GOULBURN BROKEN
CATCHMENT MANAGEMENT AUTHORITY

NORTH CENTRAL
Catchment Management Authority
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GOULBURN-MURRAY WATER

THE CHALLENGES AND OPPORTUNITIES OF CHANGES TO WATER AVAILABILITY ON THE FOOD AND FIBRE SECTOR IN THE GMID

PHASE 1 – SUMMARY FOR THE COMMUNITY

CONTENTS

Lead author: Charles Thompson, RMCG

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1. PURPOSE, BACKGROUND AND SUMMARY

1.1 PURPOSE

Climate change, implementation of the Murray Darling Basin Plan and increasing competition from new markets for water are all significantly impacting water availability in the Goulburn Murray Irrigation District (GMID).

We are already living with reduced water availability: historically up to 2,500GL of water was delivered across the GMID each year; today delivery peaks at around 1,400GL a year.

The Goulburn Broken Catchment Management Authority (CMA), through Goulburn Murray Water (GMW) and a steering committee of representatives from Goulburn Broken CMA, North Central CMA, GMW and the Victorian Government, is working on an action plan to identify the opportunities and challenges associated with this declining water availability and the effects this will have on farm and industry viability in the GMID.

There are two phases for the project. This is a summary of the work done for Phase 1. The full report is available at www.gbcma.vic.gov.au

1.2 BACKGROUND

GMID irrigators are generally supplied by gravity from a GMW supply channel (Figure 1.1). The GMID irrigation infrastructure is generally 60-80 years old and consists of 6,300km of channels, 900km of pipes and 3,000km of drains. Many of the control structures are being modernised as part of the $2 billion GMW Connections Project.

The region is part of the southern connected Murray Darling Basin (sMDB) (Figure 1.2) and as outlined later in this summary the amount of water available to the GMID is highly influenced by the water available in the sMDB and trade between industries.

The GMID encompasses five municipalities (Swan Hill, Loddon, Gannawarra, Campaspe, Greater Shepparton, and Moira) and 12 major towns/cities and has an estimated regional population of 173,000.

Employment in the region is highly dependent upon irrigation especially in the dairy and horticultural industries, which support substantial regional processing jobs. Agriculture employment declined from 2006 to 2011, particularly in the dairy industry, but food processing employment did not.

Since 2006 the GMID experienced population growth in the Shepparton (+8%) and Moira (+5%) areas, but declines in Gannawarra (-12%) and Loddon (-8%). 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. 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.

The issue of community impact of declining water availability was explored in detail in the 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.

Figure 1.1: Goulburn Murray Irrigation District (source: G-MW)

