URBAN WATER STRATEGY 2017-2065

Optimising water resources for a liveable, productive and sustainable south west Victoria. Now and into the future.

March 2017

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2	14/2/2017	Tim Harrold	New sewerage section; revised appendices
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4	24/2/2017	Julia Thompson	Tracked Changes and exec summary by Julia
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8	9/3/2017	Tim Harrold	For review by Board
9	29/3/2017	Tim Harrold; Peter Wilson; Andrew Jeffers	Minor updates, completion of option data, updated Forward

Cover photo: Gellibrand River Estuary.

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Dated:
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FOREWORD

The south-west of Victoria has been fortunate to have a climate that has delivered a reliable annual rainfall over the past 120 years to meet the water supply needs of urban and rural communities throughout the region. However, as a result of a drying climate, we cannot assume that this historical rainfall reliability will continue.

This Urban Water Strategy provides a 50-year forecast of both water supply and demand to ensure that our region's water supplies will remain sustainable and that Wannon Water will continue to meet the needs of our customers and community now and well into the future.

This strategy is not just about accounting for the projected decline in rainfall and streamflow in south-eastern Australia. It also addresses water use patterns in urban communities and using water efficiently so that future generations in the south-west can continue to flourish.

Sustainable management principles are a key focus of this Urban Water Strategy. The streams and aquifers which underpin the south-west's water supply also sustain natural systems which are vital to the liveability of our region. These natural systems will also experience the stresses of climate change. This strategy outlines a program of targeted demand reduction and actions, such as exploring options to reduce the summer flow stress on the Gellibrand River, which will ensure that natural systems are not deprived by urban water extractions.

The climate modelling used within this strategy represents the most contemporary climate science available, ensuring that the information used in the various climate scenarios is as accurate as possible.

This strategy also includes an assessment of Wannon Water's sewerage services for the first time and identifies that the Warrnambool Water Reclamation Plant is required to be upgraded within the next five years.

Wannon Water's customers and community have been involved in the creation of this strategy through community surveys, regional community workshops, local government presentations, industry and engagement with business, catchment and groundwater management agencies and traditional owner groups. The feedback, learnings and insights received from this engagement has been incorporated into the strategy.

Our ultimate aim is to create a long-term, secure water supply and sewerage services that are environmentally sustainable, socially equitable and cost-effective. With our customers' help and support, this strategy will contribute to a more liveable, productive and sustainable south-west Victoria for the existing community and its future generations.

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EXECUTIVE SUMMARY

Planning for a Secure Water Future
Wannon Water supplies water to 36 towns and communities via 14 water supply systems within its region. These systems are diverse in nature, including surface systems (rivers and streams), deep geothermal grounder water systems (aquifers) and shallow aquifer systems. Wannon Water is also responsible for residential, commercial and industrial wastewater treatment, recycling and discharge across its catchment.

Underpinning this Strategy are Wannon Water's agreed levels of service which:

- Supply customers with a reliable water supply free of water restrictions for 95 in every 100 years; and
- During times of drought or water shortage, aims to ensure that its customers are not restricted in their use of water beyond stage 3 water restrictions.

The impact of climate variability has been considered for each supply system by modelling four climate change futures, anticipated by different climate models. The four projections represent a low, medium and high impact on water availability from climate-dependent sources, plus a "step-change" scenario. This Strategy shows that the south west is well placed to retain a competitive advantage associated with access to secure supplies of water.

The approach of Wannon Water is to promote common water conservation actions and to tailor augmentation options for each water system. This approach recognises the interrelationship between water, the needs of the environment and the needs of communities.

Actions to Secure Our Water Future
Improving water systems efficiency and promoting water conservation for both the public and industry are high priorities for Wannon Water to secure our water future. The continuation of successful public education and awareness campaigns on the need to conserve this precious resource is a must, with an ongoing focus on household appliances and garden watering.

While residential demand for water per household for the largest towns in the region has remained constant over the past five years, residential customer use overall in 2015/16 (at 5278ML) was below the residential use of a decade prior (6786ML in 2005/06) – testament to concerted engagement with the public. This is further evidenced by the residential water use per person which dropped by 3% from 2009/10 to 173L/per person in 2015/16.

A suite of demand management options is included in this Strategy, with a cost/benefit analysis highlighting education regarding demand reduction, along with water pricing linked to volume use, as the options presenting the best value for money. Significant water savings are also anticipated from water efficiency improvements at council-managed properties and from leakage reduction in the reticulation network. Wannon Water aims to reduce this non-revenue water loss by 150 ML between 2016 and 2022 (from 1478ML/year to 1328 ML/year).

Overall population served is projected to increase from 84,172 in 2016 to 113,472 in 2065. In addition, the 13 major customers of Wannon water who used 25% of total consumption in 2015/16 (milk and food processing industries) must have their future plans considered. Those plans along with known plans of other future major customers will impact significantly on the demand for water. Consultation with industry has revealed that the most probable forecast is rapid growth in total demand from major customers from 2800ML to 4200ML over the next five years, and then more moderate growth in demand is projected to 2065. Most of this growth will be in the Otway System.

This Strategy shows that groundwater-supplied systems will have sufficient supply to meet projected demand up to 2065. Of the surface water systems, Glenthompson requires augmentation over the coming years to avoid water restrictions if demand increases or supply falls. Wannon Water is in an enviable position overall, however, as no other augmentation works are required to be undertaken during the next regulatory period to meet the forecast demand for water. However, if a high-demand scenario was to eventuate in regions supplied by the Otway System (by far the largest of Wannon Water's systems), its augmentation would be required as early as 2028.

The innovative Warrnambool Roof Water Harvesting Project is already alleviating demand from the Otway System, with 100% of the water for this Russells Creek growth corridor provided by the annual volume harvested from the roofs. This project will further grow over the next 30 years as land north east of Warrnambool continues to be subdivided for residential development. Projects such as these which maximise use of rainfall and stormwater are likely to be strengthened by improved collaboration between Councils, Catchment Management Authorities, state government, schools and industry as part of Integrated Water Management Forums and the subsequent Integrated Water Management Plans. Warrnambool's growth is also being planned for through bringing the existing emergency relief bore at Curdievale fully online.

The Warrnambool Water Reclamation Plant is set to be upgraded within the next five years (after an extensive assessment of the best option to deal with growth in major customer wastewater and future growth of residential customers), resulting in an increase in discharge to the ocean outfall. The salty nature of the effluent makes it inappropriate to meet irrigation needs without dilution but further recycling opportunities may arise through the development of integrated water management plans.

This Strategy also outlines management and sustainability plans to protect water supplies, taking environmental factors (including extreme events) and Drought Preparedness Plans into account, along with climate scenarios, water use patterns and community attitudes to water use.

Implementing this Strategy

Action Plans have been prepared for the Otway, Grampians, Glenthompson and Groundwater Systems operated by Wannon Water. These Plans address the need to implement actions contained in the *Urban Water Strategy 2017-2065* and the Drought Preparedness Plans to ensure that water supply exceeds demand now and in the future.

This Strategy has identified actions that need to be undertaken over the medium term (0-5 years) and long term (5-50 years) to ensure that the supply/demand balance is maintained. Actions to be undertaken in the medium term will be included in Wannon Water's 2018-2023 Pricing Submission.

Central to the development of this Strategy was engagement with Wannon Water's stakeholders and customers. Informing, consulting and collaborating with our stakeholders is a vital and established step in Wannon Water's decision-making process. This Strategy's Consultation and Engagement plan was developed and implemented between April 2016 and February 2017. The result of this engagement have been valuable in setting the direction of this Strategy

Wannon Water's Urban Water Strategy Working Group will review progress with the implementation of the actions at its quarterly meetings. Wannon Water will also make available to the public, and submit to the Department of Environment, Land, Water and Planning, by November each year during the five-year implementation period of the Urban Water Strategy, a summary of the updated Annual Water Outlook and the list of priority actions contained in the Action Plan for each of its water supply systems. Updates on the progress of this Strategy will also be included in the Corporate Plan and associated quarterly reports.

SECTION 1. PLANNING FOR A SECURE WATER FUTURE

1.1 Role of Urban Water Strategies

The purpose of Urban Water Strategies is to identify the best mix of measures to maintain a balance between the demand for water and available supply in urban supply systems now and into the future. Urban Water Strategies:

- Consider all aspects of the Urban Water Cycle across a 50-year planning horizon;
- Ensure that urban communities are resilient and liveable now and in the future;
- Are informed by local integrated water planning undertaken by agencies and authorities with roles and responsibilities across water supply, wastewater, flood resilience, urban waterway health and urban landscapes and spaces;
- Balance social, environmental and economic costs and benefits; and
- Ensure that our future portfolio of water sources is diversified and resilient.

Wannon Water's Urban Water Strategy 2017-2065 was preceded by the Water Supply Demand Strategies 2007-2055 and 2012-2060.

1.2 Objectives

The key objective of the Urban Water Strategy is to ensure that urban water planning and investment by Wannon Water is efficient and effective. This will:

- Ensure safe, secure, reliable and affordable water supplies that meet society's needs;
- Enable customers to have access to desired water products and services, and to choose to use water for activities they value highly;
- Encourage the sustainable use of water resources – including rainwater, stormwater and recycled water and rainfall-independent supplies in ways that are efficient and fit-for-purpose, whilst ensuring that public and environmental health are protected;
- Educate communities on the role of water in our urban communities to enhance liveability, productivity, prosperity and environment of our cities and towns;
- Ensure that water needs of environmental assets are transparently considered and delivered; and
- Ensure that water planning is subject to a transparent and rigorous decision-making process, with clear roles and responsibilities and accountabilities, which can adapt to the changing environment.

1.3 The South West Region

The area served by Wannon Water is shown in Figure 1. Some of the special water supply features of the region are:

- The diverse nature of the water supply systems. Surface water supplies for the Otway system are derived from the Gellibrand catchment in the Otway ranges. The Grampians system is supplied from Rocklands Reservoir and the streams of the Southern Grampians. Both systems depend on small diversion weirs. Wannon Water has no on-stream storages. The deep Dilwyn aquifer supplies seven towns, including Portland. Shallow aquifers have been developed to the west of Casterton and at Mount Rouse and Macarthur. A number of surface water systems also integrate shallow aquifer resources. There is an extensive network of supply mains interconnecting communities which allows for some flexibility in the consideration of supply augmentation and other responses to demand.

- The supply network meets the needs not just of urban communities but also of a large number of primary producers. Nearly 5% of customers are primary producers and more than 15% of total demand is driven by this customer group.

- Heavy industry and milk/food processing also generates significant demands. For some towns, a single industrial customer uses more than half of the total township demand. These industrial/processing customers are vital to the economic wellbeing of the region.

- One effect of a dozen larger industrial/processing customers and of rural customer demands is that residential customer water use is less than 50% of total use.

- Demand by residential customers is not uniform. Prevailing rainfall patterns favour the coastal strip, with this pattern extending about 20km inland.

- There are some water supply matters involving jurisdictional overlap. Wannon Water and Barwon Water both derive water from the Gellibrand River. Glenthompson is supplied from the Willaura system (a Grampians Wimmera Mallee Water headworks asset) under a Bulk Entitlement. Hamilton and Balmoral are supplied from Rocklands Reservoir (a Grampians Wimmera Mallee Water headworks asset) under a Bulk Entitlement.

Figure 1. Wannon Water – Service Area and System Features

Wannon Water's towns are supplied with water sourced from surface water and groundwater. The supply sources for each water supply zone are provided in Table 1.

Table 1: Description of Supply Sources for each Supply Zone

Supply Zone	Supply System(s)
Balmoral	Rocklands Reservoir – surface supply
Camperdown	Otway system – surface supply
Caramut	Newer Volcanic aquifer (Mt Rouse eastern slopes)
Carlisle River	Otway system – surface supply
Casterton	Bridgewater Formation aquifer (Tullich)
Cavendish	Grampians streams – surface supply
Cobden	Otway System – surface supply
Coleraine	Bridgewater Formation aquifer (Tullich)
Darlington	Newer Volcanic aquifer (Darlington) (non-potable supply)
Dartmoor	Dilwyn aquifer zone 1 (Dartmoor)
Dunkeld	Grampians streams – surface supply Rocklands Reservoir – surface supply
Glenthompson	Glenthompson Reservoir - surface supply Willaura system - surface supply
Hamilton	Grampians streams – surface supply Rocklands Reservoir – surface supply
Heywood	Dilwyn aquifer zone 2 (Heywood)
Konongwootong	Konongwootong Reservoir – supply by agreement only
Lismore and Derrinallum	Otway system – surface supply
Macarthur	Condah aquifer (Macarthur)
Merino	Bridgewater Formation aquifer (Tullich)
Mortlake	Otway system – surface supply (70%) Newer Volcanic aquifer (Mortlake) (33%)
Noorat and Glenormiston	Otway system – surface supply
Penshurst	Newer Volcanic aquifer (Mount Rouse)
Peterborough	Dilwyn aquifer zone 3 (Port Campbell)
Port Campbell	Dilwyn aquifer zone 3 (Port Campbell)
Port Fairy	Dilwyn aquifer zone 2 (Port Fairy)
Portland	Dilwyn aquifer zone 2 (Portland)
Purnim	Otway system – surface supply
Sandford	Bridgewater Formation aquifer (Tullich)
Simpson	Otway system – surface supply
Tarrington	Grampians streams – surface supply Rocklands Reservoir – surface supply
Terang	Otway system – surface supply
Timboon	Dilwyn aquifer zone 3 (Port Campbell)
Warrnambool, Allansford and Koroit	Otway system – surface supply (90%) Southwest Limestone aquifer (Warrnambool) (10%) Warrnambool roof water harvesting scheme

Notes: for aquifer supplies, the location of the bore is shown in brackets. The Otways, Grampians, and Willaura systems are supplemented by bores as described in Section 5.

1.4 State Framework

Victoria has an adaptive water management framework for water resources established under legislation – primarily the *Water Act 1989, Water Industry Act 1994*, and associated guidelines, such as the Statement of Obligations.

Water corporations have a number of responsibilities under this framework including the development of:

- **Urban Water Strategies:** Developed every five years to outline water supply security over a 50-year outlook;
- **Drought Preparedness Plans**: Developed every five years (or within 12 months of either the lifting of any period of water restrictions or the augmentation of any water supply system) to define timely and effective preparation and response to anticipated water shortages;
- **Annual Water Outlooks:** To report upon each supply system's ability to provide sufficient water security in the short term; and
- **Emergency Management Plans**: To respond to emergencies such as bushfires, blue-green algae outbreaks and other water quality incidents.

Water for Victoria (2016) outlines the water management opportunities and challenges facing Victoria over the coming decades. It builds on the planning framework established in *Our Water, Our Future* (2004), while incorporating lessons from the millennium drought and the 2010-11 floods. Among these lessons is recognition of the essential role water supply plays in ensuring that towns and cities are resilient and liveable, which is fundamental to economic prosperity, social, community and environmental wellbeing and community identity. This highlights the integral nature of integrated and strategic approaches to urban water service provisions and urban land use planning, involving water corporations, local governments, Catchment Management Authorities and community stakeholders. This has been taken into consideration in the development of the Integrated Water Management Planning Framework - introduced by *Water for Victoria* (2016) - which is described in the next sections, along with the new requirements for customer consultation.

Plans of water corporations can be influenced by long-term water resource assessments, which are a legislative requirement under Division 1C of the Water Act 1989. These assessments of the resource base and river health are required to be undertaken every 15 years, with the first in 2019. The principle objective of the long-term water resources assessment is to determine whether there has been a change in water availability that has had a disproportionate impact on any class of water entitlement or if waterway health related to flow has deteriorated. If there has been a disproportionate impact, a review will be conducted to determine how to restore an acceptable balance. This may involve corrective action to restore a balance between water available for consumption and the environment. The Water Act 1989 provides processes for making these adjustments.

Wannon Water provided input to the *Western Region Sustainable Water Strategy 2011*. Regional sustainable water strategies are a legislative requirement under Division 1B of the *Water Act 1989* and fulfil Victoria's commitment under the National Water Initiative to carry out open, statutory-based water planning. Sustainable water strategies are prepared on a regional basis by the Department of Environment, Land, Water and Planning on behalf of the Minister for Water, under the guidance of a consultative committee and an independent panel appointed by the Minister for Water. Wannon Water was represented in the formation of this Strategy by Wannon Water officers and the Managing Director. The *Western Region Sustainable Water Strategy* was released in November 2011.

The matters arising from the Strategy that have direct relevance to Wannon Water are:

- Continuation of government rebate programs to promote water conservation and efficiency;
- Exploration for potential for extending the reticulated supply network;
- Use of “declared intensive management areas” to better manage land use changes that impact on water availability;
- Exploration of options to reduce the summer flow stress on the Gellibrand River; and
- Improvement of the water quality through better catchment management and on ground actions.

These matters are discussed in more detail throughout this Strategy.

1.5 Integrated Water Management Planning Framework

Water for Victoria (2016) introduces a new integrated framework for urban water management. The framework outlines water’s role in creating resilient and liveable cities and towns through:

- Safe and secure supplies in an uncertain future;
- Effective management of wastewater;
- Flood resilience;
- Healthy and valued waterways; and
- Healthy urban landscapes and places.

The framework recognises that the urban water cycle is managed by a range of authorities, including:

- Water Corporations: Responsible for water supply and sewerage services;
- Local Governments: Providing drainage, onsite domestic wastewater management, flood protection services, open space and urban design; and
- Catchment Management Authorities: Providing waterway health, floodplain and catchment management services.

1.6 Framework for Customer and Stakeholder Consultation

Water for Victoria (2016) includes a strategic direction for the water industry requiring it to ‘engage and empower the community to help achieve water management outcomes together’. The development of Urban Water Strategies requires water corporations to engage with their communities and stakeholders in the making of decisions for matters such as:

- Appropriate levels of service (willingness to pay);
- Cost-benefit trade-offs;
- The potential need to take action to keep supply and demand in balance;
- The possible initiatives that might help to address any imbalance between supply and demand;
- Which of these initiatives should be chosen for action, and when.

As these decisions require significant value judgements to be made, there is a need to involve the public in the decision-making process. Water corporations should ensure that this public participation is undertaken via a planned and transparent consultation process.

SECTION 2. STRATEGY DEVELOPMENT PROCESSES

2.1 Outcomes of Implementing the 2012-2060 Water Supply Demand Strategy

Wannon Water's Water Supply Demand Strategy 2012-2060 contained an Index of Actions to be implemented during the five year period of the strategy to achieve the following objectives:

- Reduction in non-revenue water – target to reduce by 450 ML by 2018,
- Reduction in consumption of residential customers – target to reduce per capita consumption by 13% by 2015,
- Reduction in consumption of consumption (excluding rural and industry) – target to reduce per capita consumption by 10% by 2015,
- Determine the need for extension of water services to other regions,
- Reinforcing the security of supply for the various water supply systems,
- Investigating the options to reduce environmental impact of extractions from the Gellibrand River.
- Build relationships with Deakin and other educators relating to research into water related matters.

All the actions have been implemented and the objectives achieved or partially achieved.

In regards to non-revenue water:

- A reduction of 632ML in non-revenue water has occurred. This exceeds the target reduction that was set in the 2012 Strategy.
- The non-revenue water reduction program which commenced in 2009 has been active in towns across the region, with the estimated volume of over 100 repaired leaks equating to 880ML/year as of 2016.
- An investigation into fire services has completed. Detection and Control of Usage is now "business as usual".
- Wannon Water now no longer has unmetered customers.
- Pressure management has been implemented in Casterton using pressure reduction valves.

The reduction in consumption objectives have been partially achieved including:

- A reduction of 3% in per capita consumption (excluding rural and industry). This partially meets the target reduction of 10% that was set in the 2012 Strategy.
- A reduction of 3% in per capita residential consumption. This partially meets the target reduction of 13% that was set in the 2012 Strategy.

The objectives relating to servicing new areas, improved environmental outcomes for Gellibrand River and building relationships with educators have been significantly advanced but are ongoing in nature.

2.2 Outcomes of Implementing Drought Response Plans

Outcomes of implementing Wannon Water's Drought Response Plans during the period from 2012 to 2017 were:

- Annual Water Security Outlooks were published every November. Storage levels were internally reviewed against these outlooks on a quarterly basis, and more frequently during "heightened awareness" periods;
- Weekly storage reports were produced for internal executive review;
- "Heightened awareness" did not occur for any system except Glenthompson;

- Glenthompson experienced heightened awareness for the following periods:
    - November 2014 – January 2015;
    - September 2015 – September 2016.

  Communication with Grampians Wimmera Mallee Water (where drought supply for Glenthompson originates) and with operations staff was on an elevated basis over these periods.
- Drought response did not occur as south west Victoria has not had water restrictions since 2011.

2.3 Climate Scenarios

Victoria has a highly variable climate, being subject to the influence of a broad range of climate 'drivers'. These range from the overall context of global warming and ozone depletion at the poles, to seasonal influences such as the El Nino Southern Oscillation (ENSO), the Indian Ocean Dipole (IOD) and the Southern Annular Mode (SAM).

Despite the advances that have been made in our understanding, our climate future remains uncertain. It is therefore necessary to consider a range of possible climate futures in the development of Urban Water Strategies. The approach in this Strategy is based on *Guidelines for Assessing the Impact of Climate Change on Water Supplies in Victoria* (DELWP 2016).

Wannon Water's groundwater supply systems have very low vulnerability to climate and were not affected by the Millennium Drought. The assessment of climate change impacts for these systems that is made here does not include new water resource modelling. However, for Wannon Water's surface supply systems, it is important to explore a range of possible futures.

The 'current climate' baseline adopted in this Strategy is from July 1975 to June 2016. This baseline period is designed to reflect climate behaviour at the current level of greenhouse gas concentrations. Global climate models were applied to generate climate change projections for Victoria's river basins for the years 2040 and 2065. Three representative climate change projections have been selected from the range of possible climate futures anticipated by different climate models. The three projections represent a low, medium and high impact on water availability from climate-dependent sources. An additional 'post-1997 step climate change scenario', based on the climate since 1997 (representing a permanent shift in climate) is also modelled. The step climate change scenario captures seasonal changes in rainfall that have occurred over recent years that are not fully reflected in the global climate models. The four climate change scenarios presented in this Strategy are presented in a risk-based framework that considers the vulnerability of supply systems to climate variability and climate change. There is no 'most likely' scenario.

Table 2: Median change in average daily temperature and potential evapotranspiration (PET) for use in all GCM-based climate change scenarios (based on all GCMs)

River Basin	Temperature change relative to current climate baseline (°C)		PET change relative to current climate baseline (%)	
	Year 2040	Year 2065	Year 2040	Year 2065
Otway Coast	1.0	1.9	3.7%	6.4%
Hopkins	1.1	2.1	4.1%	6.9%
Portland Coast	1.0	1.9	3.4%	6.1%
Glenelg	1.1	2.0	3.8%	6.7%

Table 3: Change in average annual rainfall relative to the current climate baseline across all seasons (based on all GCMs)

River Basin	Average annual rainfall (mm) (1975-2014)	Change relative to current climate baseline (%)					
		Year 2040			Year 2065		
		10th percentile	50th percentile	90th percentile	10th percentile	50th percentile	90th percentile
	Historic	Low	Medium	High	Low	Medium	High
Otway Coast	950	2.1%	-3.6%	-11.7%	0.5%	-5.8%	-19.0%
Hopkins	634	2.1%	-4.4%	-11.6%	1.0%	-5.7%	-20.9%
Portland Coast	724	2.6%	-4.6%	-10.9%	-0.2%	-8.4%	-19.0%
Glenelg	655	1.2%	-5.0%	-12.7%	1.4%	-8.4%	-21.7%

Table 4: Change in average annual run-off relative to the current climate baseline across all seasons

River Basin	Average annual runoff (mm) (1975-2014)	Change relative to current climate baseline (%)					
		Year 2040			Year 2065		
		10th percentile	50th percentile	90th percentile	10th percentile	50th percentile	90th percentile
	Historic	Low	Medium	High	Low	Medium	High
Otway Coast	241	6.6%	-7.2%	-25.3%	-4.7%	-15.8%	-41.9%
Hopkins	51	14.9%	-13.0%	-35.7%	-5.2%	-28.5%	-59.8%
Portland Coast	85	15.5%	-10.8%	-36.0%	-2.7%	-30.4%	-54.8%
Glenelg	67	7.6%	-13.6%	-37.3%	-3.4%	-31.4%	-60.8%

Source: DELWP Climate Impact Guidelines, July 2016

The step-change scenario represents a permanent shift in climate similar to that experienced from July 1997 to June 2016. As the period since 1997 includes less than 20 years of data, it does not include some of the multi-year variability experienced in Victoria's climate in the long term. In order to incorporate this variability, the scenario needs to include more years of data. The long-term representation is derived by adjusting the baseline record using the flow-duration curve decile scaling method that was recommended in the 2011 guidelines.

2.4 Stakeholder Engagement

2.4.1 Engagement objectives

The objective of our engagement for the Urban Water Strategy was to ensure customers and other stakeholders had the opportunity to have input into the development of the Urban Water Strategy, with particular regard to:

- Being informed about long term urban water strategy planning
- Providing feedback on levels of service, personal water conservation, expected demand levels from industry and other major customers, broad source options and willingness to pay for system performance changes; and
- Specific feedback on plans in the case where modelling indicates that implementation of an augmentation solutions would need to commence within the next 10 years.

2.4.2 Engagement methods

A detailed Engagement Plan was prepared to gather customer and stakeholder input to inform this strategy. The table below outlines the primary methods for how customers and stakeholder groups were engaged.

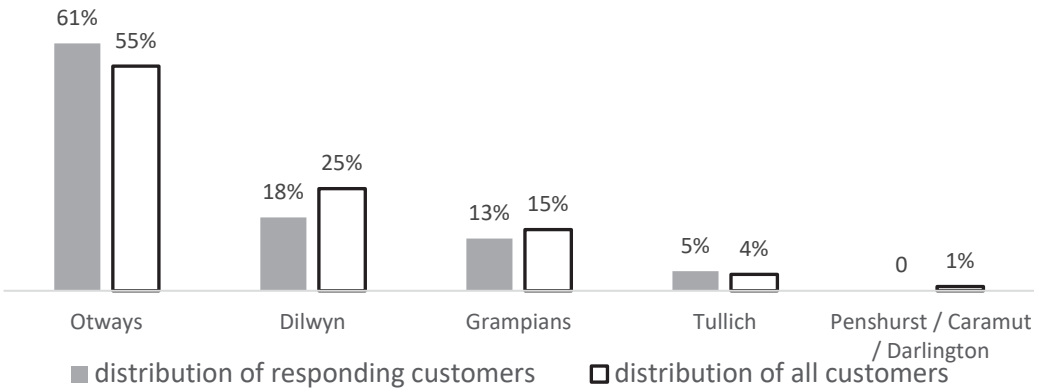
Customer and other stakeholder groups	Engagement activities	Findings incorporated into Section:
Residential and small business customers	On-line customer survey, November -December 2016. Options to complete the survey on paper were also given. 540 customers completed the on-line survey with a reasonably representative distribution from across our service area, see Figure 2 below.	Section 2.4.3
Major customers (industry and public sector)	Semi structured interviews were held with relevant staff from our 14 major customers, Jan 2017	Section 4.2
Local Government customers	Meetings held with relevant staff from the five Councils in our region, Feb 2017	Sections 3.2.4 and 3.2.5
Recycled water customers	Semi structured interviews held with 23 of our recycled water customers, Jan 2017	Section 3.1.4
Traditional Owners	Inclusion and Diversity Plan; ongoing engagement with indigenous communities	Section 2.5
Non-customer residents from a water supply catchment	Two community meetings held with members of the Gellibrand River Catchment to discuss Gellibrand Summer Flows Improvement Project	Section 3.1.1
Customer Advisory Committee	Wannon Water's Customer Advisory Committee is a 12 member group inclusive of a mix of gender, age and geographic place of residence. The group considered the Strategy at its February 2017 meeting.	No change to strategy

Glenthompson Community Engagement on their supply	Attendance at a community association meeting (inclusive of a public invitation) to discuss the water supply and demand in Glenthompson. A total of 19 people were in attendance.	No change to strategy
Warrnambool Sewage Treatment Plant Upgrade Engagement	A stakeholder engagement plan for this project was developed ready for implementation in March and April 2017. Outcomes of this engagement will inform the detailed design and implementation of the upgrade during the timeframe of this Strategy.	Engagement yet to be completed at time of writing.

