A key issue illustrated in the graphs is the low amount of water remaining for the dairy industry and GMID in a future drought.

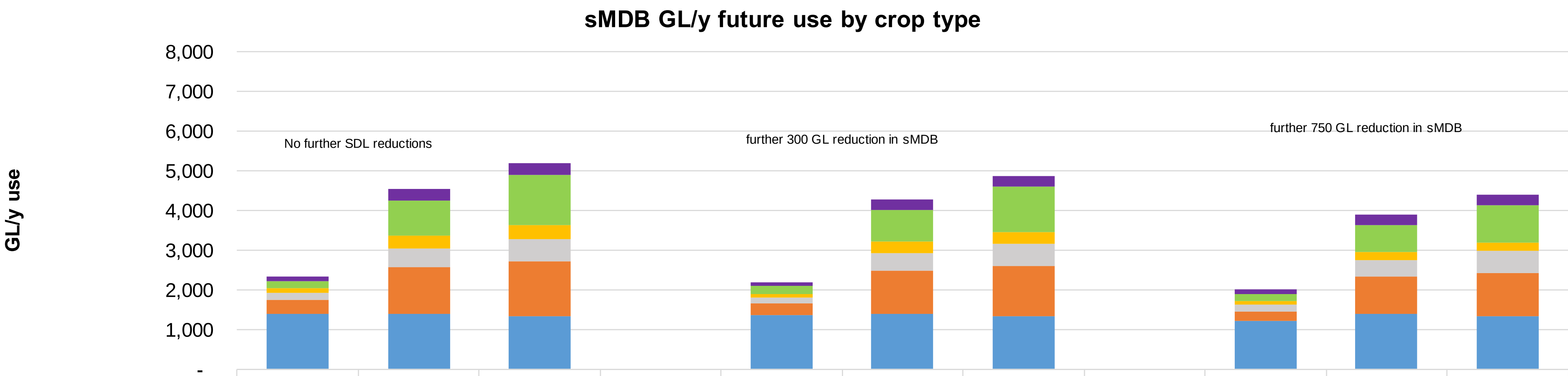
In the base case drought year, which can be expected to occur in approximately 10% of years then the water available to the GMID (after horticultural expansion to 1,400 GL/y in the sMDB) would be around 400 GL. This volume contains an estimated 70 GL of groundwater, which means the GMW channel system would only deliver 330 GL. There would be approximately 100,000 ha irrigated.

Any future reductions, scenario 1 and 2 reduces the area to 84,000 ha and 69,000 ha respectively.

In a typical allocation year there is 360,000 ha is irrigated in the base year. This reduces to 330,000 ha and 290,000 ha with future reductions in the two scenarios.

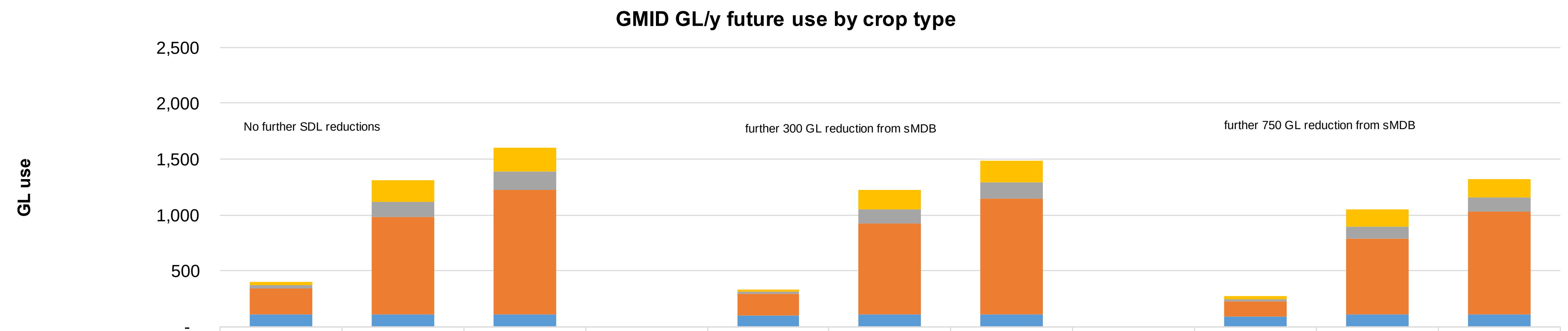
An indication of the impact of GVIAP is shown in Figure 5-9, but this should be treated with caution as it applies $12/13 GVIAP per ML to both drought and wet years. In reality the GVIAP per ML increases in the dry years as water use efficiency increases, and decreases in higher allocation years when water is more plentiful and has a lower market value.

[6] Part of this would be 70 GL of groundwater use assumed in the 1,300 GL in the GMID, which may in fact be too low (the last meeting estimated 60 GL deep lead use plus 30-100 GL from Shepparton shallow watertable).



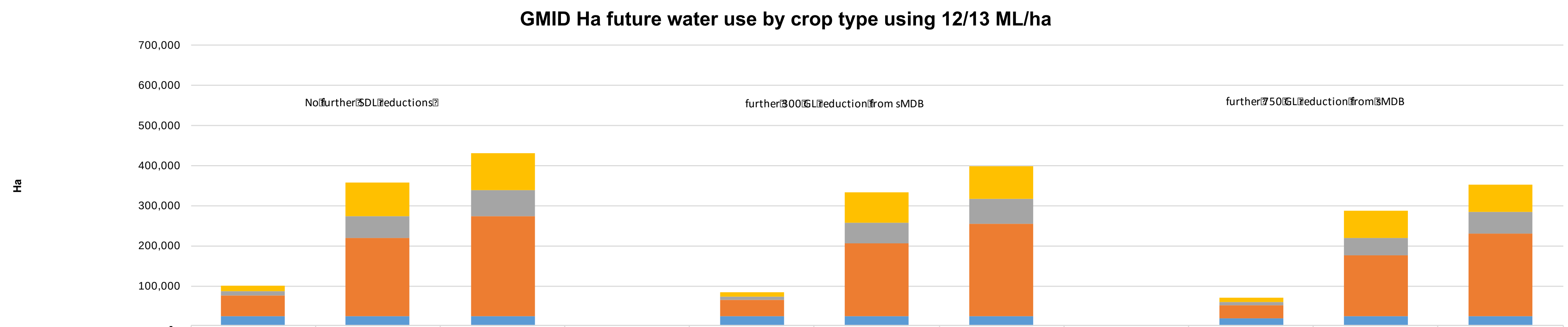
	2020/25 current pool future drought	2020/25 current pool average	2020/25 current pool future high alloc	2020/25 - 150 GL future drought	2020/25 - 300 GL average	2020/25 - 300 GL future high alloc	2020/25 - 375 GL future drought	2020/25 - 750 GL average	2020/25 - 750 GL future high alloc
Cotton GL	116	272	288	115	259	272	113	239	248
Rice GL	186	905	1,268	185	805	1138	180	678	948
Pastures non-dairy GL	116	317	346	103	279	297	110	219	226
Other crops GL	163	453	576	150	440	560	156	420	536
Dairy GL	349	1,177	1,383	284	1089	1269	235	917	1103
Horticulture GL	1,397	1,403	1,325	1360	1403	1325	1221	1403	1325
Total GL	2,328	4,526	5,762	2198	4276	5437	2016	3876	4962
long term inflows %	39%	75%	123%	39%	75%	123%	39%	75%	123%

Figure 5-6 sMDB Estimated change in future use under three scenarios for a future equilibrium



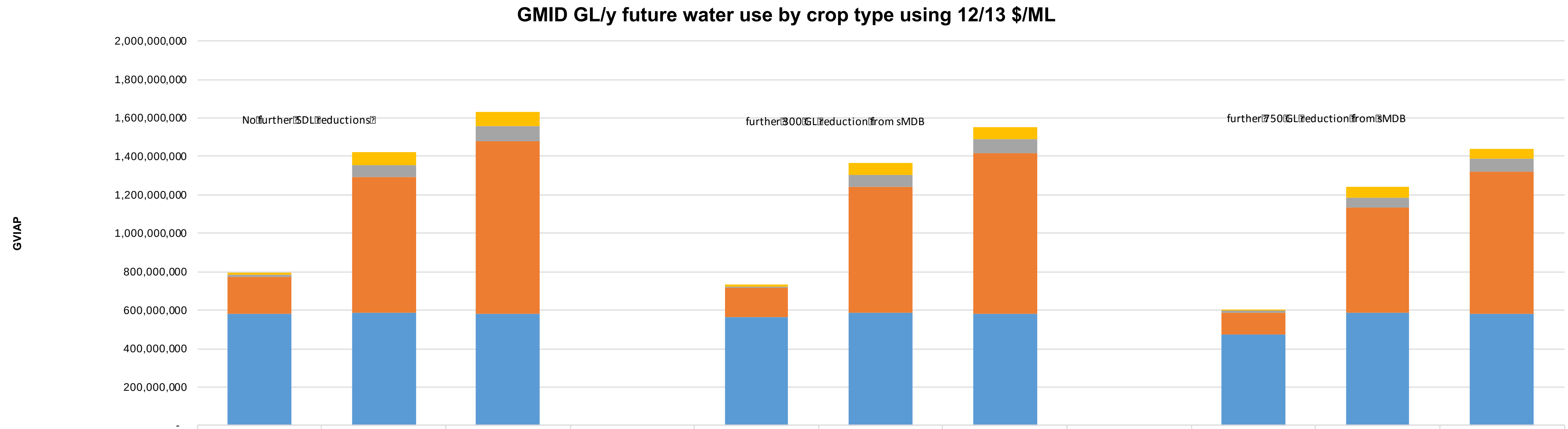
	2020/25 current pool future drought	2020/25 current pool average	2020/25 current pool future high alloc	2020/25 -150 GL future drought	2020/25 - 300 GL average	2020/25 -300 GL future high alloc	2020/25 -375 GL future drought	2020/25 - 750 GL average	2020/25 -750 GL future high alloc
Pastures non-dairy GL	32	197	216	27	179	193	26	158	160
Other crops GL	24	131	160	19	122	149	18	105	132
Dairy GL	240	879	1,120	188	818	1040	143	684	924
Horticulture GL	104	105	104	101	105	104	85	105	104
Total inc. g.water GL	400	1,312	1,600	335	1,225	1,486	270	1,052	1,320
long term inflows %	39%	75%	123%	39%	75%	123%	39%	75%	123%

Figure 5-7 GMID estimated future water use under three scenarios for a future equilibrium



	2020/25 current pool future drought	2020/25 current pool average	2020/25 current pool future high alloc		2020/25 -150 GL future drought	2020/25 - 300 GL average	2020/25 -300 GL future high alloc		2020/25 -375 GL future drought	2020/25 - 750 GL average	2020/25 -750 GL future high alloc
Pastures non-dairy 2.39 ML/ha	13,389	82,372	90,377		11,213	75,049	80,858		10,669	66,054	66,946
Other crops 2.38 ML/ha	10,084	55,145	67,227		8,172	51,469	62,447		7,353	44,221	55,462
Dairy 4.50 ML/ha	53,333	195,410	248,889		41,778	181,799	231,194		31,667	152,076	205,333
Horticulture 4.36 ML/ha	23,853	24,082	23,853		23,108	24,082	23,853		19,381	24,082	23,853
Total	100,660	357,008	430,346		84,271	332,398	398,353		69,070	286,432	351,594

Figure 5-8 GMID estimated future ha irrigated under three scenarios for a future equilibrium



	2020/25 current pool future drought	2020/25 current pool average	2020/25 current pool future high alloc	2020/25 -150 GL future drought	2020/25 - 300 GL average	2020/25 -300 GL future high alloc	2020/25 -375 GL future drought	2020/25 - 750 GL average	2020/25 -750 GL future high alloc
Pastures non-dairy $345 per ML	$11,044,436	$67,946,753	$74,549,945	$9,249,715	$61,906,827	$66,698,041	$8,801,035	$54,486,346	$55,222,182
Other crops $481 per ML	$11,552,648	$63,176,296	$77,017,652	$9,362,458	$58,964,393	$71,542,178	$8,423,806	$50,660,928	$63,539,563
Dairy $802 per ML	$192,368,699	$704,825,874	$897,720,595	$150,688,814	$655,731,779	$833,898,271	$114,218,915	$548,526,307	$740,619,491
Horticulture $5,603 per ML	$582,690,074	$588,271,946	$582,690,074	$564,481,009	$588,271,946	$582,690,074	$473,435,685	$588,271,946	$582,690,074
Total	$797,655,857	$1,424,220,870	$1,631,978,266	$733,781,997	$1,364,874,946	$1,554,828,565	$604,879,441	$1,241,945,527	$1,442,071,309

Figure 5-9 GMID estimated future GVIAP irrigated under three scenarios for a future equilibrium

(note using 12/13 $/ML will under-estimate GVIAP in a drought year and over-estimate in a high allocation year as farms adjust water use efficiency)

5.8 Sensitivity testing future water use scenarios for the GMID

5.8.1 Rationale

Section 5.7 reflects water available given the dynamic equilibrium and water affordability for each industry.

However, if there is an extended period of flows either above or below the dynamic equilibrium then this scenario could change the expected water availability in the GMID. Also GMID industry profitability, in particular the dairy industry relative to other industries is significantly changed from long term average levels.

To test this both pessimistic and optimistic scenarios for the GMID are presented below.

5.8.2 Pessimistic outlook

It is possible that the GMID could suffer greater reductions in water use, land area and value of production than estimated above in Section 5.7. For example this could occur if:-

- There is an extended period of low water availability in the sMDB, which results in lower allocations than the average used above.

Or

- horticultural growth is not constrained by low water availability in a drought, for example an extended period of high allocations could mean that horticulture grows beyond the 1,400 GL in the sMDB assumed for the dynamic equilibrium above. This would be at a very high cost to all irrigators including horticulture as it would have insufficient water for itself and this would result in abandoned plantings when low allocation years are subsequently revisited.
- Rice and or cotton or some other crop is able to outcompete dairy over the long term in the water market. This scenario has not happened to date as dairy has been a net buyer of water from these industries.

A very pessimistic scenario would be that as a result of a combination of these events the size of the dairy industry halves from current levels. This is not considered a realistic scenario, but is presented here to illustrate the level of reliance of the GMID to the dairy industry in a dynamic trading environment where water is highly mobile and can move to the industry that has the greatest ability to pay.

The results of this are shown in Table **5-6** below. This assumes dairy is 50% less than the best estimate in Section 5.7 in drought, average and high allocation years, the reality would be more complex than this.

A key issue is whether horticultural investors fully understand the level of risk to water security that is associated with continued expansion.

5.8.3 Optimistic outlook

An optimistic scenario is that the future scenarios evaluated in Section 5.7 are pessimistic and the GMID is more competitive with other industries and as a result is able to retain and attract additional water than expected. For example, if:

- There is an extended period of above average inflows in the sMDB, which results in higher allocation assumed in Section 5.7

Or

- There is a collapse in overall horticultural profitability and plantings are abandoned releasing water onto the market, which dairy can afford to buy.
- We have a sequence of wet years, NSW water allocations are high, while at the same time dairy profitability is high enough to be able to outcompete annual crops such as rice and cotton. The net import of water from NSW increases to the GMID.

A very optimistic scenario would be that as a result of a combination of these events the size of the dairy industry increases by 50% above current levels. This is not considered a realistic scenario, but is presented here to illustrate the level of reliance of the GMID to the dairy industry in a dynamic trading environment where water is highly mobile and can move to the industry that has the greatest ability to pay.

The results of this are shown in Table **5-6** below. This assumes dairy is 50% more than the best estimate in Section 5.7 in drought, average and high allocation years, the reality would be more complex than this.

5.8.4 Comparison of future best estimate, pessimistic and optimistic scenarios

Table **5-6** below shows the results of the analysis compared to historic water use and areas. Areas are calculated using ABS ML/ha for the 2013/14 year. A key issue is the impact of drought on the water available and the area irrigated. Based on the last twenty years the frequency of this type of year was around 10% of years, but a lower frequency of approximately 5% of years occurs when considering the longer inflow record.

Under the historic scenario, which was prior to water trade and the growth of horticulture in the sMDB a 50% reduction in water allocation would have met a 50% reduction in area irrigated. This has now changed to a 75% reduction in area. This is because there is little NSW water allocated in the sMDB during drought periods, as it is mostly the lower reliability general security entitlement.

Victorian HRWS is the major source of water for the sMDB. Horticulture would be expected to purchase its additional shortfall when allocations are less than 100% and as a result, temporary water prices rise. This is illustrated in Figure 5-3 for periods when there would be less than 2,500 GL available in the sMDB.

This makes it difficult for dairy and other agriculture to purchase water to meet their shortfall and non-horticultural users would tend to be net sellers at these very high prices.

Table 5-6: GMID estimated future annual deliveries and ha use under different scenarios

		GL use high alloc year	GL use average year	GL use drought year	Ha high alloc year	Ha average year	Ha dry year	Dry ha as % average ha
Historic 90's and pre basin plan	Historic	2,500	2,000	1,100	600,000	500,000	275,000	55%
Best estimate future scenario as per Section 5.7	Current pool	1,600	1,312	400	430,346	357,008	100,660	24%-32% (lower % with smaller pool)
	-300 GL	1,486	1,225	335	398,353	332,398	84,271	
	-750 GL	1,320	1,052	270	351,594	286,432	69,070	
Pessimistic Future scenario	Current pool with dairy -50%	1,040	873	280	305,901	259,303	73,993	
	-300 GL with dairy -50%	966	816	241	282,756	241,499	63,382	
	-750 GL with dairy -50%	858	710	199	248,928	210,394	53,236	
Optimistic scenario	Current pool with dairy +50%	2,160	1,752	520	554,790	454,713	127,326	
	-300 GL with dairy +50%	2,006	1,634	429	513,950	423,298	105,160	
	-750 GL with dairy +50%	1,782	1,395	341	454,261	362,471	84,903	

This strongly suggests that a key challenge for irrigators will be the ability to respond to a more variable water supply/ water market price. This is discussed further in the next section.

Also, the low water use in drought years will place increased pressure on GMW to operate the system in new ways that minimise losses.

6 Farm adaptability and resilience to changing water availability and market price

6.1 Flexibility

Recent research on climate change impacts on farming systems provide some insights into how water variability may play out in the GMID.

For example (Cowan 2012) identified models of strategic and tactical flexibility that are important increased climate variability. This paper described systems to absorb variability as:-

- Tactical flexibility as changing pre-programmed actions available to the farmer that do not involve changes to the structure of the farm system. For example, a dairy farmer may use an existing silage pit to store extra feed. Many dairy farms have already adopted tactical flexibility as water has become scarcer.
- Strategic flexibility as changing farm business strategy. A farmer may increase strategic flexibility by changing what they produce. For example, change to a new crop.

Rigid farm systems are described as having low tactical and low strategic flexibility. They are least resilient to changing water availability / price. For example, the traditional dairy farms that heavily rely on grazing of perennial pastures and have a high water dependence. The impact of the last drought saw many of these farms change to a more flexible system or to depart the industry.

Robust farming systems are described as having high tactical flexibility, but low strategic flexibility. This includes dairy farms with a mix of feed sources such as cut and carry, annual and perennial pastures, silage and holding feed stocks etc.

Elastic systems have high strategic flexibility but low tactical flexibility. For example, mixed farms may change from summer irrigated crops to annual crops or even to dryland crops and can change the cropping/livestock mix.

Water trading, carry over and other mechanisms to secure water at affordable prices are an additional tool to improve flexibility.

Knowledge of the inputs (water) available optimises the production system. Therefore, an important implication of this work is that the accuracy and timeliness of information about water availability is very important for farmers to make appropriate responses.

Another implication is that research to improve farm flexibility is important to provide cost effective options for people to respond to both reduced and more variable water availability.

A related aspect is that small family farming businesses typically have less resources than larger businesses. This is due to fewer people, which limits the potential skill set, reduced borrowing capacity and less control/influence in the market.

A large dependence on off farm income can subsidise small farm businesses to survive and even grow and develop, but small and medium sized businesses without access to off farm income are more at risk.

Larger businesses, provided they are profitable, tend to be those with surplus, that after meeting living costs, can continue to expand, invest in technology and survive.

6.2 Industry returns and water use efficiency

6.2.1 Dairy

Over the long term, dairy tends to outcompete mixed farms and cropping when water is limited, but does not outcompete horticulture.

In some areas there has been an increase in flexibility with a transition from traditional dairy farms with a heavy reliance on grazing of perennial pastures that has a high water dependence, to farms that utilise a mix of feed sources such as cut and carry, annual/perennial pastures and feed crops, silage and holding feed stocks. Provided it is profitable this trend is likely to continue. However, there are a significant number of dairy farms in parts of the GMID where there continues to be a high reliance on perennial pastures.

Continuing to become more water efficient will be important, especially for the dairy industry who need to operate profitably over a wide spectrum of temporary water prices. For some, this may involve investing in new farming system such as barns with maize production and 3 times a day milking. However, this sort of change requires scale to justify the feeding system. At least 500 cows and possibly 2,000 to 3,000 cow farms will emerge. Whether this change happens will depend upon milk prices but there is the potential to double production per ML. However, there is increased capital requirement and new management skills will be required. For example:

- traditional pasture grazing systems typically produce 1 t/ML of dry matter and 1200 litres per t/dm. ie 1,200 litres per ML.
- This compares with maize of up to 3t/ML dry matter and with sheds and 3 times / day milking it can reach 1600 litres per t/dm ie 4,800 litres per ML.

The role of new irrigation systems such as sub-surface drip and irrigation scheduling will be important. New satellite based methods of scheduling irrigation could become useful tools.

6.2.2 Horticulture

Horticulture will tend to outcompete dairy and mixed farming when water is limited.

Perennial horticulture is less sensitive to water prices, but will also continue to increase production per ML through its ongoing switch to high density fresh fruit plantings. Irrigation systems are micro sprinkler or drip that tend to be upgraded when re-development occurs.

Annual horticulture has more flexibility than perennial horticulture, it is also high value and is frequently locked into long term contracts, which require irrigation in low allocation years. This means the area and water use is not expected to significantly reduce in lower allocation years, unless horticultural prices and margins are expected to be low.

Again water use efficiency is important, but this is really driven by labour and productivity gains. Subsurface drip for tomatoes and sprinklers tend to be used for vegetables.

6.2.3 Mixed farming

Mixed farm production is often used as inputs to neighbouring dairy and other intensive animal industries. But typically it has the lowest return per ML and generally is only a significant user once horticultural and dairy water needs are satisfied.