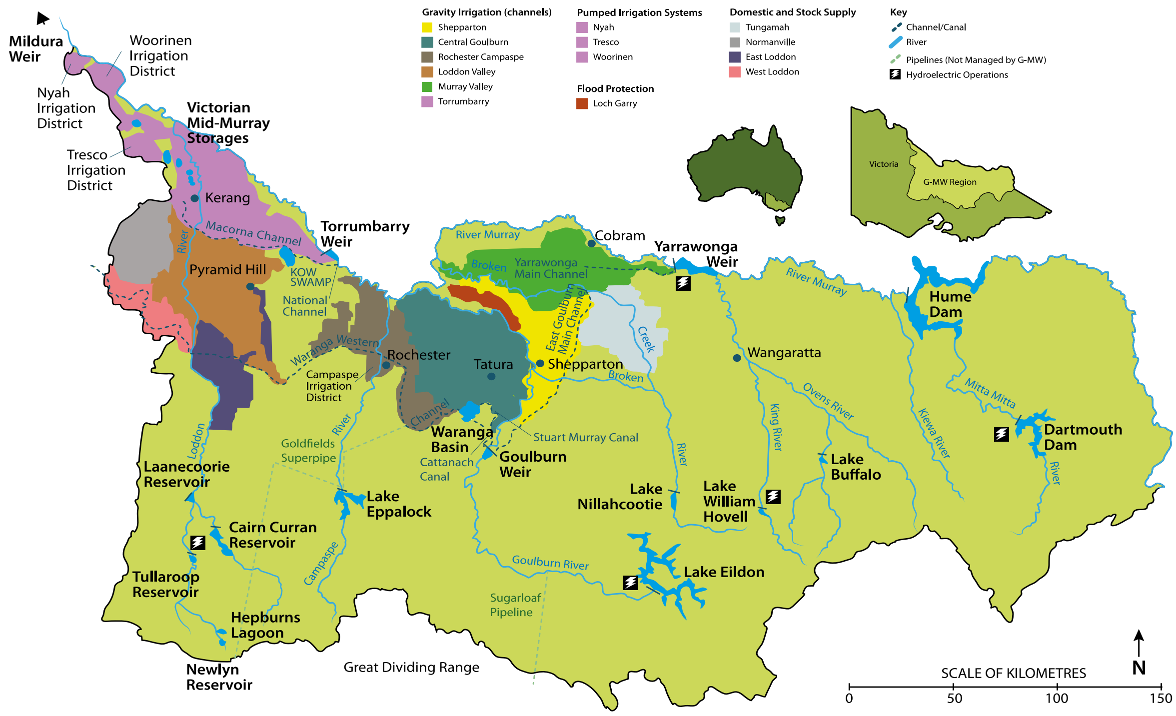
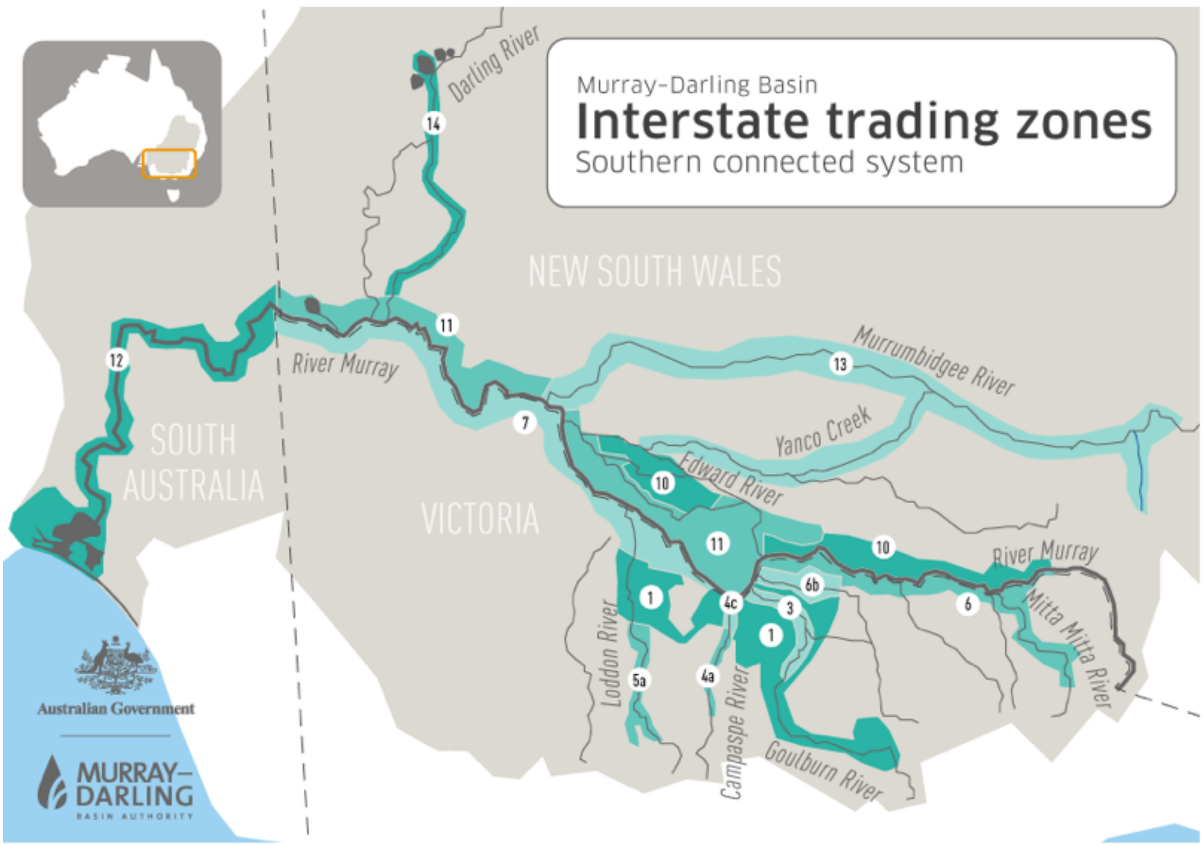


Figure 1.2: southern connected Murray Darling Basin (source: MDBA)



1.3 SUMMARY OF ISSUES AND CHALLENGES

Based on the Phase 1 project report, the following issues and challenges have been identified:

Issues:

- Increasing demand for Victorian High Reliability Water Shares (HRWS) from outside of the GMID.
- Low and declining regional irrigation water availability and therefore use, relative to historic water use and GMW system capacity.
- Exposure of irrigation industry and processing sector to less water, especially the impact during drought. Increasing variability in water availability and as a result, water market price and regional water use.
- More frequent, extreme weather events (eg, flood, fire, drought) as a result of climate change.
- Farming systems with low flexibility to adapt to changing water availability.
- 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'.
- Water service product needs of rural residential, horticultural, dairy and mixed farmers are very different.