2.4.3 Findings from customer survey

In total, 540 people responded to the online survey distributed at the end of 2017. For the size of Wannon Water's customer base, 381 random responses were required to attain a 95% confidence level (+-5%).

Figure 2. Distribution of customer survey respondents across Wannon Water's major water supply systems, compared with the actual distribution of all customers.



Use of rainwater tanks

43% of our customers indicated that they have rainwater tanks. Tank ownership decreases to 34% when considering only the customers from the Otway system and increases when considering the Dilwyn and Grampians customers (56% and 58% respectively), while 92% of customers from the Tullich system have tanks.

Figure 4 indicates how customers from the different supply systems use the water from their rainwater tanks. More than half of the respondents with tanks indicated they use rainwater for their garden, and almost half of these respondents drink the rainwater.

Figure 3. Percentage of customers with rainwater tanks by water supply system.

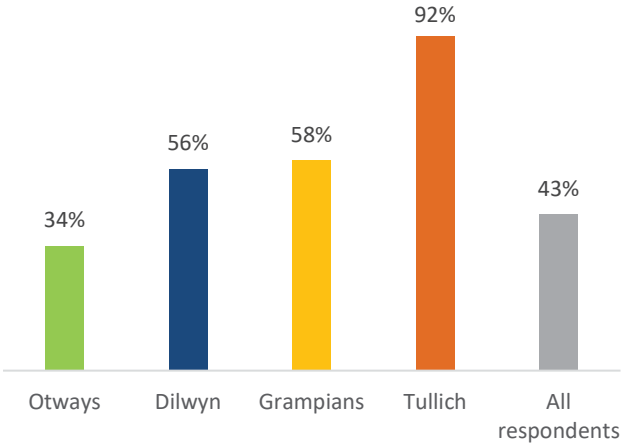
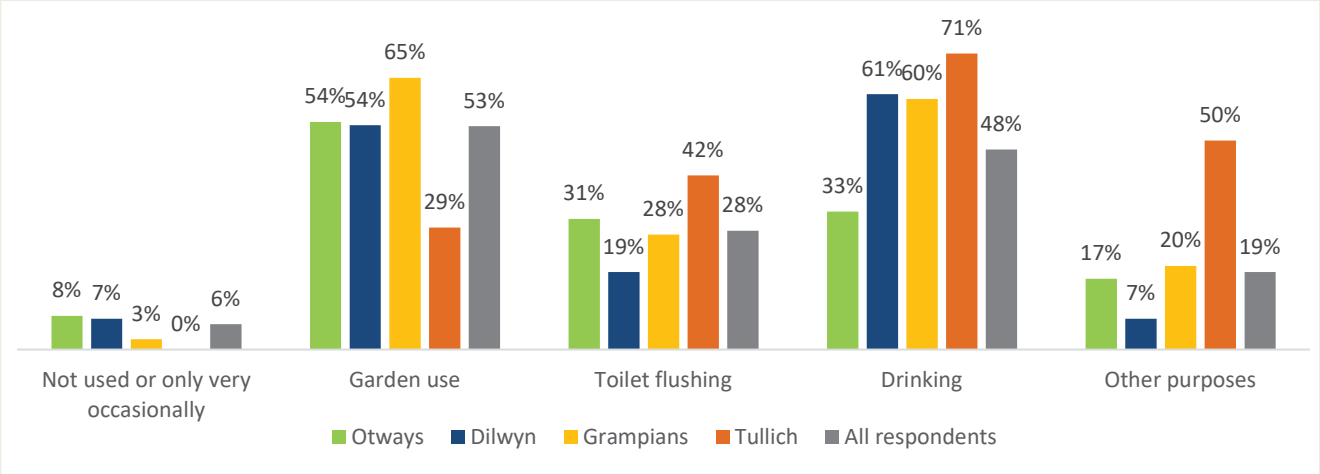


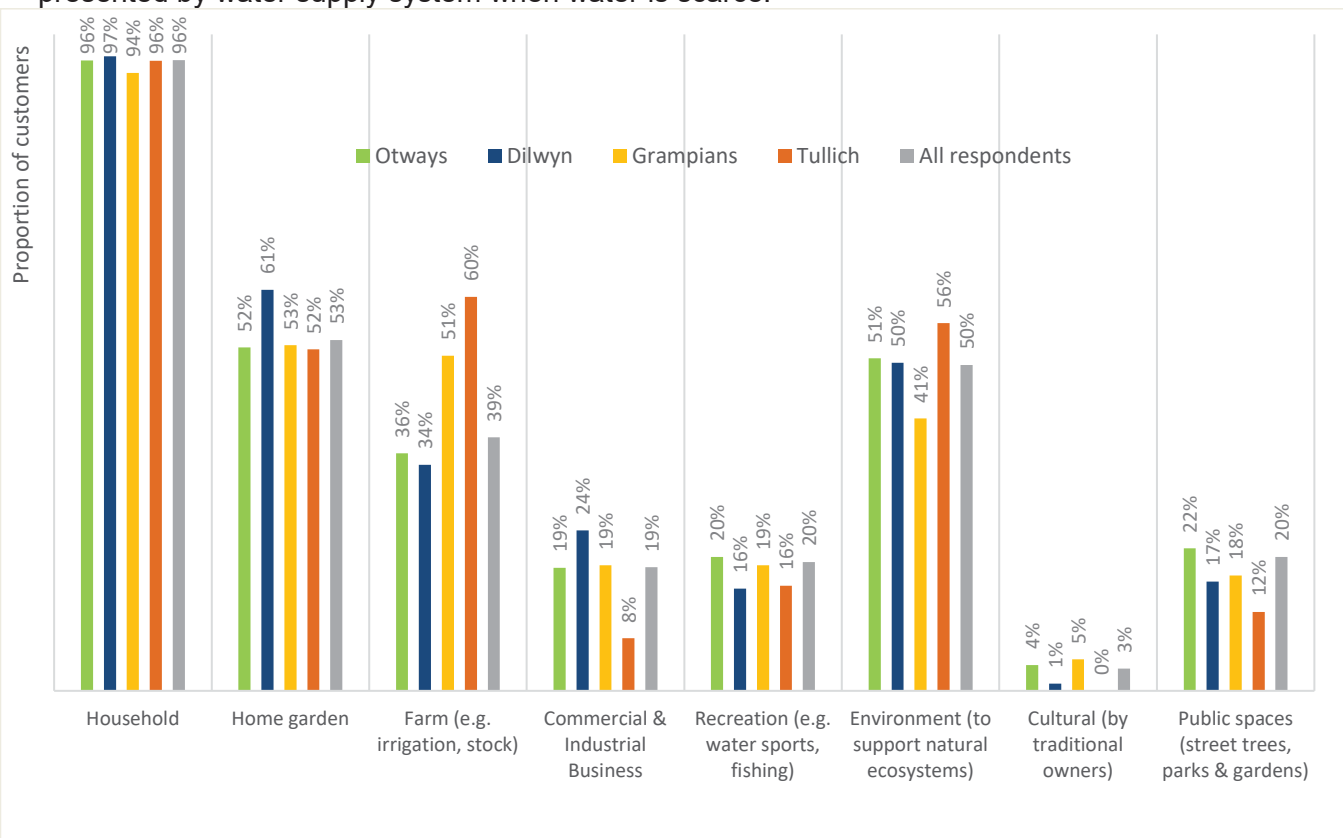
Figure 4. Of respondents with tanks, how rainwater is used (percentage of customers for each use), by water supply system.



How customers value competing uses for water

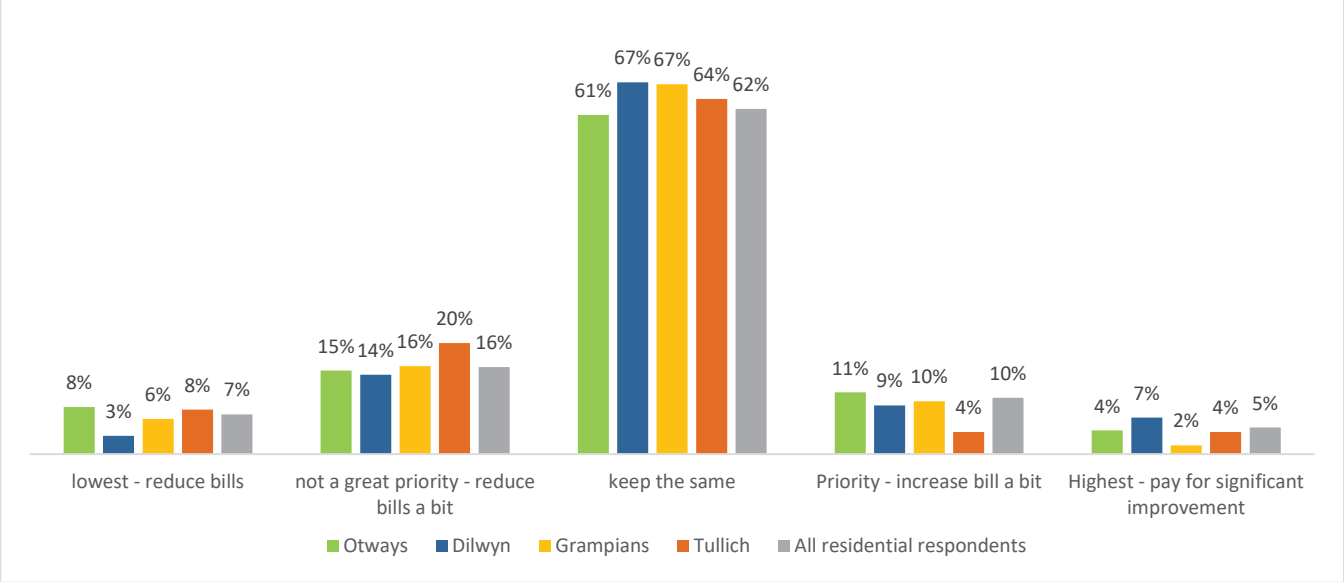
Respondents were asked to select the three water uses that were most important to them when water is scarce and there is competition for water supply. The results are shown in Figure 5 below. Household use was selected as the leading priority by almost all respondents from all water supply systems, followed by home garden, environment, and farm use. There is relatively less value placed on public space use. The results suggest that farm use is more important to Grampians and Tullich respondents than it is to other respondents in our region.

Figure 5. Water uses customers chose when asked to select the three most important uses, presented by water supply system when water is scarce.



Priority given to reducing the frequency of water restrictions
The priority that customers gave to reducing the frequency of water restrictions was measured in terms of willingness to pay for improvements via higher water bills across a number of business areas. In regards to the frequency of water restrictions, more than 60% of respondents believed the status quo was "about right". There is a slight bias towards reducing water bills slightly, but there is little appetite for paying for a higher degree of water security than is currently experienced. The results do not show variability between supply systems. See Figure 6.

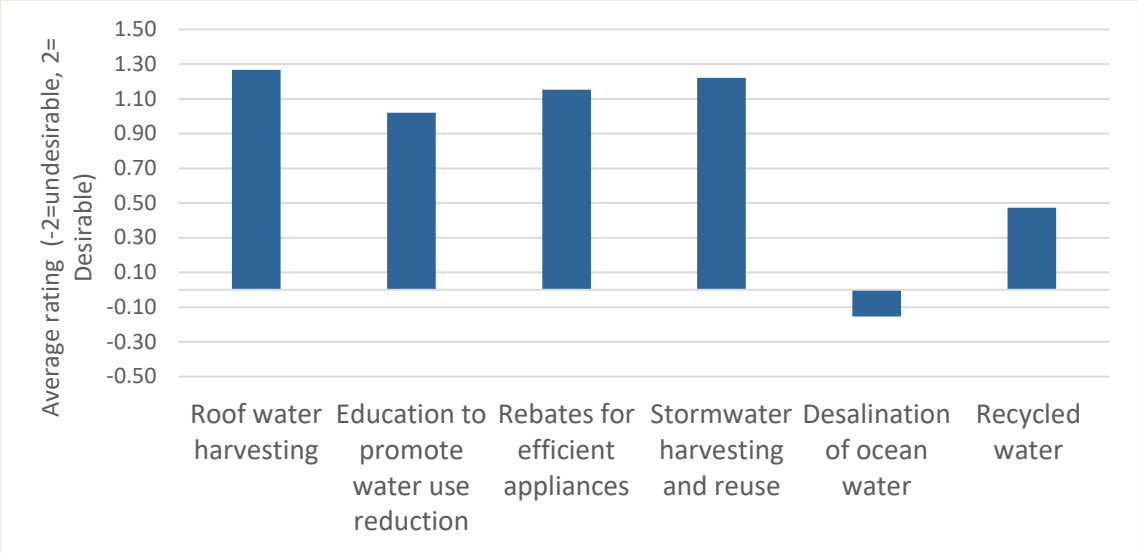
Figure 6. Customer priority given to reducing water restrictions by water supply system.



Attitudes to promoting water savings in the home
Respondents indicated they were willing to pay for measures that promote water savings in the home. While 54% of respondents think that our current programs promoting water savings are worth keeping as they are, a further 30% thought that this was a priority worthy of increases in water bills. There was also strong support for water bills to be more dependent on the volume of water used, with 62% of respondents indicating that the bill should be more dependent on use (when given the choice of 'more dependent', 'less dependent' or 'keep the same').

Support for water supply augmentation options
The survey sought customers' views on options for long-term water supply security, using a five-point scale (undesirable, less desirable, not sure, more desirable, very desirable). See Figure 7.
Roof water harvesting, stormwater harvesting, education and rebates are ranked as desirable options, while recycled water was also viewed as a reasonable option. Desalination of ocean water, however, was not viewed as a desirable option.

Figure 7. Views on potential water supply options for the future (average rated score for desirability.)



2.5 Engagement with Traditional Owners

The stakeholder engagement outlined in Section 2.4 was inclusive of the indigenous community. For example, the proportion of respondents to the survey identifying as Aboriginal and Torres Straight Islander was 1.5% (as compared to the proportion of people identifying as ATSI in our community, which is 1.3%). Wannon Water will develop an Inclusion and Diversity Plan in 2017. This will have specific actions for ongoing engagement with indigenous communities about their needs.

2.6 Integrated Water Management Planning

In October 2016, the Victorian Government outlined a strategic plan for management of water resources now and into the future, titled *Water for Victoria.* Part of this plan is to consider all aspects of the urban water cycle through integrated water management planning so that cities become more sustainable and more liveable. Integrated Water Management planning will outline water's role in creating resilient and liveable cities and towns through:

- Safe and secure supplies in an uncertain future;
- Effective management of wastewater;
- Flood resilience;
- Healthy and valued waterways; and
- Healthy urban landscapes and places.

Over recent years, local governments, CMAs and Wannon Water have individually implemented many projects that have improved the management of urban water, resulting in better use of available resources, such as:

- Harvesting of stormwater for irrigation of Hamilton golf course, Warrnambool racecourse, Warrnambool Brauerander athletics facility and others;
- Use of groundwater for irrigation of sporting ovals and parklands;
- Use of recycled water for Hamilton and Camperdown golf courses, a number of Hamilton ovals and the Hamilton turf farm;
- Use of condensate water for irrigation of Warrnambool golf course;
- Harvesting of roof water from houses and industrial roofs to supplement Warrnambool's drinking water supply, and;

- Harvesting of roof water for use at Warrnambool and Hamilton saleyards.

(Refer to Water Atlas at rear of document for more examples.)

While the above-listed projects are all good initiatives, there has been a lack of coordination and consultation between agencies. Better integrated water management planning would be achieved through all agencies responsible for the management of the urban water cycle having a commitment to collaboration, a vision for shared outcomes, and using shared data to work positively together to implement integrated solutions.

This can help to be achieved through Integrated Water Management Forums – arranged by the state government – which will bring together water corporations, local government and CMAs, as well as planning authorities, traditional owners and other relevant entities.
These forums will identify the opportunities in which to use an IWM approach, and coordinate their investigation and development into IWM Plans. Examples of opportunities are expected to include growth area servicing, urban renewal projects, infrastructure renewals and urban greening projects. The forums will also strengthen connections between state, regional and local planning. Forum participants are tasked with identifying opportunities to link state planning strategies, such as the *Victorian Waterways Strategy*, and regional planning strategies, such as Regional Floodplain Management Strategies, through the subsequent development of IWM plans.

Wannon Water will be an active member of these forums and work with local governments and others in our region to facilitate the development of Integrated Water Management plans.

2.7 Balancing Supply and Demand

A range of demand reduction measures such as leakage detection and reduction and education programs are detailed in Section 7.3. Using our water more wisely is the preferred first step rather than augmenting the system to obtain more water.

However, growth in demand is inevitable as population and industries grow, with a resultant need to augment water supply for some of our systems. The range of augmentation options are identified and assessed for a number of systems in Section 7.5.

The demand reduction and supply augmentation options have been assessed with sustainability principles considered in option rankings.

2015/2016 was selected as the “current conditions” baseline for assessment of supply and demand.

SECTION 3. OUR WATER RESOURCES AND USE TRENDS

3.1 Review of Regional Water Resources

There are five sources of water which are potentially available to Wannon Water, being:

- Rivers and Streams;
- Groundwater;
- Rainwater and Stormwater;
- Recycled Water; and
- Seawater.

Wannon Water currently draws water from rivers and streams, from groundwater aquifers and rainfall from roofs for treatment and supply as drinking water. Treated wastewater is provided to a range of customers for industrial and irrigation purposes. Volumes by source used in 2015/2016 are shown in Table 5.

Table 5: Volumes by Source in 2015/2016

Water Source	Volume Extracted in 2015/2016	% of Total
Rivers and Streams	10,790 ML	65.1%
Groundwater	4036 ML	24.4%
Roof water	20 ML	0.1%
Recycled Water	1728 ML	10.4%
Desalinated Seawater	Nil	0%

3.1.1 Rivers and Streams

Surface water is extracted from the Gellibrand River and from a number of small and sometimes intermittent streams located in the southern Grampians. Hamilton's supply is augmented by surface water extracted from the Glenelg River (Rocklands Reservoir). Balmoral also extracts water from the Glenelg River via a pumped system from Rocklands Reservoir. This supply source is managed by Grampians Wimmera Mallee Water. Glenthompson is partly supplied from a small surface water catchment located to the south of Glenthompson and partly supplied from the Willaura system (weirs and bores) managed by Grampians Wimmera Mallee Water.

All surface water diversions are defined in Bulk Entitlement Conversion Orders which fix the total annual volume able to be harvested and which specify extraction points, daily extraction limits, and other conditions such as minimum passing flows. In most cases, the full entitlement will not be available in dry years. The Wimmera system is a complex system allowing carryover of unused water in Rocklands Reservoir from year to year and allocations determined from the available water in the system. In some years there is no water allocated. .

The Bulk Entitlements held by Wannon Water total 19,312ML. The volumes for each Bulk Entitlement are provided in Table 6. Extractions in the 2015/2016 year totalled 10,790ML.

Table 6: Bulk Entitlement Details

System	Bulk Entitlement Order	Licensed Entitlement	Current Annual Extraction (2015/16)	Percentage of Entitlement extracted in 2015/16	Water in Storage 30 June 2016 (ML)	Other Conditions
Otways	Otway System 1998	12,580 ML	8,927	71%	2018	• Subject to flow sharing rules
Grampians (streams)	Hamilton 1997	3435 ML	1,504	43%	1780	• Plus drought reserve of up to 520 ML/a. • Passing flow requirements in tributary streams. • Extraction rate not to exceed 12.8 ML/d.
Grampians (Rocklands)	Wimmera and Glenelg Rivers – Wannon Water 2010	2120 ML	73	4%	4368	• Annual water availability declared by seasonal allocation. • Includes ability to carryover unused allocation from year to year. • Includes water available for Balmoral.
Grampians (Dunkeld)	Dunkeld 1997	170 ML	0	0	76	• Emergency supply for Dunkeld.
Glenthompson (Yuppeckiar Creek)	Glenthompson 1997	94 ML	1.3	1%	39	• Extraction rate not to exceed 0.9 ML/d.
Glenthompson	Willaura system – Wannon Water 2012	58 ML	39	67%	n/a	• Extraction rate not to exceed 0.55 ML/d.
Konongwootong	Coleraine, Casterton & Sandford 1997	855 ML	230	27%	1415	• Extraction rate not to exceed 4.5 ML/d.

The Konongwootong system supplies rural customers only. The Dunkeld Bulk Entitlement has been retained as an emergency back-up supply for the Grampians system, should this system be insufficient during times of severe water shortage.

Wannon Water sources and supplies water to communities within the Corangamite and Glenelg Hopkins catchments. The environmental assets within these catchments serve as a water supply source and reclaimed water sink. In particular, Wannon Water sources surface water from the Glenelg and Otway basins, which contain environmental assets of critical importance for water supply, ecosystem services and recreation.

The *Western Region Sustainable Water Strategy* identifies an opportunity for Wannon Water and the Corangamite Catchment Management Authority to work together, along with other stakeholders, to explore opportunities to improve summer flows within the Gellibrand River. This work is ongoing at the time of writing of this strategy.

The environmental flow of a waterway is a significant factor influencing its overall health. While event importance varies for different rivers, generally the summer low flow period and summer fresh events are very important. Through this Strategy, Wannon Water intends to secure the future of urban water supply in south west Victoria without compromising environmental flows.

3.1.2 Groundwater

Groundwater is water stored in natural underground formations known as aquifers. Not all aquifers are capable of yielding high-quality water. Water quality can be excellent, mineralised, brackish or saline.

Wannon Water extracts groundwater to meet all the needs of 14 towns and uses groundwater to supplement surface water supplies for the Grampians system, the Otway system, and Glenthompson. The aquifer resources of the south west range from the massive, deep and nationally important Dilwyn aquifer to modest shallow systems. The sustainable management of aquifers depends on the size of the resource, land use in the recharge areas, the volume of groundwater recharge and the pressure on the existing resource from current users.

Wannon Water commissioned a series of six groundwater resource assessments (GHD March 2012) which found:

- The response of groundwater levels to extractions over the 1997-2009 drought (combined with water balance assessments and modelling of the systems using available data) showed that each of the supplies are secure;
- The Mortlake groundwater resource may become stressed if existing licences are fully utilised;
- Higher yields from the Casterton supply have a high risk of iron fouling as aquifer levels drop below the intake screens, which may result in higher treatment costs;
- Stress on the aquifer system that supplies Macarthur will occur under predicted land use changes and 2060 climate change forecasts; recharge may reduce by 20% to 30%. A management response may be to scale back licences in the Condah Water Supply Protection Area, but Wannon Water has capacity, based on current use, to cope with a 50% reduced allocation; and
- Recommended zones for protection of the groundwater resource are proposed.

The Dilwyn aquifer is a confined water body that extends beneath much of south west Victoria and south east South Australia. It has relatively small (compared to the extent of the aquifer) outcropping zone in a line running through Dartmoor, Hamilton, Penshurst, Mortlake and the Otways. The depth of the aquifer increases as it approaches the coast. The Lower Tertiary Aquifer Groundwater Resource Assessment (SKM 2010) provides an improved understanding of this nationally significant resource. Based on the SKM 2010 assessment, the security of Wannon Water's supplies from the Dilwyn aquifer is very high regardless of climatic conditions.

Aquifers do not lose water due to evaporation but declining rainfall results in a reduction in surface water recharge and the prospect of resource depletion. Aquifers offer an exciting potential as an evaporation-free storage for stormwater or for reclaimed water. The continuation in the south west of some significant levels of rainfall and the existence of wide-ranging shallow aquifers holds out promise for the careful application of aquifer recharge technology.

Wannon Water has licensed groundwater extraction rights totalling 16,961ML per annum. In 2015/2016, Wannon Water extracted 4036ML from aquifers. The licensed volumes and 2015/2016 extractions are provided in Table 7.

Table 6: Southwest Aquifers Used by Wannon Water – Description and Supply Features

Location	Licence Number	Licensed Volume (ML/year)	2015/2016 Extraction (ML/year)	Percentage of Entitlement extracted in 2015/16	Aquifer
Portland	BEE026771	6222	1877	30%	Dilwyn zone 2
Port Fairy	BEE029010	1026	623	61%	Dilwyn zone 2
Heywood	BEE028970	333	164	49%	Dilwyn zone 2
Curdievale	BEE026252	2150	0	0	Dilwyn zone 2
Port Campbell	BEE026252	1009	365	36%	Dilwyn zone 3
Otway North (Carlisle River)	BEE029488	1800	34	2%	Dilwyn zone 3
Dartmoor	BEE032545	170	22	13%	Dilwyn zone 1
Macarthur	BEE021944	130	24	18%	Condah
Tullich	BEE022551	1000	440	44%	Bridgewater Formation
Warrnambool	BEE024155	750	338	45%	Southwest Limestone
Koroit	BEE029066	524	4	1%	Southwest Limestone
Penshurst	BEE026146	250	95	38%	Newer volcanics
Caramut (eastern slopes of Mount Rouse)	BEE021943	50	32	64%	Newer volcanics
Mortlake	BEE030858	335	14	4%	Newer volcanics
Darlington	BEE021827	10	4	40%	Newer volcanics
Headworks Creek (Grampians National Park)	BEE026192	1102	0	0	Grampians Sandstone

Plus an unused licence of 100ML for Merino.

The *Western Region Sustainable Water Strategy* (DSE 2011), proposes identification of areas which require more active management of groundwater to protect all water users and the environment. These 'Intensive Management Areas' (IMAs) will have their existing water entitlements protected, however, new developments in high water intensive industry (such as forestry) would be limited. As a stakeholder in potential IMAs located in south west Victoria, Wannon Water plans to actively work with

the Department of Environment, Land, Water and Planning and other stakeholders to ensure strategies are successfully implemented and managed. Continued management of catchments and groundwater recharge zones is very important to Wannon Water.

The *Small Towns Groundwater Appraisal, GHD March 2012* recommends areas to be protected due to their importance in groundwater recharge. These recommendations will contribute to the discussion that will take place to assess which areas may be declared as IMAs.

3.1.3 Rainwater and Stormwater

While rainfall and runoff decline looks likely to be significant across the south west region, there will continue to be reliable meaningful rainfall along the coast and for some distance inland. Rainfall accordingly presents opportunities for urban collection and use as a substitute for potable water for households, as well as to meet the needs of local government, schools, industry and sporting bodies. Connection of rainwater tanks to toilet systems will become more common for homes and businesses.

Subdivision of greenfield sites transform land that originally generated relatively small runoff to land which has large areas of impervious surfaces, resulting in significant runoff. The tenfold increase in the volume of runoff requires management to avoid adverse downstream impacts. This has been addressed in recent times by using water-sensitive urban design initiatives to “clean up” and slow down the runoff. The urban catchment presents an opportunity to harvest water that would otherwise go to waste to meet some of the growth demand growth.

Harvesting of roof water from entire subdivisions in the Russells Creek catchment commenced with a pilot project and is now being extended to new areas, as the land is subdivided. It involves the collection of roof runoff via a separate pipe network to the road stormwater system. The harvested water is mixed with other untreated water (Otway water) and following treatment, becomes is part of the drinking water supply for Warrnambool. The system is planned to expand as the Russells Creek growth corridor develops to around 3300 houses in the future. 20ML of roofwater was harvested in 2016 and a yield of 460ML is projected when the catchment is fully developed (2055).

The new Horne Road industrial estate in Warrnambool is being developed to allow the water from industrial sheds to be similarly harvested. The first stage of this development is expected to generate an equivalent volume to approximately 170 houses.

Many of the water use efficiency projects implemented by councils, schools, industry and households are based on smarter use of rainfall and stormwater. It is anticipated that further opportunities will be identified and investigated as part of the Integrated Water Management forums and the subsequent Integrated Water Management Plans. Collaboration between all agencies and stakeholders in the IWM plans will ensure that outcomes are maximised for the benefit of all stakeholders and the natural systems.

3.1.4 Recycled Water

Recycled water is water that has already been used by urban communities or industry and has been treated to a standard that is appropriate for reuse for a specific application. Recycled water is a valuable resource that can provide alternative supplies for non-drinking uses.