Mixed farming having lower returns per ML, cannot afford to over capitalise and has its place in opportunistic irrigation expanding the irrigation area when water is plentiful and low cost. Although there will be exceptions, particularly with high value or double cropping systems that can justify investment in modernising to more efficient systems.

Some mixed farms have moved to more dryland production, which has lower inputs, with opportunistic irrigation when water is more available and affordable. However, this transition can be difficult on small paddocks that are the legacy of ex-irrigation land. Farmers converting to dryland face substantial costs in removing redundant infrastructure to get the large paddocks and economies of scale required for profitable dryland production.

In areas like Pyramid- Boort, where farm sizes are larger and there is less competition for land, adaptation to less water has included transitioning from a business with smaller area and a medium proportion of irrigation to a business with a larger area and a lower proportion of irrigation. Sometimes land expansion has been funded by selling HRWS. This has been a long-term trend that has been accelerated by water trade, the drought and the Commonwealth water buy back.

These farmers have always operated some dryland with the proportion of irrigation varying with commodity price, water allocation and water price, but the response to higher water prices have been to become more dryland dependent and larger farms. Financially, farmers consider impacts on net assets and profit and for some this strategy has been very successful. However, from a regional perspective the transition has reduced the employment in this sector. It also raises questions on what is an appropriate service level/ infrastructure requirement for irrigation services, given that their needs are more intermittent than what has traditionally been the case.

The implications on service levels for different industries are discussed in the next section.

7 Implications for irrigator's costs, security of supply and service levels

7.1 Cost of irrigating

There are several components to the cost of irrigation (Croke 2016) (see submission in Appendix 9); costs include:-

- Temporary market for water purchases or interest on capital associated with owning HRWS (this can be from debt or opportunity cost/return on capital). This cost has risen due to increasing water value, especially in drier years (See Figure 5-3).
- Irrigation labour and other irrigation operational and maintenance costs
- Farm irrigation infrastructure depreciation cost
- GMW water charges.

As illustrated in Table 7-1 below the total of these farm costs can be around $300/ML or more.

Table 7-1 Farm costs associated with irrigation

Components of cost structure	assumption	$/ha cost	$/ML at 6 ML/ha/y use
Ownership. This is interest and depreciation on the capital	Gravity irrigation $6,000/ha capital with life of 25 years and 6% cost of capital	$600/ha/y	$100/ML/y
Operational & maintenance cost associated with irrigation	8 hours labour /ha at $25/hr plus repairs, maintenance, motor bike etc.	$300/ha/y	$50/ML/y
Water market cost (purchased on market or interest on HRWS)	$100/ML/y (will vary with availability)	$600/ha/y	$100/ML/y
GMW water charges	$60/ML/y (can vary see below)	$360/ha/y	$60/ML
Total		**$1,860/ha/y**	**$310/ML**

The costs in Table 7-1 will vary with the water market price, water use per ha and the farm capital invested. The margin to cover other non-irrigation costs and generate an income is difficult when there is a low gross income per ML.

Another variable is the GMW $/ML charge. This is influenced by usage, the amount of delivery share (DS) owned, number of outlets and ML HRWS held. Examples are shown in Appendix 7 for a hypothetical property in Central Goulburn with 1 DS and one outlet. This shows the water charge per ML used varies depending on the properties situation, for example, by way of illustration (simple numbers to show cost per ML rather than to represent a typical property): -

- $61/ML for a property that has 100 ML HRWS, 48 ML LRWS and uses 100 ML. This can be considered the base case for a property that has not sold water since unbundling and uses 100% of HRWS.
- $28/ML for the same property that owns the same water shares, but has bought 170 ML of temporary water in and has increased its water use to 270 ML/y
- $48/ML for the same property that has sold all its water shares and relies on the temporary water market for 100 ML of usage, where the seller pays the storage charges on the water shares.

- $3,953/ML for the same property that has sold all its water shares and buys 1 ML on the temporary market and only uses 1 ML/y.

This suggests that irrigators can reduce water charges per ML if they increase water use per DS held.

7.2 Comparison of GMID charges and other areas

The GMID competes for its share of water within the connected sMDB. In average years it has become a net buyer, but in dry years it is a net seller. The drivers for water movement are the different industries. However, differences in water charges may also have an influence. This section investigates if GMID charges are impacting on competitiveness versus other areas.

There are two main components to water charges, fixed and variable. The fixed component is tied to land and in the short term this will have less influence on whether water is used or not at a given site. The variable component may have a short term influence. Probably more important though is the total (fixed and variable) charge that long term investors consider along with land values, site suitability, service levels and other factors when choosing a site.

There can also be implications for land values, which may fall when fixed irrigation charges rise. Lower land values may also make small parcels more attractive for rural residential use.

The difference in charges between the GMID and NSW (particularly MIL) reflects the difference in land use. The GMID has a relatively fixed area of irrigation based on higher value water use (dairying) and is within a more infrastructure intensive and populated landscape, which increases costs.

The Australian Competition and Consumer Commission calculate hypothetical water bills for networks assuming the customer holds 50 ML, 250 ML or 1000 ML of water access entitlement and equivalent volume of water delivery right. Table 7-2 and Figure 7-1 are reproduced from the 2014/15 ACCC report. (ACCC 2016). GMID charges per ML fall with increased use, but not as much as in Murray Irrigation Limited (NSW). Key differences for a 100% allocation[20] year are:-

- 50 ML user in MIL pays $93/ML, where one in the GMID (Central Goulburn) pays $64/ML
- 250 ML user in MIL pays $46/ML, where one in the GMID pays $56/ML
- 1,000 ML user in MIL pays $35/ML, where one in the GMID pays $55/ML

Overall large users pay less per ML in NSW and small users pay more. This may have implications for the GMID to attract new large scale development for interruptible enterprises that are water charge sensitive. This would be for crops such as cotton, rice and other annual crops.

However, another factor is security of supply. Water charges are less important for non-interruptible higher value users than security of supply is. For example, a nil NSW Murray general security allocation may result in lack of supply from MIL (only domestic and stock supplies were delivered in the worst seasons of the last drought). Supply security can be a competitive advantage of the GMID and is underpinned by the higher security of Victorian HRWS. This is likely to be a more important factor than water charges for attracting high value developments, but can also be achieved in Victorian private diversion areas and with NSW High security entitlements.

[20] In an average year MIL allocations are closer to 65% when they are 100% in GMID so this may exaggerate the water charge difference for most years.

In conclusion, GMID water charges are not a key factor limiting investment in higher value use, but may be limiting investment for attracting lower value industries.

7.3 Water trade, conveyancing losses and implications on peak demand from river

The Water for Victoria - Water Plan (2016) recognises the need for adaptive irrigation districts. It states

"Irrigation distribution systems must adapt over time as farm businesses respond to changing climate, competition for water and market demands."

Water trade clearly has a large influence on water availability within the GMID. In average and wet years, the GMID has been a net importer of water and benefitted from trade, but in dry years is expected to be a net exporter to meet the shortfall of downstream horticulture.

The future scenarios discussed in the Section 5.7 generally depend on water trade conditions being similar to recent years and being largely unhindered. However, there are trading rules that can limit trade across trade zones and some change depending upon seasonal conditions and "back trade" opportunities.

For example, in their sMDB report for the 27th September 2016 RuralCo, a major water trading broker reported that:-

- *100 GL can enter the Murrumbidgee river from below the Murray Barmah Choke*
- *The Murray River Barmah Choke remains effectively closed*
- *Trade from New South Wales Murray into Victoria remains effectively closed*
- *The ability to trade out of the Goulburn, Campaspe and Loddon effectively closed late last week*
- *There is room for 173 GL of net trade from SA Murray and/or Victorian Murray into the Goulburn*

The fact that trade barriers into Victoria from NSW Murray was effectively closed, will limit the amount of water traded into the GMID.

Another issue raised by GMID stakeholders is the river conveyance loss that may occur when water is traded out of the GMID to a downstream region. The size of this factor is not known, but if significant this may be influencing the pool of water available in the system.

Stakeholders also raised concerns with regard to the ability of the river to supply peak demands when the original owner of the water in the GMID may have been an annual crop irrigator with autumn/spring peak demand which is then changed by the water purchaser to a peak summer demand crop. This issue can arise whether or not the higher summer demand is inside or outside of the GMID.

Table 7-2 ACCC Hypothetical bills for water charges for gravity irrigation districts

ACCC Water Monitoring Report 2014–15

Table 5.6: Off-river IOs—$ per ML hypothetical bills for irrigators in gravity-fed networks—50 ML, 250 ML and 1000 ML of water access entitlement, 100 per cent of water delivered, 2014–15

State	Operator	Network/ entitlement category	50 ML $/ML	250 ML $/ML	1000 ML $/ML	Ratio—$/ML for 50 ML delivered: $/ML for 1000 ML delivered
Vic	GMW	Central Goulburn	63.74	56.06	54.62	1.17
		Loddon Valley	65.90	58.22	53.76	1.23
		Murray Valley	62.80	55.12	53.68	1.17
		Rochester	58.90	51.22	49.78	1.18
		Shepparton	88.51	80.83	79.39	1.11
		Torrumbarry	64.40	56.72	55.28	1.16
	LMW	Merbein	113.04	111.44	111.14	1.02
		Mildura	138.30	136.70	136.40	1.01
		Red Cliffs	119.39	117.79	117.49	1.02
NSW	West Corurgan		44.50	44.50	44.50	1.00
	Moira		45.29	45.29	45.29	1.00
	MIL	B1 Class C	93.44	45.94	35.15	2.66
	Eagle Creek		20.51	20.51	20.51	1.00
	Coleambally		48.55	29.04	25.88	1.88
	MI	SAS-GS	62.70	39.22	31.02	2.02
		SAS-HS	75.47	49.53	38.92	1.94
		LAW-GS	75.61	36.56	26.77	2.82
		LAS-GS	80.18	40.34	29.80	2.69
		LAS-HS	90.86	49.03	36.55	2.49
	Hay		54.38	47.48	46.18	1.18
	Jemalong		49.8	49.79	49.79	1.00
	Narromine		54.88	51.68	51.08	1.07
	Buddah Lake		46.92	46.92	46.92	1.00
	Trangie-Nevertire		56.50	56.50	56.50	1.00
	Tenandra		46.70	46.70	46.70	1.00
	Marthaguy		43.11	43.11	43.11	1.00
Qld	SunWater	St George	62.61	62.61	62.61	1.00

Source: ACCC from data provided and published by off-river infrastructure operators.

Note: HS = high security, GS = general security, SAS = Small Area Supplies, LAW = Large Area Supply Wah Wah excluding HIS, LAS = Large Area Supply.

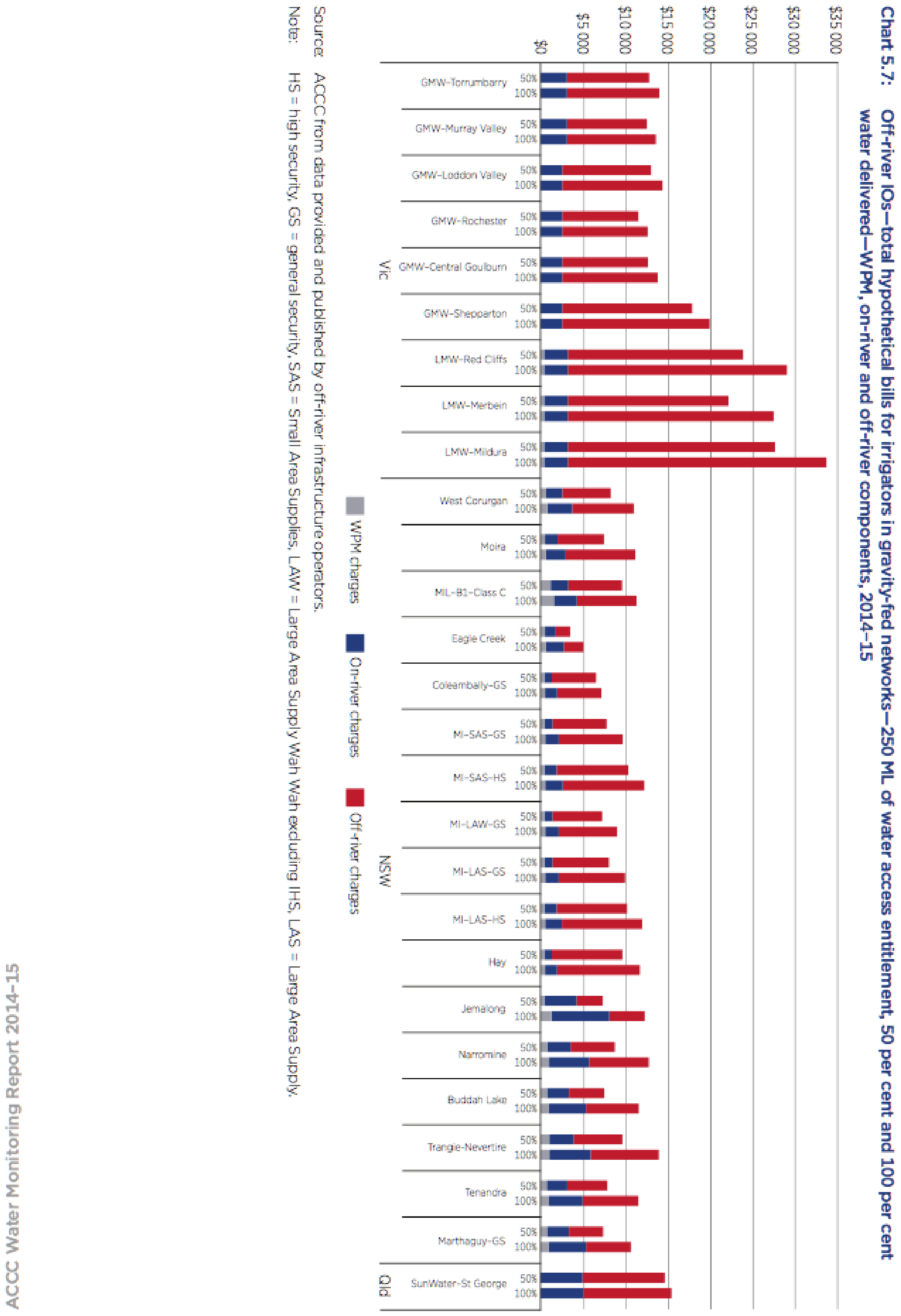


Figure 7-1 Comparison of bills for 250 ML entitlement at 50% and 100% allocation

7.4 Future outlook on water charges

GMW recently commissioned Deloitte Access Economics to review a uniform tariff for the GMID. (Deloite Access Economics 2015).

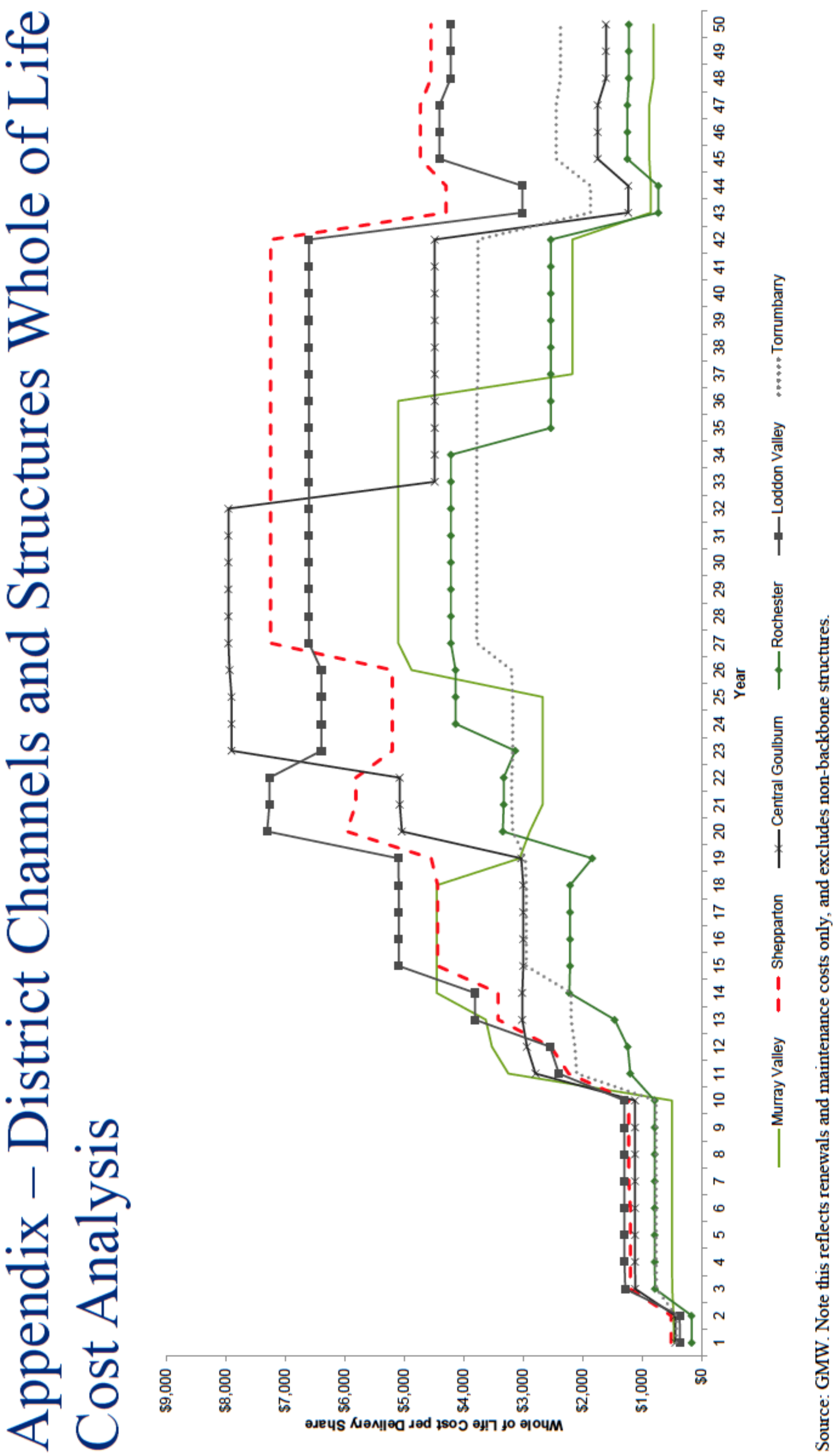
GMW prepared a long term 50-year analysis of capital and maintenance costs of its assets and allowing for forecast reductions in delivery shares under the Connections Project. The graph of predicted cost per delivery share is reproduced below.

This illustrates that there is potential for current delivery share charges to double over the next twenty years. It is uncertain what similar profiles would be for other water providers in the sMDB. However, ACCC provides the following comment with regard to increases in water charges since 2009/10.

"Hypothetical bills for Coleambally general security customers declined in real terms by 6 per cent for 50 per cent delivered and 5 per cent for 100 per cent delivered. In contrast, bills for GMW-Loddon, Hay, Narromine and Tenandra all increased by around 50 per cent in real terms (for 100 per cent delivered). In gravity-fed networks, the largest increases in hypothetical bills have been generally found in the smaller networks.

Real increases in hypothetical bills have generally been lower in Victorian networks than in networks in NSW and Queensland. An exception to this trend is MI (Murrumbidgee Irrigation) networks, for which bills remained relatively stable or declined slightly across the period."

Figure 7-2 Whole of Life delivery charges in the GMID



7.5 Cost recovery in the GMID when there is increasing dryland

Cost recovery for GMW is largely based on infrastructure access charges which are based on the number of delivery shares (DS). These were issued at 1 per 100 ML of water right, when unbundling occurred. 1 DS represents 100 to 150 ML/y historic use, which is an oversupply of DS relative to current and future use.

Properties in the GMID can expand water use up to 270 ML per DS. Those who have done this have effectively reduced their water charges per ML used, as they have not needed to increase their delivery shares (DS). However, those who have reduced water use and/or become dryland have large DS and low water use and so pay high water charges per ML used. (This was illustrated in Section 7.1).

This is becoming a high cost for dryland production on previously irrigated land. Landholders who are connected to the modernised system have the option of terminating DS at ten times the annual charge, which at current interest rates may appear attractive, as it is a guaranteed 10% return in the form of reduced water charges. However, this does not appear to have been taken up by many; perhaps this is due to uncertainty and the desire to keep the option to return to irrigation. Those who are not yet connected may reduce DS as part of modernisation/rationalisation. However, this has proved difficult in practice.

The GMW infrastructure costs are largely fixed. The GMID faces a quandary in that if DS were reduced for dryland then it would mean that DS charges for irrigated land would rise, which may act as a barrier for irrigation expansion and irrigation competitiveness.

Changing the DS charging basis would also have possible implications on land values.

7.6 Impact of smaller irrigated area on irrigation and drainage service needs

The reduction in irrigation volumes delivered has the potential to relax pressures on water delivery in peak times, but raises questions with regard to cost recovery for under-utilised irrigation supply infrastructure.

This is because the level of benefit received by properties from irrigation services is widening:

- Irrigated properties that are high use, high value, efficient and profitable operations will be able to take advantage of higher levels of service, such as water on demand from the GMW modernized supply.
- Other properties associated with the expanding area of non-irrigated land or low intensity irrigation have much lower productivity land and these properties may seek lower water charges or lower service levels, as they get lower benefit from higher service levels.

Farm structural adjustment is happening and the variability in the GMID customer base is increasing. There is more rural residential, more with large proportions of unirrigated land and fewer with large scale irrigation use. These customers have different needs and different capacities to pay.

There are also impacts on the need for drainage services. This was reviewed in detail in the 2015 Shepparton Irrigation Region Drainage Strategy, which identified that with more dryland the future need for drainage was lower than that experienced in the 1980s and 1990s. In particular, the area requiring drainage is lower and the lower intensity of irrigation means drainage service levels have changed.

This raises questions with regard to the spatial variability in irrigation demands and whether there is the opportunity to develop different water service products to reflect the increasingly varied needs. For example, rural residential, horticultural, dairy and mixed farmers all have different needs.

7.7 Farm types, their future characteristics and needs

The different industries and individual farms within them have diverse crops and different abilities to pay for water on the open market and the associated water charges. Also there are many outlets from the GMW supply system that are underutilised that now receive nil or very low water use (< 10 ML).

Table **7-3** illustrates that the main industries also can have different service needs.