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 farm and off-farm water use efficiency[1]; and measures that fully account for the environmental and social effects of irrigation.
- Ensuring that water losses between systems and third party impacts of trade[2] are properly understood and accounted for.
- Increasing knowledge of the water market and providing transparency in water trading across the sMDB so fully informed water use / business decisions are made.
- Uncertainty about 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 "up water"[3] as part of the Basin Plan. 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 business model meets future needs.
- 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.

1.4 NEXT STEPS

Phase 2 of this project will involve developing an action plan that takes into account the above issues and challenges and will highlight a range of opportunities within the GMID that will continue to make it an attractive place to invest in and grow existing and new food and fibre-related businesses. This stage of the project is due to start early 2017.

1. Including evapotranspiration (ET) demands and production per ML.
2. 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.
3. Under the Basin Plan the 2,750 GL target could be increased to 3,200 GL to meet the Sustainable Diversion Limit.

2. IRRIGATION PRODUCTION AND ITS PROSPECTS IN THE GMID

2.1 ECONOMIC SIGNIFICANCE

The GMID is the country's largest irrigation district. It produces more fruit and dairy produce than any other region, as well as supporting significant general horticulture and mixed farming.

The GMID makes up about 43% of the irrigated area, uses 31% of the water and generates 27% of the Gross Value of Irrigated Agricultural Production (GVIAP) in the sMDB. However, this will vary from year to year depending on water allocation.

The food processing industry in the GMID is a major Victorian employer and its main exporter. There are 16 dairy factories in the region with dairying producing 53% of the GVIAP and using most of the region's land and water. Horticulture produces around 36% of the GVIAP.

Total agricultural production including dryland is 18% of Victoria's Gross Value of Agricultural Production (GVAP) of $11.6 billion (ABARES 2015).

2.2 SIZE AND DISTRIBUTION OF GMID CUSTOMERS

Like all forms of agriculture, the GMID has experienced:

- growth in the number of rural residential properties that are supported by off-farm income;
- growth in larger properties, that have the cash flow to expand; and
- a reduction in medium-sized properties that find it difficult to fund expansion.

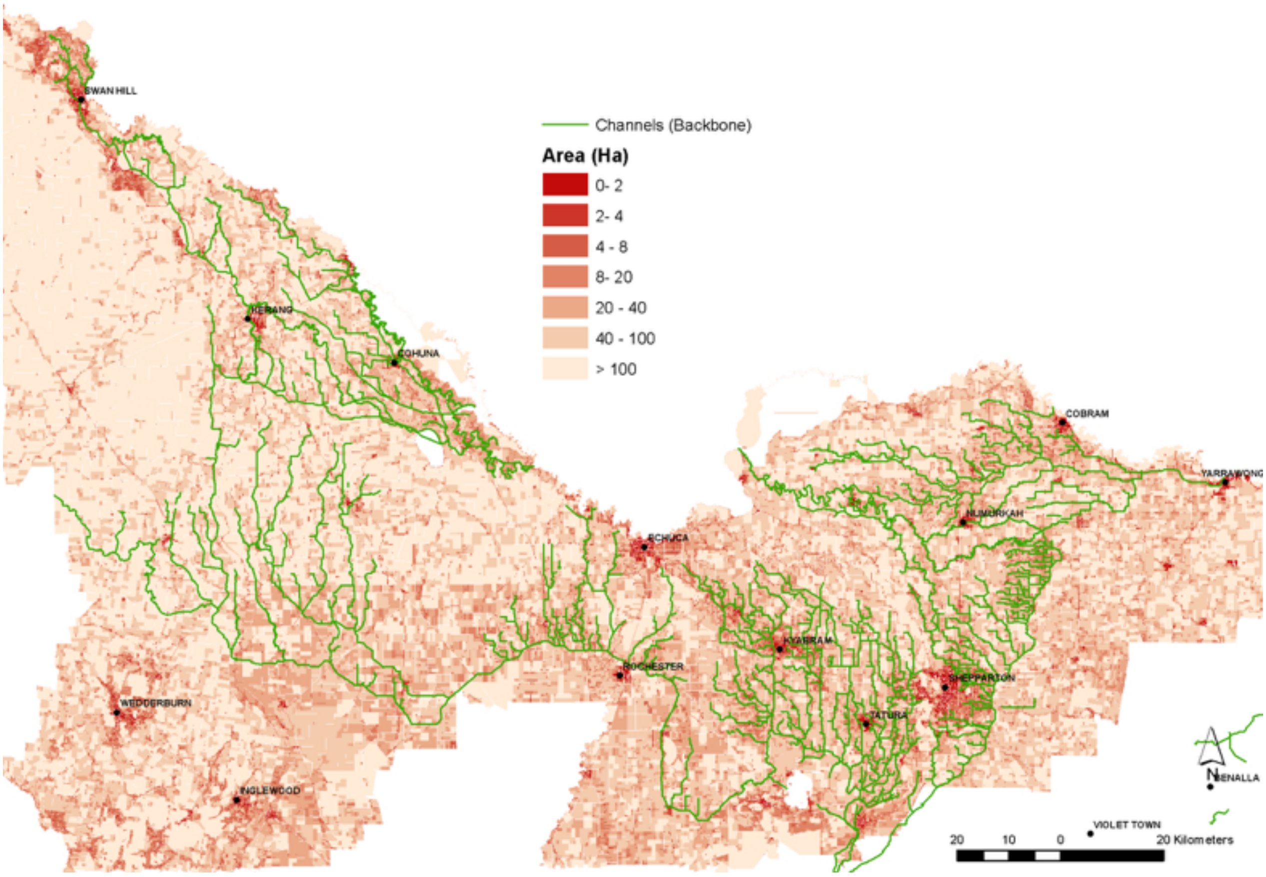
With reduced water availability this trend is increasing as there are more small-scale dryland blocks that are usually only attractive for rural residential buyers. There is expected to be future growth in rural residential as block sizes become too small for commercial irrigation and the relative price of a house in town increases compared to a block with a rural house.