Recycled water volumes available from Wannon Water will decline marginally as household water use and household water reuse becomes more efficient. The *Wannon Water Trade Waste Strategy* further encourages larger industries to improve the standard of their on-site pre-treatment systems and look for opportunities for reuse (achieving substitution of potable water or allowing for activity growth without the need to acquire more potable water).

Wannon Water manages a range of innovative reuse systems and, in some towns, has achieved 100% water recycling for beneficial use.

Wannon Water produced 8900ML of recycled water in 2015/2016 from treatment of sewage and trade waste, as shown in Table 7. Of this amount, 430ML is currently reused (substituting the use of drinking water) and 1300ML is used for agricultural irrigation.

Table 7: Volumes of Recycled Water used at Wannon Water in 2015/2016

System	Available Recycled Water ML	Recycled Water Used ML	Actual % Used
Camperdown Domestic	217	217	100%
Camperdown Industrial	39	39	100%
Casterton	50	50	100%
Cobden	125	100	80%
Coleraine	20	20	100%
Dunkeld	23	23	100%
Hamilton	653	653	100%
Heywood	218	120	55%
Mortlake	48	48	100%
Peterborough	0	0	NA
Port Campbell	24	24	100%
Port Fairy Domestic	1121	0	0%
Port Fairy Industrial	778	0	0%
Portland	168	0	0%
Simpson	3	0	0%
Terang	170	170	100%
Timboon	38	38	100%
Warrnambool	5236	226	4%*
TOTALS	**8931**	**1728**	**19.3%**

*Trade wastes in the Warrnambool/Allansford sewerage system (the largest system operated by Wannon Water) currently contribute high salt loadings to the sewage stream, meaning reuse is difficult and expensive. Approximately 150ML of the treated effluent is reused on site at the WRP for cleaning purposes and 150ML of condensate from Fonterra Dennington is reused for irrigating the Warrnambool Golf Course (not requiring treatment at the WRP).

Wannon Water operates two tertiary treatment plants, one in Mortlake and one in Hamilton. These treatment plants provide Class A water to industry as a potable water substitution. Approximately 3.5ML of recycled water is supplied at Mortlake and 130ML in Hamilton. Wannon Water continues to work with industrial customers to improve the composition of their effluent streams to increase opportunities for further potable water substitution.

The supply of recycled water for farm irrigation purposes delivers community, environmental and financial benefit (via low cost end use) as well as contributing to a stronger regional agricultural base.

Discharge of treated effluent to the Fitzroy River from the Heywood WRP has been approved by the EPA. This licence amendment provides the most cost effective and environmentally sound solution to management effluent flows during wet weather events. Wannon Water undertook a detailed study, which showed that the discharge of reclaimed water to the Fitzroy River has a negligible impact on the receiving environment during periods of high river flow. The submission included the results of a two-

year river impact study and feedback from the community consultation that was undertaken. Such opportunities to improve environmental outcomes through discharge to waterways should be considered for other systems.

Approximately 8000 ML per year of reclaimed water (the majority of which is currently discharged to the ocean) remains uncommitted and, depending on the level of further treatment required, is available for beneficial use within the southwest. This uncommitted volume of recycled water represents an important regional asset when considering the needs of industry, primary producers, and the community.

Wannon Water has previously undertaken investigations in to the interest for additional recycled water within the community. Warrnambool City Council indicated an interest in accessing recycled water for the purpose of irrigating sporting areas. One significant customer that was identified, required more water than Wannon Water was able to provide and was dependent on significant grant funding. Another potential industrial customer indicate an interest in utilising high quality recycled water from the Port Fairy WRP for use at a gas fired power station, however the power station has not progress since these original discussions.

Due to the high salt loads from major trade waste customers discharging to the Warrnambool WRP, producing high quality recycled water is cost prohibitive compared to alternative water sources and has been the key barrier to the increased use of recycled water from Warrnambool WRP. . Wannon Water will explore further use of recycled water opportunities that may arise as part of integrated water management planning with Councils.

In January/February 2017, 19 recycled water customers were interviewed. Of those surveyed, 72% used recycled water for agriculture and 28% for recreation (including watering golf courses). The majority of these customers are currently using all the available water for farming enterprises and will continue to do so. There may be an increase in use of tertiary treated water in industry as these enterprises increase production but the volumes are relatively small compared to that used by agriculture. The tertiary treated source water is from the Hamilton and Mortlake WRP's and if not used by industry is then available for irrigation.
Future allocations of recycled water will require prior assessment of the economic benefit to the region to ensure large volumes are not "locked up", preventing higher value future uses. Wannon Water will work with new industry, farms and communities to explore opportunities for the use of recycled water.

3.1.5 Seawater

Desalinated seawater is safe drinking water. Seawater is not dependant on rainfall or climate variability and, accordingly, represents a secure supply source. Current desalinisation technology can reliably remove salts and impurities from seawater but costs and energy usage (and generated greenhouse gas emissions) are high compared with other water source options. In time, a combination of improving seawater treatment technology, wind or wave-powered desalination systems, and an acceptable method of managing brine wastes, will invite access to the Southern Ocean and will reduce dependence on historical sources of water for some communities. However, Wannon Water has no plans to desalinate sea water in the planning period. For communities close to the coast, other water sources are shown in this Strategy to be reliable. Additionally, stakeholder engagement (see Section 2.4.3) has revealed that desalination of seawater is not viewed as a desirable option by our community.

3.2 Water Use Patterns and Directions

3.2.1 Households

Shifts and trends in residential water use are subject to a multitude of factors. Key influences are:

- Growth or decline in population: A growing town will require more water;
- Household water efficiency: Households with rainwater tanks, dual flush toilets and/or awareness about smart water use will contribute to a lower average level of township water consumption. New dwellings built to modern water efficiency standards also contribute;
- Weather and rainfall: Coastal towns subject to frequent, regular rainfall may use less reticulated water on gardens than towns further inland. Hotter weather lifts the demand for water. Where towns have been on severe water restrictions, household water use may stay low for some time as habits and more efficient water use practices are retained;
- Price: Pricing linked with water use encourages customers to reduce water use to save money.

While Wannon Water keeps records of the number of water connections, it does not record how many people live in each household. One source of this demographic information is within *Victoria in Future 2015*:

VIF2015 - POPD/OPD		2016
Towns included	**SA2 Name**	**Population per household**
Casterton, Dartmoor, Heywood	Glenelg (Vic)	2.22
	Hamilton (Vic)	2.20
	Portland	2.22
Cavendish	Southern Grampians	2.37
	Camperdown	2.12
Lismore, Derrinallum	Corangamite - North	2.27
Cobden, Port Campbell	Corangamite - South	2.58
Mortlake	Moyne - East	2.58
Port Fairy	Moyne - West	2.39
	Warrnambool - North	2.43
	Warrnambool - South	2.26
	Warrnambool total	2.36

Table 8 shows climate-corrected household water consumption for all Wannon Water towns for 2015/2016, which is the base year for this Strategy. Water use is shown on a kilolitre per household basis, as well as per person daily use.

Table 8: Climate Corrected Household Consumption

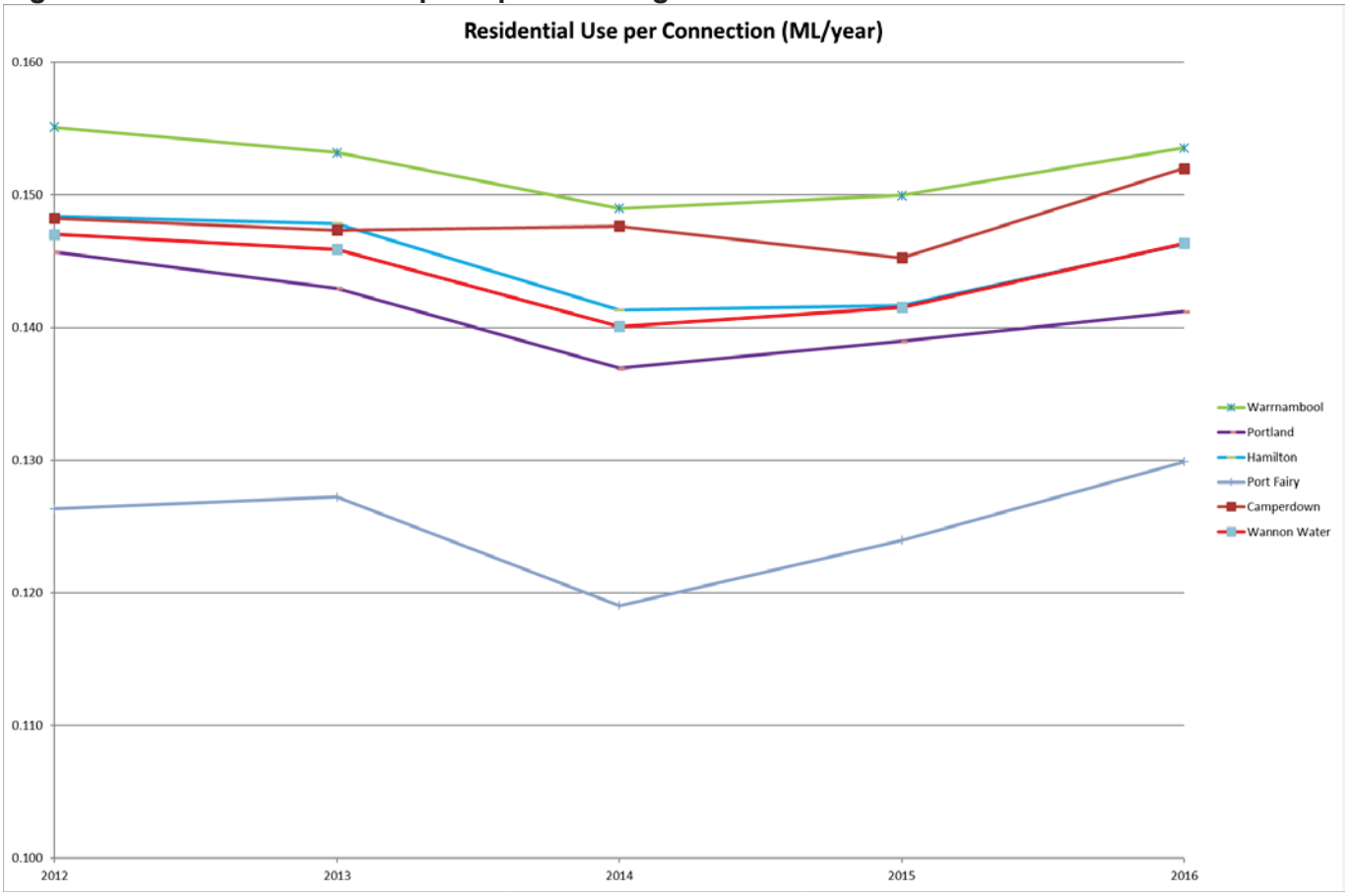
Town	Residential Use (ML)	Connections	KL/ connection	People per house	L/person/day
Warrnambool	2183	14,217	154	2.36	178
Portland	717	5081	141	2.22	174
Hamilton	691	4726	146	2.2	182
Port Fairy	272	2092	130	2.39	149
Camperdown	245	1609	152	2.12	196
Terang	145	938	154	2.58	164
Cobden	111	708	157	2.58	166
Casterton	110	819	135	2.22	166
Koroit	107	720	148	2.39	170
Heywood	92	648	141	2.22	175
Mortlake	84	577	145	2.58	154
Timboon	61	415	146	2.58	155
Coleraine	58	516	112	2.22	138
Dunkeld	56	309	182	2.22	225
Allansford	54	314	172	2.36	200
Lismore & Derrinallum	41	346	119	2.27	144
Penshurst	41	269	152	2.27	183
Port Campbell	29	256	112	2.58	119
Noorat & Glenormiston	28	159	177	2.27	214
Peterborough	23	325	71	2.58	75
Tarrington	23	137	167	2.2	208
Merino	17	129	135	2.22	166
Balmoral	15	106	145	2.22	179
Macarthur	13	142	93	2.22	115
Dartmoor	13	124	104	2.22	128
Simpson	13	78	163	2.58	173
Sandford	11	59	191	2.22	235
Glenthompson	9	99	88	2.22	108
Cavendish	8	68	117	2.37	135
Caramut	7	56	124	2.27	150
Darlington	3	19	144	2.27	174

The three largest towns have water use of about 178 litres per person per day, which is comparable to the metropolitan “Target 155” program for water efficiency. Other towns’ usage varies above and below this rate. The high-use towns include Dunkeld, Noorat, and Sandford which may have high garden use. The low-use towns include Peterborough, Port Campbell, Macarthur and Glenthompson. Peterborough and Port Campbell are tourist towns with a high occupancy rate in summer and a lower occupancy rate for the balance of the year. Macarthur and Glenthompson are thought to have a high proportion of residents who use rainwater tanks.

The equivalent regional campaign to “Target 155” is “Target Your Water Use”. This campaign recognises differences between Melbourne and the regions, in that 155 litres per person per day may not always be an appropriate target depending on climate and other factors. Target Your Water Use is a voluntary water efficiency program designed to encourage customers to use water wisely and make informed decisions. Under the program, Wannon Water is proactive in contacting customers who register a spike in their water usage.

Figure shows residential consumption per dwelling over the last five years for the largest towns in the region. There is no clear trend in consumption and for the purposes of this Strategy, residential consumption per dwelling is treated as constant.

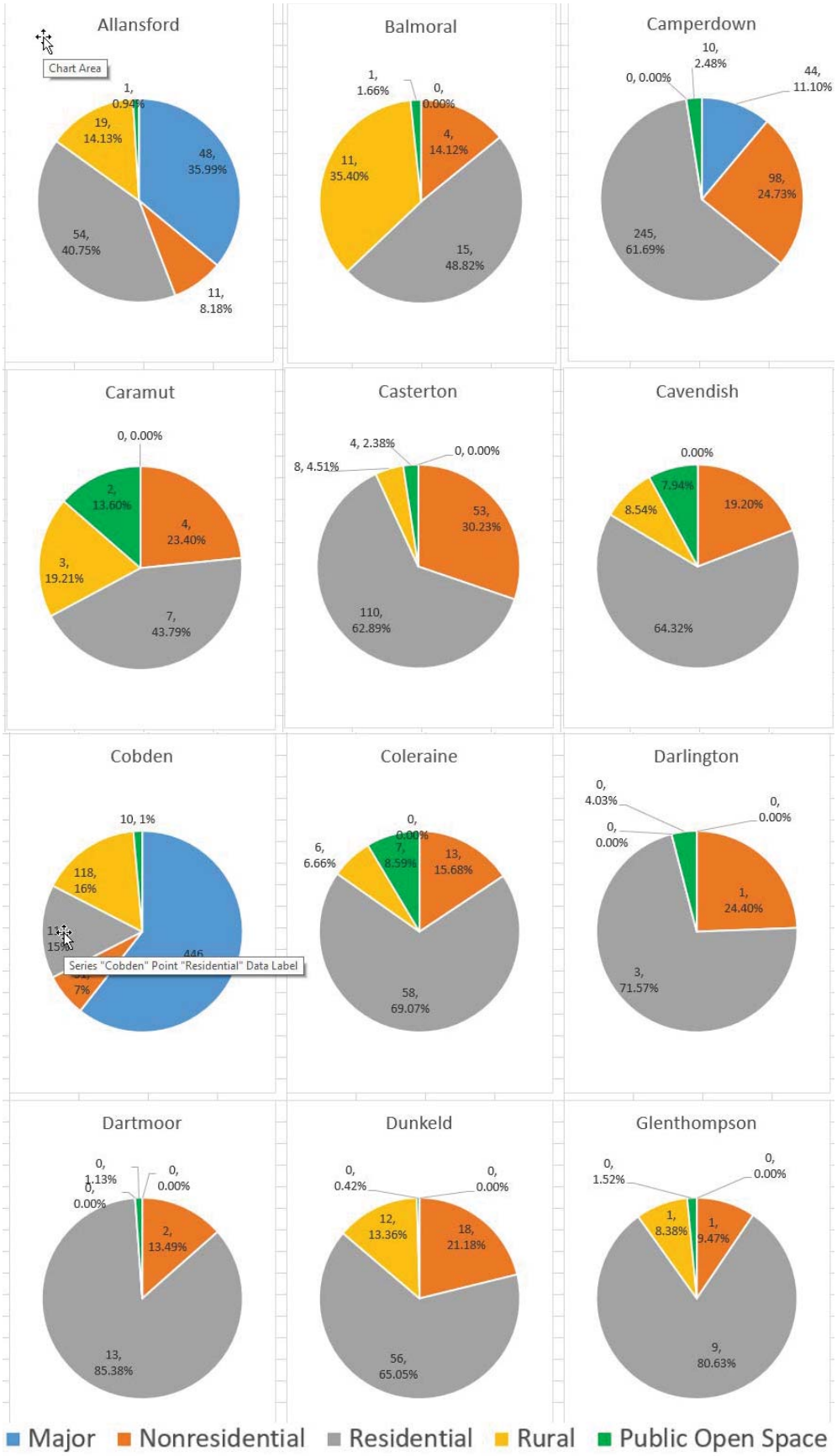
Figure 8: Residential Consumption per Dwelling



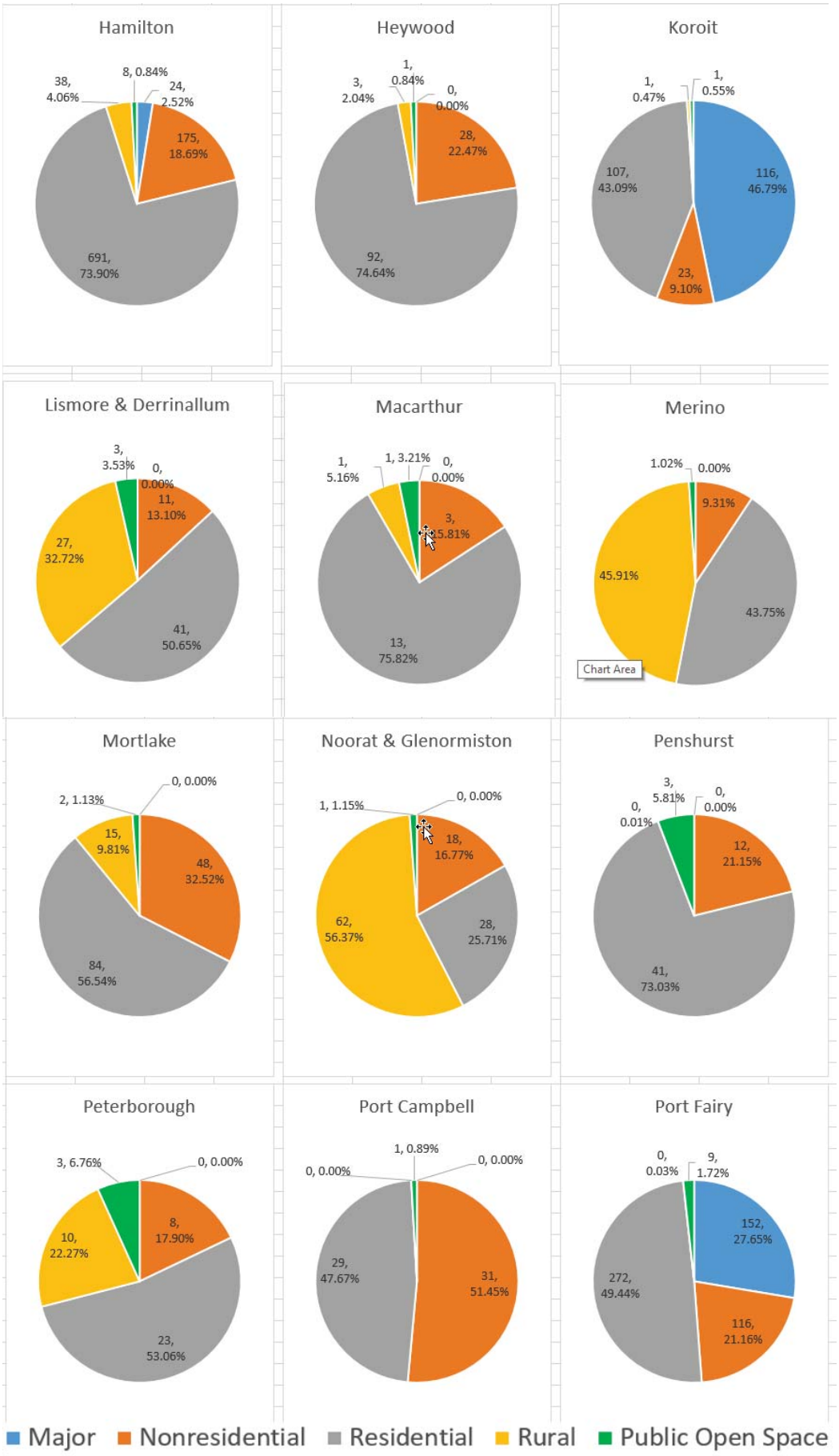
The following pie charts show consumption across all urban centres for 2015/2016. Five categories of customer type are shown. Residential consumption is clearly the dominant category of water use in all towns except Koroit and Cobden where major industries are the highest, and in Simpson which has a high volume of non-residential use. Major industries are a significant share of total consumption in Allansford, Camperdown, Cobden, Koroit, Port Fairy, Portland and Warrnambool ranging from 11 % to 60% of total consumption. The following table details the change in residential consumption over time. The share of water used for residential use has stabilised in the last 5 years with the total volume now climbing – reflecting the increased population serviced.

	2005/2006	2009/2010	2015/2016
Residential Use (ML)	6,786	5,197	5,278
Residential %age of total	42%	46%	46%

Figure 9. Consumption across all urban centres and customer zones for 2015/2016.



Note: Warrnambool Cheese and Butter, the largest individual user in the southwest (866ML in 15/16), is located in Allansford but is supplied direct from the South Otway pipeline, not from the Allansford urban supply.


Hamilton
38, 4.06%
8, 0.84%
24, 2.52%
175, 18.69%
691, 73.90%
Heywood
3, 2.04%
1, 0.84%
0, 0.00%
28, 22.47%
92, 74.64%
Koroit
1, 0.47%
1, 0.55%
107, 43.09%
116, 46.79%
23, 9.10%
Lismore & Derrinallum
3, 3.53%
0, 0.00%
11, 13.10%
27, 32.72%
41, 50.65%
Macarthur
1, 5.16%
1, 3.21%
0, 0.00%
3, 15.81%
13, 75.82%
Merino
1.02%
0.00%
9.31%
45.91%
43.75%
Chart Area
Mortlake
2, 1.13%
0, 0.00%
15, 9.81%
48, 32.52%
84, 56.54%
Noorat & Glenormiston
1, 1.15%
0, 0.00%
18, 16.77%
62, 56.37%
28, 25.71%
Penshurst
3, 5.81%
0, 0.01%
0, 0.00%
12, 21.15%
41, 73.03%
Peterborough
3, 6.76%
0, 0.00%
8, 17.90%
10, 22.27%
23, 53.06%
Port Campbell
1, 0.89%
0, 0.00%
0, 0.00%
29, 47.67%
31, 51.45%
Port Fairy
0, 0.03%
9, 1.72%
152, 27.65%
272, 49.44%
116, 21.16%
Major
Nonresidential
Residential
Rural
Public Open Space


Portland
2, 0.13%
86, 6.01%
388, 27.00%
717, 49.97%
242, 16.88%
Sandford
0, 0.00%
0, 0.31%
0, 1.06%
10, 46.84%
11, 51.80%
Series "Sandford" Point "Rural"
Value: 10 (47%)
Simpson
1, 2.49%
0, 0.04%
15, 28.97%
23, 44.04%
13, 24.46%
Tarrington
0, 0.91%
0, 0.00%
1, 4.37%
5, 16.29%
23, 78.43%
Terang
6, 3.11%
0, 0.00%
10, 4.96%
47, 22.51%
145, 69.41%
Timboon
0, 0.00%
0, 0.00%
19, 15.67%
41, 33.93%
61, 50.40%
Warrnambool
34, 0.95%
24, 0.68%
753, 21.16%
567, 15.92%
2183, 61.29%
Wannon Water
206, 1.78%
1631, 14.11%
2745, 23.74%
1702, 14.72%
5278, 45.65%
Major
Nonresidential
Residential
Rural
Public Open Space

3.2.2 Major Customers

The preceding charts demonstrate that large customer consumption is an important to Wannon Water. The charts demonstrate that a new major customer, a growing major customer or a departing major customer will have a significant impact on the water use profile of some centres. Wannon Water has, as part of this Strategy, sought input from all major customers to identify patterns of growth, potential new demand and opportunities for water use efficiency. This consultation has revealed plans for major expansion of the milk processing industry and other industry over the next five years.

Wannon Water has 13 customers each using more than 30 ML per annum with total consumption of 2,836 ML in 2015/16 compared to the 13 customers and 2,503 ML in 2010/2011. The Major customers have increased their consumption by 13% over the five year period and constitute 25% of total water consumption.

The industry group is further broken down here, showing that the milk and food processing sector is by far the major use sector.

Industry Sector Water Use

Type of Industry	No of Customers	Consumption 2015/16
Milk/Food Processing	8	2,218 ML
Metal Refinement	1	332 ML
Pharmaceutical Products	1	152 ML
Health Services	2	79 ML
Port Facility	1	55 ML

Major customers are aware that water pricing and trade waste pricing directly impacts on business operating costs and that there is a strong business driver to implement water efficiency initiatives. Further information on major customers projected consumption is given in Section 4.2 below.

3.2.3 Rural Customers

Wannon Water has a large rural customer base, many of who are supplied from the transfer pipelines from water source to major urban centre eg North Otway Pipeline and Grampians Pipeline. Water is typically used for livestock watering, plant and dairy yard wash down and domestic supply. Some rural customers are part of a large declared supply district and are embedded within the customer base. Other rural customers are subject to supply by agreement. Wannon Water will only take on new rural customers where spare capacity exists. Capacity is currently constrained across some systems.

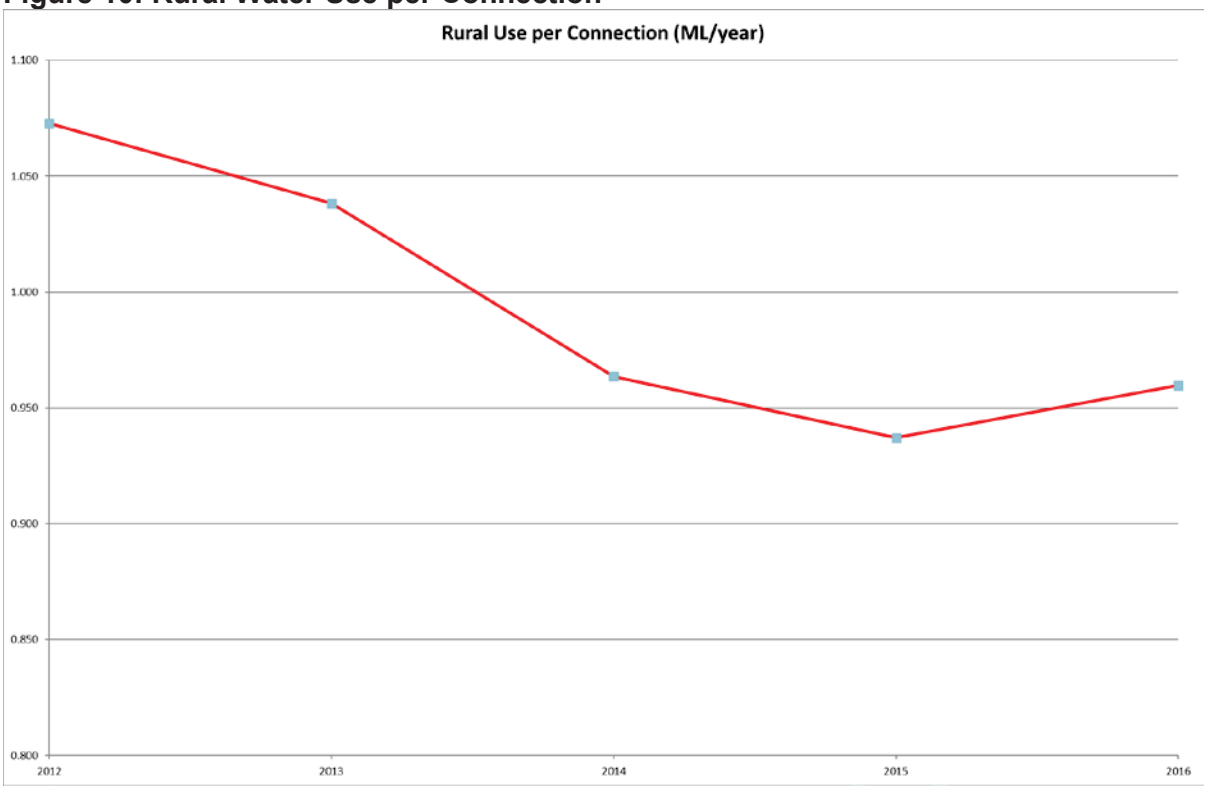
Table 10 (below) shows climate-corrected rural use for customer districts that used more than 20ML in 2015/2016. (There are a further 30 customer districts with a use of less than 20ML). 80% of this use is in the Otways System.