Table 7-3: Comparison of generalised service needs from the main GMID industries.

Attributes	Horticulture	Dairy	Mixed
$/ML GVIAP	$5,600	$800	$400
Service level	On demand	2 days	2-4 days
Period	All year round	8 months	3 months spring/ 3 months autumn
Demand characteristic	Non interruptible	Some flexibility to substitute water with feed. But domestic & stock supply is non interruptible. Milking area also has less flexibility.	Maximum flexibility. Opportunistic use.
Demand profile	constant	Flexible within limits	High nimble, will only irrigate when water available

These profiles imply that GMW might consider different service offerings that are more in line with each industries' needs. For example, the GMID system might be divided, ideally by landholder choice, into blocks that:

- receive a premium service product suitable for horticulture, domestic and stock, dairy milking areas and has highest guarantee of supply in drought years.
- receive a lower charge service more aligned to mixed farms, dairy outblocks and would be a lower priority for supply in drought years.

However, this may not be easily achieved where there is a patchwork of different needs off the same supply system, which is quite often the case.

8 Summary of issues, challenges, opportunities and the next steps

8.1 Summary of issues and challenges

Based on this report and consultation (see Section 9) the following is a summary of the issues and challenges that have been identified.

Issues:

- Increasing demand for Victorian HRWS from outside of the GMID.
- Low and declining regional irrigation water use, relative to historic use and GMW system capacity.
- Exposure of irrigation industry and processing sector to less water, especially the impact in a future drought year.
- Increasing variability in water availability and as a result, water market price and regional use.
- Need to build flexibility to changing water availability into farming systems.
- Reliance on the dairy sector which is vulnerable due to competition from other dairy regions, tight profit margins, exposure to world market fluctuations and limited water use flexibility.
- Potential significant increase in water supply cost.
- Cost of delivery share charges and how these are shared amongst GMW customers. Charges impact low intensity (low ML/ha) and high intensity (high ML/ha) water users in different ways and depend on the historic water right that was held at unbundling. It is important that water charges be competitive for irrigation to grow in the GMID.
- Trend for increasing sub-division and purchase by rural residential landowners that contribute to the area being 'dried off'.
- Spatial variability in irrigation demand and whether there is the opportunity to develop different water service products to reflect the increasingly varied needs. For example, rural residential, horticultural, dairy and mixed farmers all have different needs.

Challenges:

- More water scarcity creates increasing need to ensure irrigation is used to generate the greatest net benefit in terms of economic, environmental and social outcomes. For this to occur there need to be signals that reflect total system (farm and off farm) water use efficiency[21]; and measures that fully account for the environmental and social effects of irrigation.
- Ensuring water conveyance losses and third party impacts of trade[22] are properly understood and accounted for.
- Increasing knowledge of the water market and providing transparency in water trading across the southern connected Murray Darling Basin, so fully informed water use / business decisions are made.

[21] Including ET demands and production per ML.
[22] Third party impacts can include the environment, other irrigators whose water security may be changed, or impacts arising from land abandoned for commercial agriculture (weeds etc). It could also include the impacts on regional water charges.

- Uncertainty with regard to future water availability in the GMID. This includes impacts from water trade and the very large impact of reducing the consumptive pool by 450 GL of Upwater[23]. This uncertainty is hampering investment in the GMID.
- Ensuring land use planning supports agricultural growth and other land use such as rural residential expansion in appropriate areas.
- Increasing flexibility and diversity of farming systems so that they are more profitable and can attract water to the area.
- Ensuring GMW service offerings best meets industry future needs and maximises the productive capacity of the land.
- Provision of serviced large land parcels for attracting and growing commercially viable and profitable irrigation businesses. This could include restructuring small blocks into more viable sized parcels.
- Managing the patchwork of different irrigation service needs off the same supply system.

8.2 Opportunities and next steps:

Phase 2 will set a vision for the Region based on the objective of maximising the potential of the Goulburn Murray Irrigation District (GMID).

It will develop a Strategy that is informed by the above issues and challenges and will facilitate a range of opportunities within the GMID that makes it a more attractive place to invest and for existing businesses to grow.

It will build on the GMID's sustainable competitive advantages that include its modernised system, low energy irrigation, low ET, top quality soils, existing supporting infrastructure, proximity to markets, processing factories, skilled workforce and other advantages. A prospectus will be developed to demonstrate and market these advantages.

Phase 2 could include a range of actions that create positive change from:

- Attracting new irrigation development and investment.
- Taking advantage of global market opportunities for irrigated agriculture by investing in product quality, new technology, skills; and systems that improve water use efficiency and farm profitability.
- Encouraging profitable dairy and horticulture to continue to provide employment opportunities both on and off farm.
- Encouraging existing and new horticulture.
- Investigating scope for diversification and new high value crops (vegetables etc)
- Supporting dairying to find new more flexible and more profitable production systems.
- Considering how GMW infrastructure and services can assist industry and attract new investment.
- Enabling existing farmers to profitably expand through water trading, sound land use planning and GMW service offering including system flexibility.

[23] under the Murray Darling Basin Plan the 2,750 GL target could be increased to 3,200 GL to meet the Sustainable Diversion Limit.

- Developing farm systems and irrigation techniques that improve water use efficiency and farm profitability.
- Consider third party impacts of water trade out of GMID eg. conveyance losses.
- Consider management of summer storms and potential for capture (eg. farm storage)
- Investigating river management/spills/ environmental interactions to improve system efficiency and pool available
- GMW cost recovery, connections program and asset infrastructure adjustment to meet different needs.
- Creating opportunities from areas of previously irrigated land becoming available for productive use.
- Land use planning and matching irrigation to land capability. This includes the irrigation technology adopted is suitable for the soil type.

These actions will be further developed in Phase 2 and where appropriate integrated within other action plans. This could include the relevant land and water management plans, local government regional development plans and the GMW Strategic Plan.

Leadership, integration and coordination of roles across stakeholders with high level executive support will be key to achieving success.

8.3 Coordination for Phase 2

A gap analysis was undertaken by the Project Reference Group at its meeting on the 29th November 2016. This meeting considered lead and supporting agencies for addressing the key challenges and opportunities above. This identified the lead organisations as per

Table 8-1.

In all cases the lead will need to work with supporting agencies to achieve optimal outcomes. These actions will be further developed in Phase 2 and where appropriate integrated within other action plans. This could include the relevant land and water management plans, local government regional development plans and the GMW Strategic Plan.

Leadership, integration and coordination of roles across stakeholders with high level executive support was identified as key to achieving success.

Key gaps were identified to provide large land parcels for development, undertake land use planning changes, proactively see new investment and to investigating the scope for diversification.

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Table 8-1 Possible lead agencies for each issue

Lead	Issues
Goulburn Murray Water	▪ GMW service offerings to meet industry needs. ▪ Managing the different service needs across the supply system. ▪ Considering how GMW infrastructure and services can assist industry and attract new investment. ▪ Define GMW cost recovery, connections program and asset infrastructure adjustment will meet different needs. ▪ Improving river management and system efficiency.
Catchment Management Authorities	▪ Landscape issues (large areas of dryland available for productive use). ▪ Land capability issues. ▪ Farm storage. ▪ farm water use efficiency.
Dept of Economic Development Jobs, Training & Resources	▪ Farm systems. ▪ Irrigation techniques.
Dept. of Environment, Land and Water Planning	▪ Water markets. ▪ Conveyance losses. ▪ River management and third party impacts of water trade. ▪ Farm storage (with CMAs). ▪ Land use planning (planning portfolio).
RDV	▪ Attracting new investment
Industry bodies (Dairy & horticulture mostly)	▪ Farm profitability. ▪ Flexible farming systems. ▪ Farm employment. ▪ Encouraging new horticulture. ▪ Global market opportunities.

9 Summary of Consultation

9.1 Engagement

During October and November 2016 meetings were held with a number of stakeholders including GMW, North Central CMA, Local Government officers and the Goulburn Broken CMA (Shepparton Irrigation Region People & Planning Integration Committee).

In general, feedback from the meetings was positive and supported the study and findings to date.

Individuals also provided comments, and where appropriate this has been included in this report. The detailed feedback of comment received at the workshops is listed in Appendix 8 (attached). The key messages have been mostly drawn from areas requiring further development and are summarised below.

9.2 Summary of key messages

Water management across the sMDB

- Need to quantitatively describe impact of changing water availability on jobs.
- Can environmental water be made available for irrigation? explore the opportunity for interaction with dam spills that may make more irrigation water available when the environmental needs are met.
- Do we properly understand the third party impacts of water trade down the river? are there additional losses/costs when water moves downstream that are not being accounted for?
- Climate change impacts on reducing water availability. Are there changes in seasonal rainfall that can be better managed? Are storm events able to be captured?
- Need for certainty in water management rules such as carry over, spills. Ongoing change makes it difficult for users to keep up to date.
- Need to value environment and social values of irrigation in the GMID.
- Concern about impact of further reductions to meet SDLs. How much of the gap to SDL is already contracted?
- Has horticultural growth been underestimated, there is a risk of overshooting 1,400 GL horticultural use in the sMDB if there is a long period until the next drought, which will threaten dairy and the GMID viability.

Industry adjustment

- Need to improve certainty of water availability and operating environment to attract investment.
- Need to develop opportunities to link in with global trends and growing demand for high quality food.
- Need to assist irrigators increase scale, corporate agriculture models.
- The GMID future is highly dependent horticulture reaching a peak capped by drought and the ability of dairy to be competitive with other users.
- Could change in industry technology, e.g. new rice varieties threaten dairy?

- What would happen if dairy collapses? Impact on jobs. Assist dairy to adjust to be competitive. Link our industries in with global demands and trends, note dairy processing investment is expanding (Stanhope).
- Improve water use efficiency (eg. L milk produced per L of water)
- Diversification options for medium and small farms. Vegetable expansion. High value intensive users (intensive animals), greenhouses, horticulture
- Could cotton expand in GMID?
- Research and development into more profitable, high water use efficient and resilient systems (including gene technology)
- Need for a GMID taskforce to develop an adjustment plan and attract high value industries and jobs growth.

GMW

- GMW Connections have role in the adjustment process.
- GMW cost recovery is a major issue. How do we make it more attractive for larger water users and less attractive for smaller (noncommercial) water use.
- Can GMW cost base be reduced? Possible need to shut down parts of the GMW system in drought years. High service core areas. Beware of tipping points where industry viability/critical mass is threatened.
- More flexible supply systems
- Need to reduce complexity of water charges/rules
- Mismatch between irrigator aspirations for water use versus water available and their ability to pay for water.

Land Use Planning

- Make it easier for properties to expand to be more competitive. Link with land use planning. Coordination of land and water services (Local Government)
- Environmental impacts of land use change
- Adopt a planned “traffic light approach” similar to the CSIRO study so that the location of irrigation matches land capability, soil type (considering agronomic potential /soils) environmental risks, flooding, salinity risks etc.- Use of zoning or a market incentive for water trade so water is encouraged to be located in the most suitable areas and the GMW system then matches this.

10 Bibliography

ABARES. 2015. *Agriculture in the Shepparton region of Victoria, 2015 ABARES.* Australian Government.

ABARES Conference paper 13.6. 2013. *Global food production and prices to 2050.* ABARES.

ABARES report 16.2. 2016. “Rice Farms in the Murray Darling Basin research .” ABARES.

ABARES Research Report 15.13. 2015. “Irrigated Agriculture in the Murray Darling Basin An economic survey of irrigators 2012-13 to 2014-15 .”

ABARES Research report 15.22. 2015. *Agriculture in the Shepparton region of Victoria, 2015.* Australian Government.

ABARES Research report 16.3. 2016. *Cotton farms in the Murray Darling Basin.* ABARES.

ABARES Research report 16.4. 2016. *Horticulture Farms in the Murray Darling Basin .* ABARES.

ABARES Research Report 16.6. 2015. *Australian Dairy Financial Perfromance of Dairy Farms 2013/14 to 2015/16 .* ABARES.

ABARES Research report 16.6. 2016. *Australian dairy. Financial performance of dairy farms 2013-14 to 2015-16. .* ABARES.

ABS. 2012. *3218.0 Regional Population Growth, Australia.* http://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/3218.02010-11?OpenDocument.

ABS. 2014. *46180DO002_201213 Water Use on Australian Farms, 2012-13.* ABS.

ABS. 2014b. *75030DO002_201213 Value of Agricultural Commodities Produced, Australia, 2012-13.* ABS.

ABS. 2016. *Regional Local Government Statistics accessed 27/7/2015.* http://stat.abs.gov.au/itt/r.jsp?RegionSummary&region=215031401&dataset=ABS_REGIONAL_ASGS&geoconcept=REGION&datasetASGS=ABS_REGIONAL_ASGS&datasetLGA=ABS_REGIONAL_LGA&regionLGA=REGION&regionASGS=REGION.

ABS. 2013. “Water Use on Australian Farms, 2012-13.”

ACCC. 2016. *ACCC Water Monitoring Report 2014–15.* Australian Competition and Consumer Commission.

2015. *Agricultural Competitiveness White Paper.* Australian Government.

Cowan, L, Kaine G, & Wright V. 2012. *The Role of Strategic and Tactical Flexibility in Managing Input Variability on Farms.* Research Paper, Systems Research and Behavioral Science Syst. Res (2012) (wileyonlinelibrary.com) DOI: 10.1002/sres.2137.

Croke, B. 2016. *Money needed to irrigate. A Shepparton Irrigation Region example.* unpublished.

Dairy Australia / DEDJTR. 2015. *Dairy Farm Monitor Project Victoria Annual Report 2014/15.* Victorian Government Department of Economic Development, Jobs, Transport and Resources .

Deloite Access Economics. 2015. *Goulburn-Murray Water Review of Tariff Strategy Final Report #4023944.* Accessed August 23, 2016. http://www.g-mwater.com.au/downloads/gmw/Water_Plans/TATDOC-_4042921-v1-TARIFF_REFORM_DELOITTE_FINAL_REPORT_AUGUST_2015_WEB_VERSION.pdf.

Eady, Hajkowicz &. 2015. *Rural Industry Futures - Megatrends impacting Australian agriculture in the coming twenty years.* RIRDC and CSIRO.

EBC, RMCG, MJA, EconSearch, Geoff McLeod, Tim Cummins, Guy Roth and David Cornish. 2011. *Community impacts of the Guide to the proposed Murray-Darling Basin Plan.* MDBA.

GMW. 2015. “2016-2020 Draft Water Plan.”

GMW. 1988. *Results of Irrigated Farm Census 1997.* Goulburn Murray Water.

GMW. 2016. “Senate Select Committee on the Murray-Darling Basin Plan- Submission.”

—. 2016. *Water for Victoria GMW Submission.* Accessed September 29, 2016. http://www.g-mwater.com.au/downloads/gmw/Water_Plans/GMW_2016_Water_Plan_summary.pdf.

Goulburn Murray Water. 2013. *Goulburn Murray Water Blueprint. .* Goulburn Murray Water.

Meyer. 2005. *The Irrigation Industry in the Murray and Murrumbidgee Basins.* CRC Irrigation Futures & CSIRO.

Michael Harvey, Rabobank. 2016. *Global dairy markets- are the storm clouds finally clearing?* Murray Dairy Presentation August 2016.

RMCG. 2016. “Draft - Basin Plan- GMID socio-economic impact assessment.” GMID Water Leadership Forum.

RMCG. 2016. *The Basin Plan- GMID socio-economic impact assessment.* GMID Water Leadership Forum.

SunRise 21. 2011. *SunRise 21. Mallee Irrigated Horticulture 1997-2009. Report Number: 0910/00026, Mallee CMA.* Mallee CMA, Mildura. Mallee Catchment Management Authority Report Number: 0910/00026. 30 October. http://www.malleecma.vic.gov.au/resources/reports/mallee-irrigated-horticulture-section1.pdf accessed on 30 October 2011., 2010.

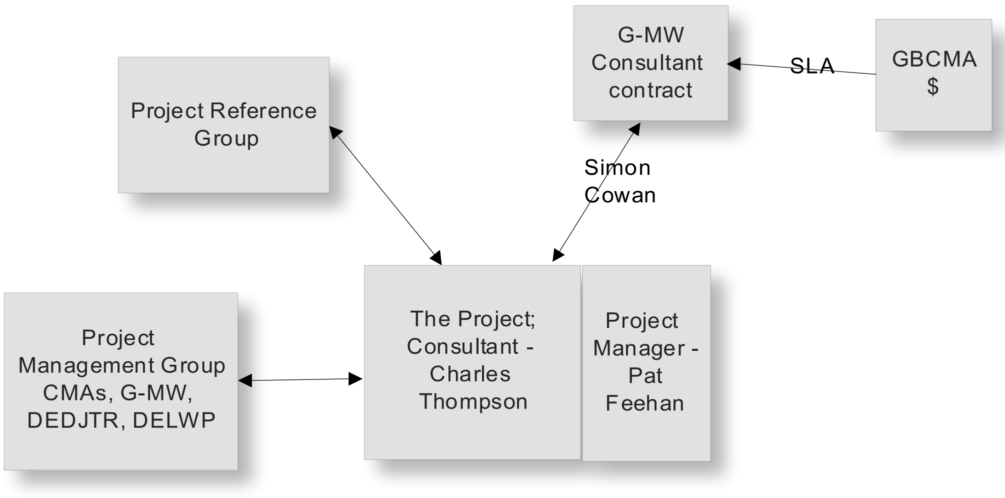
Tim Cummins & Associates. 2016. *Trends in Northern Victorian Water Trade 2001-2015.* DELWP.

Timbal. 2015. *Murray Basin Cluster Report, Climate Change in Australia Projections for Australia’s Natural Resource Management Regions: Cluster Reports. .* CSIRO and Bureau of Meteorology, CSIRO.

11 Appendix 1: Steering Committee

There is a Project Management Group (PMG) made up of agency staff to oversee the consultancy.

There is also a broader Project Reference Group (PRG) that will host workshops for the purpose of consulting with industry and others.



12 Appendix 2: Operating Context

Figure **12-1** below was adopted by the Project Management Team to identify the key issues involved with the study.

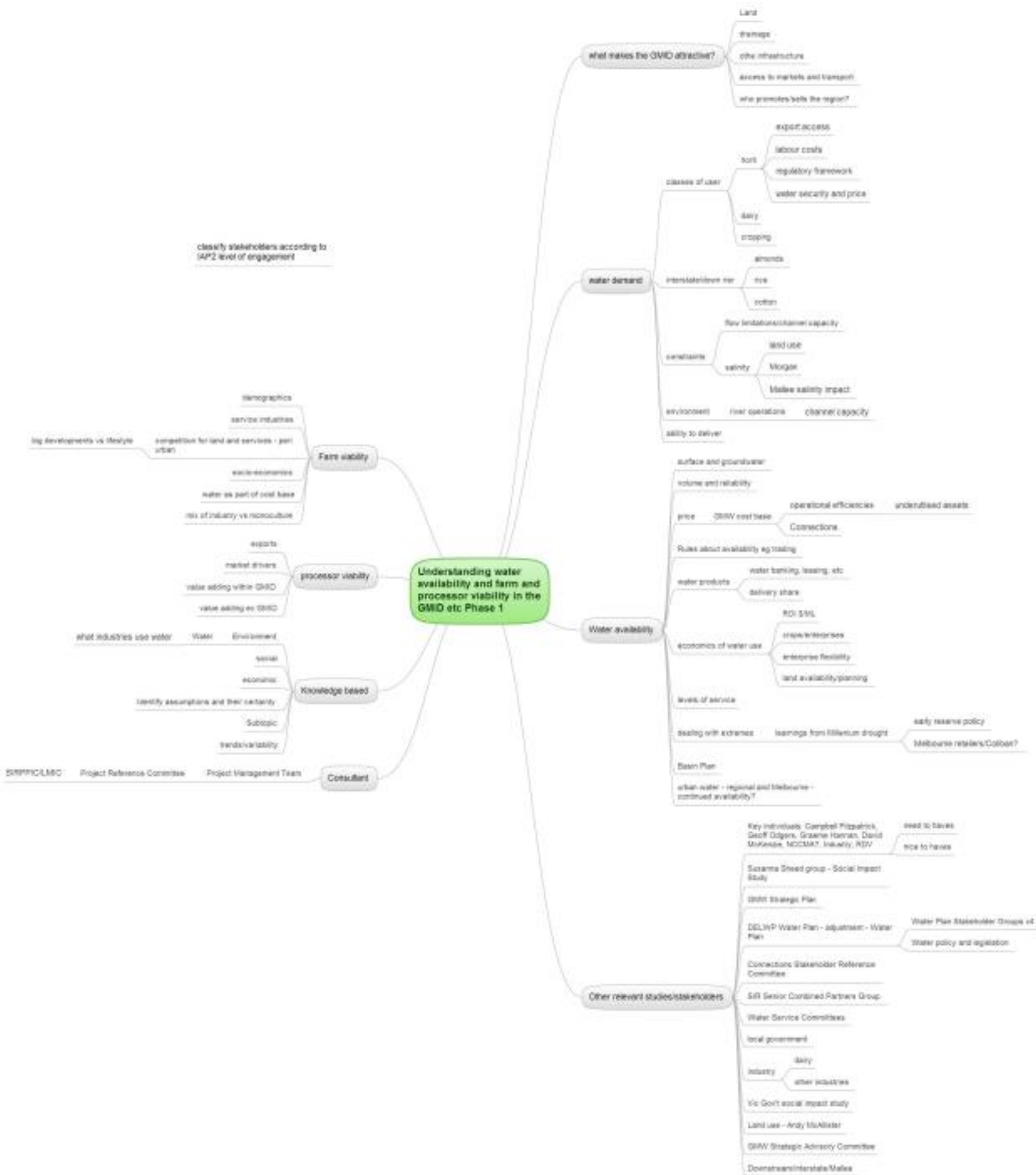


Figure 12-1 Mind map of issues affecting water availability study

13 Appendix 3: Population and Employment

Table 13-1: Estimated Resident Population for Local Government Areas in the GMID ((ABS 2012)

LGA code	Local Government Area	2006	2011	2015p	change since 20006	% change
26610	Swan Hill (RC)	20,950	20,865	20,409	-541	-3%
21370	Campaspe (S)	36,969	36,855	36,747	-222	-1%
22250	Gannawarra (S)	11,413	10,453	10,019	-1,394	-12%
22830	Greater Shepparton (C)	58,688	61,744	63,366	4,678	8%
23940	Loddon (S)	7,922	7,546	7,283	-639	-8%
24900	Moira (S)	27,477	28,406	28,820	1,343	5%
	total	**171,028**	**173,052**	**173,403**	**2,375**	**1%**

A large proportion of jobs are dependent upon the irrigation industry. The CRC for Irrigation Futures (Meyer 2005) reported employment multipliers for the Goulburn- Broken Region of:

- 1.9 for dairy and 4.0 for dairy processing
- 1.7 for fruit and 2.8 for fruit processing
- 1.5 for cereals, 2.4 for grazing

This means that every job in dairy there are an additional 0.9 jobs to support dairy; while dairy processing generates 3 additional jobs. However, these are considered generous multipliers (they consider direct, indirect and induced effects) and a more conservative guide is that every job on farm supports one off farm.