Future economic activity depends on growth and expansion of the larger properties, however, this may become difficult when block sizes are small and when their price is 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 they are more likely to have a cash surplus after they have met their living costs to invest in additional land, water or 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; or
- dairy farms with more than 1,000 ML/y use and 300 ha of irrigated land; or
- mixed farms with more than 2,000 ML/y use and 600 ha of irrigated land.

The number of properties that match this definition in the GMID is relatively small, but they make up a large proportion of water use and value of production. See Figure 2.1.

Figure 2.1: Size distribution of land parcels in the GMID (Supplied by DEDJTR, 2016)



2.3 LAND-USE PLANNING

Land-use planning is important to support existing agriculture and ensure 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, making it too expensive for farm expansion. Managing housing development to prevent ad hoc rural living development on small allotments is critical. This is particularly true for modern irrigation operations as they run 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 particularly horticulture and dairy enterprises. This includes expansion into traditional mixed farming areas where block sizes are generally larger and larger-scale units can be achieved.

2.4 GMID IRRIGATION INDUSTRY PROSPECTS

The competitiveness of dairy and horticulture in a global environment and the ability to compete with other industries within the sMDB for water are critical to the GMID's prosperity and viability.

Dairy is the GMID's biggest water user and also underpins many mixed farms who produce feed for the dairy industry. Recent market analysis (Michael Harvey, Rabobank 2016) suggests that once the current downturn is over, dairying in the GMID can continue to be a major industry.

Horticulture is a relatively small GMID water user (<10%) and makes up only 10% of the total horticultural water use in the sMDB. However, it generates a very high return per ML: significantly higher than other horticultural regions in the sMDB. Its competitive advantages need to be maintained and enhanced to ensure horticulture continues to grow in the region.

CSIRO (Eady 2015) identifies a bright future for Australian agriculture, with diverse opportunities that are driven by:

- global growth in demand for high quality food and fibre products;
- income growth in Asia that will see diets diversify, protein consumption rise and niche markets for boutique foods becoming mainstream markets;
- new technologies combined with improved knowledge that reduce costs, improve product quality, manage risk and make supply chains operate more efficiently;
- a knowledgeable customer, who is more demanding about provenance, ethics, sustainability and health benefits; and
- climate change, globalisation and environment change posing risks to 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 and improve water-use efficiency.

In general, agricultural industries are aware of these drivers and are investing considerable resources to maximise their opportunities for growth. The key competitive advantages for the GMID compared to 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 evapotranspiration (ET) demand and higher rainfall than other areas in the sMDB mean that pasture can be grown using less water per ha (more tonne 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, which can cause crop losses through sunburn and wind damage, than other parts of the sMDB.
- Water security - the GMID has much higher water security than NSW and potentially less water losses as water is traded between systems compared to downstream use.
- Water quality – lower salinity risks 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.
- Land availability – there is a lot of land that is currently unirrigated that is serviced by the GMW supply system.
- Modern infrastructure - for example, road access, subsurface and surface drainage services.
- Good transport links - proximity to the Melbourne-Sydney corridor.
- Food processing investment – established milk factories, fruit processing factories and transport hubs.
- Skilled people and well-developed stakeholder partnerships - a pool of skilled people and organisations in the region. Access to research through government departments and university campuses in the region.
- Strong social fabric - The GMID supports well-serviced, increasingly diverse rural towns and major centres, which combined with the region's attractive climate, proximity to Melbourne and natural attractions, creates vibrant communities that have the capacity to adapt to change.
- Low cost base for setting up irrigation in the region versus large capital needed for private diversion.

2.5 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 2.2 below shows water delivered in the GMID since 1984/5.

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 actively irrigated (and may be much lower in drought) . 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 (SDLs), water trade to horticulture and climate change. Each of these are discussed below.