Table 10: Climate-corrected rural use in 2015/2016.

Customer District	Climate corrected rural use (ML) in 2015/2016
Camperdown Rural	482
Carpendeit Water Works	171
Cobden Water Works	150
Cobden	118
Terang Water Works	72
Noorat & Glenormiston	62
Timboon Rural	59
Warrnambool Pipeline	48
Konongwootong pipeline	43
Hamilton	38
Camperdown Water Works	31
Lismore Rural (pre-Ettrick)	27
Lismore & Derrinallum	27
Willaura pipeline	25
Warrnambool	24
Hamilton pipeline	23
Purnim	20

The overall rural use per connection is shown in Figure 10. This has been stable over the last three years.

Figure 10: Rural Water Use per Connection



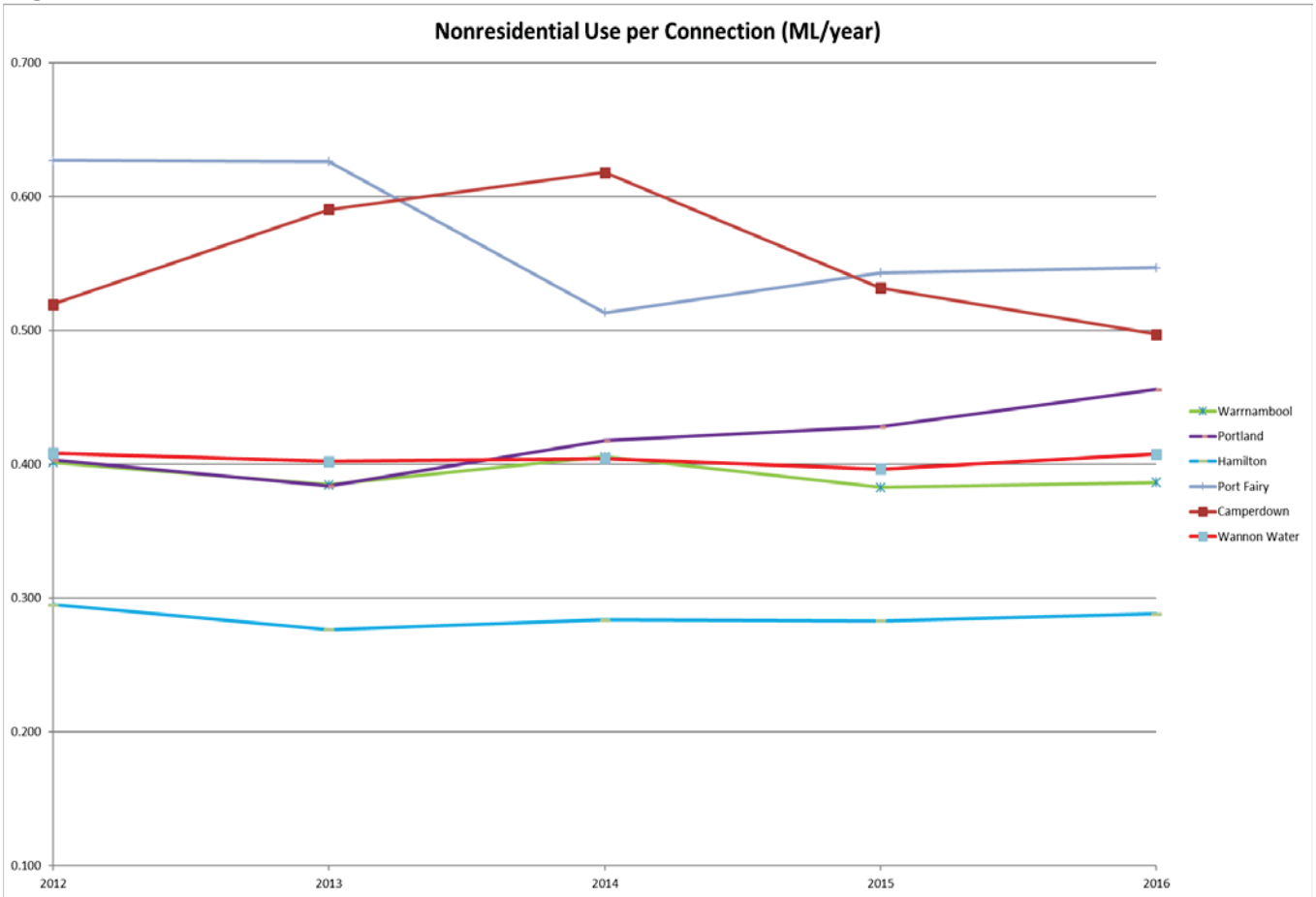
3.2.4 Non-Residential Customers

This customer group comprises shops and retail outlets, small-to-medium manufacturing businesses, food service and accommodation providers, as well as charitable and private sporting properties and facilities. There are also multi-site water users such as local government and schools.

Wannon Water's non-residential customers used 2400ML of water in 2005/2006 (17% of all water consumption). This reduced to 1860 ML in 2009/2010 (16% of consumption), and in 2015/16 non-residential use was 1656 ML (15% of consumption).

Climate corrected non-residential water use per connection for the five largest towns is shown in Figure 11. There are no clear trends in use displayed.

Figure 11: Non-Residential Water Use per Connection



The five councils of the region collectively used 514ML of water supplied by Wannon Water in 2015/2016, which is 25% more than used in 2009/2010. Together with additional water sourced from bores or stormwater systems, this supply is used for open space maintenance, saleyards, swimming pools, road construction and for other social and community purposes. Consultation with the five councils in February 2017 revealed an appetite to reduce water use and thus to save costs.

Warrnambool City Council is developing its Lake Pertobe Master Plan, which is a plan for integrated water management in Warrnambool's "playground". The plan includes stormwater capture and open space irrigation from stormwater, bores, and potable sources. WCC also plans to explore the expansion of stormwater capture and reuse in the Russell's Creek growth corridor. Southern Grampians Shire Council expects water use at the Hamilton Saleyards (their largest user) to come

down, and is actively seeking water efficiencies at the airport and other locations. SGSC asked Wannon Water to investigate the feasibility of using Konongwootong Reservoir for public open space watering in Coleraine. Corangamite Shire is keen to explore opportunities to reduce potable water use across their properties. The new saleyards planned at Mortlake in Moyne Shire is planned with water efficiency in mind, Including stormwater capture and reuse. Moyne Shire will work to make water use more efficient in the caravan parks that it manages. Glenelg Shire is developing an open space strategy over the next two years.

The availability of technology that can provide almost 'real time' usage information (at cost) was discussed with the five councils. A sixth (neighbouring) council, Colac Otway Shire, has purchased this service from Barwon Water and is using them to monitor for leaks in real time.

Regional development is influenced by council strategies to attract business and industry investment and/or support residential growth. In some instances, these investments are reliant on large volumes of water and Wannon Water needs to work closely with councils and project proponents as these types of projects progress. Wannon Water has developed Alternative Water Atlases for the Warrnambool, Hamilton, Portland, Port Fairy, Camperdown and Glenthompson systems as part of this document which identify water opportunities (treated, untreated, stormwater or recycled water) for water-dependant investments.

The education facilities of the south west are another generic multi-site large user of water. Grants made available through Commonwealth and state programs have resulted in a number of schools installing water tanks and other water-saving measures. Wannon Water continues to support schools in educating students about the water cycle and conservation.

3.2.5 Public Open Space

Public Open Space use is tracked as a separate category for the first time in this Strategy. While it is expected there will be some misclassification in the "property type" field (which has not been actively used or audited in the past), the following property types have been classified as public open space:

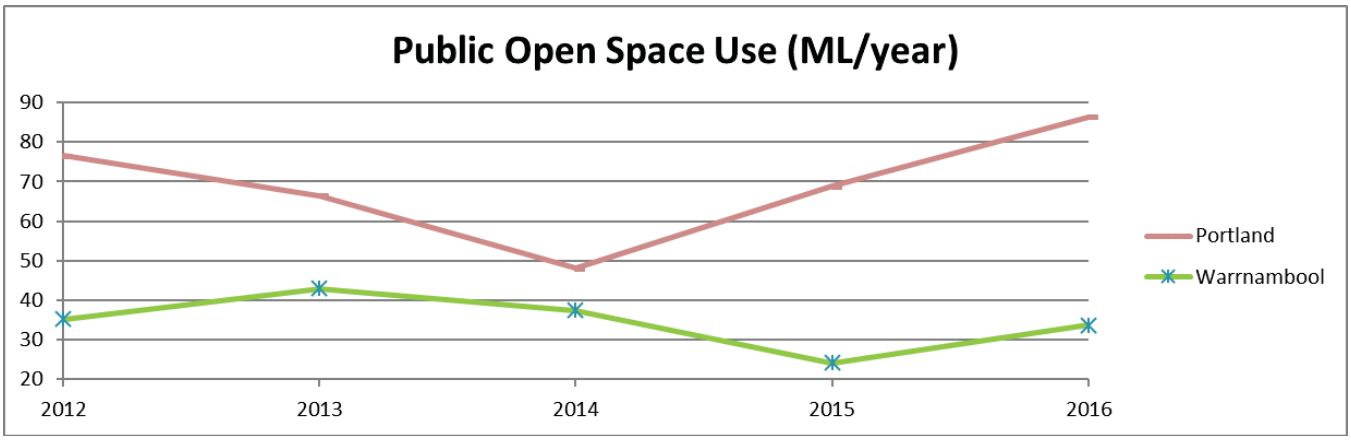
CE	Cemetery
MS	Median Strip
PG	Parks, Gardens & Reserves
RB	Roundabout
SG	Sporting/Recreation Grounds (without function rooms)

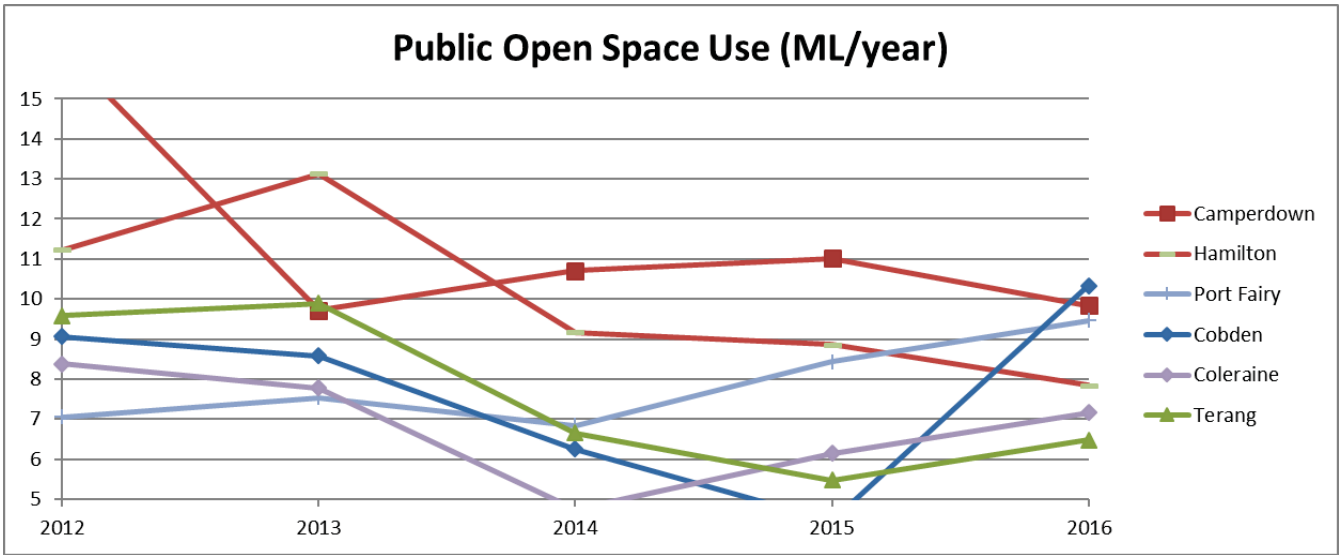
Warrnambool City and a number of schools have licences to access the shallow aquifer around Warrnambool. The groundwater resource is used for the greening of a significant portion of the public open space assets of Warrnambool. Southern Grampians Shire uses an historic municipal reservoir for the maintenance of the Hamilton Botanic Gardens and several popular playing fields. It will be vital for these municipal systems to be managed in a sustainable way because, should these systems fail, there would be a step increase in the demand on the drinking water supply.

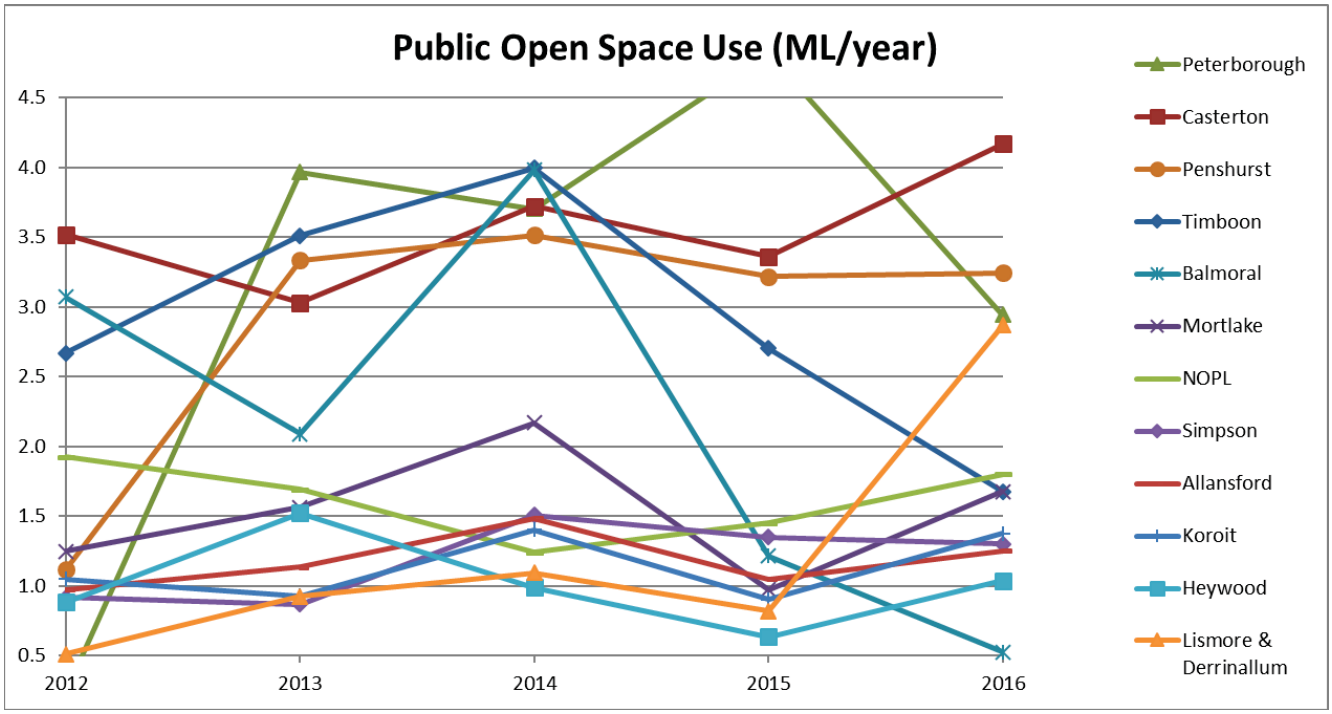
Open spaces in many cases are looked after by committees of management. In the cases where the committee of management pays the water bill, they have a stronger incentive to use water efficiently.

Public open space contributes 2% to Wannon Water's consumption and is included in the Figure 9 pie charts for each town. Trends in public open space use for selected towns in south west Victoria are shown below in Figure 12.

Figure 12. Trends in public open space use for selected towns in south west Victoria







3.2.6 Non-revenue Water

Non-revenue water is water entering customer districts which is not able to be accounted for. Customer districts begin at the outlet of the water treatment plant or the branch off a trunk pipeline, or are the sum of rural customer meters off a trunk pipeline. Every customer district (except rural districts on trunk pipelines) has its own reticulation pipe network, which can leak. Reticulation networks are also flushed on a regular basis for water quality reasons.

The WSDS set a target for volumetric reductions in non-revenue water from 2010/2011 levels. This target has been met and exceeded. Non-revenue water has changed from 2110ML in 2011 to 1478ML in 2015/2016, a reduction of 632ML. Volumetric reductions in non-revenue water have occurred in all systems. These results are due to active implementation of the *Non-Revenue Water Reduction Strategy*. Much work has been done since 2007 to better monitor water use, and a large number of significant leaks have been found and repaired. Losses tend to be greater in older systems and where soil types make leak detection difficult. Night flow monitoring has been invaluable in prioritising the leak detection and repair effort. Acoustic detection of leaks has been utilised successfully. Pressure reduction works have been undertaken in Coleraine to reduce the frequency of bursts and reduce overall leakage.

Reducing losses further will be a continued focus for Wannon Water. *The Non-Revenue Water Reduction Strategy* identifies a range of actions to be pursued. These actions include:

- Investigating the cost effectiveness of possible improvements to flushing/air scouring;
- Implementing a bulk meter accuracy verification program;
- Create new zones to better monitor water balances and minimum night flows;
- Continuing to monitor night flows to identify suspect areas and targets for active leakage control;
- Continuing to implement a prioritised program of leak detection and repair;
- Upgrading our fleet of metered hydrants to include smart metering;
- Targeted customer meters replacements and trialling 15mm meters to determine if the improved measurement accuracy warrants a change from 20 mm to 15 mm.; and
- Explore and implement further opportunities for pressure/surge management.

3.2.7 WTP and Systems Losses

This Strategy accounts for “raw water demand” at the (flow meter closest to the) point where water is extracted from the environment. Wannon Water has flow meters that record the water that is extracted from:

- Groundwater bores;
- The Gellibrand River
- Arkins Creek;
- The tributaries of Tea Tree Creek in the Grampians;
- Rocklands Reservoir;
- Glenthompson Reservoir (local catchment);
- Glenthompson pipeline offtake at Willaura; and
- Konongwootong Reservoir.

Wannon Water has system storages downstream of these extraction points, but upstream of water treatment plants, as described in Sections 5.3, 5.4, and 5.5.

Water extracted from the environment is called “raw water”. Raw water demand is this volume adjusted by change in system storage.

Losses occur between the extraction point and the point where water enters customer districts. Pipelines can leak, evaporation and seepage occurs from system storages and there are losses as

water flows through water treatment plants.

Wannon Water does not currently meter all losses through water treatment plants on a systematic basis. An audit of all treatment plants will be done to determine what volumes are currently not being accounted for and how these volumes are best determined. This will allow a more accurate determination of treatment losses.

Extensive metering of the Otway system has been completed which will allow evaporation, seepage and pipeline losses to be determined. These losses will be determined each year and tracked along with water consumption. .For other systems, an assessment will be made of the metering and measurement requirements to better quantify losses.

Table 11: Estimated WTP and systems losses in 2015/2016 were:

System	WTP losses	Other systems losses
Otways	380	700
Grampians	40	221
Glenthompson	3	6
Portland	157	0
Port Fairy	48	0
Casterton System	7	6
Port Campbell System	44	0
Heywood	11	0
Dartmoor	0.2	0
Penshurst	1	0
Caramut	7	0
Darlington	0.2	0
Macarthur	3	0

These estimated WTP and systems losses total 1600ML, which is 11% of raw water demand.

SECTION 4. CHALLENGES AND CHANGE

4.1 Population Growth and Population Decline

Changes in residential water use are closely linked to population changes. Throughout the region there are towns in growth and towns in decline.

As required by the Urban Water Strategy Guideline, household and population projections are based on the *Victoria in Future* projections (2015) within the Wannon Water region.

Population and household projections are detailed in Table 12. These projections are based on Wannon Water's records of the number of residential connections in each system in 2016 plus household size and number of household projections from *Victoria in Future 2015*. The 2065 values are Wannon Water projections.

Overall growth or decline in water demand has been calculated from the household projections and is incorporated into this Strategy. The projected consumer demand from Wannon Water's 36 towns and communities have been consolidated into the projected demand for the 13 water supply systems; see Section 5.2.

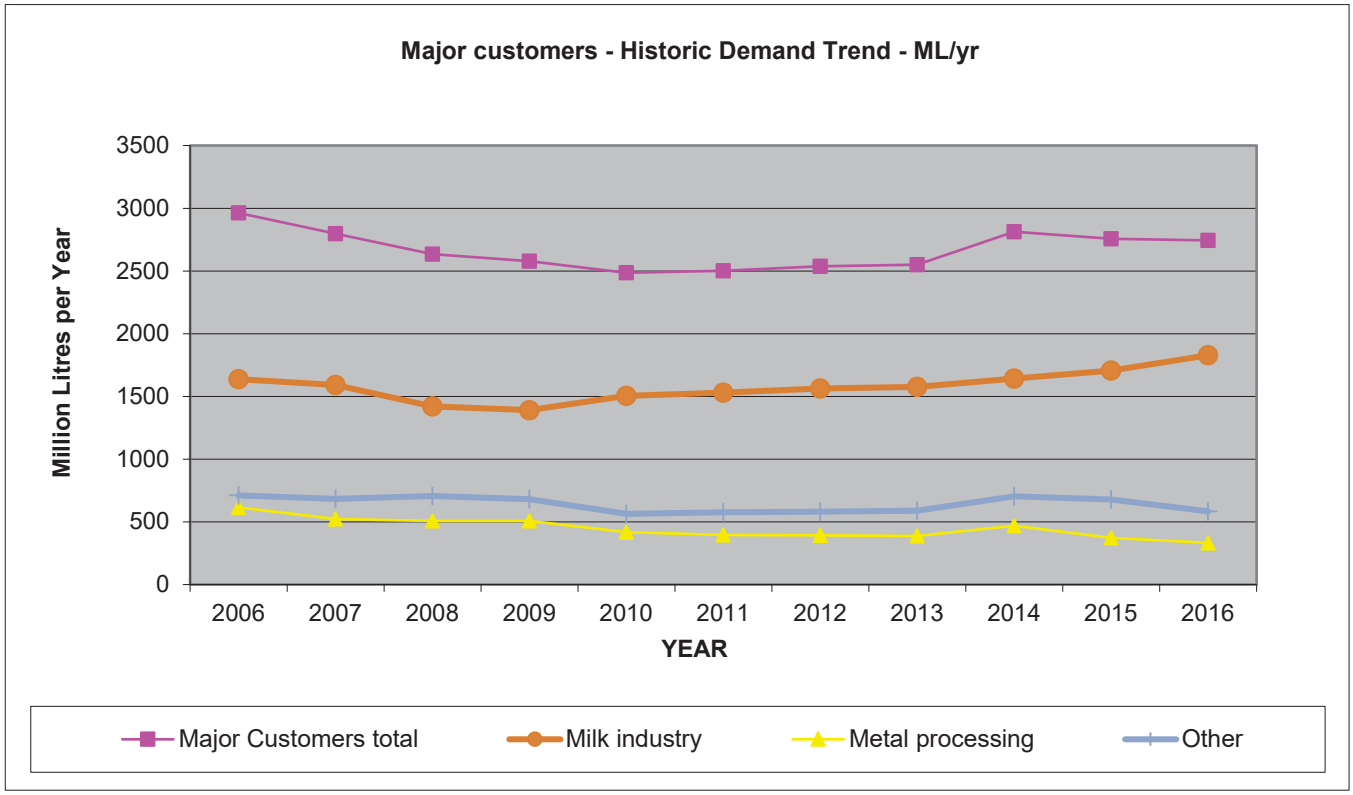
Table 12: Population and Household Projections

	Estimated Population Served					Households				
	2016	2021	2026	2031	2065	2016	2021	2026	2031	2065
Otways System	47,244	48,748	50,526	52,517	72,027	19,666	20,783	21,936	23,162	32,604
Grampians System	11,825	11,649	11,535	11,447	11,133	5,346	5,350	5,390	5,416	5,255
Portland	11,370	11,550	11,735	11,956	13,898	5,081	5,266	5,439	5,605	6,497
Port Fairy	5,032	5,327	5,596	5,820	7,752	2,092	2,287	2,459	2,607	3,505
Tullich System	3,407	3,317	3,271	3,251	3,236	1,523	1,536	1,567	1,593	1,582
Port Campbell System	2,229	2,264	2,300	2,344	2,724	996	1,032	1,066	1,099	1,274
Heywood	1,450	1,411	1,392	1,383	1,377	648	654	667	678	673
Penshurst	614	591	575	565	497	269	264	260	261	227
Macarthur	324	312	303	298	262	142	139	137	138	120
Dartmoor	283	272	265	260	229	124	122	120	120	105
Glenthompson	226	217	212	208	183	99	97	96	96	84
Caramut	125	122	120	120	119	56	56	58	59	58
Darlington	43	42	41	40	35	19	19	18	18	16
Wannon Water	84,172	85,822	87,872	90,210	113,472	36,061	37,606	39,212	40,850	52,000

4.2 Patterns of Industrial Water Use

The 13 major customers of Wannon Water used 2836 ML of water in 2015/2016, constituting 25% of total consumption. Since 2007, Grampians Wool Industries Pty Ltd and Dairy Farmers Simpson ceased operation, while Sungold milk water use has grown beyond 30 ML and Camperdown Dairy Industry has commenced operation from the old Bonlac factory site in Camperdown. Closure of the other two industries has removed a significant annual demand of about 180ML from Hamilton and 45ML from Simpson. Figure 13 details the overall decline in major customer demand of 480ML from 2005/2006 to 2010/2011 and subsequent growth of about 260ML to 2015/2016.

Figure 13. Major Customer Usage

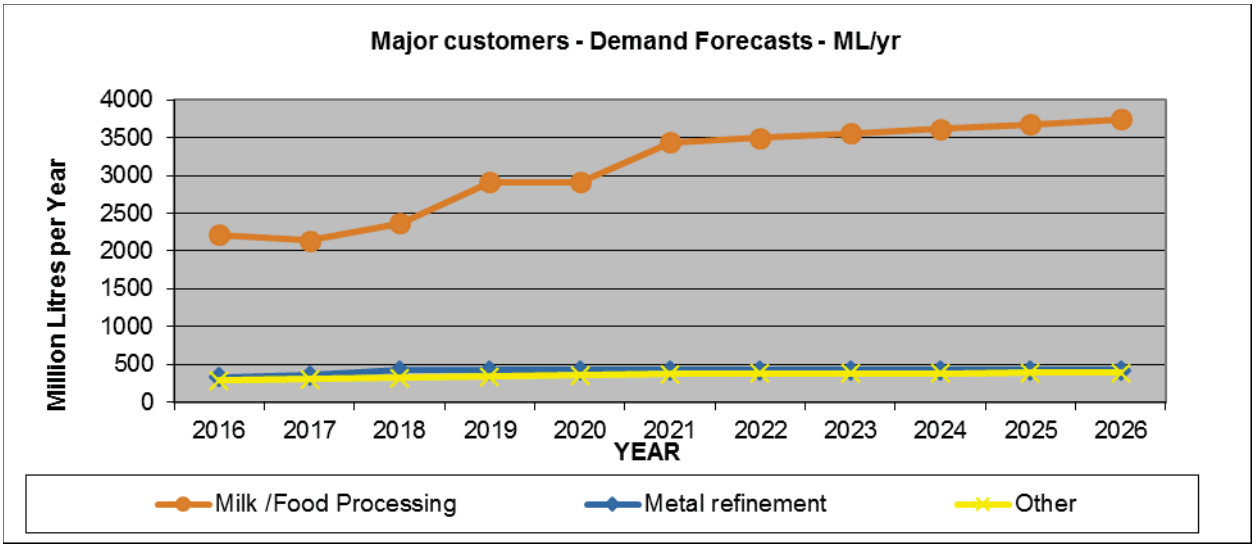


Milk and food processing industries are by far the largest category of industry and are highly dependent on overseas markets. Due to difficulties in arriving at accurate long-term forecasts of market demand, it is not possible to project demand with any certainty. Three scenarios are considered in this Strategy. In all scenarios, it is projected that the milk industry will grow to take advantage of the comparatively higher rainfall and production strengths of the region. Expansion of existing facilities and the construction of new manufacturing capacity has been allowed for in the projections.