Table 13-2: Employment by sub-industry, GMID

Industry	2006	2011
Agriculture, Forestry and Fishing		
Agriculture - Dairy	4,144	2,791
Agriculture - Horticulture	1,523	1,341
Agriculture - Other	3,364	3,128
Agriculture, Forestry and Fishing Support Services	357	298
Agriculture, Forestry and Fishing Total	**9,388**	**7,558**
Mining total	**77**	**195**
Manufacturing		
Food Product Manufacturing - Dairy	1,515	1,480
Food Product Manufacturing - Horticulture	1,577	1,278
Food Product Manufacturing - Cropping	404	439
Food Product Manufacturing - Livestock	558	438
Food Product Manufacturing - Other	428	522
Other Manufacturing	3,541	3,301
Manufacturing Total	**8,023**	**7,458**
All Other Industries total	**39,055**	**41,785**
Total	**56,543**	**56,996**

Agricultural employment data for the following irrigation statistical divisions (ABS 2016) shows:-

- Loddon in 2010/11, agriculture employed 38% or 1,036 people for an agricultural turnover of $323 M, which is $312,000 per job.
- Gannawarra Shire in 2010/11, agriculture employed 32% or 920 people for an agricultural turnover of $224 M, which is $244,000 per job.
- Lockington- Gunbower in 2010/11, agriculture employed 30% or 534 people for an agricultural turnover of $158 M, which is $296,000 per job
- Rochester in 2010/11 agriculture employed 18% or 296 people for an agricultural turnover of $51 M, which is $172,000 per job
- Kyabram in 2010/11 agriculture employed 14% or 625 people for an agricultural turnover of $156 M, which is $250,000 per job
- Shepparton West in 2010/11 agriculture employed 20% or 869 people for an agricultural turnover of $264 M, which is $303,000 per job
- Shepparton East in 2010/11 agriculture employed 20% or 429 people for an agricultural turnover of $115 M, which is $268,000 per job
- Nurmurkah in 2010/11 agriculture employed 22% or 1,194 people for an agricultural turnover of $300.5 M, which is $252,000 per job

Total of above is 5,900 jobs and $1,591 million GVAP (includes agricultural production from dryland, but excludes some GMID irrigation in Swan Hill). Farm jobs averages $270,000 in gross agricultural turnover per job. This is consistent with typical industry employment of one job per 60 ha of irrigation or per 300 ML of broad acre use (excludes horticulture, which has higher labour use per ha and per ML).

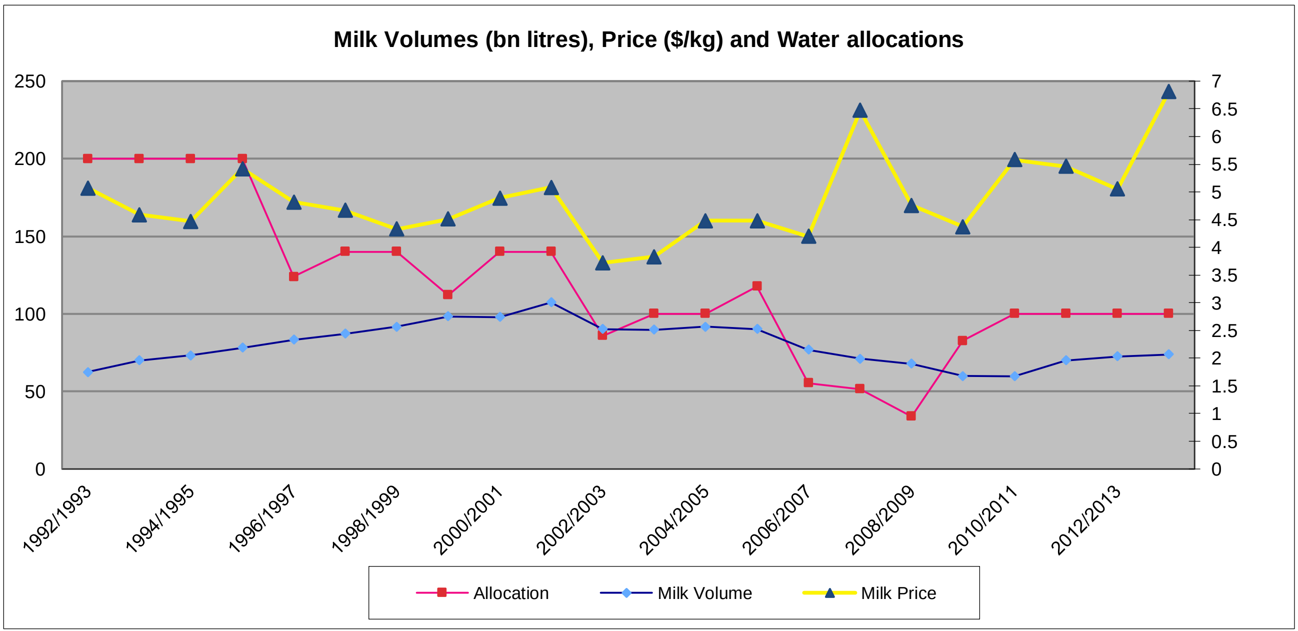
14 Appendix 4: Financial performance of GMID industries

14.1 Dairy

The dairy industry in northern Victoria has been the largest milk producing area within Australia and is the biggest water user in the GMID. All the major milk processing companies have established themselves within this region, with the majority of manufactured milk products going to export markets. The industry has an extensive service sector, and with significant processing activities occurring in the region it has been a critical component of the region's economy.

There are 1,200 dairy farms in the GMID with around 300,000 cows producing 2 billion litres of milk worth $850M/yr. Total production peaked in 01/02 at over 3 billion litres and then was adversely affected by the drought which resulted in a substantial reduction in production.

Figure 14-1: Dairy sector production: GMID 1992- 2014



Production has recovered since the worst of the drought. However, the total dairy herd in the GMID declined by 100,000 since 2005 to its current value of 300,000 cows and around 2 billion litres. Irrigated dairy production in the GMID generated a farmgate value of $850M in 2013-14, although this value was influenced by the high bulk milk price that year and it is expected to be much lower this season in response to lower international milk prices.

To cope with reduced water availability, farmers made enormous changes, integrating more flexible feeding systems with a higher reliance on annual crops and bought in fodder. However, that has come at a cost in terms of higher risk, with added complexity and increases in the cost of production compared to the past when water was lower cost and more readily available. A move into cut and carry, and feed-pads, in place of the previous sole reliance on pasture based feed has occurred. There has also been a significant move into summer crops (particularly corn). Corn grown for dairy feed (or 'chop') typically needs to be grown within 1 or 2 km of the dairy herd to retain moisture.

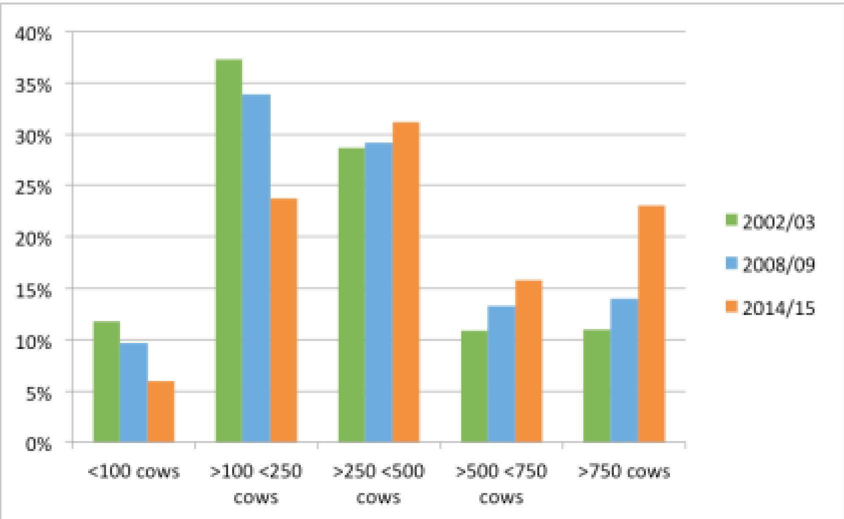
The number of dairy properties in the GMID decreased from a total of 1,955 in 2005-06 to 1,383 in 2010-11. The decrease was mainly in medium-sized properties with an EVAO[1] of between $100k and $350k. There was an increase in the number of large dairy properties with an EVAO greater than $500k.

Table 14-1: Dairy production in GMID

Date	2006	2007	2008	2009	2010	2011	2012	2013	2014
Number of cows ('000s)	393	330	258	232	195	258	298	328	300
Value of production ($M)	707	578	746	524	372	633	674	684	850

This story is apparent in the production figures (Figure 14-2). This shows that the percentage of milk produced on properties with larger herds has increased dramatically over the last ten years, while the contribution of smaller herds has declined.

Figure 14-2: Change in dairy herd size - 2002/3 to 2014/15 (% of volume produced)



Source: Dairy Australia

Dairy profitability is currently very low and likely to be negative due to the 2016 price reductions. ABARES have surveyed industry profitability in the Murray Darling Basin. (ABARES Research Report 15.13 2015). The results are shown below.

Table 14-2 Financial performance, dairy farms, Murray–Darling Basin, 2012–13 to 2014–15 (ABARES Research Report 15.13 2015)

average per farm

Dairy	Unit	2012–13	2013–14	2014–15
Farm cash income	$	180 121	296 233	197 909
Farm business profit	$	43 082	186 319	76 553
Rate of return	%	3.1	6.1	3.7

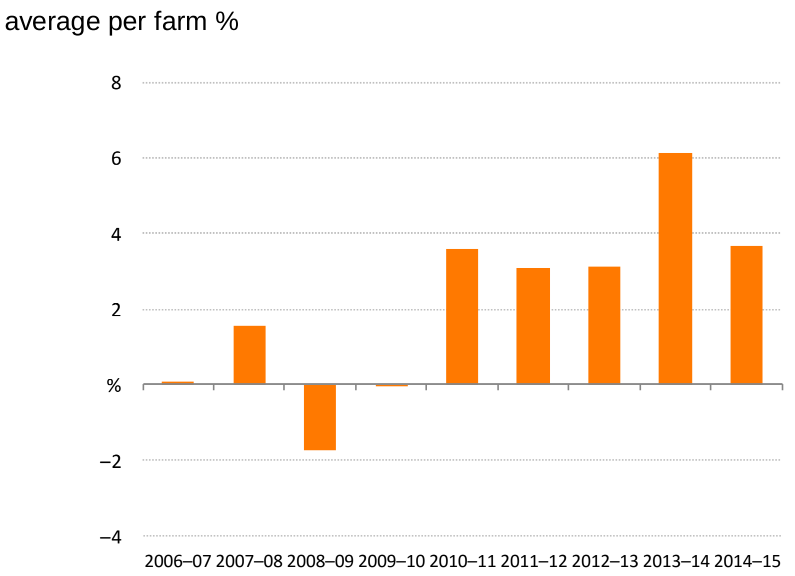
Note: 2014–15 data are provisional estimates. Rate of return excludes capital appreciation. Source: Murray–Darling Basin Irrigation Survey

[1] Estimated Value of Agricultural Operations

In 2014/15 more than 40 per cent of dairy farms recorded a positive rate of return up to 5 per cent and 30 per cent of farms recorded returns greater than 5 per cent. Around one-quarter of dairy farms recorded negative rates of return.

Rate of return is not a good indicator of an industries ability to expand as property values generally increase while an industry is profitable and the return remains the same.

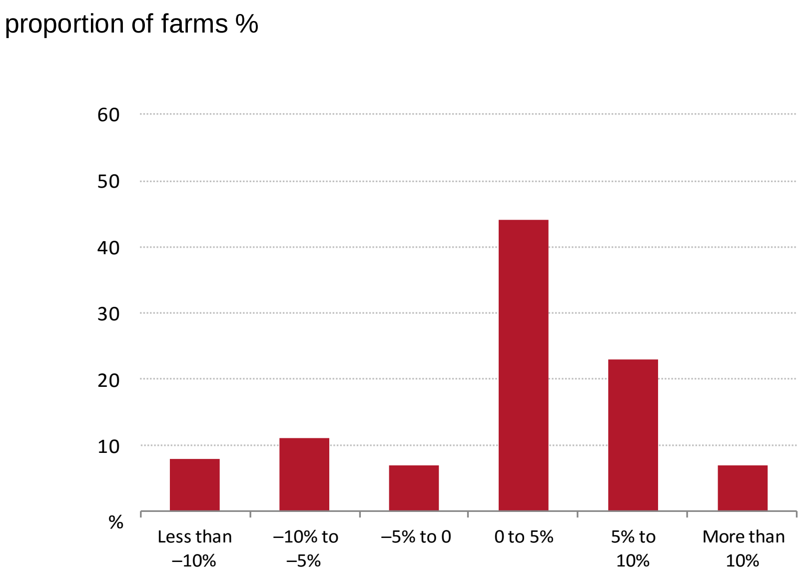
Figure 14-3 Rate of return, dairy farms, Murray–Darling Basin, 2006–07 to 2014–15 (ABARES Research Report 15.13 2015)



Note: 2014–15 data are provisional estimates. Rate of return excludes capital appreciation.

Source: Murray–Darling Basin Irrigation Survey

Figure 14-4 Distribution of dairy farms by rate of return, Murray–Darling Basin, 2014–15 (ABARES Research Report 15.13 2015)



Note: 2014–15 data are provisional estimates. Rate of return excludes capital appreciation.

Source: Murray–Darling Basin Irrigation Survey

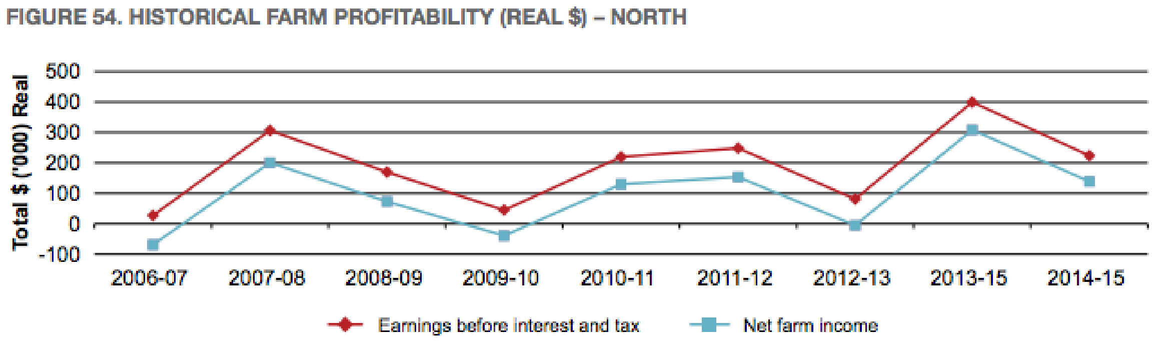
A more recent ABARES report (ABARES Research Report 16.6 2015) shows that for the average sample in the Murray Region from 2013/14 to 2015/16 (See Appendix 1).:-

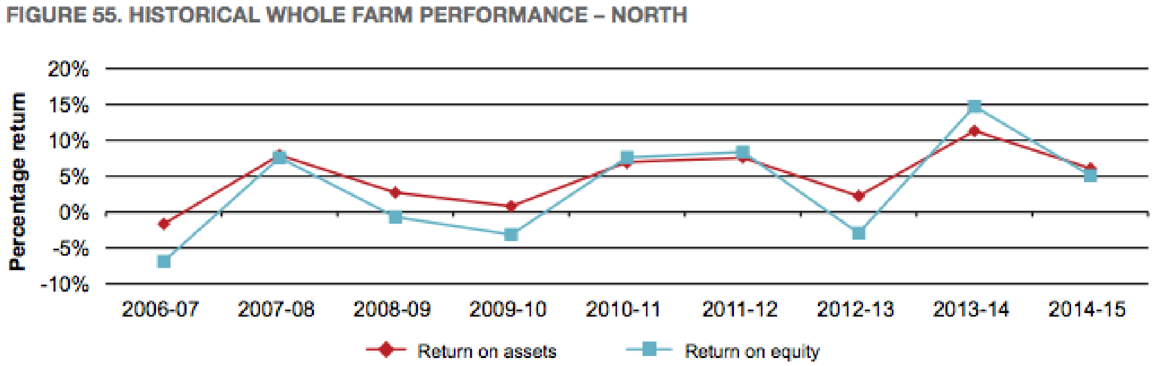
- Milk receipts have declined
- Cash costs have increased
- Farm cash income has declined
- Farm business profit became more negative

The Murray Dairy region financial performance is similar to other regions in Australia for the years of 13/14 and 14/15., which suggests that as long as its performance is similar to 13/14 and 14/15 it will remain competitive. But profitability declined relative to other areas in 15/16 when water prices were higher. This shows that dairy profitability is sensitive to water availability and price.

Dairy Australia also commission an annual Dairy Farm Monitor Project (Dairy Australia / DEDJTR 2015). This report shows a similar story of profitability. Again 2015/16 and 2016/17 data is expected to show substantially lower (negative) performance.

Figure 14-5 Dairy Farm Monitor Project change in profitability





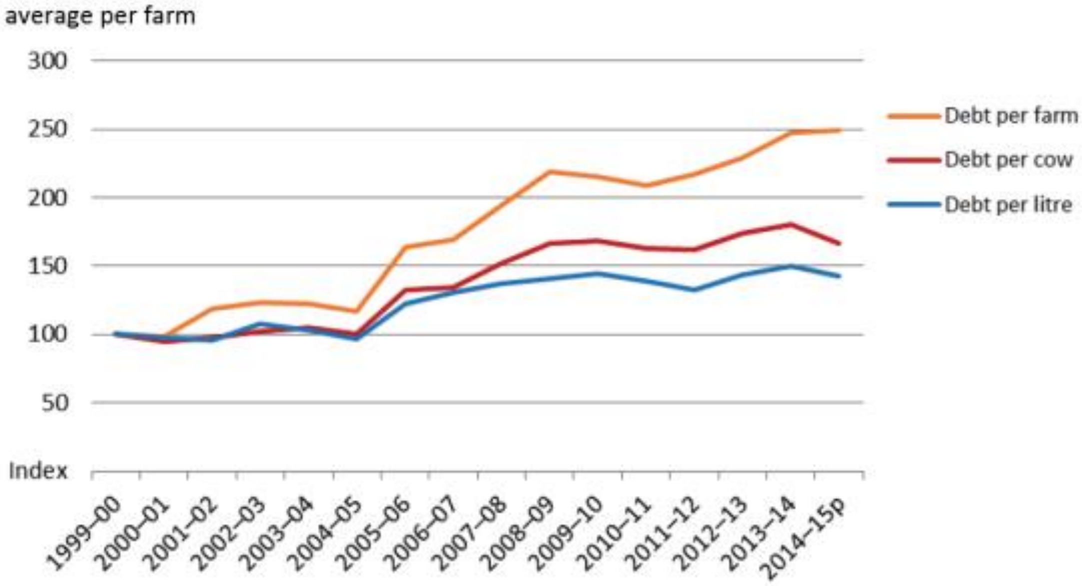
Low profitability is expected to result in industry contraction in the short term. However, the long term prospects are positive. This is discussed in section 4.4.2.

Improving farm productivity will be a critical component in reducing the impact of future reduced water availability. The focus will need to be on improved water use efficiency so that farms can produce more from less. This will also need to be achieved with a milk price that is driven by the export market.

There is a significant challenge for the region's dairy farmers to increase productivity and remain globally competitive in a future with less water. Implementing improved irrigation technologies and develop the flexibility required in farming systems will be important for the industry to adapt and retain competitiveness with other industries in the sMDB.