Figure 2.2: GL/y water deliveries in the GMID

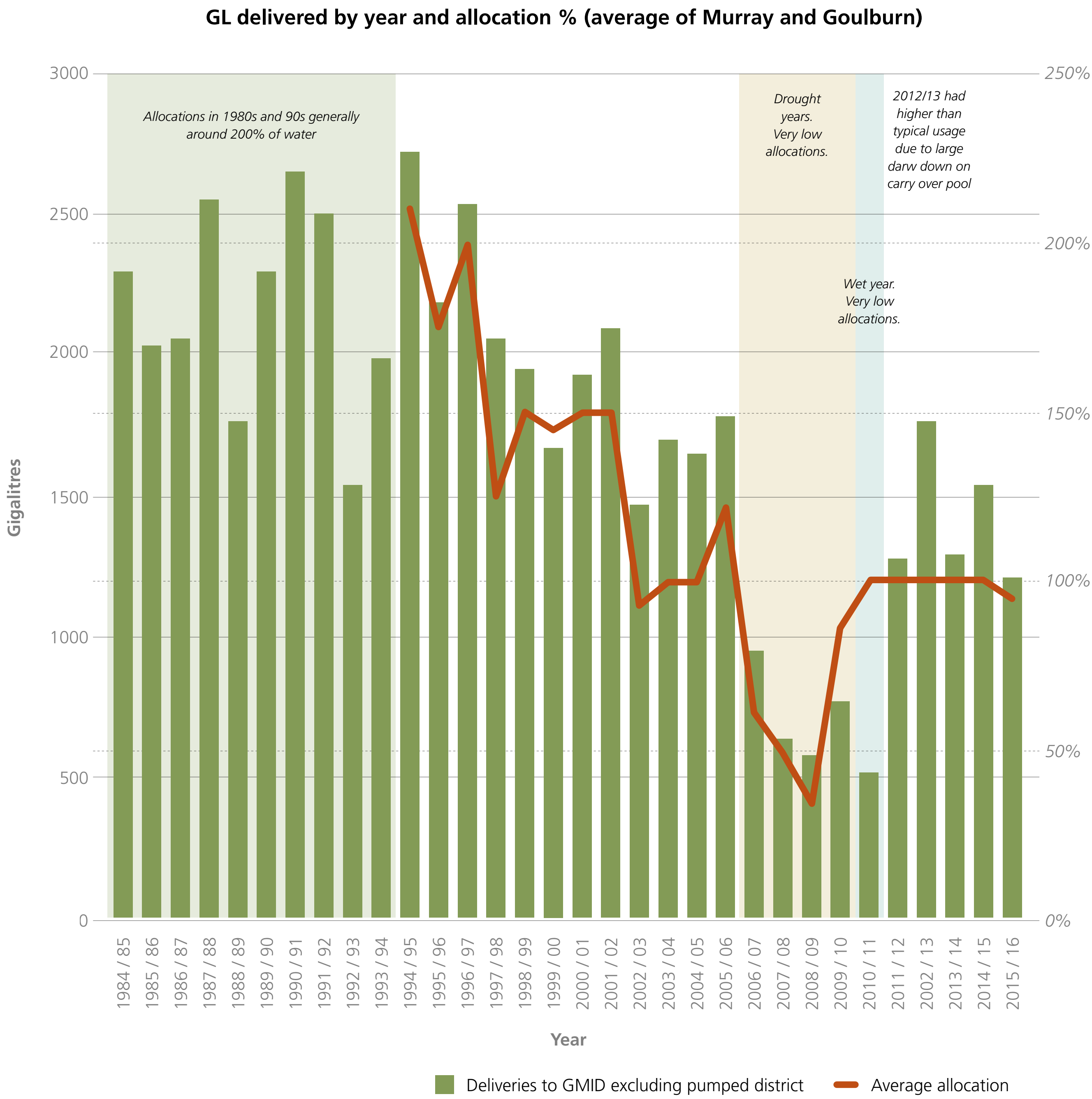


Table 2.1: Water recovery to meet Basin Plan SDLs at 30/9/2016

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

Water recovery

The adoption of SDLs under the Basin Plan has resulted in substantial buy back of water entitlement and significant investment in farm irrigation and network delivery infrastructure improvements to reduce water losses. Table 2.1 shows the volume of water remaining at September 30 2016[4] to meet the 2,750 GL target[5].

It is unclear how much of the water recovery remaining to meet the SDLs will be delivered from infrastructure savings and environmental works that create SDL offsets. There is also the possibility of an additional 450 GL of "up water" water recovery (3,200 GL of water recovery rather than 2,750 GL in the MDB) that if it proceeds would further reduce water availability. This additional water recovery is contingent upon there being no socio-economic impact.