The future plans of these major industries were canvassed as part of the engagement program of this Strategy. The projected demands account for both development plans and planned water use efficiency initiatives. This engagement has revealed plans for major expansion in the milk industry and in other industry over the next five years and this has been incorporated in to the modelling within this section.

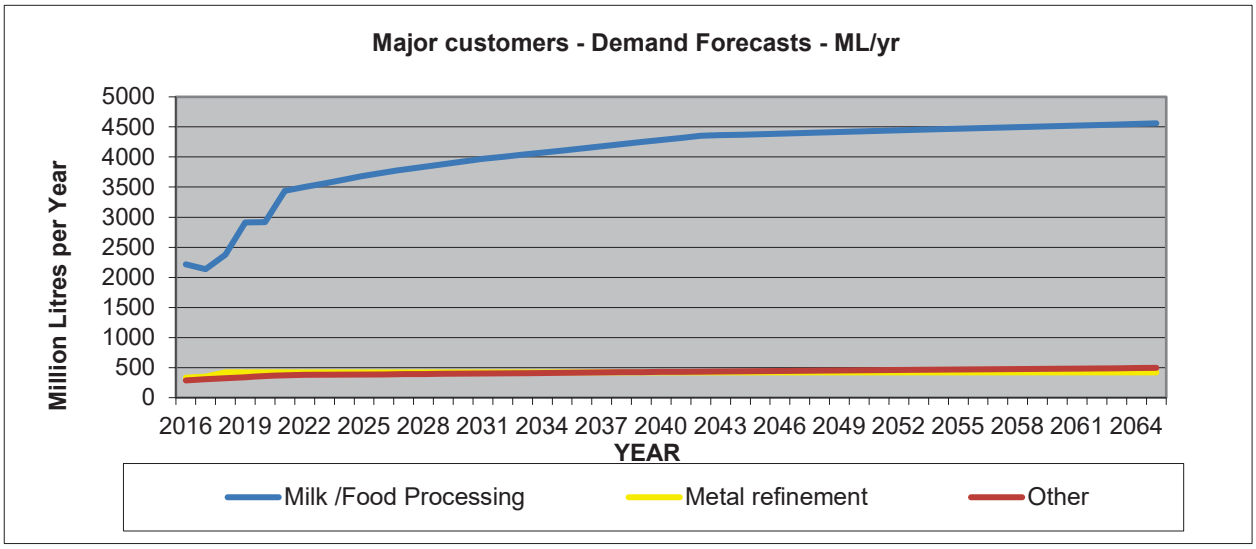
Figure 14 shows most probable demand projection for the three industry groups. The most probable forecast is rapid growth in total demand from 2700ML to 4200ML over the next five years, and then more moderate growth in demand is projected to 2065.

Figure 14: 10 year Forecast Major Customer Demand



For some new industries requiring potable water, or for existing industries wishing to expand production, augmentation can be brought forward to meet new demand across most supply systems. Bringing augmentation works forward does not prejudice the longer-term Strategy. For supply systems that are currently stressed or are small but sustainable, the prospect of a large, single new customer will see Wannon Water encourage the proponent to consider investment where there is available supply capacity.

Figure 15: 50 year Forecast Major Customer Demand



4.3 Climate Impacts

The climate scenarios presented in Section 2.3 present multiple possible outcomes.

Of the climate scenarios considered:

- Low Impact scenario – this scenario presents little challenge to this Strategy. Demand is not expected to grow to this level of supply within the planning timeframe, except in the Otways System. Augmentation of the Glenthompson system (beyond the immediate improvements described in Section 7.5.3) will not be required.
- Medium-impact scenario: There is no practical difference to the low-impact scenario (as outlined above) except in the Otways, and that impact will not be felt untillate in the planning period.
- High-impact scenario: This affects all three of the Otways, Grampians and Glenthompson systems. The augmentations described in Section 7.5 would be required.
- Step Change scenario: This scenario presents little challenge to this Strategy. There is no practical difference to the low-impact scenario.

As explained in Section 3.1.2, Wannon Water's groundwater-dependent supply systems are secure under these scenarios.

This Strategy will enable Wannon Water to realistically and efficiently respond to changes in demand and climate as they occur. The regional community of the day will have access to costed, sustainable options for action. The process of regular review of the Strategy will allow for judgement about which scenario should be responded to.

4.4 Contributing to Healthy Rivers

Wannon Water is dependent on a healthy Gellibrand River and on the small streams of the southern Grampians Ranges.

The health of all rivers in the south west is important to the landscapes of the region, to the complex ecosystems of rainforest, bushlands, plains and estuaries and to our feelings of identity with this region. The high-impact climate scenario considered in this Strategy clearly signals the prospect of major natural systems trauma.

Effective demand management and use of groundwater and harvested roof water over the past decade has reduced extractions from the Gellibrand River and contributed to the maintenance of natural system diversity. Wannon Water is confident that continued focus on water use efficiency and use of alternate water sources will minimise the impact of extractions from the Gellibrand River.

Wannon Water is coordinating an investigation into the availability of groundwater at the South Otway offtake, as a substitute to extracting water from the Gellibrand River during summer low flow periods. This investigation is part of Action 7.3 from the *Western Region Sustainable Water Strategy* partnering with Corangamite Catchment Management Authority, Southern Rural Water and DELWP to achieve a good environmental outcome for the river and estuary. Wannon Water will continue to work with these stakeholders to determine the best substitution option for reducing extractions over the summer low flow period and assist in its implementation.

4.5 Aquifer Protection and Utilisation

The reliance of Wannon Water on the aquifers of the region and the prospect that future supply security is reliant on sound aquifer management is clear. Wannon Water is only one of many water stakeholders reliant on the use of groundwater. Continuing investments in aquifer usage will be undertaken by local government, schools, industry and the private sector to substitute for, or

supplement the use of, surface water resources.
Wannon Water is working closely with the Department of Environment, Land, Water and Planning and its delegated aquifer management agency, Southern Rural Water, to better understand the groundwater resources of the region. To this end, Wannon Water has been a partner in the Lower Tertiary Aquifer Groundwater Resource Assessment and has commissioned groundwater resource assessments of its shallower groundwater supplies. Wannon Water is a stakeholder in the management of the recharge zones for these aquifers and will work with local government in the design of planning controls that are appropriate for these zones. Monitoring of aquifer health and understanding recharge mechanisms will be essential in ensuring that groundwater is used in a sustainable way.

4.6 Community Attitudinal Changes to Water Use

Central to this Strategy is the belief that an aware regional community will respond to the challenges ahead. This has been demonstrated over the past 10 years with significant reductions in residential and industrial water use while both sectors have continued to grow. There have been some remarkable changes in water use within the south west over this time. Wannon Water is confident that those changes will continue.

The community engagement undertaken as part of the development of this strategy and the current pricing submission, has confirmed a willingness for the community to be engaged with water matters. The responses to the survey indicate most customers recognise the importance of water conservation and value the importance of water in supporting natural ecosystems.

Stakeholder engagement is an important part of this Strategy. Wannon Water will work with its stakeholders to deliver improved linkages with educators and others across the region.

4.7 Extreme Events – BBA Outbreaks, Bushfire

Urban Water Strategies must include a qualitative assessment of the risks associated with extreme events (such as blue green algae (BGA) outbreaks and bushfire) that may make sources of water unavailable.

The qualitative assessment of risks should consider the diversity of the water corporation's supplies.

The Otway water supply system comprises north and south Otway pipelines that supply water from the Gellibrand River. These two pipelines supply four storages (Warrnambool 1 & 2, Brierly Basin and the Grieve Street Raw Water Storage) located at Warrnambool to buffer the high summer demand from Warrnambool, Koroit and Allansford – refer to Figure 15 for a system plan. The southern supply passes through Plantation Road Storage and the northern supply passes through Ewens Hill and Tank Hill storages. All these storages have experienced algae outbreaks at various times during the last 10 years but never at the same time, allowing unaffected storages to be used while affected storages are treated.

The algae risk is managed through selective harvesting of water (not harvesting high turbidity water with associated high phosphorous levels), close monitoring and isolation and treatment of storages with algaecide when a bloom occurs. If algaecide is applied, storages are kept offline for at least two weeks.

The risk associated with algae outbreaks in raw water storages was elevated from medium to high in February 2015 following blooms in Warrnambool Storages 1 and 2 in November 2014 that resulted in

more than 70 customer complaints. Climate change has the potential to aggravate this risk; increased temperatures, in particular, contribute to conditions that encourage algal blooms. Wannon Water is exploring options to reduce algae risk.

The existing system is relatively flexible in its ability to isolate and selectively use storages but the following improvements are proposed:

- Install a bypass on the Plantation Road Storage
- Ensure valving is suitable for bypassing Brierly Basin
- Improve the transfer capacity from Tank Hill Storage to Warrnambool
- Improvement to the treatment process at Warrnambool water treatment plant or other option to better control the algae events.

The risk of fire in the Otways remains one of the highest risks to the security of supply for the Otway System. The risk is managed by:

- Being proactive in fire management activities with other agencies responsible for the land in the Otways including undertaking fuel reduction burns around Wannon Water assets.
- Use of groundwater that can supply north Otway pipeline customers if river water is unusable
- Having an emergency bore at Curdievale on the southern pipeline that can be bought into service to supply Warrnambool if river water is unusable for an extended period.
- Providing water in reserve in system storages to allow for power outages and asset damage.
- Having a transportable replacement switchboard for fast installation should existing switchboards be damaged.

Other catchments with fire risk include Glenthompson and Southern Grampians. Both these systems have adequate off-stream storages to maintain security of supply.

SECTION 5. SUPPLY DEMAND EQUATIONS TO 2065

5.1 Overview

This section of the Strategy details the 14 water supply systems that service the 36 towns and communities in Wannon Water's region. There are four surface water systems: the Otway system, Grampians system, Glenthompson system and the Konongwootong system (which is for rural supply only). These systems and the Tullich and Port Campbell bore systems have pipelines that transfer water over substantial distances to a number of towns. Portland, Heywood, Port Fairy and several other towns are supplied from local bores. The volume of available supply for each system is assessed in the individual subsections that follow.

Demand projections are formed by aggregating the estimated consumption for the customer categories of major, residential, rural, non-residential and public open space. Non-revenue water and system losses upstream of water treatment plants are also included in the estimates. The resulting reported demand is for "raw water", that is, water that is extracted from the environment. Supply is also reported at the point where it is extracted from the environment.

5.2 Development of Demand Projections

The 2015/2016 year has been selected as a representative year from which to base future projections.

The trends in residential, rural and non-residential use in Sections 3.2.1, 3.2.3 and 3.2.4 do not give a strong indication of future trends; therefore, the demand projection assumes that per connection use will remain constant. Additionally, the projection assumes that the number of rural connections will remain constant into the future. Demand projections for major customers are described in Section 4.2. They are directly incorporated into the demand forecasts.

Residential and non-residential demand is based on the number of connections and demand per connection. Growth in connections is derived from *Victoria in Future 2015* (refer to Section 4.1) and this growth is applied to both residential and non-residential connections.

Analysis of the water use for relatively new subdivisions in Warrnambool showed that these were 6% more water efficient than in Warrnambool as a whole. This efficiency was applied to new residential connections in the forecasts.

In addition to the median scenario, a low demand and a high demand scenario was formulated. The low demand scenario assumes a 1% per year reduction in demand per connection until 2026. The high demand scenario assumes 1% per year increase in demand per connection, also until 2026. These changes are applied to residential, non-residential, rural and open space use.

The final two components of the demand forecast are non-revenue water (in the reticulation system) and systems losses. These are estimated based on 2015/2016 metered data and then assumed constant going forwards.

Table 13 is a summary of the 14 systems' current and future supply and demand, taking into account projected growth rates and impacts of climate variability. The estimates of supply are based on the medium-impact climate change scenario. The groundwater-supplied systems have their supply set equal to the licensed extraction volume (except for Macarthur, where the future scenario is 70% of the licensed volume). The estimates of current demand are climate-corrected values for 2015/2016. (Note that this summary table does not include the effect of any supply augmentations or demand-side actions. The summary table represents a no-intervention position.)

Table 13: Summary of Wannon Water Systems Supply-Demand Balance

	Current Status (2016)			Adopted Growth in resi and nonresi connections (% p.a.)							Future Status (2065)		
	Supply	Demand	Supply less Demand	*2017-21*	*2022-26*	*2027-31*	*2032-36*	*2037-41*	*2042-46*	*2047-2065*	Supply	Demand	Supply less Demand
Otways System	13,441	9343	4,098	*1.1%*	*1.1%*	*1.1%*	*1.0%*	*1.0%*	*1.0%*	*1.0%*	11,914	14124	- 2,210
Portland	6,222	1881	4,341	*0.7%*	*0.6%*	*0.6%*	*0.5%*	*0.4%*	*0.4%*	*0.4%*	6,222	2320	3,902
Grampians Syster	2,212	1615	597	*0.0%*	*0.1%*	*0.1%*	*-0.1%*	*-0.1%*	*-0.1%*	*-0.1%*	1,797	1647	150
Port Fairy	1,026	661	365	*1.8%*	*1.4%*	*1.2%*	*1.0%*	*0.9%*	*0.9%*	*0.8%*	1,026	987	39
Tullich System	1,000	460	540	*0.1%*	*0.3%*	*0.3%*	*0.0%*	*-0.2%*	*-0.1%*	*0.0%*	1,000	467	533
Port Campbell Sys	1,009	367	642	*0.7%*	*0.6%*	*0.6%*	*0.5%*	*0.4%*	*0.4%*	*0.4%*	1,009	416	593
Heywood	333	154	179	*0.1%*	*0.3%*	*0.3%*	*0.0%*	*-0.2%*	*-0.1%*	*0.0%*	333	157	176
Penshurst	250	93	157	*-0.4%*	*-0.4%*	*0.0%*	*-0.1%*	*-0.3%*	*-0.5%*	*-0.5%*	250	85	165
Konongwootong	100	68	32								80	68	12
Glenthompson	48	48	0	*-0.4%*	*-0.4%*	*0.0%*	*-0.1%*	*-0.3%*	*-0.5%*	*-0.5%*	39	46	- 7
Macarthur	80	24	56	*-0.4%*	*-0.4%*	*0.0%*	*-0.1%*	*-0.3%*	*-0.5%*	*-0.5%*	56	21	35
Caramut	50	31	19	*-0.4%*	*-0.4%*	*0.0%*	*-0.1%*	*-0.3%*	*-0.5%*	*-0.5%*	50	29	21
Dartmoor	170	21	149	*0.1%*	*0.3%*	*0.3%*	*0.0%*	*-0.2%*	*-0.1%*	*0.0%*	170	22	148
Darlington	10	5	5	*-0.4%*	*-0.4%*	*0.0%*	*-0.1%*	*-0.3%*	*-0.5%*	*-0.5%*	10	4	6
Wannon Water		14,770										20,394	

The summary in Table 13 demonstrates that all systems currently have sufficient supply to meet demand. However, the Glenthompson system needs immediate augmentation to ensure security in future years, as described in Section 5.5.3.

For groundwater systems and for surface water systems under medium-impact climate change, the only further augmentation required to 2065 is for the Otways System and Glenthompson System.

The need for augmentation under various scenarios is described below in Sections 5.3.3, 5.4.3 and 5.5.3. Proposed demand-side actions and supply-side actions to improve the supply-demand balance are described in sections 7.3 and 7.5 respectively.

5.3 Otway System – Supply Demand Forecasts and Assumptions

5.3.1 System Description

The Otway water supply system, as shown in Figure 16, is by far the largest of Wannon Water's systems. It obtains its primary supply from two pumped offtakes on the Gellibrand River and by gravity diversions from weirs on three Arkins Creek tributaries. The allocation of water is governed by the Bulk Entitlement and mirrored in the *Gellibrand Streamside Management Plan 1998* which sets out environmental issues and defines water sharing arrangements between the environment, rural extractors and Wannon Water. Water is diverted westwards via two pipelines to supply the towns of:

- Simpson;
- Camperdown;
- Cobden;
- Derrinallum;
- Lismore;
- Terang;
- Noorat;
- Glenormiston;
- Mortlake;
- Purnim;
- Allansford;
- Warrnambool;
- Koroit; and
- A number of smaller townships and numerous rural properties.

The Otway system is supplemented from two groundwater bores at Carlisle River. Supply to Warrnambool, Koroit and Allansford is augmented by roofwater harvesting in the Russells Creek Growth Corridor and by a shallow groundwater borefield adjacent to the Warrnambool Water Treatment Plant at Albert Park, contributing approximately 10% of the supplied water. The Otway supply to Mortlake is mixed with groundwater from bores in Prentices Lane Mortlake (Absaloms bore). The bore contributes up to 33% of Mortlake's supply.

The water supplied into the Otway System is taken under entitlements set out in the Water Act 1989. Surface water is subject to Bulk Entitlements, and groundwater is subject to groundwater licences (with BEE numbers) administered by Southern Rural Water. These entitlements are listed in Table 14.

Table 14: Otway System Entitlements

Source/Location	Bulk Entitlement Order or BEE number	Licensed Entitlement	Current Annual Extraction (2015/16)	Comments
Gellibrand River; Arkins Creek	Otway System 1998	12,580 ML	8,927	Subject to flow sharing rules
Curdievale	BEE026252	2150	0	Dilwyn zone 2; Emergency source
Otway North (Carlisle River)	BEE029488	1800	34	Dilwyn zone 3
Warrnambool	BEE024155	750	338	Southwest Limestone
Koroit	BEE029066	524	4	Southwest Limestone; Emergency source
Mortlake	BEE030858	335	14	Newer volcanics

Diversions from the Gellibrand River at Carlisle and extractions from the Carlisle bores are used to supplement flows from Arkins Creek into the North Otway pipeline. The maximum capacity of the North Otway pipeline is 22.5ML/day and the maximum capacity of the South Otway pipeline is 21.5ML/day.

The borefield at Carlisle River is licensed for a maximum daily extraction of 6ML/day. This enables diversions from the Gellibrand River to be partly or completely replaced by bore water during a river contamination event or diversion limitation as part of the flow sharing rules. The groundwater licence entitles Wannon Water to extract a maximum of 1800 ML annually.

The groundwater licence for the Albert Park borefield allows extraction of up to 750ML per annum. Current extraction is about 400ML per year, to provide 10% of the water supplied to Warrnambool. The Mortlake bore has a groundwater licence of 295ML pa, and planned extraction of about 50ML per year, to provide 33% of the water supplied to Mortlake. These blending ratios have been set for water quality reasons. Both these sources have significant spare licenced volume.

In addition to urban supplies there are close to 1000 rural connections to the North Otway pipeline. Approximately 460 connections supply farms and the small rural communities of Carlisle, Carpendeit, Cudgee and Garvoc direct from the North Otway pipeline. The Camperdown (Otway) Rural District is an area mostly to the north and west of Camperdown, providing about 370 connections to domestic, stock and dairy-related customers. This reticulated system is supplied by pipeline from the Camperdown water treatment plant.

There are no permanent connections to the South Otway pipeline.

Water storages located throughout the system (summarised in Table) are used to balance supply during peak periods. The active on-line storage is equivalent to less than 20% of the average annual demand. Consequently, during the peak summer demand period when storages are drawn down, less than one month of unrestricted demand may be available in storage. The operational trigger for drought response in the Otway system is based upon a set of restriction rule curves related to total storage in the system, including all the storages listed in Table .

Table 15: Otway System Storages

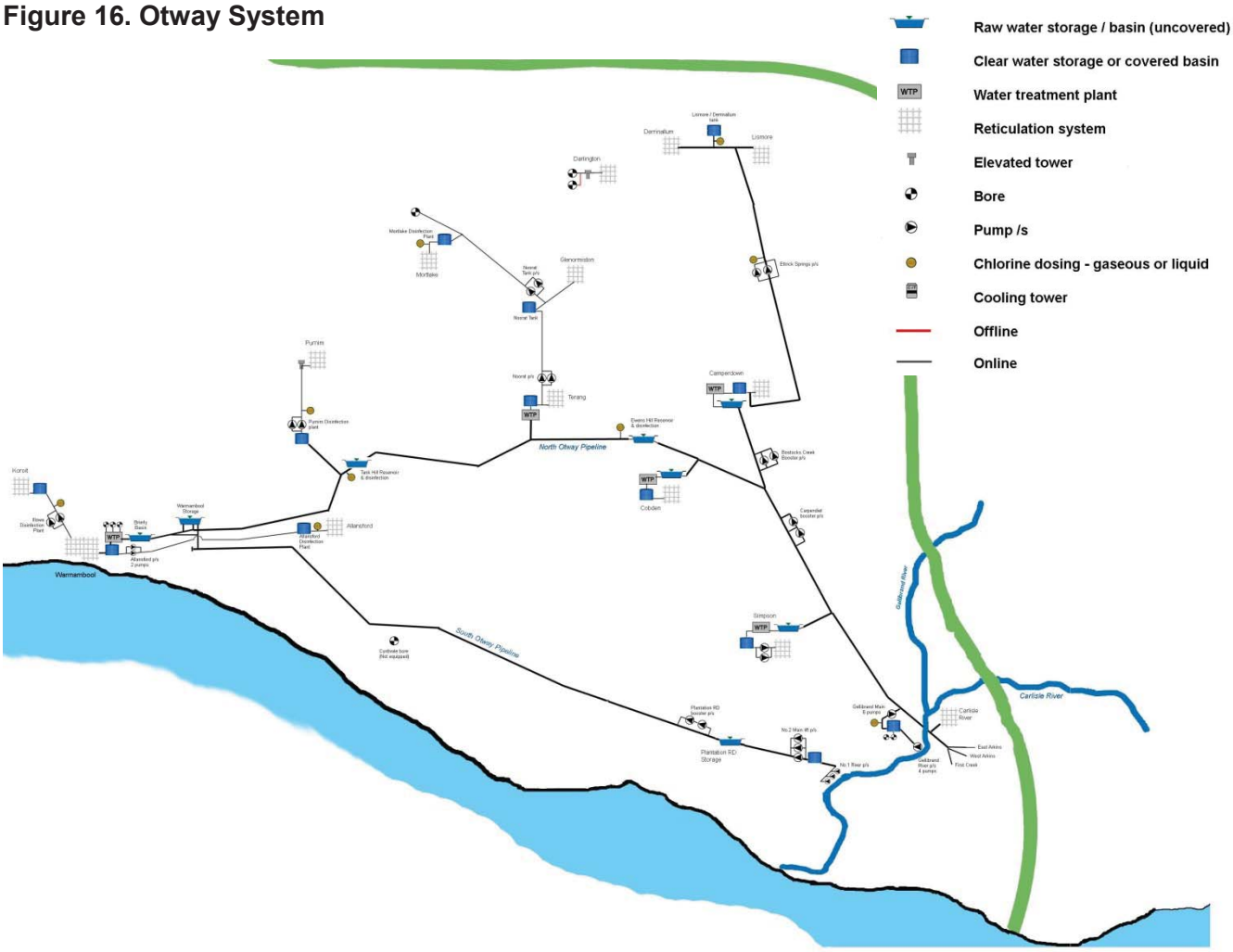
Storage Name	**Volume (ML)**
Simpson Storage	34
Donalds Hill Storage	207
Cobden Basin	52
Ewens Hill Storage	625[1]
Tank Hill Reservoir	774
Warrnambool Basin	640
Plantation Road Storage	100
Brierly Basin	51
Total Storage	**2483**

1. To be increased to 900 ML capacity in 2020.

The system is operated to minimise the cost of pumping, which is defined by a set of operational curves for each of the storages described in Table 15. These operational curves provide control over the rate

and magnitude of drawdown and filling, whilst providing a reserve volume in each storage for contingency purposes.

Figure 16. Otway System



5.3.2 Supply Forecasts

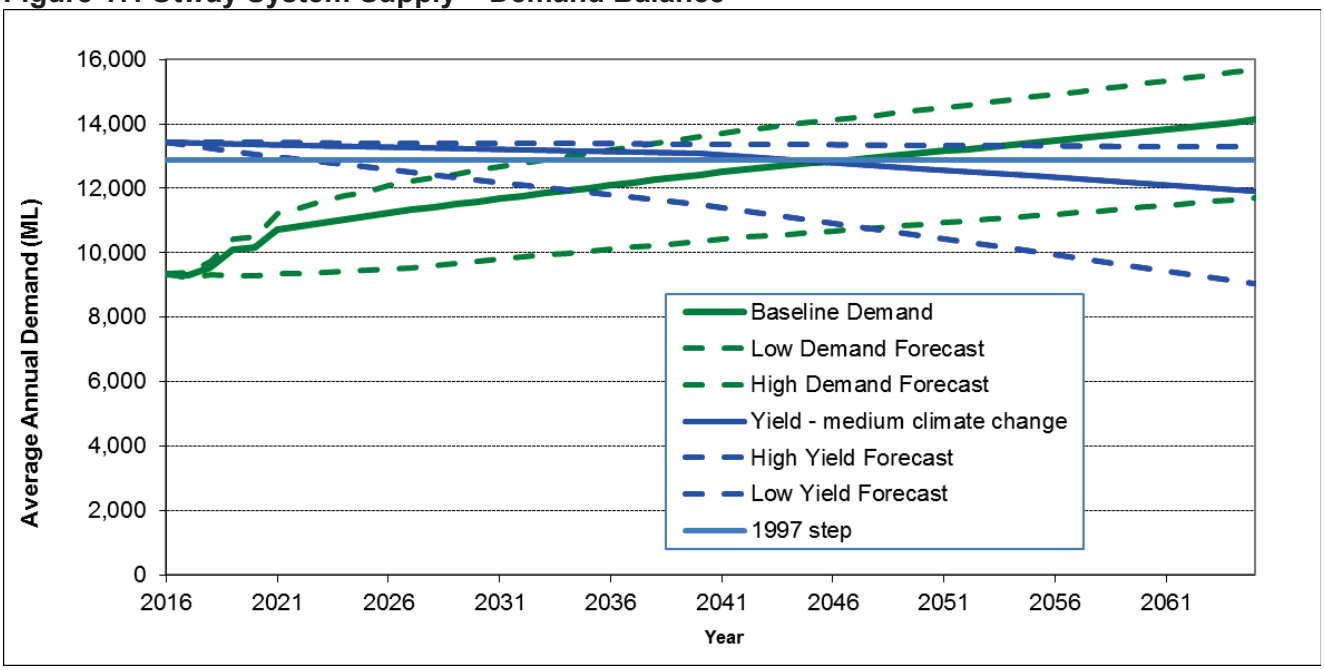
The yield (supply available) of a water supply system is defined as the average annual level of raw water extractions that can be supplied from the water supply system, subject to resource availability, operational rules, demand patterns and reliability criteria. The reliability for all Wannon Water systems is specified as 95%, that is, water restrictions should only occur on average for one year in every 20 years. The raw water extractions and corresponding yield available from the Otway System has been determined using a water resource computer model (REALM) that accounts for the reduced runoff associated with climate change projections. The REALM model has used the last 40 years of rainfall and stream flow data, adjusted to account for climate change. The same operating rules and flow sharing rules as currently apply under the Gellibrand River Management Plan have been used. Other assumptions are:

- The low-impact, medium and high-impact climate scenarios outlined in Section 2.3 apply to the Gellibrand River catchment; and
- The Carlisle River bores provide water without restriction (apart from pipeline capacity) up to the current licenced limit of 1800 ML/year.