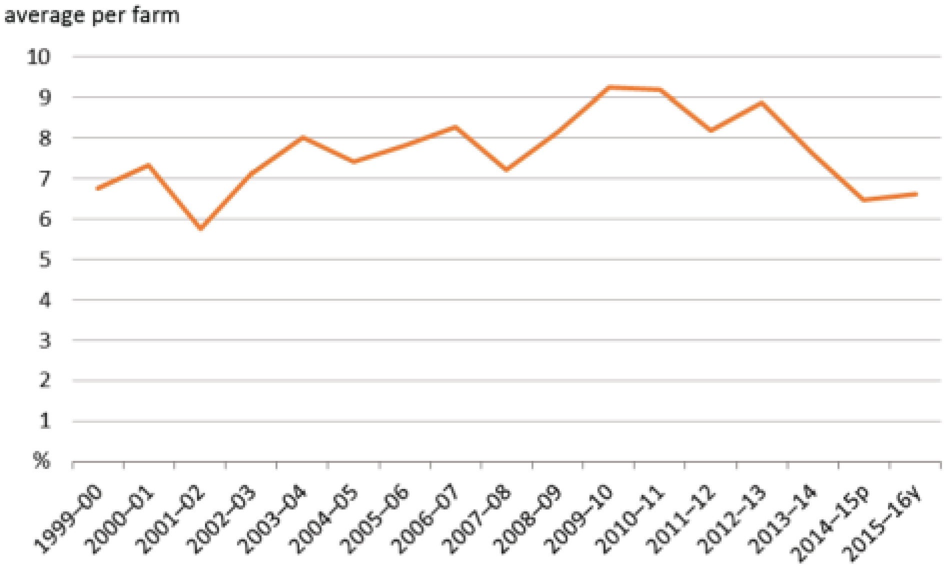
Figure 14-6 National dairy farm debt levels have increased but low interest rates mean % of interest paid has declined (ABARES Research report 16.6 2016)

Figure 13 Total farm debt, Australian dairy farms, 1999–2000 to 2014–15



p Preliminary estimate. y Provisional estimate.
Source: ABARES Australian Dairy Industry Survey

Figure 14 Ratio of interest paid to total cash receipts, Australian dairy farms, 1999–2000 to 2015–16



p Preliminary estimate. y Provisional estimate.
Source: ABARES Australian Dairy Industry Survey

Dairy ABARES Survey results

Source (ABARES Research Report 16.6 2015, ABARES Research report 15.22 2015, ABARES Research report 15.22 2015)

Table A1 Selected estimates, dairy farms, Murray region

average per farm

Physical indicators	**Unit**	**2013–14**	**2014–15p**		**2015–16y**
Area of land operated at 30 June	ha	288	322	(13)	319
Dairy herd at 30 June	no.	356	381	(6)	410
Cows milked for at least 3 months	no.	208	225	(5)	243
Milk production	L	1 327 170	1 388 778	(6)	1 347 935
Milk production per cow	L	6 388	6 186	(4)	5 546
Cash receipts					
Total milk receipts	$	675 710	669 500	(5)	634 000
Dairy cattle sales	$	42 870	56 400	(13)	56 000
Beef cattle sales	$	11 140	7 100	(52)	9 000
Crop receipts	$	2 130	2300	(106)	0
Total cash receipts	$	757 840	766 000	(6)	719 000
Cash costs					
Dairy cattle purchases	$	11 750	3 500	(39)	2 000
Hired labour	$	34 690	32 300	(16)	43 000
Fertiliser	$	28 660	22 800	(17)	20 000
Fodder	$	173 210	187 200	(7)	212 000
Fuel, oil and lubricants	$	21 930	19 300	(12)	20 000
Electricity	$	17 880	18 100	(12)	19 000
Repairs and maintenance	$	35 270	42 300	(13)	38 000
Interest payments	$	43 300	38 600	(13)	41 000
Total cash costs	$	571 890	608 100	(7)	637 000
Financial performance					
Farm cash income	$	185 950	157 900	(23)	82 000
plus build-up in trading stocks	$	–730	15 400	(63)	7 000
less depreciation	$	40 150	44 700	(10)	47 000
less owner–manager and family labour	$	70 990	72 100	(10)	75 000
Farm business profit **a**	$	74 070	56 400	(60)	–33 000
Rate of return **b**					
– excluding capital appreciation	%	4.8	3.2	(36)	0.4
– including capital appreciation	%	7.1	9.9	(20)	na
Farm debt at 30 June **c**	$	674 200	666 700	(13)	780 000
Equity ratio at 30 June **cd**	%	75	80	(4)	na

a Defined **as farm cash income plus build-up in trading stocks, less depreciation and the imputed value of owner–manager, partner(s) and family labour. b** Rate of return to farm capital at 1 July. **Calculated by expressing profit at full equity as a percentage of total opening capital. c Average per responding farm. d Equity expressed as a percentage of farm capital. p** Preliminary estimate. **y** Provisional estimate. **na** Not available.
Note: Figures in parentheses are standard errors expressed as a percentage of the estimate.
Source: ABARES Australian Dairy Industry Survey

Table Key financial performance, Australian dairy farms, by region

average per farm

Farm cash income	Units	2013–14	2014–15p		2015–16y
Subtropical	$	67 210	89 900	(20)	87 000
Murray	$	185 950	157 900	(23)	82 000
Tasmania	$	238 130	221 800	(10)	123 000
Western Australia	$	161 260	234 900	(10)	259 000
South Australia	$	162 980	133 500	(26)	79 000
Gippsland	$	166 500	101 200	(27)	75 000
Western Victoria	$	168 620	204 700	(26)	109 000
New South Wales	$	123 790	208 000	(13)	187 000
Australia	$	163 280	156 300	(4)	101 000
Farm business profit a					
Subtropical	$	–25 300	–8 900	(210)	–36 000
Murray	$	74 070	56 400	(60)	–33 000
Tasmania	$	123 100	112 700	(24)	–14 000
Western Australia	$	70 910	149 400	(20)	107 000
South Australia	$	62 910	–9 000	(410)	–50 000
Gippsland	$	68 920	18 700	(120)	24 000
Western Victoria	$	87 480	134 500	(30)	–3 000
New South Wales	$	15 150	105 300	(26)	60 000
Australia	$	64 330	64 400	(21)	–14 000
Rate of return (excluding capital appreciation) b					
Subtropical	%	0.6	1.2	(38)	0.3
Murray	%	4.8	3.2	(36)	0.4
Tasmania	%	4.7	4.1	(14)	2.0
Western Australia	%	2.1	2.7	(15)	2.2
South Australia	%	3.7	1.7	(47)	0.6
Gippsland	%	3.8	2.3	(23)	1.0
Western Victoria	%	4.2	4.8	(22)	1.4
New South Wales	%	1.9	3.6	(15)	2.5
Australia	%	3.6	3.2	(11)	1.2

a Defined as farm cash income plus build-up in trading stocks, less depreciation and the imputed value of owner–manager, partner(s) and family labour. b Rate of return to farm capital at 1 July. Calculated by expressing profit at full equity as a percentage of total opening capital. p Preliminary estimate. **y** Provisional estimate.
Note: Figures in parentheses are standard errors expressed as a percentage of the estimate.
Source: ABARES Australian Dairy Industry Survey

14.2 Horticulture

Irrigated horticulture in the GMID covers a wide range of crops, both fruit and vegetables, involving both permanent tree crops and annual plantings of vegetables. The sector is dominated by four major industries (Table 2-1).

Table 14-3: Primary irrigated horticultural crops in the GMID 2011

Sector	Value ($'000)
Pome (apples and pears)	373,338
Olives	123,787
Stone fruit (nectarines and peaches)	117,128
Tomatoes (processing)	45,633

Source: ABS and Neil Clark and Associates

Perennial horticulture

Perennial horticulture is centred in the Goulburn Valley due to the combination of suitable climate, soil types and a reliable water supply. Perennial horticulture is capital intensive to establish ($25,000/ha to $50,000/ha) and has a long lead-time from establishment to full production (three to seven years).

Crops are generally high value when not in over-supply. Profitability is highly variable across perennial horticultural crops and is related to international competition and the relative value of the Australian dollar.

Annual horticulture

The major annual horticultural crop grown traditionally in the region is tomatoes, both fresh and processed. The processing industry is dependent on global markets and the relative value of the Australian dollar. There are processing plants located in Echuca and Shepparton.

The region has the potential to grow a range of other annual horticultural crops including vegetables. It has appropriate soils, water and infrastructure capacity, but currently this sector, especially vegetables, is facing extreme pressure from overseas imports due to the high Australian dollar. This is likely to continue as this sector has low entry costs relative to other forms of horticulture and the sector always has been very competitive.

The period from 2001 to 2011 has seen notable changes in irrigated fruit production across the Goulburn Valley:

- A reduction in the total number of properties
- A reduction in the overall volume of production (kg)
- A remarkable increase in the value of production ($M in 2011 values) as people have moved to fresh fruit from canning production.

Table 14-4: Fruit production Goulburn Valley

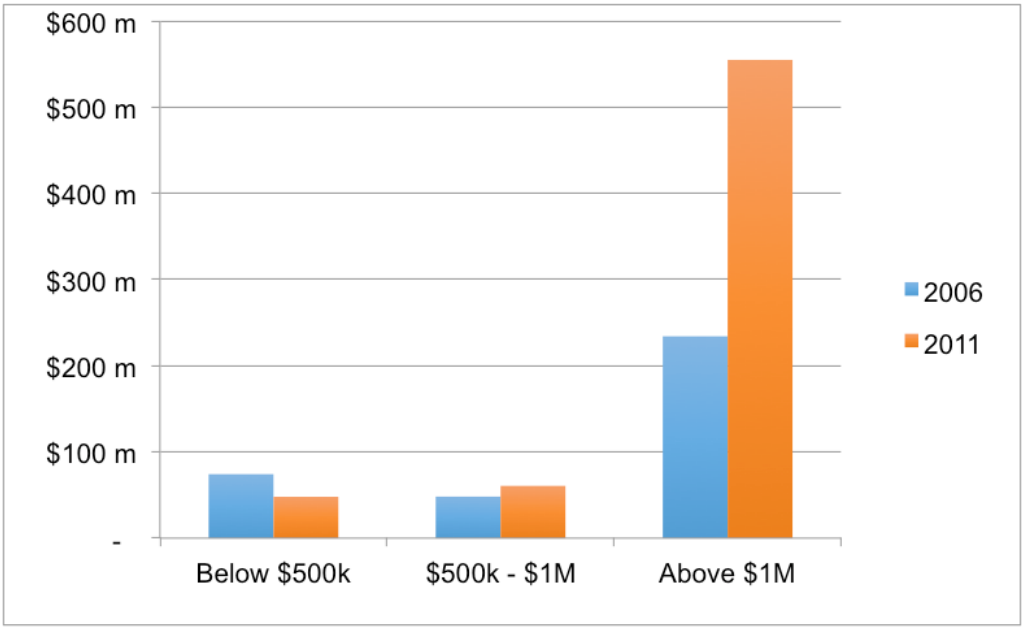
Year	2001	2006	2011
Production (kg)	273	269	254
Value (2011 $M)	269	308	441
Producers (#)	1,112	1,110	806

The period from 2001 to 2011 saw a consolidation in the fruit growing sector in the Goulburn Valley:

- Total fruit production volumes declined by 7%, but the nominal value increased by 64% in real terms
- There was a reduction in the total number of properties by 28%, but an increase in the number of much larger properties
- There was an increase in the total area under production by 26% and an increase in the intensity of production with a tighter spacing/density of planting
- Processing of products declined significantly, in the case of peaches by 53% and for pears by 65%, but there was an offsetting marked movement towards production of fresh fruit and innovative processed products.

The change in property scale is particularly noticeable when presented as the relative value of production by size category, where the total value of production of the property category 'Above 1 million" doubled in size from $234M in 2006 to $555M in 2011.

Figure 14-7: Size distribution of horticultural production - total value by category



ABARES reported on the profitability of citrus, pome fruit and stone fruit growing farms in the southern Murray-Darling Basin. (ABARES Research report 16.4 2016). Most of the pome fruit in the sMDB is grown in the Goulburn Valley.

In 2014-15 the average rate of return (excluding capital appreciation) was 0.7 per cent for pome and stone fruit growers. This averages canning and fresh fruit varieties and the performance of fresh fruit would be significantly higher.

The horticultural returns at $4,700 GVIAP/ML are higher than the average for the sMDB at $2,900/ML. This is largely due to different crops and lower water requirements of those crops.

Dealing with low water availability

Horticulture businesses in the region have dealt with low water allocations over the past decade.

Water is an essential component of horticulture production and good irrigation practices are critical for both quantity and quality management. Unlike dairy, there is no substitute for water for horticulture, and therefore it needs to purchase water to sustain production.

Many growers were highly exposed to the extremely high temporary water prices experienced during the drought. SPC assisted farmers during the low allocation seasons through purchasing temporary water to help growers maintain plantings. The tomato processing industry declined from 320,000 tonnes in 2005 to 151,000 tonnes in 2008 as a direct result of reduced water availability, as growers were unwilling to make the high-cost investment to plant without security of water access.

Growers have learnt to adapt to low water availability, with significant changes to their farming systems. Strategies have included:

- more precise irrigation scheduling using soil moisture monitoring and weather based mechanisms;
- focusing only on highly productive areas with early removal of non-profitable blocks;
- irrigation of reduced area with replanting of older varieties;
- more precise use of other inputs (e.g. chemicals and fertilisers);
- move to more intensive production systems; and
- purchase of temporary and permanent water allocations.

Horticulture producers continually are striving for increased productivity to maintain their global competitiveness. There are many factors impacting on the viability of horticulture industries including production costs, the value of the Australian dollar and competition. Reduced water availability and consequent increased water costs will influence the profitability of horticulture producers. However, that is not likely to be the dominating factor in determining longer-term sustainability of horticulture industries.

14.3 Mixed farms

Irrigated mixed farming is broadly defined as farms that are involved in irrigated cropping activities and/or the raising of livestock (beef and sheep). The sector spans a spectrum ranging from farms that are 100% cropping (e.g. canola and grains) to farms that are 100% livestock, and all combinations in between. Crops include winter cereals such as wheat, barley and triticale, and oilseeds (canola, sunflower and safflower). The latter have been an important part the Murray Valley, feeding GrainCorp's oilseed plant at Numurkah.

Historically, mixed farming has been the second biggest user of water behind dairy in the Goulburn Murray Irrigation District (GMID). It has also been a significant support industry to dairy, providing both fodder and agistment options for dry and replacement stock.

Significant pressure on water availability will challenge these sectors - unless yields and water-use efficiency continue to improve. The sector is seeing a move into a smaller number of larger, more productive enterprises, concentrating on higher yields with associated increased water-use (up to

8ML/ha). It is also integrating irrigated and dryland production systems into single farms to achieve economies of scale. These producers supply products directly into the local dairy sector and into export markets. At the other end of the spectrum, there are an increasing number of smaller properties which are struggling to compete and are likely to move out of irrigated production.

Traditionally there was an assumption that irrigated cropping farmers could maintain a successful farm business – simply by supplying grain to intensive livestock operations and as supplementary feed to dairy farmers. Given the pressure on water availability, irrigated cropping farmers within the GMID will only compete with dairy-industry demand for irrigation water if they can grow high yielding irrigated crops. Equally, a traditional view was that irrigated mixed farms were protected from droughts when dry-land cropping areas suffered reduced yields. However, if drier seasons lead to temporary water prices above $150/ML it is unlikely the increased cropping yield will warrant irrigation of wheat and barley crops.

Mixed farms are looking for scale in paddock size so that they can compete with dryland operations and use the same machinery as dryland farms. They use irrigation strategically to supplement winter rain fed crops. The water market influences summer cropping decisions and irrigation use. These operations are trending to 1,000 ha plus. Increasing competition for water resources, and increasing costs, put pressure on the viability of mixed farming operations even before the onset of reduced water availability. Mixed farming operations have been more opportunistic in their use of water and have been net sellers of water during low allocations years. There are always exceptions, with some mixed farmers actually growing, but the overall trend has been a decline in water use by the mixed farming operations.

As there is limited post-farm processing in the region, the majority of mixed farming value-adding occurs outside of the region, a potential decline in the mixed farming industry would translate to a lesser economic impact to the region, compared with dairy or horticulture which have significant local processing infrastructure.

A key challenge for mixed farms will be the affordability of an irrigation supply whilst being only an opportunistic user. With reduced irrigation, the income-generating capacity of land declines and this generates pressure to increase in scale in order to remain viable. An expanding mixed farming operation will have to fund the rationalisation of unused farm infrastructure, which can limit the financial and logistical feasibility of expansion.

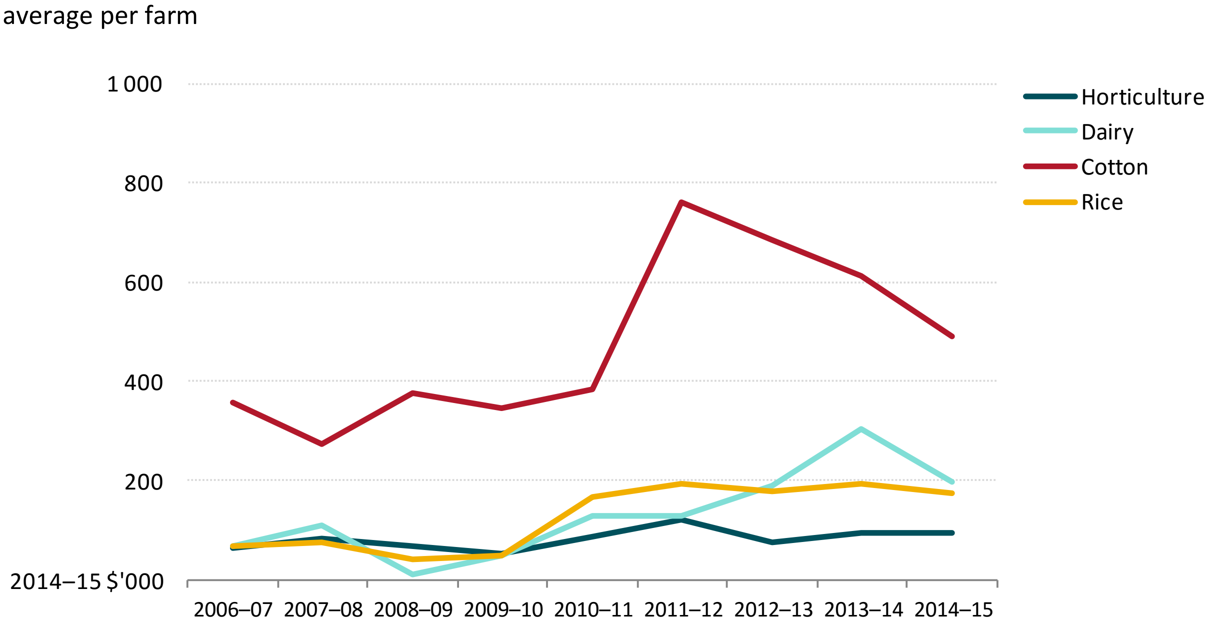
These issues are less in NSW where there are larger farms. If there were to be expansion in the mixed farming and irrigated cropping sector, the GMID is less well placed than the irrigated cropping areas of NSW.

15 Appendix 5 - Industries outside of the GMID that compete for sMDB water

15.1 Overview

(ABARES Research Report 15.13 2015) survey of irrigated agriculture reported increasing farm cash income (cash receipts less cash costs) after the drought as per the figure below.

Figure 15-1 Farm cash income, by industry, 2006–07 to 2014–15 (ABARES Research Report 15.13 2015)



Note: 2014–15 data are provisional estimates.
Source: Murray–Darling Basin Irrigation Survey

The average rate of return to capital over the period (2006–07 to 2014–15) was horticulture farms 1.8 per cent, dairy farms 2.2 per cent, rice farms 1.5 per cent and cotton farms 4.9 per cent.

The return on capital varies enormously depending on the seasonal commodity price. (ABARES Research Report 15.13 2015, ABARES Research Report 15.13 2015) report:-

- Cotton prices almost doubled in 2010–11 and then lost most of this gain the following year.
- Rice prices rose sharply in 2008–09, declined in the following two years and then rose by 25 per cent in both 2013–14 and 2014–15.
- Lamb prices increased for four consecutive years from 2006–07 onwards, fell significantly in 2012–13 and then increased again the following year.
- Farmgate milk prices fluctuate with world prices, rising in 2007–08, 2010–11 and 2013–14 but falling in all other years. Milk prices rose by 27 per cent in 2013–14 before falling by an estimated 14 per cent in 2014–15. And further again in 2016/17
- Wine grape prices declined by around 50 per cent from 2006–07 to 2009–10 with little recovery since then.

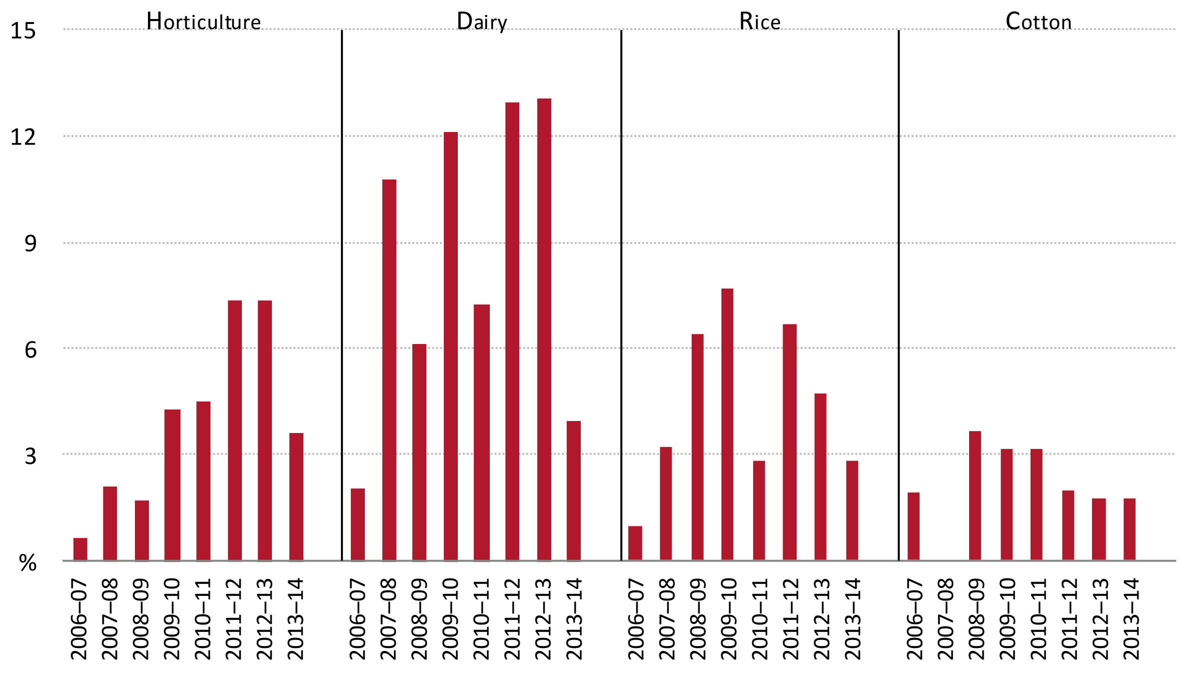
- Average vegetable prices fell by 6 per cent in 2013–14 before rising by around 2 per cent in 2014–15. Prices for individual vegetables may have fluctuated more than the vegetable price index.

The use of historic return on capital as a guide to predict future growth or retraction of an industry is not reliable as there is usually more variability within an industry than between industries. Also property values can rise with improved profitability, which means that the return on capital remains the same.

For example, the average return on capital reported by ABARES for horticulture is low, but this industry has experienced the most growth in water use in recent years. This is because some sectors, especially nuts, have been highly profitable and are seen by investors to have good long term prospects. While the average producer may be small in scale and producing another crop with a low return on capital.

Up until 2012/13 many irrigators were selling permanent entitlement, especially in the dairy industry. As a result they have become more reliant on the temporary water market. This is illustrated in the chart below.