Water trade to horticulture

Horticultural water use is expected to grow. Expansion is likely to be through buying HRWS 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 (around 1,400GL/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 2.7.

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 means that we can expect lower volumes harvested by water storages (dams) 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 (see Section 2.7) scenarios have assumed inflows of 75% of the long-term average as being a future "typical year". This is similar to the average inflows of the past 20 years.

4. http://www.mdba.gov.au/sites/default/files/docs/environmental-water-recovery-estimates-as-at-30-september-2016-details.pdf
5. 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")

2.6 IMPACT OF DECLINING WATER AVAILABILITY ON THE WATER MARKET PRICE

The market price of water is related to the water available in the sMDB. High-value horticulture sets the price when water is in short supply while lesser value rice sets the price when water is plentiful. The impact of a 20% reduction in the pool (amount of water) has been estimated:

- in drought years water prices rise by around $158/ML due to lower water availability;
- in wet years it rises around $32/ML; and
- an 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.

2.7 INDUSTRY RESPONSE TO WATER AVAILABILITY

The responses of each industry in the sMDB now form "a dynamic equilibrium", which affects water use in the GMID.

This equilibrium is made up of:

- opportunistic croppers who expand and contract their water use in response to changing water price/availability;
- rice growers who expand and contract production 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 from dairy; and
- 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.
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. Livestock production based on broad pasture-based mixed farming can use large amounts of water 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

This means that there will be always be a mix of enterprises that suits the water that is available.

The future for irrigation in the GMID depends on the region's ability to compete for a share of a decreasing amount of water.

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

DROUGHT

(39% inflows of average inflows)
2,328 GL across the sMDB

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 across the sMDB

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 across the sMDB

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;
- growth of horticulture occurs to reach a maximum limit of 1,400 GL/y usage in an average year; andrelatively constant use across the three climate scenarios.

SCENARIO 1

- 300 GL reduction to reflect the 350 GL of offsets against the 650 GL SDL reduction that is remaining to reach 2,750 GL.

SCENARIO 2

- 750 GL reduction includes the 300 GL in scenario 1 plus 450 GL of "Upwater".

Scenarios 1 and 2 assume 350 GL of offsets are achieved. The MDBA has so far modeled 15 of 37 offset projects, which have an estimated offset of 370 GL, but the SDL Adjustment Stocktake report estimates current projects under consideration would give 500 GL of offsets. 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.

In a "base case drought year", which can be expected to occur in approximately 10% of years (based on the last 20 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. Scenarios 1 and 2 reduce the area to 84,000 ha and 69,000 ha respectively.

In a "base case typical year" there is 360,000 ha irrigated in the base year. This reduces to 330,000 ha and 290,000 ha under the two scenarios.

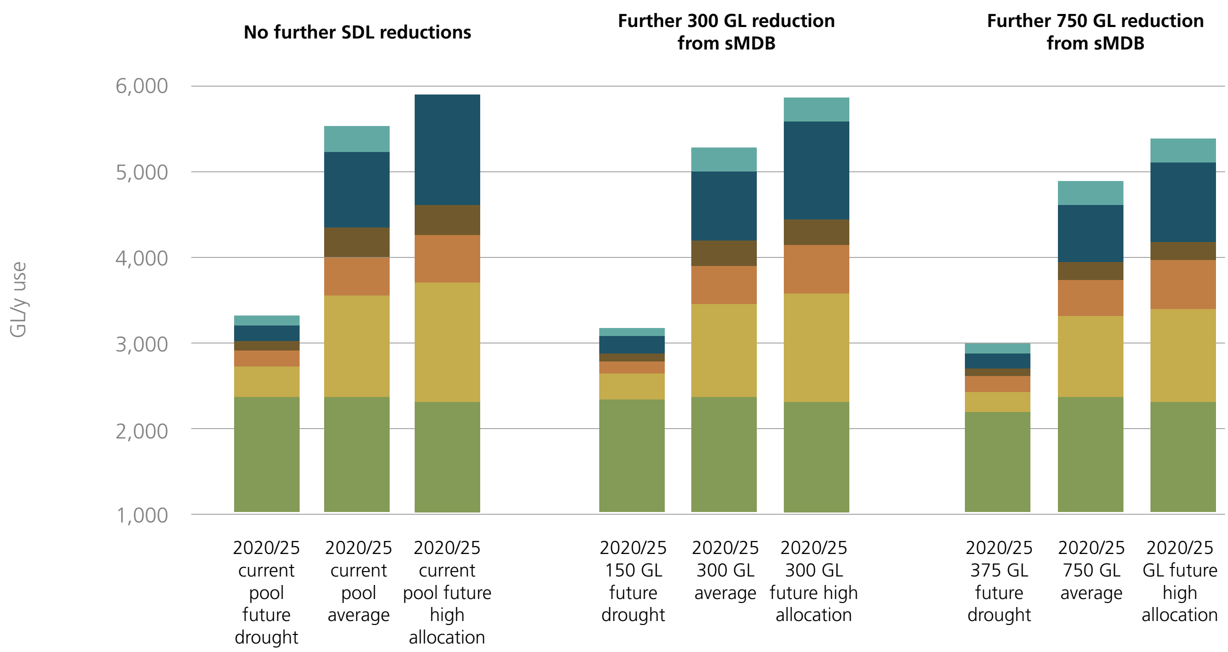
2.8 MANAGING A FUTURE DROUGHT FOR THE GMID