This model predicts that the maximum average annual extraction available from the system reduces from 13,441ML to 11,914ML by 2065 under a medium-impact climate change scenario.
There have been no substantial fires in the Gellibrand River catchment in recent history that would impact on the catchment yield. Should a fire occur in the catchment, it is not anticipated yields would be significantly impacted as the Wannon Water share of flow from the river is approximately 5% in an average year. The major issue would be the resulting water quality should heavy rainfall occur following a fire, resulting in high sediment loads. Wannon Water's emergency response plan is to stop harvesting from the river and utilise water in the storages within the Otway system together with the Carlisle River bores and the Curdievale emergency bore. When water quality improved, water would again be sourced from the river.

Figure 16 shows the supply and demand projections without any new demand management measures or system augmentation. The baseline projections are shown as solid lines while low and high scenarios are shown as dotted lines. The 1997 step change climate scenario is shown as a light blue line. Figure 17 shows that augmentation is expected to be required. If the high demand scenario eventuates, supply augmentation may be required as early as 2028. This "earliest augmentation" scenario is discussed further in Section 7 below.

Figure 17. Otway System Supply – Demand Balance



5.4 Grampians System – Supply Demand Forecasts and Assumptions

5.4.1 System Description

The Grampians water supply system provides water to the five urban zones of Balmoral, Cavendish, Hamilton, Tarrington and Dunkeld, and also to a number of rural customers located along the main supply pipelines.

Water from Rocklands Reservoir is supplied to Balmoral via a 10km pipeline constructed in 1964 and to the southern part of the system via a 52km pipeline constructed in 2009/2010. Note that the Wimmera and Glenelg Rivers – Wannon Water 2010 Bulk Entitlement allows for trading of allocation to other Bulk Entitlement holders at times when sufficient volume is in storage to secure supply.

The main supply for Hamilton is obtained from the western slopes of the Victoria Range in the southern part of the Grampians National Park. Water is diverted from eight small streams and the Headworks bore. The first diversion, on Headworks Creek, has been in place since 1904 and the most recent diversions, on No's 2 and 3 streams, since 1960. The Bulk Entitlement specifies passing flow requirements in five of these streams. The water flows by gravity through 47.4km of pipeline to storages north of Hamilton. The maximum capacity of the supply system is approximately 12.8ML/d.

The water supplied into the Grampians System is taken under entitlements set out in the Water Act 1989. Surface water is subject to Bulk Entitlements, and groundwater is subject to groundwater licences (with BEE numbers) administered by Southern Rural Water. These entitlements are listed in Table 16.

Table 16: Grampians System Entitlements

Source/Location	Bulk Entitlement Order or BEE number	Licensed Entitlement	Current Annual Extraction (2015/16)	Comments
Grampians (streams)	Hamilton 1997	3435 ML	1,504	• Plus drought reserve of up to 520 ML/a. • Passing flow requirements in tributary streams. • Extraction rate not to exceed 12.8 ML/d.
Grampians (Rocklands)	Wimmera and Glenelg Rivers – Wannon Water 2010	2120 ML	73	• Annual water availability declared by seasonal allocation. • Includes ability to carryover unused allocation from year to year. • Includes water available for Balmoral.
Grampians (Dunkeld)	Dunkeld 1997	170 ML	0	• Emergency supply for Dunkeld.
Headworks Creek (Grampians National Park)	BEE026192	1102	0	• Grampians Sandstone

The Grampians storages are summarised in Table 17. The total capacity of the storages is approximately 2652ML.

Table 17: Grampians System Storages

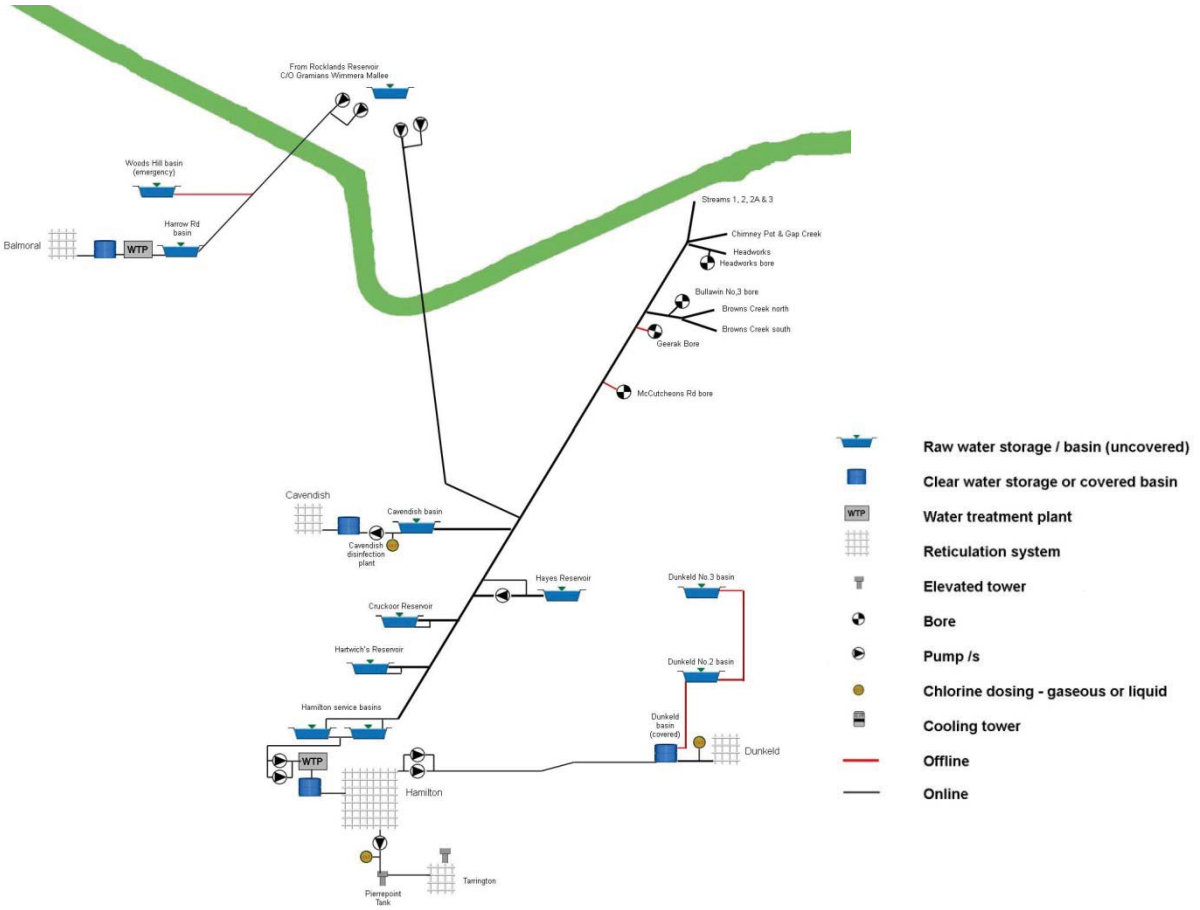
Southern Storages	Volume (ML)
Hayes Reservoir	1200
Cruckoor Reservoir	990
Hartwichs Reservoir	330
No. 1 and 2 storages	132
Total of Southern Storages	**2,652**
Rocklands Reservoir	**348,300[1]**

1 The Rocklands Reservoir has a full supply level of 195.47 m AHD which corresponds to a capacity of 348,300 ML, however, current operating guidelines restrict its maximum operating level to 194.67 m AHD which corresponds to a volume of 296,000 ML

Hartwichs Reservoir is used to mix water from the northern and southern Grampians sources to provide a more consistent water quality in terms of salt level. During times when Rocklands Reservoir is relatively low, the salt level becomes elevated and it must be mixed with the better quality water from the southern Grampians streams to achieve an acceptable salt level (aim is to achieve less than 500 mg/L of total dissolved salts).

Water is treated at the Hamilton and Balmoral water treatment plants and delivered to 11ML and 1ML treated water tanks, respectively, before being supplied to the reticulation system.
A schematic plan of the Grampians system is shown in Figure 18..

Figure 18. Grampians System



Water is pumped to the town of Tarrington via a 1ML tank on the top of Mount Pierrepoint from where it gravitates to Tarrington. Cavendish is supplied via a 100mm gravity main from the southern Grampians pipeline to a 2.25ML shadecloth-covered storage on high ground to the east of the town. Water gravitates from the reservoir to the town. During summer low flow periods, when all the stream flow is used to meet the environmental flow requirements, the Headworks bore is used to supply the town. Dunkeld is supplied via a 33km pipeline to a 6.3ML clear water (lined and covered) storage. Water gravitates from the storage to the town.

5.4.2 Supply Forecasts

As with the Otway system, a REALM model has been used to determine the yield associated with the four climate scenarios to 2065. The model has been run using the last 50 years of rainfall and streamflow data, adjusted to account for climate change. The same operating rules as currently apply to the Hamilton system have been used. Other assumptions are:

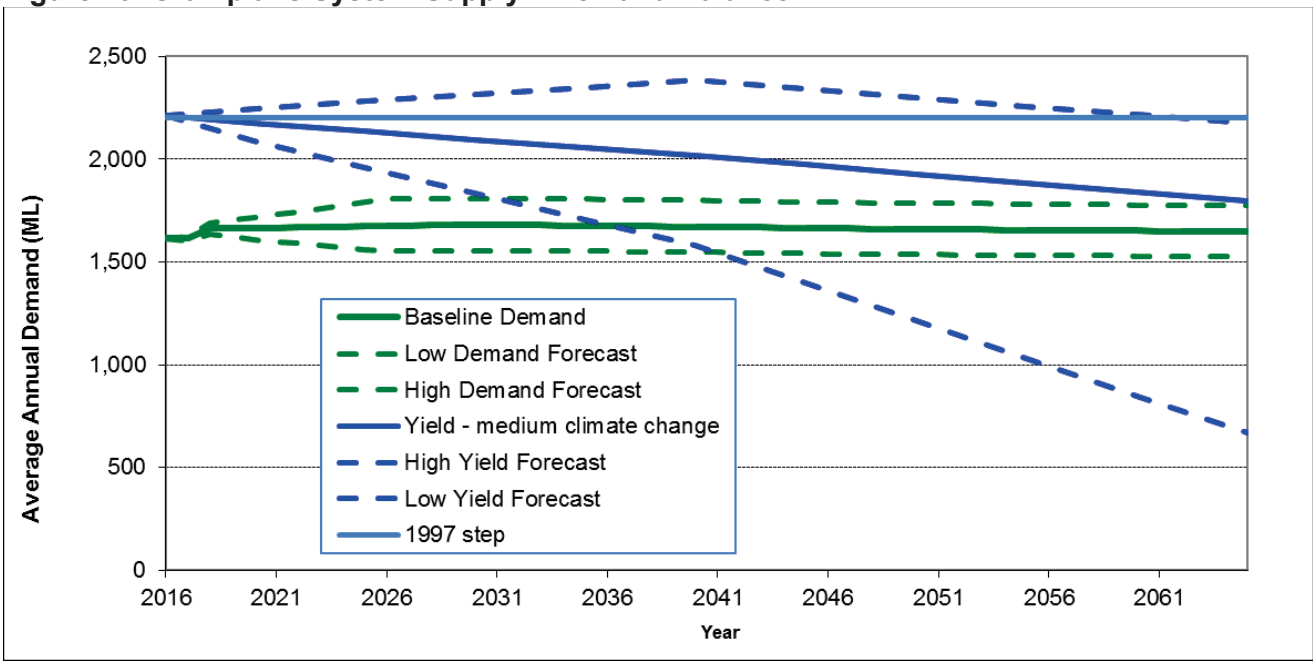
- The climate scenarios detailed in Section 2.3 apply;
- The Headworks and other emergency bores do not contribute to the yield;
- Passing flows are provided for in the streams in accordance with the Bulk Entitlement; and
- Unused Entitlement is able to be retained in Rocklands from one year to another. This is termed “carry over” and allows Wannon Water to better manage years of low water availability.

5.4.3 Supply Demand Status

The construction of the Hamilton Grampians pipeline (to Rocklands Reservoir) in 2010 greatly improved the security of Hamilton’s supply. With the pipeline in place, a repeat of the 2006-2009 dry conditions will not result in water restrictions being applied.

Figure 19 shows the supply and demand projections without any new demand management measures or system augmentation. Supply only declines to levels that are lower than projected demand in one of the four supply projections. Baseline demand is expected to be met under all supply scenarios to at least 2035. However, if the high demand scenario eventuates, augmentation may be required as early as 2030. This “earliest augmentation” scenario is discussed further in Section 7 below.

Figure 19. Grampians System Supply – Demand Balance



5.5 Glenthompson System – Supply Demand Forecasts and Assumptions

5.5.1 System Description

The Glenthompson supply system is shown in Figure 20. The reservoir has a capacity of 110 ML, is located close to the township and has a small surface catchment. Infrastructure to harvest water from a nearby catchment (Railway Reservoir) was decommissioned in 2015 following cost-benefit analysis that identified its use did not substantially improve system security but required significant works. The Willaura pipeline is used to supply rural customers and supply the reservoir when levels are low. The pipeline is supplied from Grampians Wimmera Mallee Water's Willaura system. The source for this is surface run-off from offtakes on Mount William Creek and Masons Creek in the Grampians National Park, supplemented by supply from a borefield on Mount William Creek. The borefield capacity was increased significantly to 1 ML/d in the Millennium drought.

An important feature of the system is that approximately half of the demand on the system is from the rural users along the Willaura pipeline, before the pipeline reaches the Glenthompson reservoir. These customers have similar access to water as Grampians Wimmera Mallee Water's (GWMW) rural customers on the upstream pipeline. However, due to the relatively high elevation of the Glenthompson storage and the associated hydraulics, Glenthompson storage is only supplied for limited periods requiring GWMW to isolate part of its system. Wannon Water liaises with GWMW in respect of the timing of delivery from the Willaura pipeline to Glenthompson Reservoir. The security of the town supply is heavily reliant on this delivery because the local catchment for Glenthompson reservoir does not produce runoff in dry years.

The Willaura System is managed by GWMW. The Glenthompson township and our pipeline customers only constitute a small proportion (15%) of the overall demand on the Willaura System.

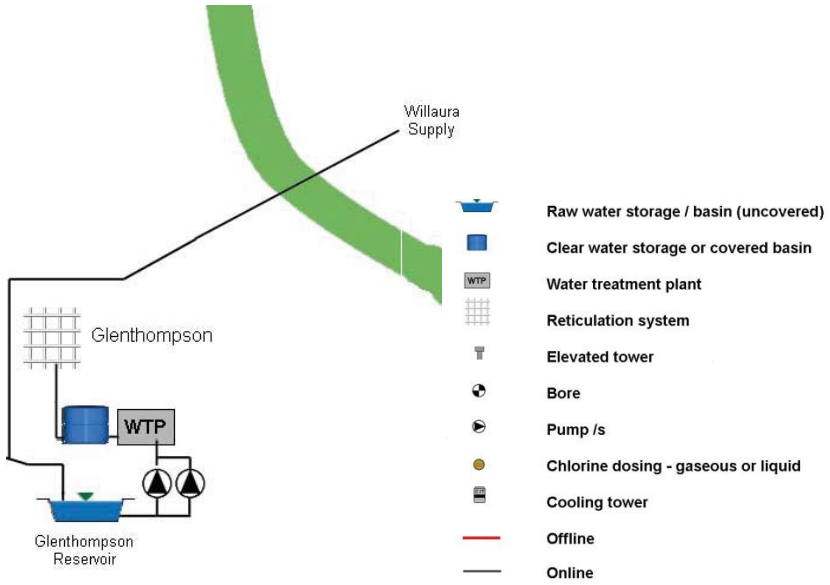
A schematic of the proportion of the supply system managed by Wannon Water is shown in Figure 19. Connections for the rural properties are provided along the 24km pipeline that connects the Willaura System to Glenthompson Reservoir.

The water supplied into the Glenthompson System is taken under entitlements set out in the Water Act 1989. Surface water is subject to Bulk Entitlements, and groundwater is subject to groundwater licences owned by GWMWater. The Wannon Water entitlements are listed in Table 18.

Table 18: Glenthompson System Entitlements

Source/Location	Bulk Entitlement Order or BEE number	Licensed Entitlement	Current Annual Extraction (2015/16)	Comments
Glenthompson (Yuppeckiar Creek)	Glenthompson 1997	94 ML	1.3	• Extraction rate not to exceed 0.9 ML/d.
Glenthompson	Willaura system – Wannon Water 2012	58 ML	39	• Extraction rate not to exceed 0.55 ML/d.

Figure 20. Glenthompson System



Water is treated and stored in a 0.15ML tank on elevated land adjacent to the reservoirs. Water is supplied to the town by gravity from this tank.

5.5.2 Supply Forecasts

As with the Otway and Grampians systems, a REALM model has been used to determine the yield associated with four climate scenarios. The model has been run using the last 40 years of rainfall data, adjusted to account for climate change. The same operating rules as currently apply to the Glenthompson System have been used. Other assumptions are:

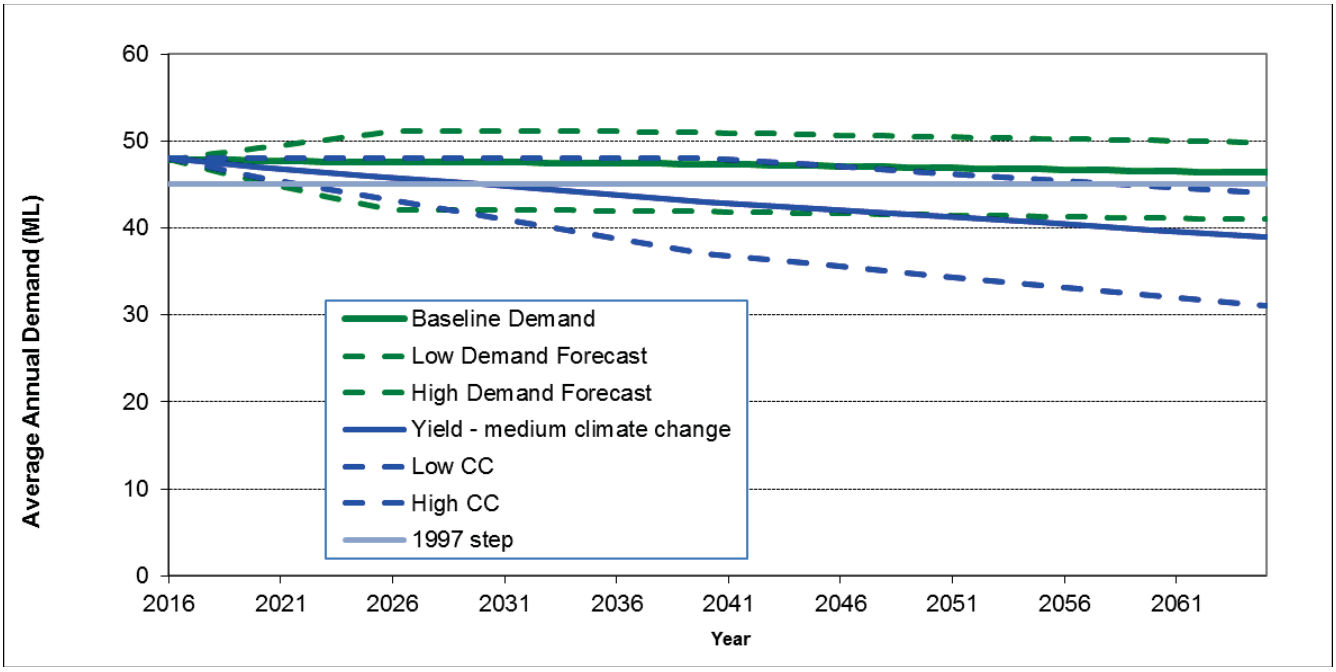
- The climate scenarios detailed in Section 2.3 apply to the Glenthompson Reservoir catchment and to the Willaura headworks catchment; and
- Assumptions regarding timing of access for Glenthompson Reservoir to the Willaura system, sufficient to transfer 6.6ML/month in each of September, October and November.

Note that GWMW's assessment of the security of the Willaura supply system was not complete at the time of writing of this Strategy. As a result of this (and because access arrangements are under negotiation) the yield assessments are highly uncertain. This uncertainty is so great that the supply forecasts make the (conservative) starting assumption that the yield equals the current demand.

5.5.3 Supply Demand Status

Using the conservative assumption that supply equals current demand, any increase in demand or decrease in supply availability may push the system towards storage levels that trigger water restrictions. In response to this status, immediate augmentation of the system (booster pumping on the Willaura Pipeline to Glenthompson reservoir) is proposed in Section 7 below.

Figure 21. Glenthompson System Supply – Demand Balance



5.6 Konongwootong System

5.6.1 System Description

Konongwootong Reservoir is a 1920ML storage that was used in the past to supply water to Coleraine. Connection of Coleraine into the Tullich system (supplied by the Tullich bores) occurred in 2010. Konongwootong Reservoir is maintained by Wannon Water as an urban reserve supply. It is also made available by Wannon Water as a recreational water body. The water is also used for stock watering (and for dairy washdown by one user). The rural supply system is non-potable and provided on a 'supply-by-agreement' basis. The rural demand was 48ML in 2015/2016.

Supply forecasts are not provided, and Supply-Demand status is not assessed for the rural system. However, the storage is large and the pattern of inflows is large compared to rural demands.

5.7 Groundwater Systems – Supply Demand Forecasts and Assumptions

5.7.1 Overview

Portland, Heywood, Dartmoor, Port Fairy, Port Campbell, Timboon and Peterborough are supplied from the deep Dilwyn Aquifer. Bores range in depth from 100m (at Dartmoor) to 1400m (at Portland) with some bores being artesian (flow from the ground without pumping). As discussed in Section 3, this aquifer is extensive and has been identified in the *Western Sustainable Water Strategy* as strategically important. Casterton, Coleraine, Merino and Sandford are supplied from the Tullich borefield. The Tullich borefield accesses a relatively shallow aquifer. Similarly, the towns of Penshurst, Caramut and Darlington access local shallow groundwater. Macarthur is in a different situation to the other towns since the system it is in (the Condah aquifer) has many users and is over-allocated compared to resource availability under climate variability. This is accounted for in Section 5.2 by assuming that future supply is 70% of current, i.e. that there may be a future 70% allocation in this system.

Assessments made in the 2012 Strategy (refer to Section 3.1.2) found that these supplies are secure under dry conditions and under high-impact climate change. It is therefore assumed that the current available supply from each groundwater resource is equal to its licensed volume.

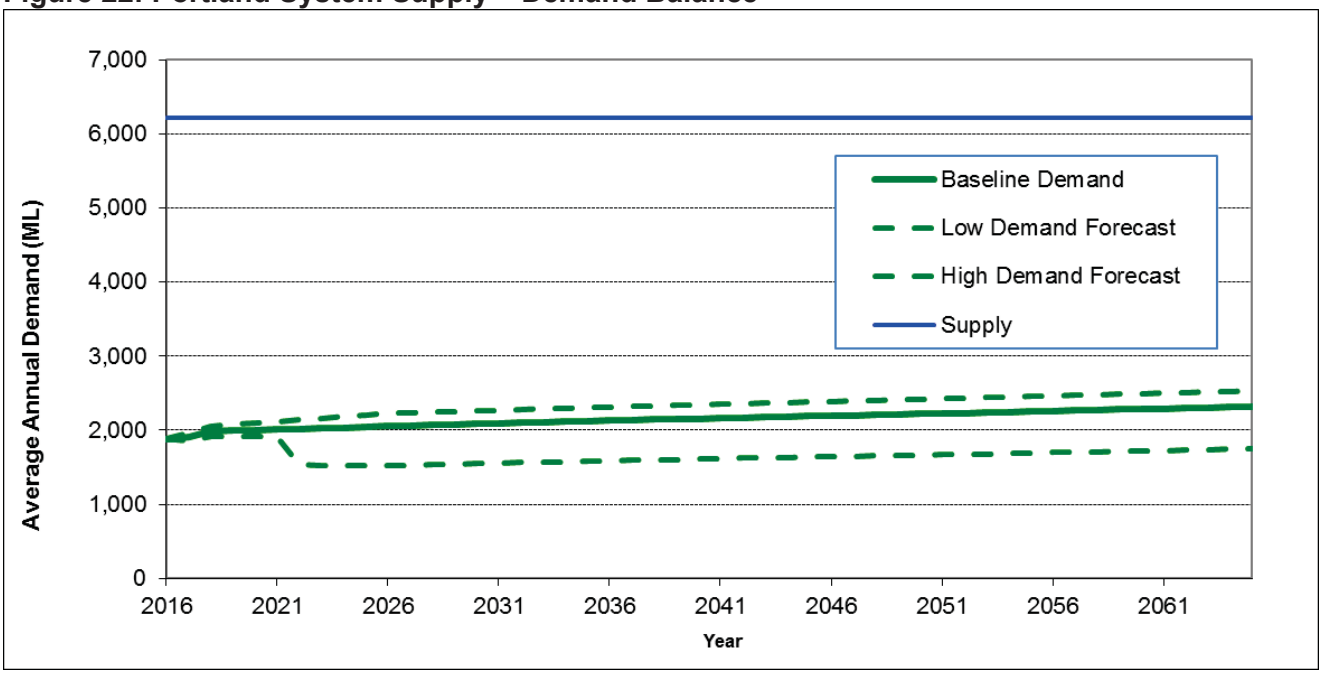
Further details of the larger supply systems are provided below.

5.7.2 Portland

Two 1250 m deep bores constructed in 2008/2009 (plus one 1300 m deep emergency back-up bore at Wyatt Street) provide water from the Dilwyn aquifer via cooling towers to a 32ML storage located to the south of the town. Water gravitates to the town from this storage.

Figure 22 indicates that continuing stable aquifer conditions present Portland with a very secure supply system.

Figure 22: Portland System Supply – Demand Balance

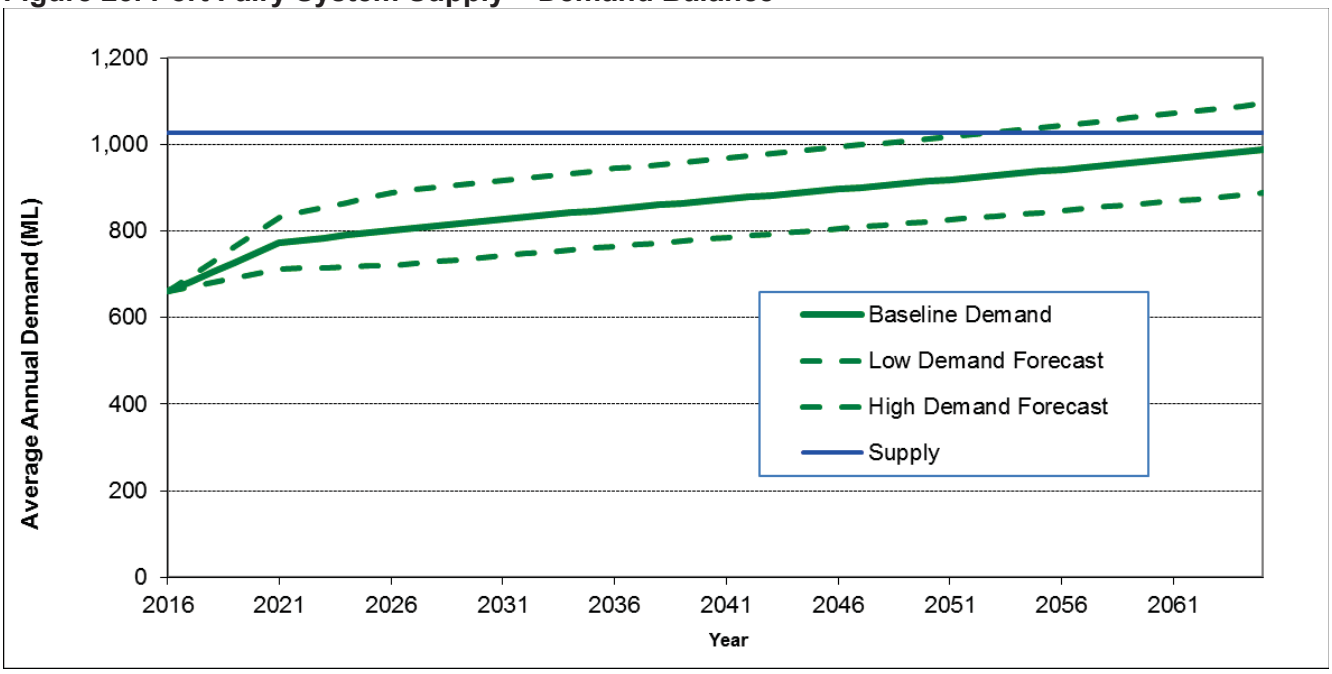


5.7.3 Port Fairy

Two 800m deep bores constructed in 2008/2009 provide water from the Dilwyn aquifer via cooling towers and a pumped main to a 2.3ML tank on high land to the south west of the town. Water gravitates to the town from this tank.