Figure 15-2 Proportion of farms selling permanent water entitlements, Murray–Darling Basin, 2006–07 to 2013–14 (ABARES Research Report 15.13 2015)



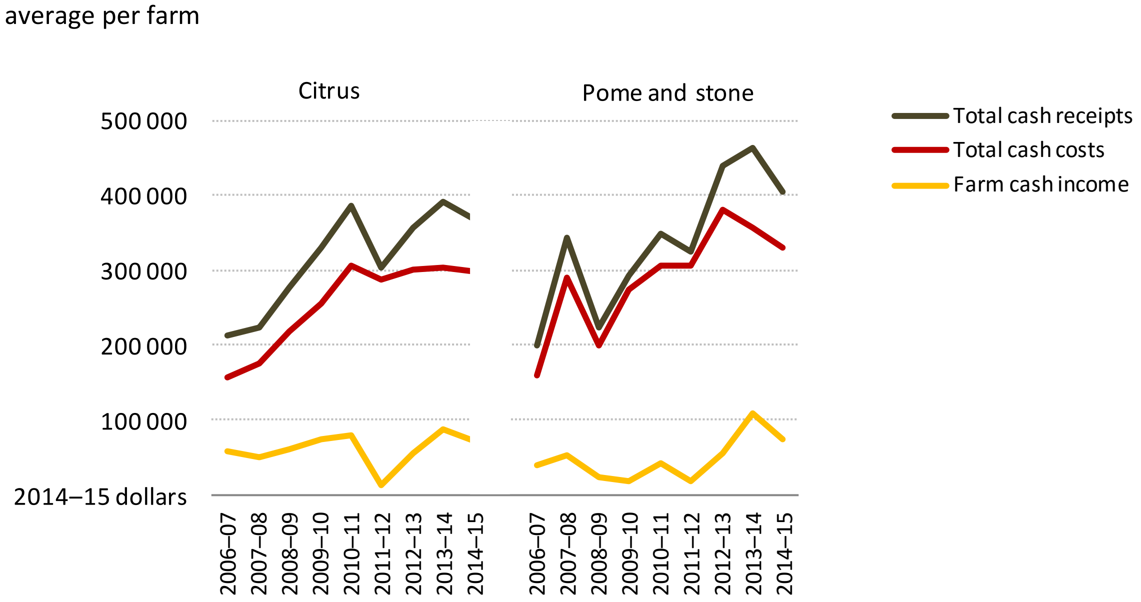
Note: Water trade data not available for 2014–15.
Source: Murray–Darling Basin Irrigation Survey

15.2 Horticulture

Average farm cash income of irrigated horticulture is estimated to have been similar in 2014/15 to 2013/14 as lower receipts for apples, pears, stone fruit, wine grapes and vegetables were offset by increased receipts for citrus and nut crops. (ABARES Research report 16.4 2016).

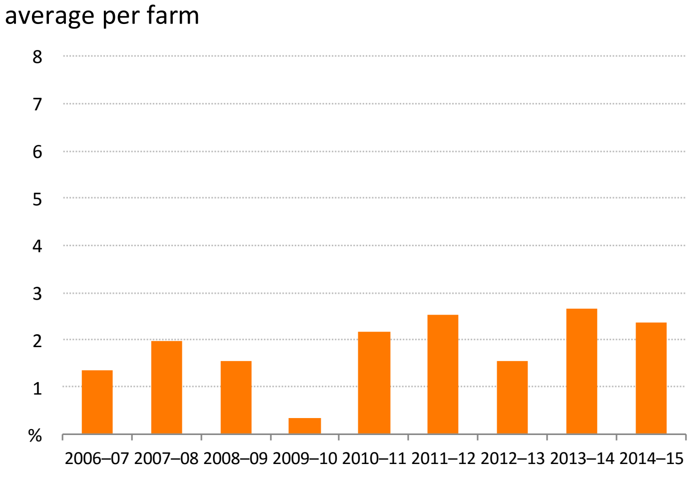
The change in farm cash income for citrus and stone/pome fruit growers is illustrated below.

Figure 15-3 Farm cash income horticulture, Murray–Darling Basin, 2006–07 to 2014–15 (ABARES Research report 16.4 2016)



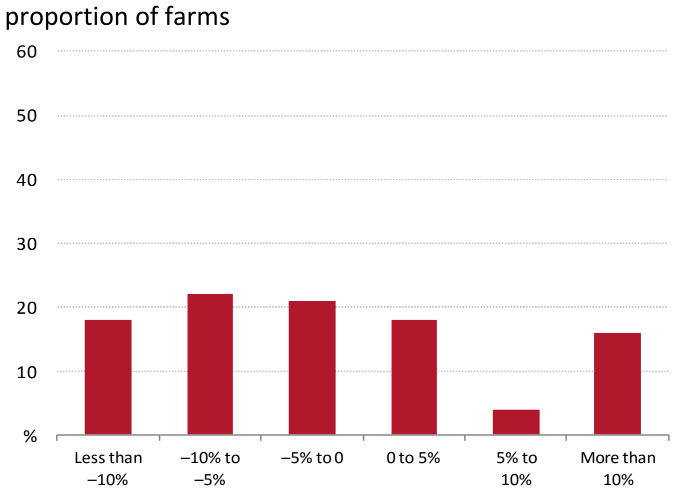
The average rate of return (excluding capital appreciation) for irrigated horticulture farms increased to 2.7 per cent in 2013–14, before declining slightly to 2.4 per cent in 2014–15; the average rate of return (excluding capital appreciation) from 2006–07 to 2014–15 was 1.8 per cent. Most of the farms with low rates of return grew crops with falling prices, such as wine grapes, while those with high rates of return grew crops with rising prices such as nuts.

Figure 15-4 Rate of return, horticulture farms, Murray–Darling Basin, 2006–07 to 2014–15 (ABARES Research report 16.4 2016)



Note: 2014–15 data are provisional estimates. Rate of return excludes capital appreciation.
Source: Murray–Darling Basin Irrigation Survey

Figure 15-5 Distribution of horticulture farms by rate of return, Murray–Darling Basin, 2014–15 (ABARES Research report 16.4 2016)



Note: 2014–15 data are provisional estimates. Rate of return excludes capital appreciation.
Source: Murray–Darling Basin Irrigation Survey

Future plantings of horticulture

In terms of horticulture outside of the GMID: -

- Almond prices, which were around $5/Kg five years ago and they peaked at $13/Kg last year and in 2016 fell to around $8/Kg. At this price the industry is still growing rapidly.
- Table grape prices have been attractive and the industry has been expanding
- Dried fruit has tended to be stable, but is a much smaller industry than twenty-five years ago
- Citrus has been a stable industry, although recent export growth to China is prompting some new development and growth.

- There are areas of dried off land not in production, in the older irrigation districts on smaller land parcels. These areas may come into production as table grapes expands or if there is an improvement in dried vine fruits or vegetable prices.

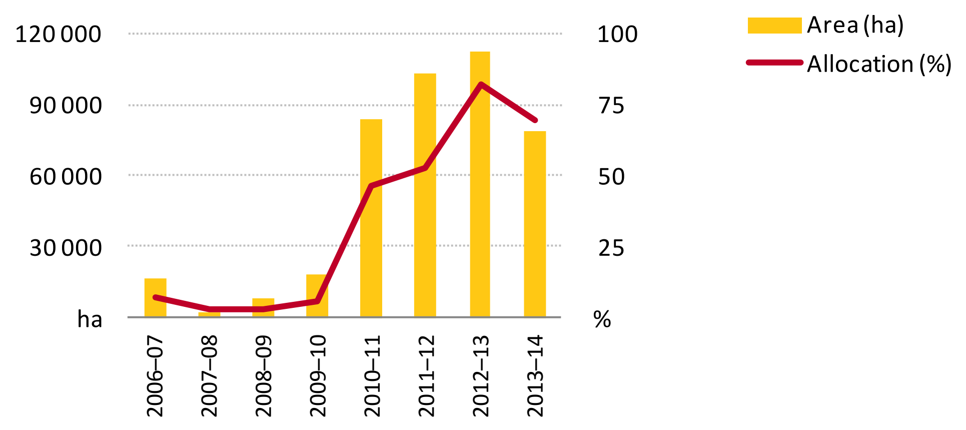
Discussions with industry sources indicate that there is around 250 to 350 GL of additional new demand (once crops are mature) in the Mallee region of Victoria, NSW and SA. This is mostly in almond crops but also includes citrus, pistachios and other crops. Much of this has recently been planted or is close to approval. Over 200 GL of this is in Victoria.

This new development is being driven by growing global demand for nut crops and a more attractive exchange rate for the Australian dollar than has been the case in recent years. Therefore, horticultural water use in the sMDB is expected to continue to grow from around 1,100 GL to 1,400 GL/y.

15.3 Rice

Rice farms tend to be diverse operations with income sourced from a variety of crop and livestock activities. But ultimately the financial performance of rice farms depends on water availability. Rice production (ABARES report 16.2 2016) increased upwards from the early 1970s until the early 2000s. Low water availability dramatically depressed plantings between 2002–03 and 2009–10.

Figure 15-6 Rice area and prices 2006–07 to 2013–14 with NSW General security allocation (ABARES report 16.2 2016)



Notes: Allocations do not include carry-over water.
Sources: Rice Marketing Board New South Wales; NSW Department of Primary Industries; ABARES estimates

Table 15-1 Financial performance, rice growing farms, Murray–Darling Basin, 2012–13 to 2014–15

average per farm

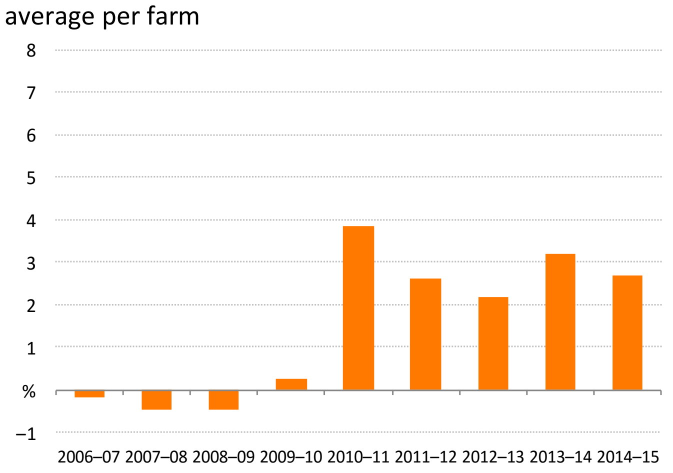
Rice	Unit	2012–13	2013–14	2014–15
Farm cash income	$	169 722	187 026	173 933
Farm business profit	$	27 982	80 361	58 405
Rate of return	%	2.2	3.2	2.7

Note: 2014–15 data are provisional estimates. Rate of return excludes capital appreciation.
Source: Murray–Darling Basin Irrigation Survey

The average rate of return (excluding capital appreciation) of rice growers was estimated to have been 3.2 per cent in 2013–14 and 2.7 per cent in 2014–15, compared with an average of 2.2 per cent in 2012–13 (**Figure 15-7**). In comparison, the average rate of return over the entire period of the survey—from 2006–07 to 2014–15—for these farms was around 1.5 per cent.

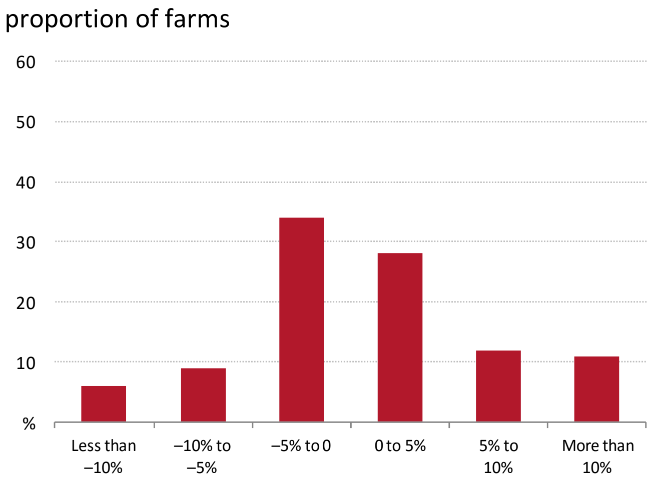
Rates of return during the drought period were negative. But over the longer period around half of rice farms recorded positive rates of return and half negative rates of return. A majority of farms recorded returns between –5 per cent and 5 per cent.

Figure 15-7 Rate of return, rice growing farms, Murray–Darling Basin, 2006–07 to 2014–15 (ABARES Research report 16.4 2016)



Note: 2014–15 data are provisional estimates. Rate of return excludes capital appreciation.
Source: Murray–Darling Basin Irrigation Survey

Figure 15-8 Distribution of rice growing farms by rate of return, Murray–Darling Basin, 2014–15 (ABARES Research report 16.4 2016)



Note: 2014–15 data are provisional estimates. Rate of return excludes capital appreciation.
Source: Murray–Darling Basin Irrigation Survey

Rice water use is expected to continue to decline from around 1,150 GL/y in recent years to around 900 GL/y in a typical sMDB allocation of 4,500 GL year. But this will vary from 200 GL/y in low allocation years to more than 1,300 GL/y in high allocation years.

15.4 Cotton

Most of the cotton-growing farms are in the northern Basin, although cotton production is now expanding in the Murrumbidgee and Murray parts of the sMDB.

The (ABARES Research report 16.3 2016) irrigation survey includes broadacre cotton farms; as per rice some of these farms did not grow irrigated cotton in the drought years, particularly 2006–07 to 2008–09.

Table 15-2 Financial performance, cotton growing farms, Murray–Darling Basin, 2012–13 to 2014–15

average per farm

Cotton	Unit	2012–13	2013–14	2014–15
Farm cash income	$	650 936	597 125	489 689
Farm business profit	$	487 429	441 541	332 494
Rate of return	%	6.8	5.7	4.9

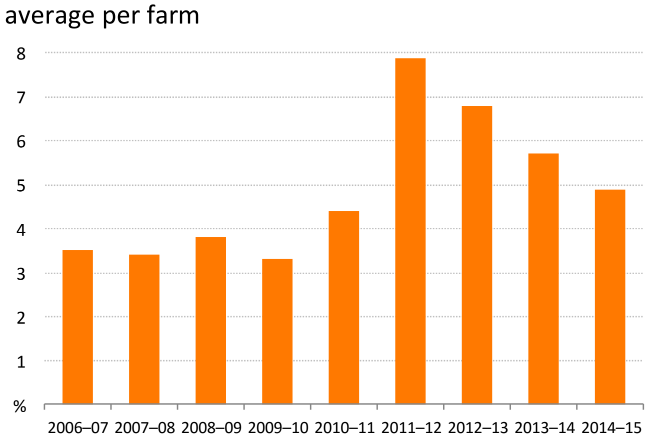
Note: 2014–15 data are provisional estimates. Rate of return excludes capital appreciation.
Source: Murray–Darling Basin Irrigation Survey

Cotton growers' incomes fell in 2013–14 and again in 2014–15. In 2013–14 an increase in total cash receipts was more than offset by higher total cash costs, resulting in an 8 per cent decline in farm cash income. In 2014–15 total cash receipts fell by around 8 per cent as lower receipts from cotton were partly offset by higher receipts from sorghum. Total cash costs fell by around 4 per cent resulting in an 18 per cent reduction in farm cash income in 2014–15.

The average rate of return (excluding capital appreciation) for cotton growers was estimated to have been 5.7 per cent in 2013–14 and 4.9 per cent in 2014–15, compared with an average of 6.8 per cent in 2012–13. In comparison, the average rate of return over the entire period of the survey—from 2006–07 to 2014–15—for cotton growing farms was around 4.9 per cent (Figure 15-9).

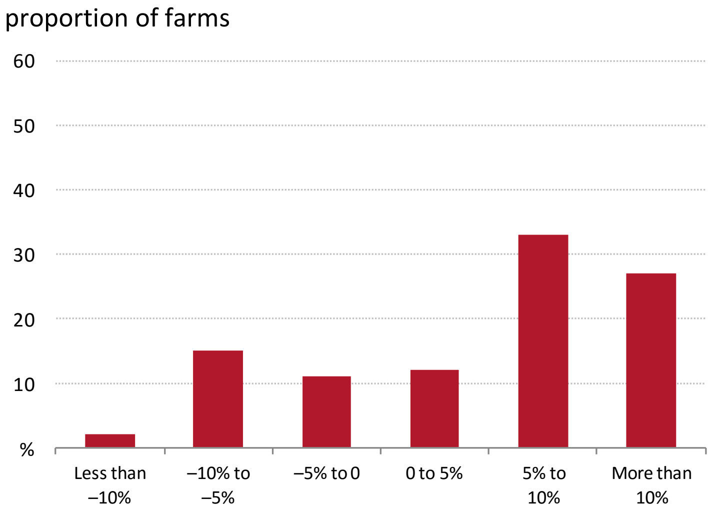
Despite the declines in farm financial performance in the latter years, the proportion of farms with positive rates of return was 72 per cent. Around 60 per cent of cotton growers recorded rates of return greater than 5 per cent.

Figure 15-9 Rate of return, cotton growing farms, Murray–Darling Basin, 2006–07 to 2014–15



Note: 2014–15 data are provisional estimates. Rate of return excludes capital appreciation.
Source: Murray–Darling Basin Irrigation Survey

Figure 15-10 Distribution of cotton growing farms by rate of return, Murray–Darling Basin, 2014–15



Note: 2014–15 data are provisional estimates. Rate of return excludes capital appreciation.
Source: Murray–Darling Basin Irrigation Survey

There is less water trading in the northern Murray Darling Basin, where most of the cotton is grown, than in the southern connected Basin. This is because of the reduced connectivity of the northern systems. However, water trading has assisted the expansion of cotton growing into the Murrumbidgee and Murray regions in recent years. Cotton in the sMDB has expanded from a low base and used around 320 GL in 2014/15. Rice and cotton together are expected to maintain a similar water use but in the future cotton may continue to expand at the expense of rice.

16 Appendix 6 GMID crop water requirements versus other areas in sMDB

Figure 16-1 Annual point potential ET

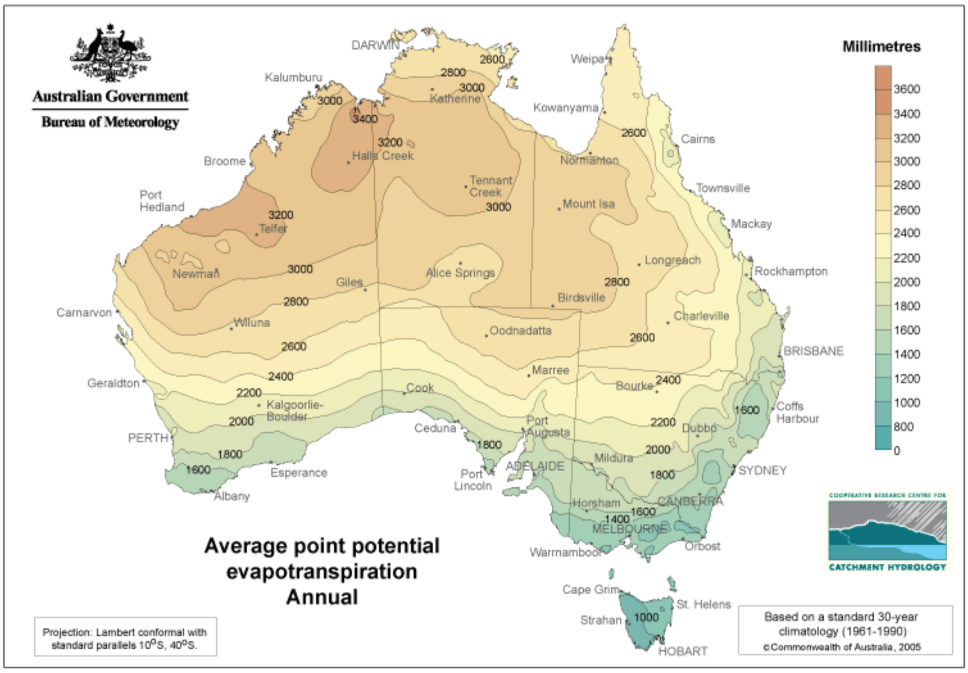
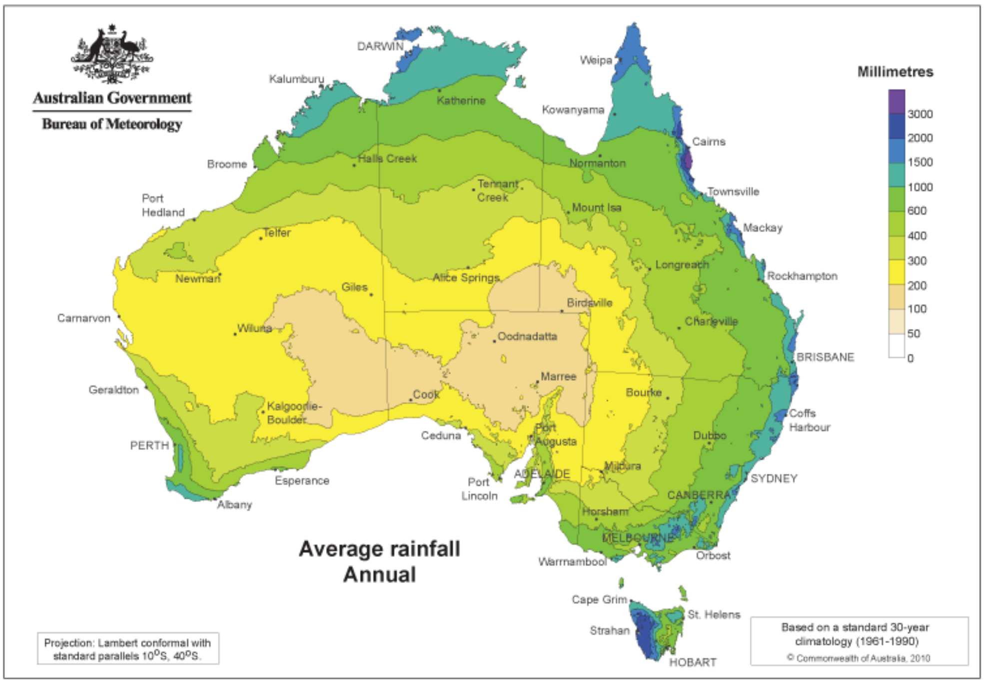


Figure 16-2 Annual rainfall



Note: GMID ET values are 200-400 mm lower than other parts of the sMDB and GMID average annual rainfall is also 100 to 200 mm higher. **This means irrigation crop requirements are typically 2 ML/ha lower in the GMID. However, the rainfall risk for harvest periods is higher.**

17 Appendix 7 Structure of GMW water charges

The examples below show how the cost per ML can vary for a hypothetical property with 1 DS and 1 outlet within Central Goulburn using the GMW pricing simulator. The base case assumes no water trade since unbundling when 100 ML of water right was converted to 100 ML HRWS and 48 ML LRWS (low reliability water shares).