Historically, prior to water trade and the growth of horticulture in the sMDB, a 50% reduction in water allocation would have meant a 50% reduction in area irrigated in the GMID. This has now changed to a 75% reduction in area. Also, the low water use in drought years will place increased pressure on GMW to operate the system in new ways that minimise losses.

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 with increased climate variability. Water trading, carry over and other mechanisms to secure water at affordable prices are ways to improve flexibility. Predictive knowledge of 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, eg. feed substitution for water.

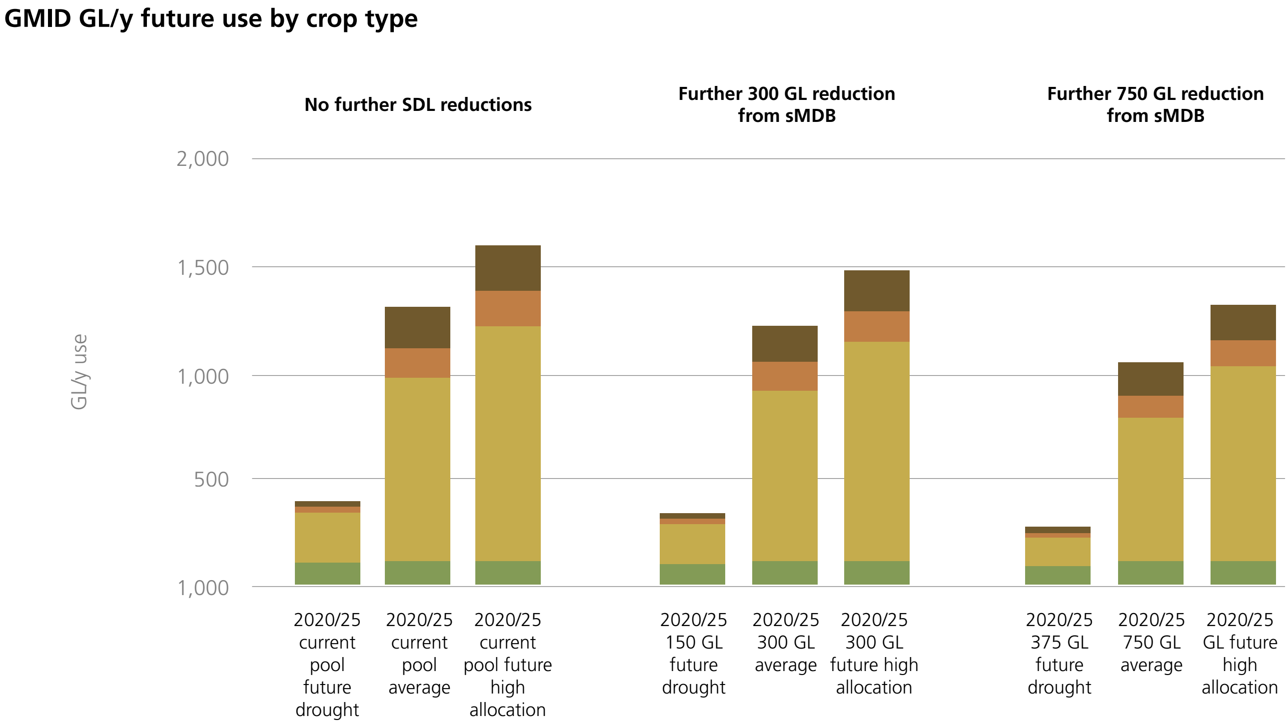
Figure 2.4: sMDB Estimated change in future use under three scenarios for a future equilibrium

sMDB GL/y future use by crop type



Cotton GL	116	272	288	115	259	272	113	239	248
Rice GL	186	905	1,268	185	805	1,138	180	678	948
Pastures non-diary GL	116	317	346	103	279	297	110	219	226
Other crops GL	163	453	576	150	440	560	156	420	536
Diary GL	349	1,177	1,383	284	1,089	1,269	235	917	1,103
Horticulture GL	1,397	1,403	1,325	1,360	1,403	1,325	1,221	1,403	1,325
Total GL	**2,328**	**4,526**	**5,762**	**2,198**	**4,276**	**5,437**	**2,016**	**3,876**	**4,962**
Long term infows %	*39%*	*75%*	*123%*	*39%*	*75%*	*123%*	*39%*	*75%*	*123%*