Figure 23 shows demand approaching supply towards the end of the forecast period. This is not a major concern as it is anticipated that the licensed volume will be able to be increased with appropriate hydrogeological investigation to support the application.

Figure 23. Port Fairy System Supply – Demand Balance



5.7.4 Port Campbell, Peterborough and Timboon System

The towns of Port Campbell, Timboon and Peterborough are supplied (as shown in Figure) from a 500m deep artesian bore (pumped at peak demand) constructed in 1996, harvesting water of the Dilwyn aquifer. Water is treated at Port Campbell and stored in a 1ML treated water tank at the treatment plant site.

Port Campbell is supplied via a 1.2km pumped main from the treated water tank to 1.2ML tank on high ground to the east of the town from where it gravitates to supply the town.

Timboon is supplied via a 16.6km pumped main from Port Campbell to a 9.1ML covered storage on high ground to the south of Timboon. Water gravitates from the storage to most of Timboon and is pumped to a portion of the town.

Peterborough is supplied from the Timboon pumped main, via a 3.7km pipeline to a 0.7ML tank and then by gravity via a 5.5km pipeline to the town.

Demand for water at Port Campbell and Peterborough varies seasonally due to the high tourist population during summer. Some 40 rural users also draw water direct from the pipelines supplying Peterborough and Timboon.

Figure 24. Port Campbell/Peterborough/Timboon System

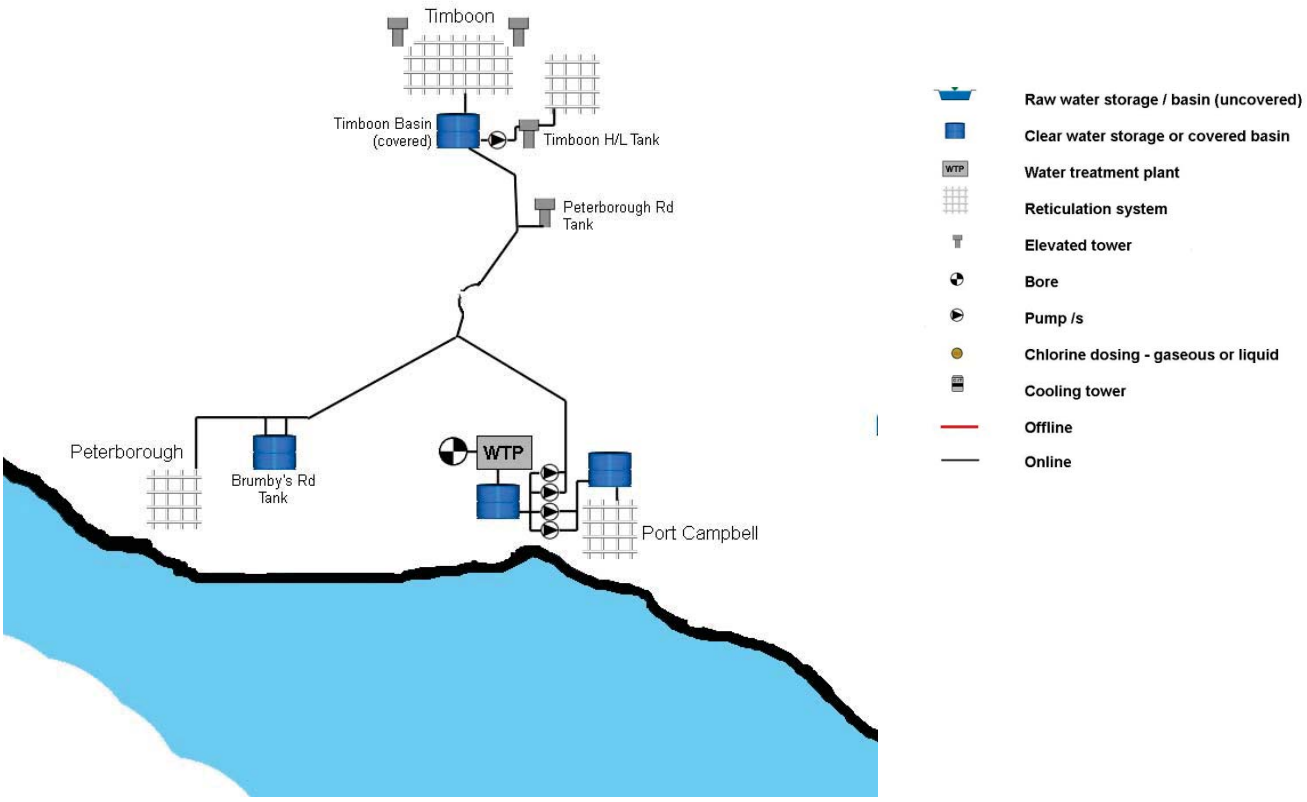
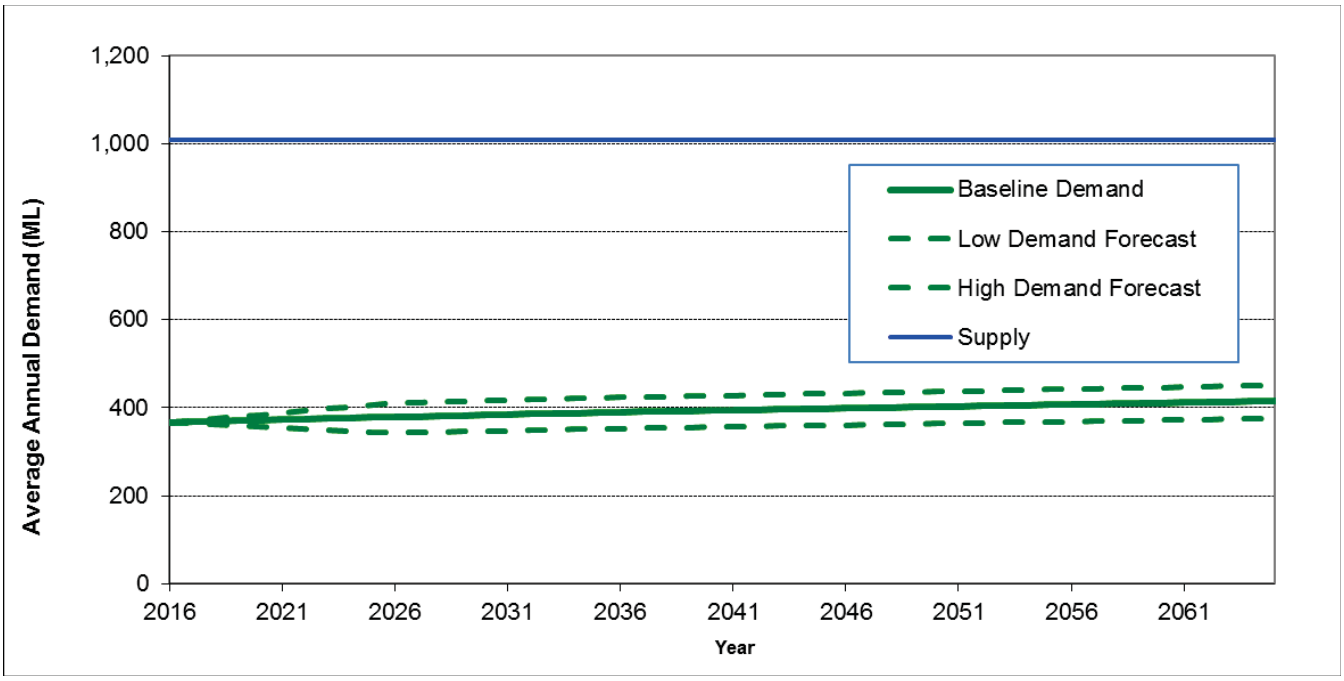


Figure 25 indicates that the stable large aquifer provides for a very secure supply system.

Figure 25. Port Campbell/Peterborough/Timboon System Supply – Demand Balance



5.7.5 Tullich Supply System

The Tullich borefield consists of four production bores, all of which are used to supply peak demands during summer. This groundwater supplies the towns of Casterton, Sandford, Merino and Coleraine as shown in Figure .

Water from the Tullich borefield is pumped via a 14.4km pipeline to the Casterton Water Treatment Plant. The treated water is stored in a 1.5ML tank and 2.9ML covered storage basin from where it supplies Casterton and Sandford by gravity. Water is pumped to Coleraine via a 32km pipeline to a 1ML tank from where it gravitates to the town. The town of Merino is supplied via a 20.2km pumped main from Casterton to a 0.2ML tank on high ground adjacent to the town. Water gravitates from the storage to the town.

The 1000ML per annum of available supply for the Tullich supply system comfortably exceeds demand, which is forecast to reduce by 2065 due to decline in population. Figure 26 indicates that the stable aquifer provides for a very secure supply system.
About half of the native bush that surrounds the Tullich bores was burnt out in 2006. The low scrubby bush is regenerating. Although the fire occurred in the recharge area of this aquifer, the recharge volumes are not expected to be significantly impacted due to the nature of the vegetation in this region (shallow rooted and relatively sparse).

Figure 26. Tullich System

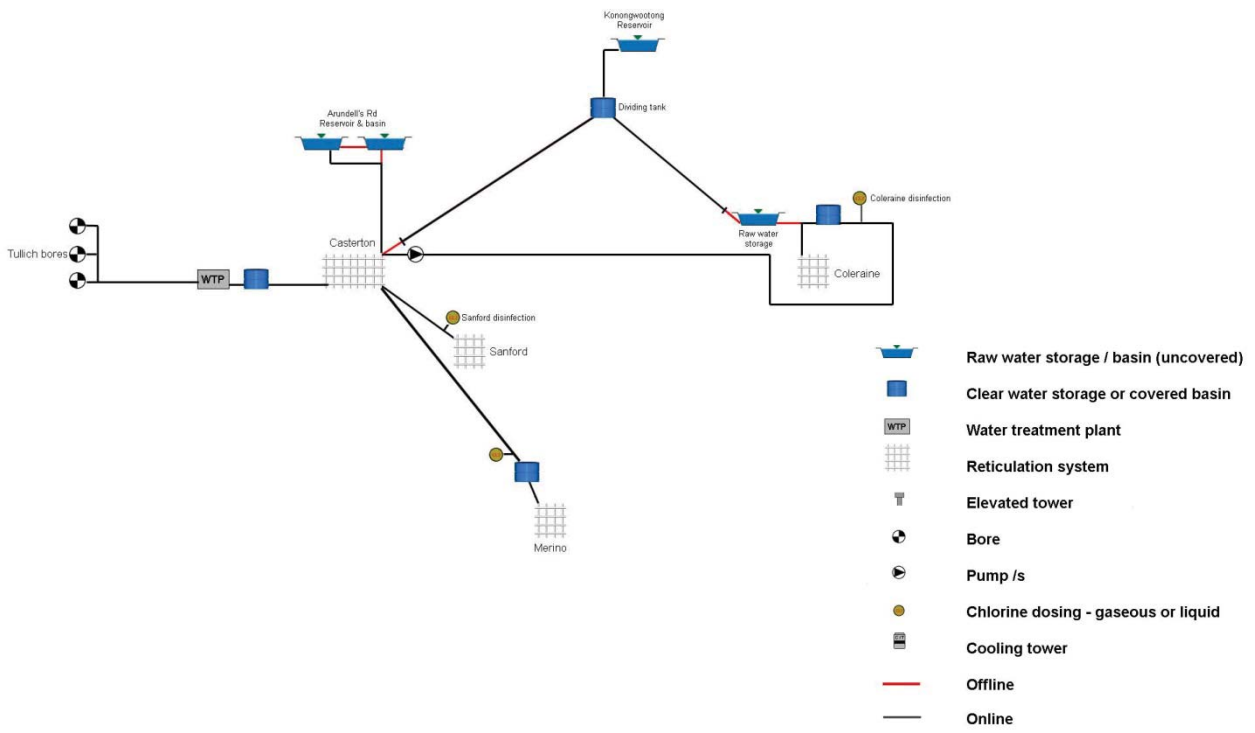
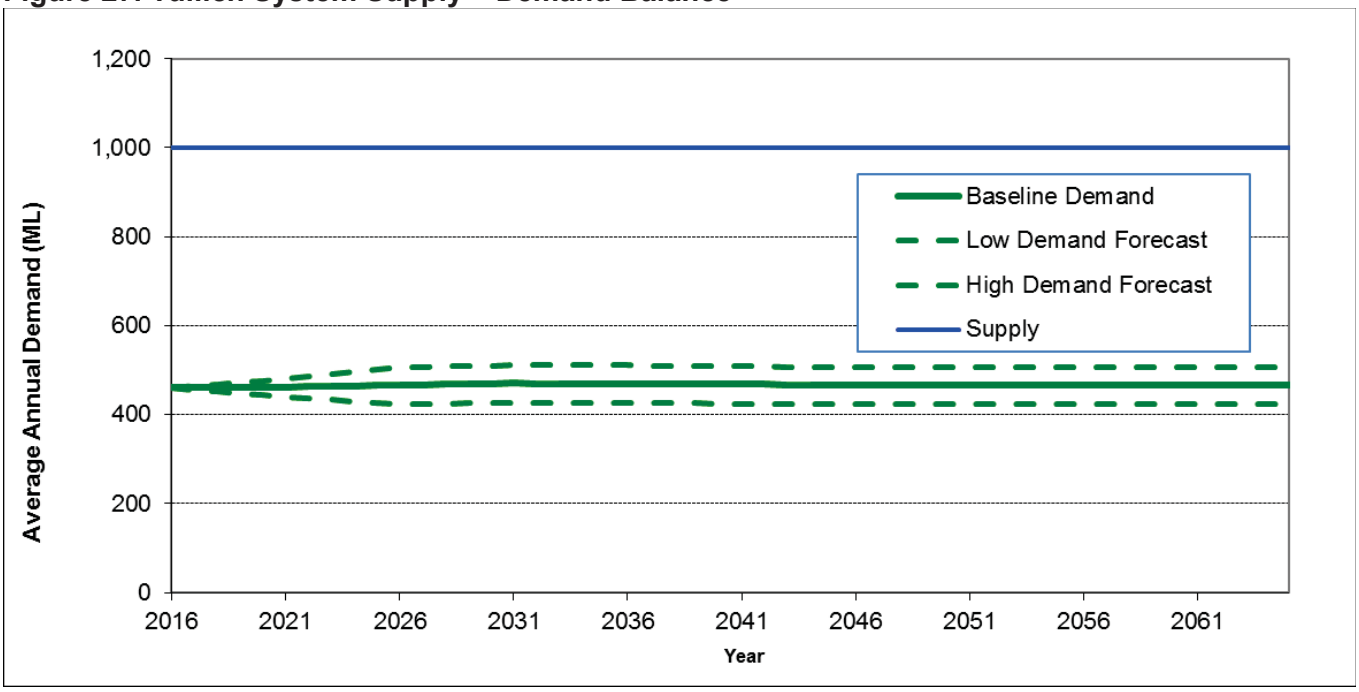


Figure 27. Tullich System Supply – Demand Balance



SECTION 6. SEWERAGE

Wannon Water provides sewerage services to a permanent population of 80,000 people covering 24,500 square kilometres. A total of 16 Water Reclamation Plants (WRPs), two Industrial Water Reclamation Plants (IWRPs) and two Tertiary Water Reclamation Plants (TWRPs) provide waste water treatment processing to 18 towns as well as a number of major and minor trade waste customers.

The majority of Wannon Water's WRPs operate winter storages and irrigation facilities, however three sites Warrnambool, Port Fairy and Portland utilise Ocean Outfalls. Tertiary Water Reclamation Plants operate in Hamilton and Mortlake and provide Class A recycled water to Industrial Customers.

All sites operate under EPA licences to ensure Wannon Water meets required environmental standards.

6.1 Warrnambool System

6.1.1 System Description

The Warrnambool Sewer System is the largest of Wannon Water's Sewer systems, servicing a total population of approximately 34,600 (VIF 2015) with a mixture of customers, predominantly residential, with a number of large individual trade waste dischargers. The Warrnambool Water Reclamation Plant (WRP) treats sewage flows collected from Warrnambool and the towns of Allansford and Koroit.

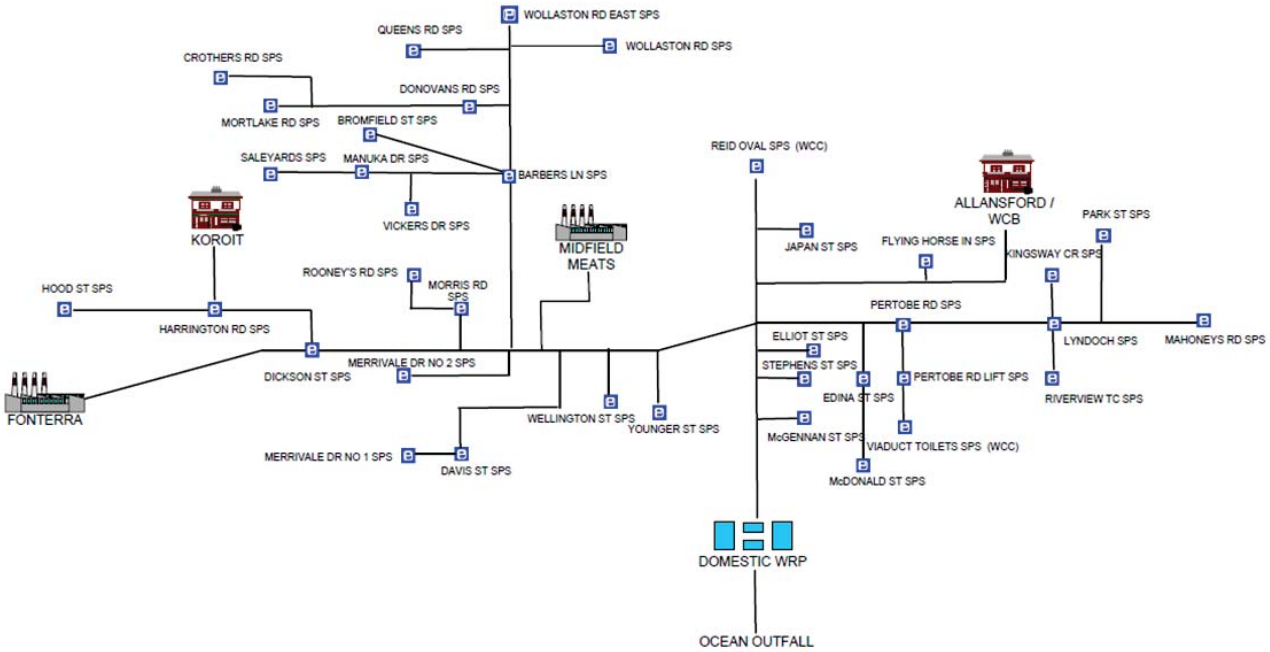
Warrnambool's catchment covers the largest area of the system, servicing a residential population of approximately 31,000. An extensive gravity pipe network is about 300 km in length (of various pipe materials). However, due to the topography of Warrnambool, 35 sewer pump stations are required to transfer sewage to the WRP. There are seven major pump stations and a further 28 smaller sewer pump stations (SPS), not including the Allansford and Koroit SPS (two pump station each).

The Warrnambool WRP (sewerage treatment plant), commissioned in 1996, is located approximately two kilometres south west of the Warrnambool CBD, next to the Southern Ocean, and utilises an Intermittently Decanted Extended Aeration (IDEA) process to treat the waste water. Following treatment, the effluent gravitates out to sea via a 1200mm diameter polyethylene-lined steel-encased pipe. This pipe discharges sub tidally at the edge of the shoreline just west of Thunder Point. The receiving environment is of a very turbulent nature, with natural formations aiding in the mixing and dispersion away from the shoreline. The current mixing zone is identified as a maximum 300 m radius from the end of the outfall pipe. The quality of water discharged is of a high standard in compliance with the EPA discharge licence. The system is summarised in Table 19 and Figure 28.

Table 19: Warrnambool Sewer Network Summary

Number of Customers	**16,170 (including Koroit and Allansford)**
Pipe Network	300 km of pipe of different materials and sizes
Pump Stations	35 Barber's Lane SPS (Major) Japan Street SPS (Major) Morris Road SPS (Major) Dickson Street SPS (Major) Harrington Road SPS (Major) Lyndoch SPS (Major) Pertobe Road (Major) 28 other minor SPS
Treatment Faculties	Warrnambool WRP IDEA Plant
Reuse/Discharge	Discharge to Ocean via Ocean Outfall. Minor reuse onsite as part of cleaning processes of WRP.
Year Sewered	1937
Major Waste Suppliers	Warrnambool Cheese and Butter (Supplied from Allansford) (Annual Vol – 1338 ML) Midfield Meat (Annual Vol – 670 ML) Warrnambool Saleyards (Annual Vol – 60 ML) Fonterra (Annual Vol - 250 ML waste water, 50 ML Condensate)

Figure 28. Plan of the Warrnambool Sewerage system



6.1.2 Population and Connection Forecast

The Warrnambool area is the largest population centre within the Wannon Water service area. The area has a relatively steady growth that is expected to continue into the future. Table 20 details the growth in the number of customers in Warrnambool, Allansford and Koroit over the past four years.

Table 20: Warrnambool Connection History

Connection Type	Period (Years)					Annual Growth Rate
	2010/11	2011/12	2012/13	2013/14	2014/2015	
Residential	13,702	13,994	14,192	14,442	14,682	1.8%
Non-Residential	1088	1099	1116	1118	1117	0.7%
Trade Waste*	353	358	363	367	371	1.3%

*Excludes major trade waste customers

Table 21 details the future projection of sewer connection over the next 15 years. The number of connections for 2014/2015 is used as the base year and forecasts are based upon the Victoria in Future 2015 data projections.

Table 21: Warrnambool Connection Growth Forecast

Connection Type	Period (Years)			
	2015	2020	2025	2030
Residential	14,682	15,959	17,229	18,557
Non-Residential	1117	1214	1311	1412
Trade Waste*	371	403	435	469
Annual Growth Rate		1.74%	1.59%	1.54%

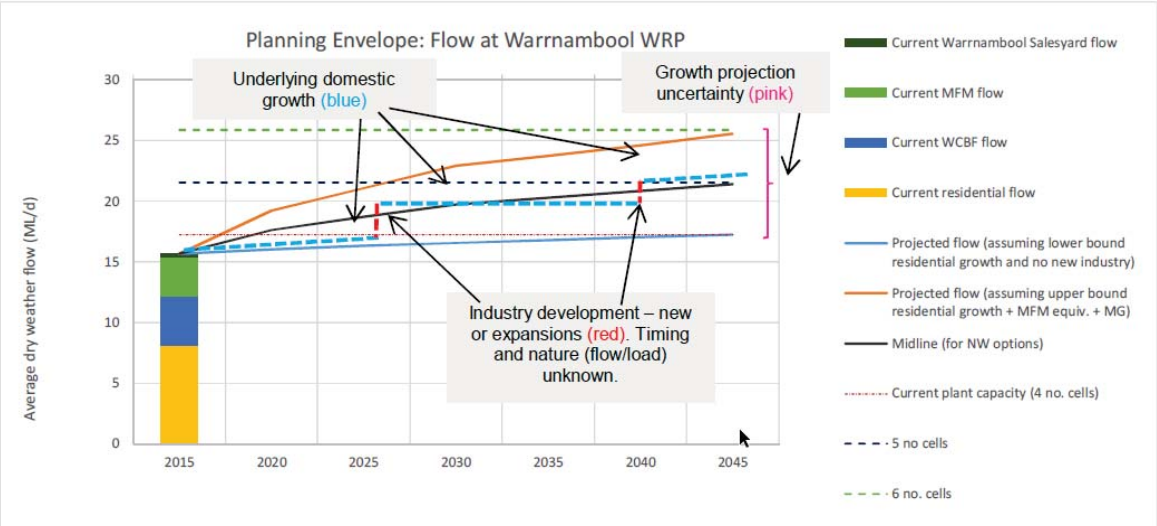
6.1.3 Major Customer Growth

Major trade waste discharge is also a large contributor to the total volume entering the Warrnambool WRP. Approximately 36% of the total inflow into the WRP originates from large trade waste customers. The largest volumetric contributor is Warrnambool Cheese and Butter (WCB), which produces approximately 24% of the total inflows treated by the Warrnambool WRP. The largest biological load comes from Midfield Meat and represents approximately 55% of the total biological load at the plant.

An increase in Major Trade Waste Customer discharges is expected to occur in the near future with the growth of current customers and the possible connection of new large customers over the next five years. Although the precise level of growth of discharges is uncertain, growth in the dairy and food industry is expected to occur in the region. Wannon Water has had discussions with Murray Goulburn about the possibility of connecting to the network and this connection would be timed to match a possible upgrade at the Koroit factory. Midfield Meat's Rendering Plant will also be connecting to the system in the near future. These new customers, along with growth of current customers such as Warrnambool Cheese and Butter and Midfield Meats International, represent a large step change is discharges to the sewer network.

Figure 29 shows the ranges of growth expected to occur in the system and the impact of growth from large trade waste customers.

Figure 29. Expected growth in the Warrnambool sewer network



6.1.4 System Capacity – Warrnambool WRP

The Warrnambool WRP treats all wastewater collected from domestic and industrial customers in Warrnambool and the nearby towns of Koroit an Allansford. Fonterra Dennington currently discharge condensate to the Warrnambool Golf Club via a dedicated pipeline for reuse. The WRP operates under an EPA licence that specifies effluent discharge limits. Warrnambool's trade waste is predominately food waste and salty waste, not heavy metal-based trade waste. This means that effluent discharge to the ocean is an appropriate and low-risk activity.

Due to growth in Major Customer discharges and the future growth of residential customers, an upgrade to the Warrnambool WRP is required to be undertaken in the near future. Wannon Water has undertaken an extensive options assessment to identify the most appropriate option for the future demands of the Warrnambool system. A Multi-Criteria Assessment (MCA) of the options, as shown in Table 22 was undertaken to ensure the most appropriate option was selected. The following options were considered in this options assessment.

Table 22: Warrnambool WRP Upgrade Options

Option	Description
Option 1	Base case (continue expanding existing WRP)
Option 2a	New WRP north of Warrnambool that discharges to the ocean
Option 2b	New WRP north of Warrnambool that provides water for irrigation
Option 2c	New WRP north of Warrnambool that discharges to the river
Option 3	New WRP north of Warrnambool, sending treated wastewater to irrigation and divert industrial wastewater to existing WRP.
Option 4	New WRP north of Warrnambool and provide treated effluent for indirect potable reuse (to defer upgrades to the Otways pipeline)
Option 5	New WRP north of Warrnambool and provide treated effluent as Class A recycled water via a dual pipe network.
Option 6	New WRP east of Warrnambool to recycle treated wastewater to the Warrnambool Cheese and Butter Factory.
Option 7	All additional flow to the existing WRP and extend the outfall for ocean treatment with environmental offsets.
Option 8a	New WRP west of Warrnambool to incorporate Murray Goulburn and further treat to remove salt and irrigate.
Option 8b	New WRP west of Warrnambool to incorporate Murray Goulburn and irrigate with an increased proportion of domestic wastewater.
Option 9a	New coastal Plant with new outfall.
Option 9b	New coastal Plant for WCBF, with new outfall.
Option 10 (Very Similar to Option 1)	Intensify the process at the existing WRP by inclusion of membrane bioreactor or another technology.