Figure 17-1 Base case - 100 ML usage, 100 ML HRWS , 48 ML LRWS and 1 DS

Irrigation Area - Fixed Charges

2016/17 Charge Details

Storage	2015/16	2016/17	Change (%)
Entitlement Storage Fee 100 ML Goulburn High Reliability @ $10.70 /ML	$1,057.00	$1,070.00	1.23%
Entitlement Storage Fee 48 ML Goulburn Low Reliability @ $5.24 /ML	$248.64	$251.52	1.16%

Delivery	2015/16	2016/17	Change (%)
Service Fee $110.00	$100.00	$110.00	10%
Infrastructure Access Fee 1 ML/day Delivery Share @ $2,896.00 /ML/day	$3,290.00	$2,896.00	-11.98%
Domestic and Stock Service Point Fee 1 @ $90.00 each	$80.00	$90.00	12.5%
Service Point - Remote Operate Fee 1 @ $575.00 each	$400.00	$575.00	43.75%

Surface Drainage	2015/16	2016/17	Change (%)
Service Fee $110.00	$100.00	$110.00	10%
Area Fee 30 HA @ 80% of @ $6.83 /HA	$147.12	$163.92	11.42%
Total	$5,422.75	$5,266.40	-2.88%

About the Changes

This year your account has changed by -$156.35

	2015/16	2016/17	Change (%)
Total Fixed Charges:	$5,422.75	$5,266.40	-2.88%
Total Variable Charges:	$0.00	$0.00	0%
Total Account:	$5,422.75	$5,266.40	-2.88%

Irrigation Area - Variable Charges

2016/17 Charge Details

Irrigation	2015/16	2016/17	% Change
Infrastructure Use Fee 100 ML @ $5.93 /ML	$650.00	$593.00	-8.77%

Surface Drainage	2015/16	2016/17	% Change
Water Use Fee 100 ML @ 80% of $2.93	$241.60	$234.40	-2.98%
Total:	$891.60	$827.40	-7.2%

About the Changes

This year your account has changed by -$220.55

	2015/16	2016/17	Change (%)
Total Fixed Charges:	$5,422.75	$5,266.40	-2.88%
Total Variable Charges:	$891.60	$827.40	-7.2%
Total Account:	$6,314.35	$6,093.80	-3.49%

The total water charge per ML is $6,093.80/100 = $60.94/ML used.

Figure 17-2 Case A- Buys 170 ML temporary water in to achieve 270 ML usage, with 100 ML HRWS, 48 ML LRWS and 1 DS

Irrigation Area - Fixed Charges

2016/17 Charge Details

Storage	2015/16	2016/17	Change (%)
Entitlement Storage Fee 100 ML Goulburn High Reliability @ $10.70 /ML	$1,057.00	$1,070.00	1.23%
Entitlement Storage Fee 48 ML Goulburn Low Reliability @ $5.24 /ML	$248.64	$251.52	1.16%

Delivery	2015/16	2016/17	Change (%)
Service Fee $110.00	$100.00	$110.00	10%
Infrastructure Access Fee 1 ML/day Delivery Share @ $2,896.00 /ML/day	$3,290.00	$2,896.00	-11.98%
Domestic and Stock Service Point Fee 1 @ $90.00 each	$80.00	$90.00	12.5%
Service Point - Remote Operate Fee 1 @ $575.00 each	$400.00	$575.00	43.75%

Surface Drainage	2015/16	2016/17	Change (%)
Service Fee $110.00	$100.00	$110.00	10%
Area Fee 30 HA @ 80% of @ $6.83 /HA	$147.12	$163.92	11.42%
Total	$5,422.75	$5,266.40	-2.88%

About the Changes

This year your account has changed by -$156.35

	2015/16	2016/17	Change (%)
Total Fixed Charges:	$5,422.75	$5,266.40	-2.88%
Total Variable Charges:	$0.00	$0.00	0%
Total Account:	$5,422.75	$5,266.40	-2.88%

Irrigation Area - Variable Charges

2016/17 Charge Details

Irrigation	2015/16	2016/17	% Change
Infrastructure Use Fee 270 ML @ $5.93 /ML	$1,755.00	$1,601.10	-8.77%

Surface Drainage	2015/16	2016/17	% Change
Water Use Fee 270 ML @ 80% of $2.93	$652.32	$632.88	-2.98%
Total:	$2,407.32	$2,233.98	-7.2%

About the Changes

This year your account has changed by -$329.69

	2015/16	2016/17	Change (%)
Total Fixed Charges:	$5,422.75	$5,266.40	-2.88%
Total Variable Charges:	$2,407.32	$2,233.98	-7.2%
Total Account:	$7,830.07	$7,500.38	-4.21%

Fixed charges are identical to the base case but variable charges have increased with water use.

The total water charge per ML is $7,500.38/270 = $27.78/ML used.

This is much lower per ML used than the base case.

Figure 17-3 Case B- Sold all water shares but buys 100 ML temporarily. 100 ML usage, Nil ML HRWS, Nil ML LRWS and 1 DS

Irrigation Area - Fixed Charges

2016/17 Charge Details

Delivery	2015/16	2016/17	Change (%)
Infrastructure Access Fee 1 ML/day Delivery Share @ $2,896.00 /ML/day	$3,290.00	$2,896.00	-11.98%
Domestic and Stock Service Point Fee 1 @ $90.00 each	$80.00	$90.00	12.5%
Service Point - Remote Operate Fee 1 @ $575.00 each	$400.00	$575.00	43.75%

Surface Drainage	2015/16	2016/17	Change (%)
Service Fee $110.00	$100.00	$110.00	10%
Area Fee 30 HA @ 80% of @ $6.83 /HA	$147.12	$163.92	11.42%
Total	$4,117.10	$3,944.90	-4.18%

About the Changes

This year your account has changed by -$236.40

	2015/16	2016/17	Change (%)
Total Fixed Charges:	$4,117.10	$3,944.90	-4.18%
Total Variable Charges:	$891.60	$827.40	-7.2%
Total Account:	$5,008.70	$4,772.30	-4.72%

Irrigation Area - Variable Charges

2016/17 Charge Details

Irrigation	2015/16	2016/17	% Change
Infrastructure Use Fee 100 ML @ $5.93 /ML	$650.00	$593.00	-8.77%

Surface Drainage	2015/16	2016/17	% Change
Water Use Fee 100 ML @ 80% of $2.93	$241.60	$234.40	-2.98%
Total:	$891.60	$827.40	-7.2%

About the Changes

This year your account has changed by -$236.40

	2015/16	2016/17	Change (%)
Total Fixed Charges:	$4,117.10	$3,944.90	-4.18%
Total Variable Charges:	$891.60	$827.40	-7.2%
Total Account:	$5,008.70	$4,772.30	-4.72%

The total water charge per ML is $4,772.30/100 = $47.72/ML used.

This charge is lower by $13/ ML used than the base case, but the property will need to depend on the temporary water market (where the seller pays for the entitlement storage fee of $1070+$251=1,321 or $13/ML).

Figure 17-4 Case 3- Sold all water shares and has become dryland. Buys 1 ML temporarily.

1 ML usage, Nil ML HRWS, Nil ML LRWS and 1 DS

Irrigation Area - Fixed Charges

2016/17 Charge Details

Delivery	2015/16	2016/17	Change (%)
Infrastructure Access Fee 1 ML/day Delivery Share @ $2,896.00 /ML/day	$3,290.00	$2,896.00	-11.98%
Domestic and Stock Service Point Fee 1 @ $90.00 each	$80.00	$90.00	12.5%
Service Point - Remote Operate Fee 1 @ $575.00 each	$400.00	$575.00	43.75%

Surface Drainage	2015/16	2016/17	Change (%)
Service Fee $110.00	$100.00	$110.00	10%
Area Fee 30 HA @ 80% of @ $6.83 /HA	$147.12	$163.92	11.42%
Total	$4,117.10	$3,944.90	-4.18%

About the Changes

This year your account has changed by -$172.85

	2015/16	2016/17	Change (%)
Total Fixed Charges:	$4,117.10	$3,944.90	-4.18%
Total Variable Charges:	$8.92	$8.27	-7.29%
Total Account:	$4,126.02	$3,953.17	-4.19%

Irrigation Area - Variable Charges

2016/17 Charge Details

Irrigation	2015/16	2016/17	% Change
Infrastructure Use Fee 1 ML @ $5.93 /ML	$6.50	$5.93	-8.77%

Surface Drainage	2015/16	2016/17	% Change
Water Use Fee 1 ML @ 80% of $2.93	$2.42	$2.34	-3.31%
Total:	$8.92	$8.27	-7.29%

About the Changes

This year your account has changed by -$172.85

	2015/16	2016/17	Change (%)
Total Fixed Charges:	$4,117.10	$3,944.90	-4.18%
Total Variable Charges:	$8.92	$8.27	-7.29%
Total Account:	$4,126.02	$3,953.17	-4.19%

The total water charge per ML is $3,953.17/1 = $3,953/ML used.

This is much higher per ML used than the base case, as the fixed costs are only applied to 1 ML. .

18 Appendix 8- Feedback from consultation

Understanding water availability Workshop Notes

Engagement sessions from SIRTTEC (14/10/16 Tatura), North Central CMA (13/10/16 Huntly) and Municipalities (4/11/16 Echuca) – raw notes

Session	1 The GMID	2 Water Availability	3 Implications & next steps
Words, phrase that stand out	▪ Employment ▪ Population decline ▪ Property size ▪ Range of property sizes – large number of small farms ▪ Rural LGA population decline ▪ Horti & dairy job reliance ▪ Water entitlement reduction ▪ 5% water used by 60% of customers ▪ Population decline in Rural Ag jobs decline ▪ What is GVIAP? ▪ Need for larger blocks ▪ Dairy & hort major users ▪ 600,000 ha footprint 390,000 ha irrigated ▪ Is there a need to consider other factors in looking at <u>value</u> of different land uses. What effect does larger blocks have on other environment NRM factors such as biodiversity? ▪ Population decline in some areas ▪ Small farms represent 60% of customer base ▪ Large farms using 70% of water ▪ Dairy & hort largest production & water use ▪ Decline in medium size properties ▪ "Need to support large land owners to keep water in region"	▪ Dairy, hort biggest users ▪ Dried off areas ▪ Ceiling for hort water use ▪ Reduction in water availability ▪ Ceiling of 1400 GL ▪ Opportunistic irrigators ▪ 600kha by 2000GL, now 390kha by 1400GL ▪ 250-300GL leaving to future Horti ▪ Huge Mallee horti growth ▪ GMID dropping to 400GL in drought ▪ 40% reduction in HRW ▪ Nett water importer -> use is higher than allocation Almonds ▪ Historic production shifts with changed water availability ▪ 40% loss of HRWS ▪ Horticulture continues to expand ▪ That potentially horticultural industries could require entire water available (1400 GL) ▪ Move to more horticulture ▪ Very negative picture which limits investment prospects in region by comparison with Murray Mallee ▪ Location is all important. We are competition but we also have distinct advantages which can use water efficiently	▪ Opportunity for growth for some industries, however water & property availability could hold this back ▪ Cost v return for water (per ML) ▪ Water charges ▪ Future development areas – where are they? ▪ Need for a flexible Ag system to adjust to variable water price & availability ▪ How do you run system, do you shut some down? ▪ Need to invest in water efficiencies ▪ Water is getting more expensive ▪ Water removal & drought will threaten the GMID ▪ Potential increase in water supply costs ▪ Predicting market trends & effective commodity forecasting ▪ Responsiveness of systems, infrastructure & governance ▪ Land use planning & multi factorial overlays ▪ A wealthier world ▪ Good soils & low cost irrigation ▪ Water security ▪ Dryland agriculture is important ▪ Global growth / population growth. Our trading partners have subsidies that we do not ▪ "Protect large blocks" what does this mean? ▪ Growth

Session	1 The GMID	2 Water Availability	3 Implications & next steps
	▪ Change in population -> impact flexibility & scale ▪ Dairy farms leasing to high value annual crops – options needed for this industry (dairy) although large operators seem to hold the key to the future. ▪ Kilter avoid dairy (my words) ▪ Local processing for perishable produce ▪ Employment in Ag declining with water availability declining ▪ Farm size increasing ▪ Size of land parcels ▪ Feel that jobs in agriculture & processing are understated as there is a knock on effect ▪ 10% producers producing 70% of value ▪ Larger properties – large % water used ▪ Decrease population agriculture ▪ Value of agricultural production ▪ Jobs ▪ Dairy and hort most important industries ▪ Rural lifestyle/residential ▪ Mining jobs – where are they? ▪ GMID current water volume 1300 GL/yr; hort and dairy use 90% of this ▪ Rural lifestyle customers ▪ Hort GVIAP in GMID> than other areas – the reasons are… ▪ Less water ▪ East population increasing ▪ West population declining ▪ Ag jobs reduced ▪ Rural residential up ▪ Large properties up	▪ Horticulture expansion ▪ Fall in water shares in the GMID ▪ The high value of Victoria's product – vulnerability of GMID? ▪ Dairy is going to have to be much more flexible ▪ This will flow on to factories ▪ Water is service! ▪ History table ▪ Scenario table ▪ Reduction in water availability ▪ Reliance on temporary trading ▪ Buybacks ▪ Forecasts are quite concerning ▪ Temp trade ▪ GMID approx. future ha ▪ 252 GL to go ▪ Consistent water share reduction ▪ High reliance on temporary trade ▪ Horticulture is growing to a limit ▪ Future ha vs past ha ▪ Big change in historical supply ▪ Dairy reliant on temporary water ▪ Return on rice increasing ▪ Water shares – 405 reduction consistent across most districts ▪ Horticulture expansion limited due to drought water availability – cannibalise itself	▪ Strengths ▪ Increasing variability in water supply ▪ Dairy & horticulture are the engine rooms of production ▪ We need to maintain support for these enterprises come what may ▪ Should question the merits of this assessment ▪ Need for Flexible Systems and Water Products ▪ SID – GMID has many advantages water availability has had big impact on water price ▪ GMID offers greater security & attractive to hort & dairying (higher price GMID) ▪ Water is getting more expensive & variable ▪ High cost on unirrigated land that holds delivery share ▪ Population growth, higher demand ▪ Wealthier, but choosier customers ▪ Technology ▪ Costs of water and delivery shares ▪ GMID strengths and opportunities – apart from water limitations lots of strengths ▪ Manufacturers are under pressure – higher wage costs, and increasing energy cost are making them less competitive on the world stage ▪ CSIRO megatrends – ethics of food production ▪ Just like Hazelwood?

Session	1 The GMID	2 Water Availability	3 Implications & next steps
Key messages, concepts or implications	▪ Water usage & southern pool implications ▪ Hort. Growing ▪ Dairy worst affected ▪ Upwater ▪ Population decrease linked to dependence on agriculture -> strong correlation with job availability ▪ BP recovery has huge implications for future of GMID ▪ GMID relies on successful dairy and horti industry for jobs, production & regional variability ▪ Significantly less irrigation water use GMID over time ▪ Distribution of water usage vs property size ▪ Agriculture is driver of job – particularly on large properties ▪ Small farms 60% customers 5% water use Med 30% customers 25% water use Large 10-15% customers 70% water use Large properties need large blocks ▪ GMID GVIAP – Dairy highest followed by horti ▪ Large growth in Rural – Residential which competes with Ag ▪ Ganawarra 12% popn decrease Loddon 8% popn decrease ▪ GMID Ag -> 90% dairy / hort ▪ Small & med properties 90% of GM customers ▪ Med farms struggling to expand ▪ Importance of local scale in processing – value adding ▪ Likely increase in area under horticulture due to water availability & economic returns ▪ Ability to transport to manufacturing sites… cannot just rely on dairy & horticulture ▪ Good value in land use mapping as can identify areas of low intensity to identify areas where could get biodiversity gains	▪ During drought years would systems be shut down ▪ 40% reduction of water shares ▪ GMID importing water ▪ Dairy water use fluctuates the most in wet / dry years ▪ Pressure upon GMID irrigators ▪ Sourcing HRWS to meet plan targets ▪ Viability in dry years ▪ Remaining in industry given potential adverse scenarios ▪ GMID is net importer of water ▪ Mixed cropping / grazing have become opportunistic irrigators ▪ Horti is in expansion mode ▪ Massive horti losses during drought ▪ Pasture (non-dairy) reduced greatly ▪ Land use change ▪ Large reduction in footprint ▪ 40% reduction in HR water shares since 2001 ▪ GMID ▪ Landscape change map (pod wateruse) ▪ Hort looking for another 250-300GL increase (10-14000 ha) ▪ Almonds, citrus, pistachios ▪ Value of production vs cost of water delivery vs environmental risks / impacts ▪ Costs of exceeding drought water availability limits -> system viability constraints: social & economic impacts ▪ Disassociated water hard to track ▪ Permanent plantings (almonds) & future water availability	▪ Dairy worst affected but currently has highest ownership / usage ▪ Would potentially see decline of industry ▪ Future of almonds / hort – has peaked ▪ Competition between commodities ▪ Buyback significantly distorts the water market ▪ Due to GMW cost recovery, as per current system, the cost of water will increase ▪ Water trade (outside GMID) still to come ▪ Must be more water efficient ▪ GMID water is cheaper for small users & more expensive for large users rather than MIL ▪ Services from GMW need to be more flexible ▪ Becoming more water efficient is more important ▪ Land use planning to support Ag & maintain or facilitate Rural-Residential in the appropriate areas without eating into high value Ag land ▪ 50% footprint reduction ▪ 200-300 GL traded into GMID ▪ Climate change modelling for water availability & crop viability? ▪ SDL models under current water availability conditions? ▪ Globalised markets & uncompetitive behaviours (dumping, subsidies) ▪ Market variability, unpredictability ▪ Impact on big sector & communities? ▪ Need for flexible production systems ▪ Importance of pricing signals & change frameworks to support best practice ▪ Ability of water users to pay for water ▪ Farm debt. ▪ Water availability is not a given

Session	1 The GMID	2 Water Availability	3 Implications & next steps
	▪ What is total area at GMID if only 390,000 is irrigated? ▪ With the area so reliant on dairy & hort, large implications if one experiences market issues ▪ Issues with promoting large irrigators, what impact on medium properties / community ▪ 90% of productivity from dairy & horticulture ▪ Small no's large properties produce higher returns! ▪ Focus on dairy / horti ▪ Perhaps need to look at innovation ▪ The past is not necessarily the marker for the future ▪ Larger Towns and lifestyle locals are growing as they are not as dependent on Agric. ▪ Hort & dairy main drivers ▪ Have to look after larger water users & more productive farmers ▪ The criticality of integrated land use planning ▪ Pyramid Boort is a long way from the water source yet pay the same prices? ▪ Using much less water ▪ What about remaining assets ▪ Water availability is CRITICAL for our economic well being ▪ Small farmers only use small part of available water ▪ Linkage of enterprises to understand land use & water use e.g. traditionally adj properties. Social impacts -> link to land use mapping project results ▪ Highlight value of horticulture, dairy and jobs ▪ Importance of maintaining jobs ▪ Protecting large (ha) land for ag expansion ▪ Value of dairy and hort to GMID ▪ Employment associated with dairy and horticulture ▪ Lower return on hort outside GMID	▪ More water required to meet Basin Plan ▪ 12 months irrigation supply from Murray R. ▪ Temp trade in when opportunity is there. Is this what you would modernise a system as? ▪ In dry years, there won't be enough to go around! ▪ Implications of Darying changing land use in dry years ▪ EWL can release water back to the system ▪ Also possible to maximise alternative water sources ▪ Rainfall / runoff / localised water harvesting ▪ Groundwater / Shallow Deep ▪ Recycled water / Urban stormwater ▪ Not much use but could promote localised development ▪ What stands out that the whole system cannot be run for the whole season in dry years ▪ Limited availability of water movement of water to the hort. Industry ▪ Matching the irrigation system (with appropriate flexibility) to long term (and variability) water availability is critical ▪ Does the GMID need to be modernised to the extent being planned & undertaken ▪ Water has moved because it is cheaper to develop green field sites and pump from the river than supporting the cost at a channel system ▪ Competition -> drives up the price ▪ Impact of further recovery/buyback & next industry impacted? E.g. hort ▪ Highlight opportunities for diversification in commodities that aren't reliant on high volumes of water ▪ Greater requirement for technology to increase	▪ Need to be flexible in our service provision, how do we support different segments? ▪ Impact cost of water ▪ Impact climate ▪ Dairy & horticulture important industries ▪ Must realise opportunities posed by region ▪ Competition from other regions ▪ Dairy & horti need to be reviewed ▪ Expanding whilst cost going up and water availability reducing seems a different situation ▪ DS prices increase – not an incentive to farm here ▪ Dairy under most threat with water availability ▪ Change is happening ▪ The need for GMW business flexibility ▪ The need for farm system flexibility ▪ GMW must become more efficient in water delivery & pricing ▪ The latest flood shows that the MDBP is flawed paper ▪ Dairying becoming riskier in the future ▪ Highlight GMID strengths ▪ Land use change – intensive agriculture increasing ▪ Water cost increasing ▪ Complexity of water management regime ▪ Delivery shares charges and land use relationships ▪ Water fees are very complicated ▪ GMW asset base can't shrink – few terminating delivery shares ▪ Social implications of large scale agriculture or dairy? Impacts on traditional farmers? ▪ Delivery share sticking to land creating nooses around other necks

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	▪ 80:20 rule small farms vs large farms ▪ 1 farm job = 1 manufacturing job (does this hold in other regions?) ▪ Horticulture presents a great opportunity (fresh fruit) only 5% of irrigated area thus far ▪ Horti elsewhere is less/ML and fresh fruit is better	water efficiency ▪ Linkage with land use mapping – land use change map ▪ Decline in availability of irrigation land in drought (ie ~100,000 ha) leading to economic impact ▪ People use temp trade to make up permanent water shortfalls ▪ Significance of change in area under irrigated ag in the future ▪ NSW water availability is very important to GMID ▪ Lower Murray in same boat – losing water ▪ The unbundled water world is much more flexible and allows adaptation to happen ▪ The environment water volume of less flexible or not adaptive, unless rules change ▪	▪ The SMDB needs to be looked at as a whole ▪ Will the Premier chair a work group in GMID – more job losses, etc?