Figure 2.5: GMID estimated future water use under three scenarios for a future equilibrium



Pastures non-diary GL	32	197	216	27	179	193	26	158	160
Other crops GL	24	131	160	19	122	149	18	105	132
Diary GL	240	879	1,120	188	818	1,040	143	684	924
Horticulture GL	104	105	104	101	105	104	85	105	104
Total GL (inc. g.water)	**400**	**1,312**	**1,600**	**335**	**1,225**	**1,486**	**270**	**1,052**	**1,320**
Long term infows %	*39%*	*75%*	*123%*	*39%*	*75%*	*123%*	*39%*	*75%*	*123%*

3. COMPETITIVENESS AND VIABILITY OF IRRIGATION IN THE GMID

3.1 COST OF IRRIGATING

GMID's viability depends upon its irrigators being able to make a profit. This is influenced by market demand, prices and their cost of production. There are several components to the cost of irrigation (Croke 2016) including:

- 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.
- Irrigation labour and other irrigation operational and maintenance costs.
- Farm irrigation infrastructure depreciation cost.
- GMW water charges.

The total of these farm costs can be around $300/ML or more. One variable is the GMW $/ML water charge. This is influenced by usage, the amount of delivery share (DS) owned, number of outlets and ML HRWS held.

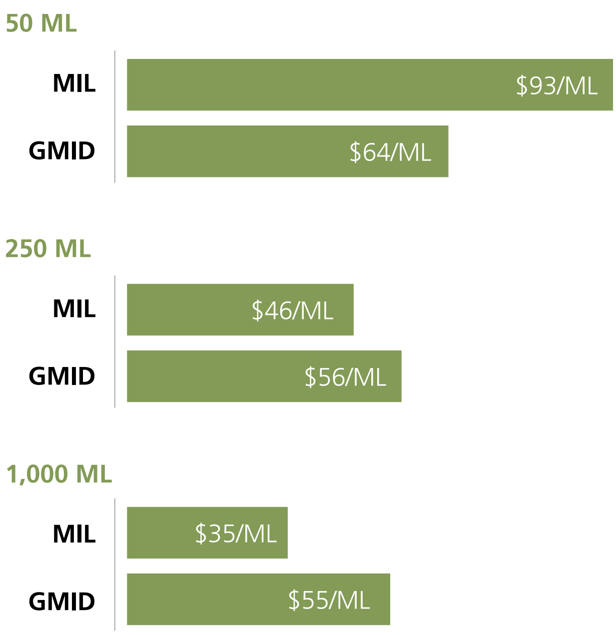
The following simple example illustrates how cost per ML can change:

- $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 GMID irrigators can reduce water charges per ML if they increase water use per DS held.

3.2 COMPARISON OF GMID CHARGES AND OTHER AREAS

The Australian Consumer and Competition Commission calculates hypothetical water bills for irrigation networks assuming the customer holds 50 ML, 250 ML or 1000 ML of water entitlement and an equivalent volume of water delivery right. (ACCC 2016). GMID charges per ML fall with increased use, but not as much as in NSW's Murray Irrigation Limited (MIL). Key differences for a 100% allocation[6] year are:



6. 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.

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 zero NSW Murray general security allocation may result in no 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.

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.

3.3 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 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 it is expected to be a net exporter to meet the shortfall of downstream horticulture. The future scenarios previously discussed in the Section 2.7 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 rules change depending upon seasonal conditions and "back trade" opportunities.

Another issue raised by GMID stakeholders is the river conveyance loss (the volume of water "lost" in transit through the system) that may occur when water is traded out of the GMID to a downstream region. 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.
The impact of these changes on the timing and location of water demands needs to be monitored to support the reliability of water entitlements.

3.4 COST RECOVERY IN THE GMID WHEN THERE IS LESS IRRIGATED LAND

There is potential for current GMW delivery share charges to double over the next 20 years to cover the increased cost of replacing infrastructure assets. It is uncertain what similar profiles would be for other irrigation water providers in the sMDB, but it is likely to be a key issue facing many water providers.

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 are able to expand water use up to 270 ML per DS. Those who have done this have effectively reduced their water charges per ML used (as illustrated in Section 3.1), 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 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 10 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.

3.5 IMPACT OF SMALLER IRRIGATED AREA ON GMW 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-used irrigation supply infrastructure. 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 more dryland 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.

GMW might consider different service offerings that are more in line with each industry's 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; and
- 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.

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GOULBURN BROKEN CATCHMENT MANAGEMENT AUTHORITY

PO Box 1752
Shepparton VIC 3632

Tel. (03) 5822 7700
Fax. (03) 5831 6254
Email. reception@gbcma.vic.gov.au

www.gbcma.vic.gov.au

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