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Areas requiring further development, refinement or research	▪ Connections / modernisation overlays all of this ▪ Whole GMID issue ▪ Ability for medium sized properties to expand to become large enterprises & further drive the engine room ▪ Where is it sustainable / viable to expand properties? ▪ Need to get things right so the properties that want to get larger can, e.g. connections, planning, etc. ▪ Water use for recreation or tourism based industries ▪ Impact of enviro water on water avail ▪ Can it be released when allocations are low to irrigators early in the season ▪ Mapping -> modernised vs non-modernised & planned against land availability ▪ How to facilitate land transfers ▪ Affordable land is hard to come by ▪ If horticulture uses less water / $ return then should that industry be 'promoted' rather than dairy? ▪ How sustainable is dairy in the long term? –e.g. climate change ▪ Which ones provide most jobs? ▪ Rural population is in decline in certain areas but larger blocks of land are available there. Why are these areas declining? ▪ What are the requirements of different industries / sized properties in terms of future irrigation plans? How many will move on, what will this look like? ▪ New industry? Development ▪ Population shift implications ▪ Free Range Options and Intensive Animals complement increased interest in cropping ▪ Much of my recent work is with grain production. The demand for grains is huge on a world market. We must looks at the world situation	▪ Changes in water use ▪ 1400 GL "ceiling" on water availability – how accurate, length of timeframe (future) applicable? ▪ What happens & GMID viability if dairy industry collapses ▪ Water use ▪ Land use ▪ Region's future – jobs, $s, towns ▪ Land use change ▪ Is it adapting to less water? ▪ Or market? ▪ Are some moving to high water use in GMID (other than Mallee)? ▪ GMID availability 1400GL av year 4500GL avail Sthn Basin ▪ Further reductions with SDL reductions & horti expansion for other industries (dry years significant) ▪ Industry trends new markets ▪ Enviro water availability to purchase ▪ Industry diversification within regions ▪ Social & economic costs of production overshoot & rebalance ▪ Which crops, where & how it manifests ▪ Planning & transparency ▪ Impact on GMID with 300 GL of water to go downstream for almonds ▪ Salinity impacts?? ▪ Need/ability to close down parts of the system during drought N.B. Would have thought that irrigated cropping has increased over the last 10 years	▪ No certainty for future investment ▪ Uncertainty for future in dairy due to commodity prices ▪ How can we make $/ML water price cheaper for large users and more expensive for small users? ▪ Can the GMW cost recovery be restructured to maintain or reduce cost of water in future? ▪ Land use planning importance – not just property size but like 4% Exemption map (soil type/capability, drainage access, subject to flooding, backbone proximity) ▪ Our view of regional development takes into consideration "what is sustainable", but if water savings (GMW CP) drives the irrigation footprint then there won't be alignment ▪ We don't know what GMW CP "reset" is ▪ Majority of irrigators still want to be connected BUT there is not enough water to support them ▪ How do we deliver connections when we know that not all the land that is being connected can be irrigated into the future? ▪ Large users should pay less per ML and small users should pay more ▪ Delivery share ▪ How can MIL be cheaper? Is this something GMW can learn from? ▪ Can land use planning play a larger part in providing a solution? ▪ How will the Connections Reset affect this? ▪ Global growth for high quality produce ▪ GMID strengths – natural environment high quality produce -> clean green image ▪ Can we increase horti in GMID, how? ▪ Suitable land use areas for different industries (most suitable areas promote)

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	▪ Large parcels are not always or the only answer ▪ Horticulture Is a different size scale ▪ *Land and water are not always in the right place ▪ Implications of climate change on irrigation capacity / productivity ▪ The unification of Local Gov't land use planning and strategy across the GMID – never been more important! ▪ While Council will not allow any smaller blocks to build on than 100 acres it is hard to join properties also they allow residential Blocks near dairy the complaints start ▪ Land use planning ▪ Do you mean Statutory Planning is so when has this ever been shown to solve agricultural land use issues ▪ Can we / should we "help" the smaller properties to survive? ▪ Nomination of social / econ value of the environment in GMID!! ▪ Highlight diversification for these medium and small size farms ▪ Education for those operators for diversification ▪ Alignment with dairy processors and suppliers ▪ Linkage of land use with (ha) map ▪ Linkage of ag jobs to multiplier effect eg manufacturing ▪ Expansion of dairy processing ▪ Other industries eg cotton ▪ How does SIR compare with GMID? ▪ Does the work that Neil Barr fit in here? ▪ Where are the mining jobs? ▪ Jobs/ML or cow? ▪ Investment profiles of large dairy companies ▪ Small farms proportionally high – need to protect bigger blocks	▪ Amount of water available in GMID ▪ Ability to trade Enviro water ▪ Must focus on opportunistic irrigation which suits the location of the Goulburn & Murray Valleys ▪ Also can we water to guarantee winter crop or facilitate free range or intensive production ▪ The effect of Carryover as to hold water available in the Drought year for hort. With the expected planned expansion ▪ Hort why has permanent water price dropped ▪ Changes in low reliability water shares ▪ See above… Do we have a high service 'core' then a broader / low cost opportunistic zone/s? ▪ Disagree with the assumption that small business have a lower skill set than large business ▪ The environment must start paying their way (e.g. storage and using GMW assets) ▪ Modernisation has not been carried out as the original plan (NVIRP) which would have solved some of the costs for high water users ▪ Where does environmental water fit into all of this ▪ Are pre-season spill flows (as this year) counted as environmental flows? If so, are irrigators compensated or "given" access to this water ?? is saved from the environmental pool? ▪ Interactive / competition environmental and production water ▪ Do we follow free market mechanism pricing system? (where there is market failure) ▪ Cost recovery for GMW to maintain infrastructure cost delivery share ▪ Impact of 250-350GL water trade to Mallee ▪ Good opportunity to reference the social economic impact analysis undertaken by GMID leadership	▪ Connections influence (reset?) ▪ Where is infrastructure demand likely & how can we plan to minimise costs & impacts? ▪ Where do we need to engage? ▪ Other costs of intensive production that uses less water ▪ Food security & trade: Ag. Policy that runs long term & consider water, climate & transport policy & changes. ▪ Governance recommendations ▪ Frameworks ▪ Systems ▪ Especially GMW connections. Long term water policy & alignment with Ag. Policy ▪ Variable water charges M.I.L. vs GMID ▪ Smaller users (including D&S) should pay more, although they are large in numbers and may not be "politically" a good option ▪ More work needed on land use planning ▪ Impacts on rural communities when small dairy farms move to larger areas ▪ Future of Carry Over ▪ Future of Delivery Shares ▪ What are the total inputs of each industry – not just water? ▪ Does SMOB pool consider climate change? ▪ CSIRO have climate change figures / maps of likelihood / degree of change etc that may be of use ▪ Kate Brunt GBCMA can help ▪ Timing of rain could also impact irrigation – e.g. what does it mean if we get more summer rain & much less in winter & spring? i.e. not just about drought but changes in times of rainfall ▪ Will farmer be able to afford water if the whole 600,000 ha footprint is modernised, with water leaving GMID &

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	▪ Total jobs to get percentages ▪ Rural residential – how much is aligned to regional production for jobs not ag related	group (particularly in relation to jobs) ▪ Agriculture industry breakdown by geographic area, then apply trends ▪ How much has permanent water ownership changed over time? ▪ Reduction in water volume of dairy 900 l water to produce 1 l milk now 450 l for 1 l; how much further can it be improved? ▪ Is cotton industry saying anything about growth in GMID? ▪ Water requirements of crops on drier and hotter and sunnier climates ▪ Cost of trade downstream (exchange rate) ▪ What is the outlook for cotton; what is the outlook for GVIAP for cotton? ▪ What are the drivers for landscape change – the reasons for the change and why the differences; overlay property size ▪ Climate change impact on ET; crop type and WUE ▪ How important is annual vs permanent horti ▪ How much water is still to be recovered ▪ Litres of water per litre of milk ▪ Climate change impacts on volume ▪ Only 252 GL to go including SDL off sets – how much of the 252 is contracted or is this all uncontracted?	climate change ▪ Impact footprints declining ▪ Cost of Del scheme ▪ Different needs – different pricing for water del ▪ Must compare & contrast regional development performance with competing regions ▪ Are consumers prepared to pay for future food demands ▪ Standard assets ▪ Where is the tipping point – there will a point soon where there are too few active irrigators to pay for an expensive irrigation system ▪ Promote innovation ▪ Ensuring land use planning supports innovative and productive Ag rather than agricultural growth ▪ Does/will GMW's irrigation infrastructure (and the irrigation system) support and enable the sort of flexibility needed? ▪ Rules regarding Carry Over & spills must not be constantly changing so there is some certainty in the future. ▪ Works on gene technology to grow more with less water or salty water ▪ Look at more storages and manage the existing one better ▪ Dairying is possible w/out growing pasture. Buy-in feed from croppers (it happened in Hamilton) ▪ More flexible options from GMW ▪ Flexibility for use of water within property, ie at the dairy vs outer blocks ▪ Encouragement of new and existing horticulture and investigating other commodities that are not as popular in the region eg vegetables, brassicas ▪ Greater bureaucracy in water management (eg GMW) ▪ Greater scale investment opportunities – Kilter corporate

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			farm model? ▪ Glen Goulburn case study? ▪ Dryland cropping/land use opportunities? ▪ Environmental impacts of land use change, particularly intensive agriculture ▪ Need to look at strengths and weaknesses against the stuff done for north Australia project – comparison will be interesting ▪ Need a handle on the feedlots and numbers

19 Appendix 9 – Papers submitted by Barry Croke to illustrate case study on costs of irrigation

MONEY NEEDED TO IRRIGATE

A Shepparton Irrigation Region example

The following discussion attempts to give a dissected account of financial issues that an irrigator has to consider and integrate into the farm's annual budget.

The discussion differentiates between PRICE, COST and VALUE of water. This is done to help appreciate the factors which contribute to the outlays needed to operate an irrigation enterprise.

The trends in PRICE, COST and VALUE are considered separately and related to the trends in net farm returns from an irrigated enterprise. A more detailed explanation of "PRICE, COST and VALUE" is given in Appendix 1.

The following discussion is based around a simple example farm. It is 100 ha in area and has a 400 Ml water right pre unbundling.

WATER PRICE

This farm nowadays attracts a set of fees from Goulburn Murray Water as follows.

Service fee	$ 107
Service point fee : 2 outlets @ $560	1120
Infrastructure access (Delivery Share)	14000
Infrastructure use 400 Ml x 6.34	2536
Entitlement storage fee 400Ml x 13.04	5216
Drainage water use fee 400Ml x 3.34	1336
Drainage area fee 100ha x 8,.71	871
	$25,186

If 80ha of this farm is irrigated it represents $315/ha. LRWS has been disregarded . Traditionally an irrigator would have seen water price as $25186 divided by 400 equals $63 per megalitre (Ml).

WATER COST

The cost of water is now additional to water PRICE. COST reflects market value for water, both permanent (HRWS) and temporary water. If the irrigator owns the water, say in HRWS, then the money invested in this asset has an opportunity cost determined by the alternate ways this money could be used. If the irrigator only has land that can be serviced by G-MW the actual water will be purchased on the temporary market.

The specifics of these alternatives are:

(a) 400 Ml HRWS has a value of 400 x $2850 = $1,140,000.00. The interest value of this capital at 8% = $91,200. With this water used over 80 ha, this represents $1,140/ha/yr opportunity cost.

(b) The temporary market maybe at around $300/Ml and while the storage fees may not be payable, GMW transfer fees and brokerage may cancel this out. Cost maybe 400 Ml x $300 = $120,000. Over 80 ha this is $1500/ha/yr. Temporary water at $150/Ml is also considered in Table 2.

FARM INFRASTRUCTURE for irrigation has Asset and Operating costs.

These could be

Either (a) gravity system

Annual channel & drain spraying	$ 1500
2km channels, $20,000 x 5% depreciation	1000
Channel and bay structures @ 70 x $800 X 10% deprec.	5600
Laser levelling 80 ha x $1000 x 10% deprec.	8000
	$16,100

Or (b) run water through mobile sprinklers

Irrigators $500,000 with a 15 year life	33,333
Power, say 140 Kwh/Ml x 400 x 20 cents/Kwh (50% off peak)	11,200
	$44,533

For the comparison in Table 1 there is no allowance for management and labour used in irrigating.

Tablel 1 : Outlays needed to irrigate example farm using different methods

	$ Total	$ per ha irrigated
Water Price	25,186	315
Water costs		
If own HRWS	91,200	1,140
If buy temporary water	120,000	1,500
Farm Irrigation Infrastructure		
If gravity	16,100	201
If sprinkler	44,533	556

So the irrigation costs on this place are somewhere between 315 + 1140 + 201 = $1,656/ha if the water is owned and gravity flow is used. With purchased temporary water distributed through a sprinkler costs are 315 + 1500 + 556 = $2371/ha. With water cost at $150/Ml this could be as low as 315 + 750 + 201 = $1266/ha with the water use of only 5 Ml/ha.

A difference exists in the different combinations of the above. If the higher labour requirement was attributed to the gravity system, the difference diminishes.

The conclusion for this fairly modest farm is

1. Irrigation can cost between $132,486 (25186 + 91200 + 16100) and $189,680 (25186 +120000 + 44533) per annum. With water at $150/Ml this becomes $101,286 (25,186 + 60,000 + 16,100).

2. In the total view of irrigation buying in temporary water is not that different to owning HRWS. In fact, the irrigator dependent on purchasing temporary water would almost certainly play the market, perhaps buying at $150/Ml which is less than the opportunity cost of $228/Ml if the water is sourced from HRWS.

3. It is highly probable that the irrigator buying in temporary water has less Delivery Share on the farm. Only 1.48 DS are needed to have 400 Ml delivered, and if this is the case this farm saves $8820 p.a. compared to the original example.

4. The differences in owning HRWS and buying temporary water are not that great, and over a run of several years may even favour the purchase of temporary water. But the risk can be extreme in a very dry year when the temporary water becomes more costly and this has to be accommodated in an annual cash flow further affected by higher bought in fodder costs and perhaps lower farm returns.

THE BIG ISSUE

The total costs of irrigation are presented as a proportion of enterprise returns in Table 2 . With this example farm an uncomplicated view could have a good operator using 7 Ml/ha to water 57 ha producing 12 tonne of Dry Matter per ha giving 684 tonne DM with 6 t DM being needed per cow. This allows for 114 cows and if they produce 6500 litres annually @ 40 cents per litre, there is a gross milk income of $296,400. Certainly feed could be bought in to increase the herd, dry country would produce something and the example does not acknowledge the myriad of other farm costs. These would include feed requirements for replacement dairy cattle. With an operation of this size, two age groups of 25 heifers would require approximately 200 t DM of high quality feed.

The important story is that true irrigation costs are somewhere between 46% and 80% of milk returns with a milk price typical of the last couple of years. Even with milk at 60 c.p.l. , irrigation is at least a third of gross milk income. With milk returns of 20 c.p.l., following the May 2016 price drop, irrigation costs are between 91% and 128% of gross returns for milk.

Table 2 : Money need to irrigate as a proportion of Gross Returns from dairying***

		Irrigation Outlay($)**		
Milk Returns at	Gross Farm Returns $	Gravity Flow Irrigation	Sprinkler Irrigator	Gravity with water at $150/ML
		$ 132,486	$189,719	$101,286
60 cents per litre	444,600	30%	42.6%	23%
40 c.p.l.	296,400	45%	64%	34%
30 c.p.l	222,300	60%	85%	46%
20 c.p.l.*	148,200	89%	128%	68%

* typical returns in May 2016 following price drop.

** figures chosen to show range. Actuals would depend on prevailing water market values, interest rates and milk prices etc., which can be easily substituted in the formats of the previous tables. First two columns cost temporary water at $300/Ml.

*** no allowance for farm labour and management in irrigating.

About 50 years ago, when money needed to irrigate was 10 to 15% of farm returns, the Shepparton Irrigation Region was regarded as one of the nation's best dairying areas. Nowadays is it Atherton Tableland or Tasmania?

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Appendix : Price, Cost and Value of Water

Discussion of the monetary outlays to irrigate can be confusing unless done within a defined framework. The following indicate how PRICE, COST and VALUE associated with irrigation water have changed in the past decade. Some of the implications to irrigated and dry land enterprises are discussed.

In the Northern Victorian irrigation districts it was once relatively simple. Water right was attached to land gazetted as irrigable, with the volume primarily determined by soil type and location. Irrigators paid a PRICE for water delivered which was set annually by the State Rivers & Water Supply Commission. Other services associated with irrigation, e.g. drainage, subsequently attracted a set PRICE each season. So irrigators operated in each season with a known pre-set PRICE designed to either partly or fully recoup the money required to operate the delivery system.

Furthermore irrigators were able to buy “sales” water in addition to that determined by the farm’s water right. In the 25 years up to 2000 most progressive dairying enterprises became used to accessing 100% sales (double water right). “Sales” availability at a pre-determined PRICE also set annually by the water authority was the main factor underpinning growth in herd sizes and the farm business’ ability to contend with the cost-price squeeze. The revenue from “sales” water was a significant part of the water authority’s balance sheet.

In the early 1990’s it became possible to transfer irrigation water within a season on a temporary basis. Initially this applied to water that was within a neighbour’s entitlement and was within the local channel system. This evolved with increasing competition to access this “temporary” water. The money paid was no longer a set PRICE but rather a value determined by competition between irrigators. So this trade in temporary water assumed a COST to the irrigator that increasingly related to what others were prepared to pay.

In 2007 irrigation water and land became separate entities (unbundling). Irrigators’ water rights became High Reliability Water Shares (HRWS). “Sales” water was to be administered with the issue of Low Reliability Water Shares (LRWS) with the volume approximately equivalent to 50% of property’s water right. In the nine years since the issue of LRWS there has never been an allocation of what was former sales water. In these nine years the main function of LRWS has been to give owners of water a “licenced bucket” or volume within reservoirs that allows water (unused or purchased) to be carried over into the next season.

The transferability of HRWS and LRWS on both a permanent and temporary basis has meant increased competition between purchasers of water. The popular view, eager to seize on a one line comment, now likes to use what irrigators pay in these transactions as the COST of irrigation. This paper attempts to show this is a serious misrepresentation of the total picture.

Whilst water authorities continue to set an annual PRICE for their services associated with water storage, delivery and drainage, the market sets the COST of water that an irrigator may purchase (or sell). The COST of HRWS and LRWS is subject to daily influences of supply and demand.

During the drought (2005 – 2009) water allocations did not allow full allocation of water right or HRWS entitlements to be satisfied. In this period, and subsequently, more than a third of HRWS has been purchased by down river users either to satisfy both State and Murray Darling Basin recently defined environmental needs or new irrigation developments usually in semi-arid regions where land price is much less. Coincidentally money from these water sales relieved many irrigators in the Shepparton

Irrigation District of extreme financial stress that they faced in their farm enterprises. This was due to marked reduction in actual water availability, serious fluctuations in returns and demand for farm produce, and most significantly the inability of farm enterprises to keep pace with increasing fixed costs such as water, shire rates, electricity, and personnel servicing farm infrastructure.

The COST of water is the main factor which rural enterprises have had difficulty in adapting to. Farmers were used to dealing with the PRICE of water and accommodating it in annual budgets. Historically farmers used their water prices as G-MW charges divided by the volume of water right. Today this is about $63/Ml; the example indicates $25186 divided by $400 Ml.

Nowadays irrigation farms are sold without a water right, but have infrastructure access (commonly known as Delivery Share). On these farms irrigators have to either own HRWS or be prepared to purchase water on the temporary market.

This need to purchase water introduced a new concept. …. The COST of water. The concept of COST presented difficulties for many. It is additional to PRICE considerations.

The COST ($/Ml) is a function of supply and demand. E.g. allocations in Victoria, NSW Murray and NSW Murrumbidgee, other irrigators who may need a little more water to finish a crop, or large corporate farms with permanent plantings. COST is usually greater when an irrigator's business is already stressed by seasonal factors. High water COST can make savage inroads into budget projections set back in June/July.

Beneath these issues of PRICE and COST of water there is the underlying factor driving the change. This is society's current approach to placing a VALUE on water. In recent years our society, through legislation, has shown how it values ephemeral water bodies. e.g. 1,000,000 Ml in lower estuarine lakes being allocated just for evaporation so these water bodies are maintained.

Even within irrigated agriculture the financial structure of some enterprises can enable a VALUE to be placed on water that is not commensurate with that in conventional cropping and dairying systems. These enterprises include Managed Investment Schemes and large corporate groups, usually with permanent planting of trees, who operate within different taxation and cash flow constraints to conventional farming enterprises.

Clearly, the biggest underlying factor now shaping the future of irrigated agriculture in the Shepparton Irrigation Region is how the social and economic forces determine the VALUE of water. Most of these forces come from outside the region.

The COST of water will continue to be an increasingly difficult factor for people to include in seasonal budgets typically set in June/July. Factors causing difficulty include increased competition between irrigators for the marginal last bit of water to finish a crop.

The PRICE set for supplying services to deliver irrigation water continues to increase at a rate far greater than net farm returns. This divergence is understandable when the major increase in value of G-MW infrastructure is noted together with our extremely high costs of doing operation and maintenance tasks for the delivery system. Perhaps the most concerning aspect of PRICE is the fact that only half the water is being now being delivered in irrigation districts. The PRICE is becoming increasingly difficult for enterprises to accommodate. This PRICE, being a fixed charge on potentially irrigable land, is now a significant issue for the farms that no longer irrigate. Operating these properties as dry land enterprises becomes an almost absurd proposition if there is a "tax" of around

$300/ha for fixed charges. Unless the Delivery Share on a previously irrigated farm is paid out, by presenting G-MW with ten times the annual Delivery Share fee, these properties become most unattractive to buyers seeking land for dry land farming activities.

The farmers' inability to accommodate rising fixed charges is a consequence of most of the produce from irrigated agriculture being unable to achieve a similar trend in farm gate prices. It has become much more difficult to tackle the "cost price squeeze". In the previous four or five decades the "cost price squeeze" was managed by increasing production per labour unit, better output from farm machinery, improved irrigation layout, genetic improvements in pastures and animals, and the availability of affordable "sales" water. Most of these efficiency gains are now large exploited.

Clearly there is an urgent need to reconsider the fundamental factors shaping our irrigated agriculture. With current trends, enterprises traditionally dependent on irrigation, are becoming increasingly uncompetitive to similar enterprises elsewhere in the world.