The MCA considered a number of areas including cost, impact on the environment, community concerns, future upgrade capacity, changes to the future growth (increased and decreased) and future demand for alternative sources of water in the future.

The preferred option is to keep the WRP at the current site and continue to discharge all sewage and trade waste to this facility and upgrade the treatment plant via a yet-to-be determined treatment process. This option was selected due to its superior scoring in its cost effectiveness, timing of implementation, environmental impact and ability to meet changes to growth and needs of the customers.

The WRP is planned to be upgraded within the next five years.

6.1.5 System Capacity – Ocean Outfall

Warrnambool does not have a winter storage and all flows from the WRP are discharged to the ocean via the ocean outfall pipeline. The old reinforced concrete ocean outfall pipe was replaced in 2009 with a new 1200 mm polyethylene-lined steel-encased pipeline.

Numerous studies have been undertaken since the late 1980s and all have found that the effects of the ocean discharge are limited and contained to the immediate vicinity of the outfall. Due to the salty nature of the effluent, discharging this effluent to the ocean is more appropriate than using the effluent for irrigation.

Table 23 details the compliance levels achieved in the discharge to the ocean from the Warrnambool WRP. No non-compliances were recorded for 2015 to 2016.

Table 23: Warrnambool Ocean Discharge Compliance

Warrnambool WRP					
Indicator	**Number of samples**	**Median limit**	**Number of samples exceeding median**	**Date range median**	**Compliance with annual median**
Ammonia as N	53	2	1	0.4	**Yes**
BOD	53	10	2	5.0	**Yes**
Total Suspended Solids	53	15	3	8.0	**Yes**
Total Nitrogen as N	53	30	17	21.0	**Yes**
Phosphorus	53	30	21	29.0	**Yes**
pH(Maximum)	53	9	0	8.1	**Yes**
pH(Minimum)	53	6	0	7.7	**Yes**

6.1.6 System Capacity – Sewer Network

The Warrnambool sewer network is a large system made up of a number of different catchments. The Warrnambool system also receives the sewage flows from Koroit and Allansford. The overall system has a total of nine major pump stations and a further 30 smaller sewerage pump stations. The Warrnambool WRP Upgrade Options assessment incorporated the cost of changes to the sewerage network to deliver the flows to the WRP site for each option. Thus all the costs associated with each option were considered in the assessment. Table 24 details the required upgrades and changes to the network that are necessary to cater for residential and industrial growth with the upgrade occurring at the current WRP site.

Table 24: Upgrades required in the Warrnambool Sewer System

Location	Upgrade Required	Timing
Wellington St Sewer Main	Duplicate 470 meter length of gravity sewer with 525 mm diameter sewer from Wellington Street to Harris Street	2016-2018
Morriss Road SPS	Upgrade to 100 L/s and construct a new 375 mm diameter rising main	2016-2018
Russell Creek Sewer Main	Pipe burst 140 meters of 225 mm sewer to 300 mm sewer	2016-2018
Flying Horse Inn SPS	Upgrade to 20 L/s	2022-2024
Riverview Terrace SPS	Upgrade to 22 L/s and construct a new 150 mm diameter rising main	2024-2026
Hood Street SPS	Upgrade to 35 L/s, and construct a new 1.2 km rising main	Later than 2028
Dickson Street SPS	Upgrade to 95 L/s	Later than 2028
Harrington Road SPS	Upgrade to 80 L/s and construct a new 300 mm diameter rising main	Later than 2028
Japan Street SPS	Upgrade to 70 L/s and construct a new 300 mm diameter rising main	Later than 2028

Location	Upgrade Required	Timing
Lyndoch SPS	Upgrade to 75 L/s and construct a new 300 mm diameter rising main	Later than 2028
Barbers Lane SPS	Duplicate the 117 meter of 375 mm main gravity sewer upstream of SPS Upgrade SPS to 170 L/s and construct a new 375 mm diameter rising main	Later than 2028
New SPS's	Construct a new 90 L/s pump station near Aberline Road, which receives flows from the top of the Barbers Lane Catchment and discharges flows to the WRP via a new rising main Construct a new pump 76 L/s station to serve the Horne Road industrial precinct	Depending on development of Estate

With the growth occurring in the Allansford system due to additional discharges from Warrnambool Cheese and Butter, Wannon Water is upgrading the rising main to allow higher flows and pressures through the system to the WRP. This work will occur in 2017. Additional upgrades of the system may be required if additional discharges occur in the future.

To allow the connection of Koroit's Murray Goulburn Dairy Factory (as a new large trade waste customer) a new dedicated rising main and pump station would be required to be constructed to transfer waste directly through to the Warrnambool WRP. The timing of this will coincide with the upgrade to the factory.

6.1.7 Reuse at the WRP and Golf Course

Currently the only recycled water that is produced by the WRP is for cleaning processes at the Plant and for biosolids processing and washdown. This reuse has saved about 150 ML of potable water. Additional to this reuse, the Warrnambool Golf Course is supplied with condensate from Fonterra Dennington Dairy Factory. This reuse has saved about 80 ML of potable water use diverting it from being discharged to the ocean. A number of the large trade waste customer process and reuse portions of their waste volumes in their own processes. All other effluent from the WRP discharges to the ocean via the ocean outfall.

In 2008 Wannon Water undertook an Expression of Interest regarding recycled Water opportunities in Warrnambool. This process received seven submissions however it was decided that Wannon Water would put the process on hold pending the development of high end market uses (eg gas fired power stations) where the cost of additional treatment to manage the salt makes the opportunities more economically viable.

Currently there are no plans to increase reuse from the Warrnambool System however, Wannon Water will investigate opportunities to use recycled water as they arise.

6.2 Hamilton

Hamilton residential growth is relatively stable and the sewer network has adequate capacity to meet demand into the future. A new industrial customer (an abattoir to the west of the town) is, however, expected to connect to the system in the near future. Due to its proximity to the WRP, the abattoir will discharge directly to the WRP and not via the current sewer network. Wannon Water is currently working with the customer to fully understand the future loading and flows expected to be discharges and the implications of this on the Hamilton WRP. An upgrade to the facility may be required if the current capacity cannot meet the possible increase in loadings.

6.3 Camperdown

Camperdown residential growth is relatively stable and the sewer network and domestic WRP has adequate capacity to meet future demands. A new industrial trade waste customer is considering establishing a new dairy factory in Camperdown. This factory would discharge to the Camperdown Industrial WRP. Wannon Water is working with the new customer to understand the loadings and flow requirements to assess the most appropriate upgrade of the existing plant.

6.4 Portland

Wannon Water recently undertook a major upgrade to the Portland WRP to ensure that the WRP meets the required Environmental Regulations set out by the EPA. The WRP was upgraded from a lagoon and reed bed based system to an IDEA process based plant. This upgraded also provide additional capacity in the system for future growth.

Portland sewer system was expanded recently to include two new backlog sewer areas of West Portland and Dutton Way. These areas were previously unserviced and due to environmental issues of the septic systems in the residential areas new schemes where required and constructed by Wannon Water.

Future growth in Portland is relatively stable and no major upgrades to the system are expected in foreseeable future.

6.5 12 Apostles Project

Wannon Water has recently taken on the management of the sewerage treatment system at the 12 Apostles Visitor Centre. Wannon water is currently working with Parks Victoria, the manager of the 12 Apostles Visitor Centre to develop a plan to improve the treatment and disposal of wastewater from the facility. Construction of a new pump station and pipeline to transfer the wastewater to the Port Campbell WRP has been selected as the preferred option following consideration of constructing a new treatment facility. Construction of these works are planned to be completed by 2018/2019.

6.6 Other systems

Currently all other systems are either growing or declining marginally in population and Wannon Water does not expect any new large customers to connect to these systems; hence no major upgrades or new facilities are planned to be constructed. Wannon Water will continue to work with local councils and large customers to ensure future demand is catered for in the sewerage networks and treatment facilities.

SECTION 7. ACTIONS TO SECURE OUR WATER FUTURE

7.1 Defining a Secure Water Future

A secure water future can be defined and needs to be defined so that water managers are aware of the key assumptions, so that reality can be checked against assumptions and so that customers gain an understanding of these assumptions. Such a definition also sets out a form of supply contract with customers and establishes a base for performance assessment and accountability. With a clear set of assumptions customers have a basis for challenging, influencing or changing the supply framework.

The customer consultation undertaken as part of the development of this strategy identified that the majority of customers:

- Accept that the current level of water restrictions (including Permanent Water Saving Rules) is reasonable and indicated an acceptance that more frequent restrictions would be acceptable if there was a cost advantage.

This Strategy is built around this acceptance and on the following assumptions:

- Customers understand that, for some supply systems, water restrictions are an appropriate response to extreme seasonal events. Further, that it is reasonable for Wannon Water to plan an investment and demand management program around the current frequency of restrictions being restrictions at one year in every 20-year period or, on average, 95% of the time having no restrictions.
- Given the social impact of stage 4 restrictions and the relatively small impact on the demand volume, stage 4 restrictions are not proposed to be implemented except in extreme circumstances not historically experienced. That is, the systems will be planned for augmentation to avoid the need to use stage 4 restrictions.
- The impact of climate change is evaluated by exploring the impact of four different climate outcomes as required by DELWP being low, medium and high impact on water availability and a post-1997 step climate change scenario. Refer to Section 2.3 for more detail. The supply-demand balance will be reassessed every five years.

Adoption of these assumptions allows Wannon Water to carry out modelling of supply and demand so as to arrive at the lowest possible costs for new investments.

- Note that systems totally reliant on groundwater are insulated from seasonal supply fluctuations. Where research establishes that sustainable consumption from an aquifer requires a reduction in demand, this is best responded to by broad and permanent demand reduction programs rather than by way of seasonable restrictions;

Wannon Water believes that the assumptions underpinning this Strategy: entail low levels of risk; that variations and inevitable changes will be able to be understood and be managed in a straightforward way; and that the Strategy will accordingly deliver a secure water future for the region.

7.2 Demand Reduction Targets

7.2.1 Achievements under the Water Supply Demand Strategy 2012-2060

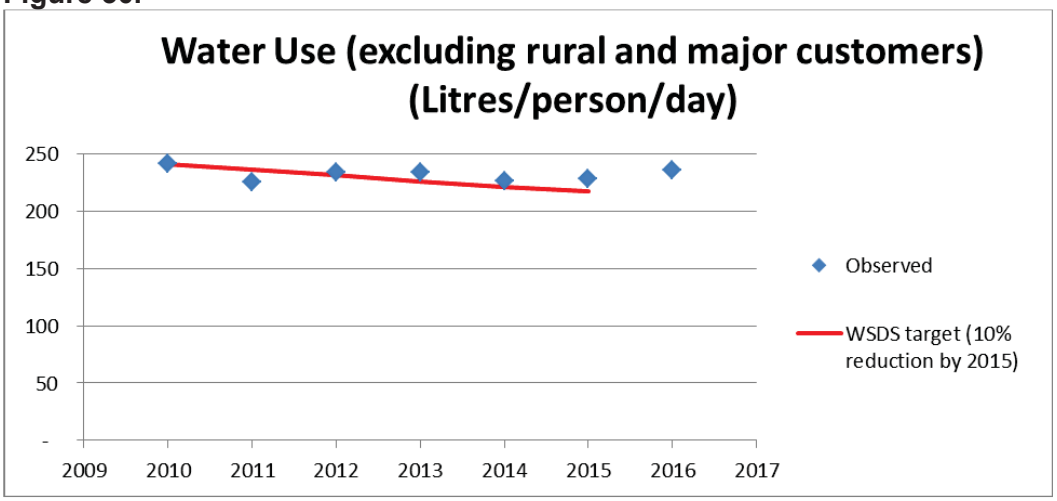
The *Water Supply Demand Strategy 2012-2060* (WSDS) nominated the reduction targets for per capita use that are detailed in Table 25. These two targets were partially met.

Table 25: 2012-2060 Demand Reduction Targets

Measure	Target reduction by 2015
Per capita consumption (excl. rural & industry)	10% [1]
Per capita residential consumption	13%

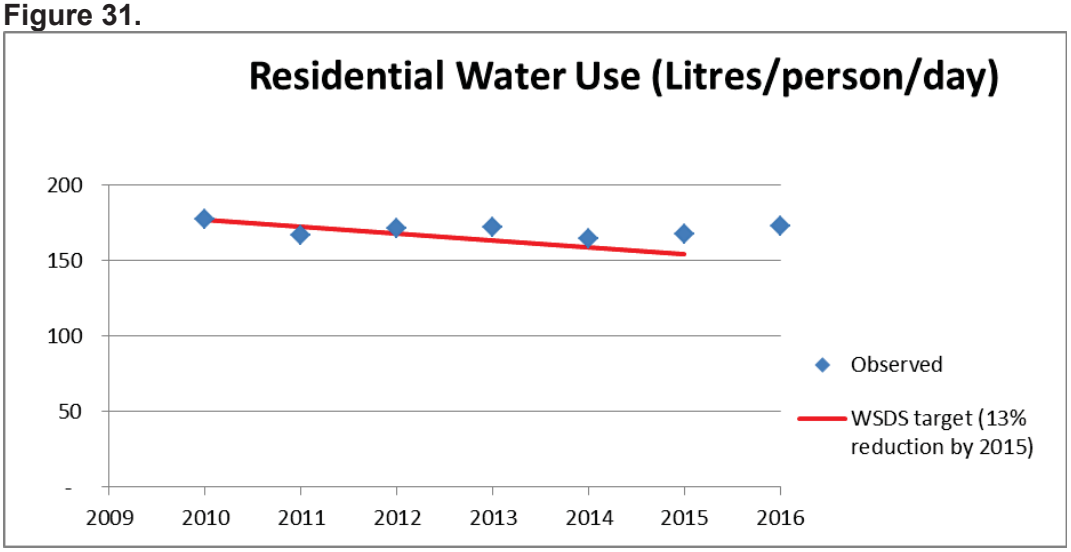
[1]This table shows percentage reduction from the 2009/2010 base year.

Figure 30.



In 2015/2016, water use (excluding rural and industry) was 236 litres per person per day, down from 242 litres per person per day in 2009/2010 (a 3% reduction). This 3% reduction equates to a volume of 220ML.

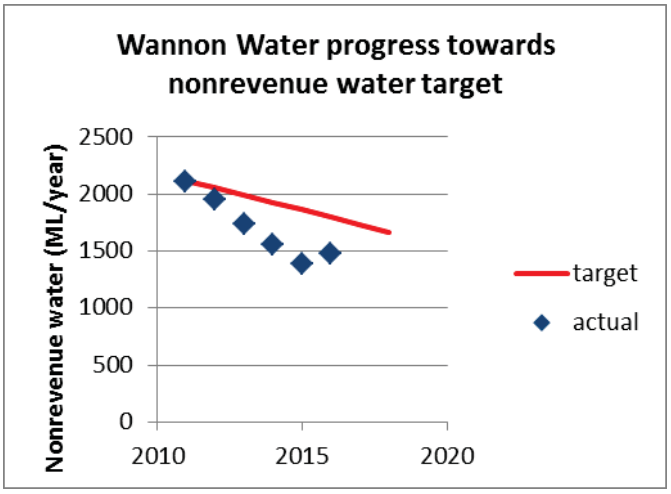
Figure 31.



In 2015/2016, residential water use was 173 litres per person per day, down 3% from the 2009/2010 value of 177 litres per person per day, as shown in Figure 31.

The WSDS 2012 sets a target for volumetric reductions in non-revenue water from 2010/2011 levels. This target has been met and exceeded. Non-revenue water has fallen from 2110ML to 1478ML, a reduction of 632ML. Volumetric reductions in non-revenue water have occurred in all systems.

Figure 32. Progress against WSDS Non-revenue water targets



The non-revenue water reduction program which commenced in 2009 has been active in towns across the region, with the estimated volume of over 100 repaired leaks equating to 880ML/year as of 2016.

7.2.2 Demand Reduction Targets

Figure 29 & 30 show that residential consumption has started to climb over the last two years. Target 155 and other media promotion to conserve water have been effective in the past in reducing residential consumption. The new “target your water use” media campaign that will be undertaken over the coming years together with ongoing education and pricing more linked to use, is expected to result in residential and non-residential consumption (excluding rural and major customers) per connection dropping to 2013/2014 levels – a drop of 4% from 2015/2016 levels by 2022, equivalent to 340ML.

Figure 31 shows the substantial reduction in NRW over the last 5 years but also shows it increasing in the last year. To continue to reduce NRW at the same rate is not realistic as many of the leaks that did exist have now been repaired and systems are in place to find leaks and repair them quickly as they occur. A more modest target of reducing NRW by 150ML by 2022 is proposed.

7.3 Demand Reduction Options

Wannon Water has set a target to reduce water usage by 490ML/year by 2022 (using 2015/16 as the base year). The following demand management options will be implemented to meet this demand reduction target.

Table 26: Demand Reduction Options

	Otway System	Grampians System	Other systems	Combined Wannon Water Systems	
	Water Savings in 2022 (ML/yr)	Water Savings in 2022 (ML/yr)	Water Savings in 2022 (ML/yr)	Costs $NPV/kL	Water Savings in 2022 (ML/yr)
Target Your Water Use This is a voluntary water efficiency program designed to encourage customers to use water wisely and make informed decisions. We are proactive in contacting customers who register a spike in their water usage.	45	10	25	$0.09	80
Education regarding demand reduction Wannon Water has an active education role in the community to promote water savings and wise water use. Partnerships exist with schools and local government.	45	10	25	$0.09	80
Pricing of Water linked to Volume of Use Wannon Water will change its billing system to make bills more dependent on the volume of water used. This will provide an incentive for more efficient use of water by households and businesses that use a lot of water.	45	10	25	$0.05	80
Council water savings Wannon Water will work with the five councils in our region to identify opportunities for water savings. A saving of 100ML is 20% of the water used by councils in 2015/2016.	55	15	30	$0.07	100
Leakage reduction - reticulation network The leakage in Wannon Water's reticulation network ranges from 8% to 20%. Wannon Water will target its leakage detection and reduction program.	75	30	45	$0.50	150
TOTAL PROGRAM	265	75	150	$0.25	490

Education and Pricing are the options with the best value for money. The major component of the demand reduction package adopted is leakage reduction (non-revenue water). Wannon Water has adopted a target of 1328ML non-revenue water by 2022. The non-revenue water targets for individual systems are shown in Table 27.

Table 27: Non-Revenue Water Targets

System	Baseline NRW (2016)	%	Reduction Target (2022)	Target NRW (2022)
Otways System	725	(10%)	75	650
Grampians System	227	(16.5%)	30	197
Portland	285	(16%)	30	250
Port Fairy	66	(11%)	4	62
Casterton System	82	(20%)	6	76
Port Campbell System	19	(7.5%)	1	18
Other towns	74	(31%)	4	70
Wannon Water	1478	(12.6%)	150	1328

The non-revenue water reduction targets aim to reduce the levels across each system by the above amounts by 2022.

The combined demand reduction targets by 2022 are detailed in Table 26 above.

7.4 Supply Demand Equations

Supply-demand curves for the five largest systems, incorporating the package of demand reduction measures (plotted as “high demand including non-revenue water target”), are shown below in Figure 33 to

Figure **37**. These graphs are based upon worst-case scenarios – that is, with low system yield and high demand. The resulting dates for augmentation are therefore the earliest expected dates that action may be required. Under the most likely demand scenario, the need for augmentation of the Otway and Grampians systems is delay by approximately 5 years. (Note that the high demand scenario may not eventuate. Wannon Water continually monitors demand and the projection may be revised downward (and the dates for augmentation pushed back) when this Strategy is reviewed in five years’ time.)

Figure 33. Otway System Supply – Demand Balance – Post Demand Reduction

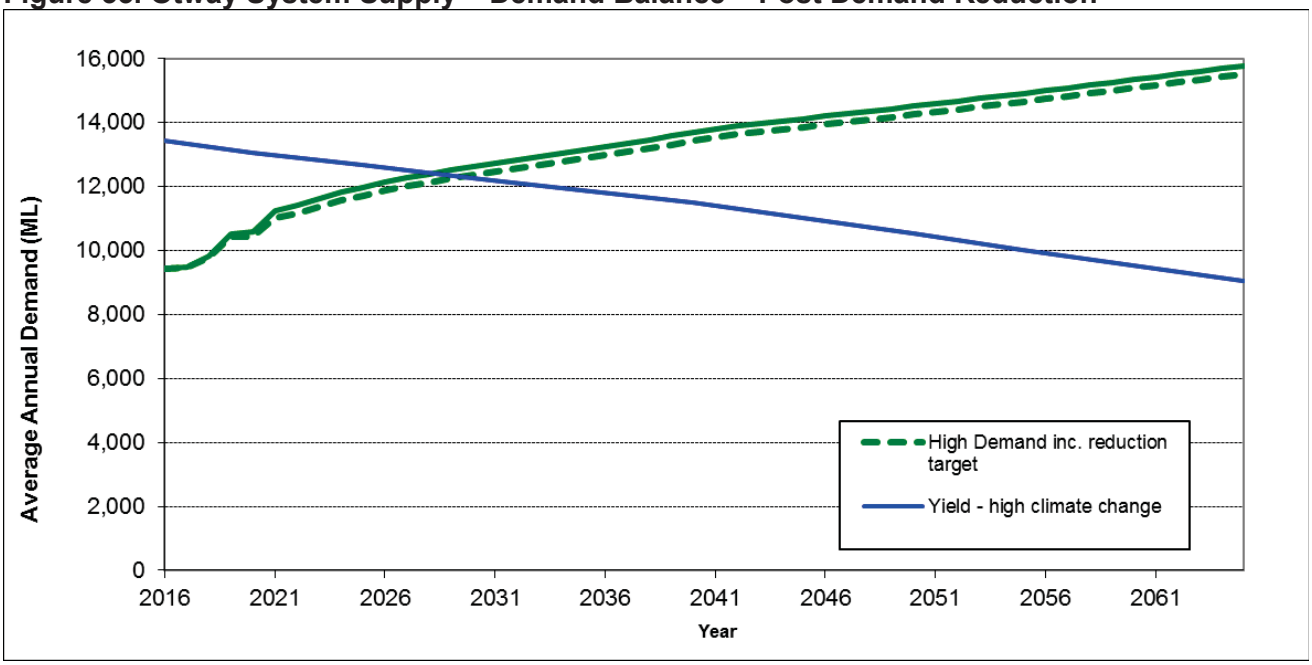


Figure 34. Grampians System Supply – Demand Balance – Post Demand Reduction

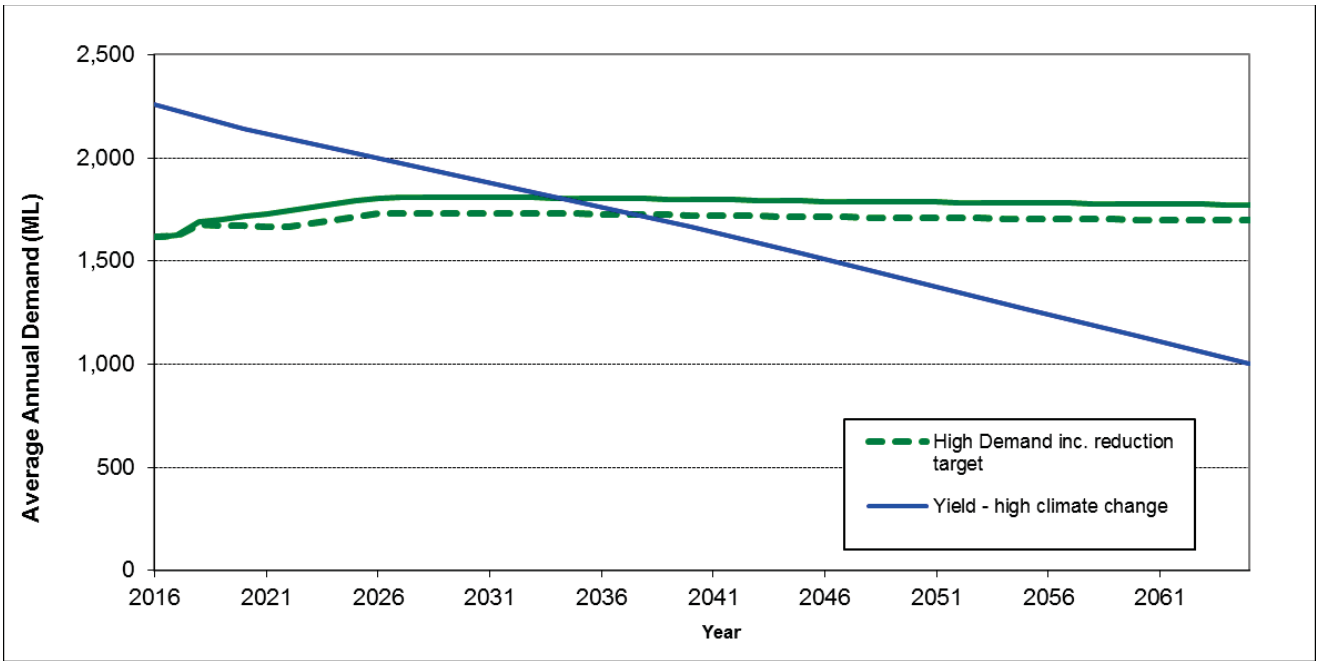


Figure 35. Portland System Supply – Demand Balance – Post Demand Reduction

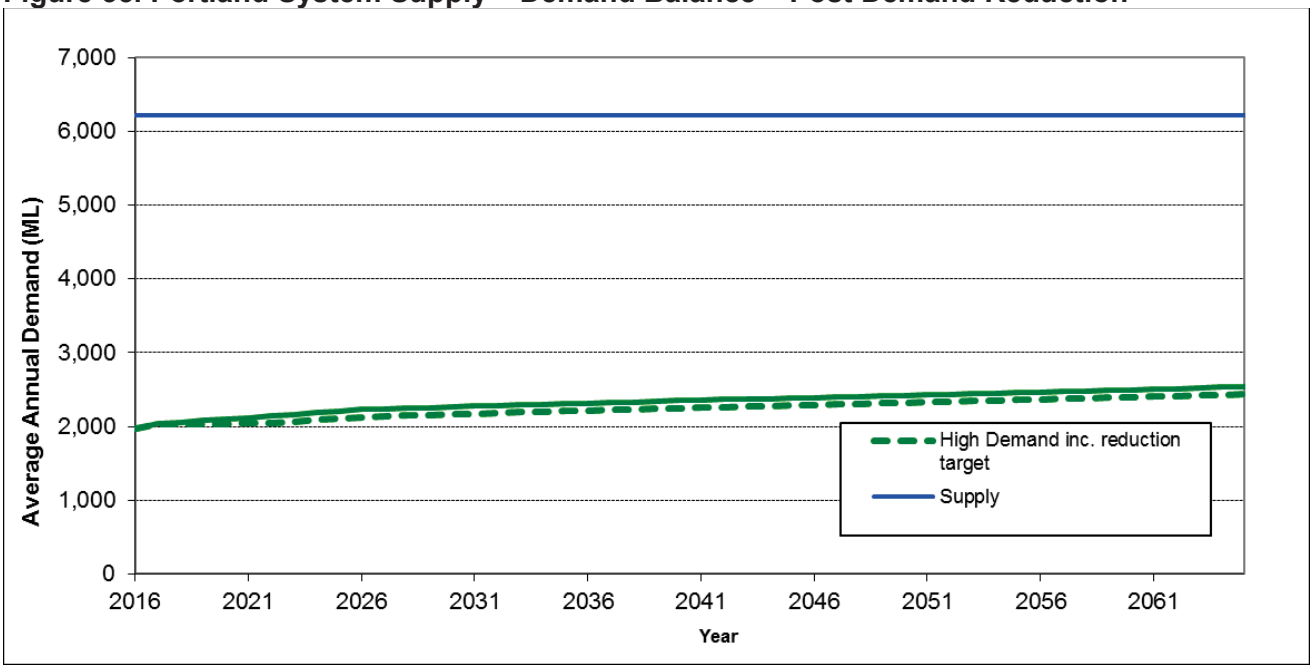


Figure 36. Port Fairy System Supply – Demand Balance – Post Demand Reduction

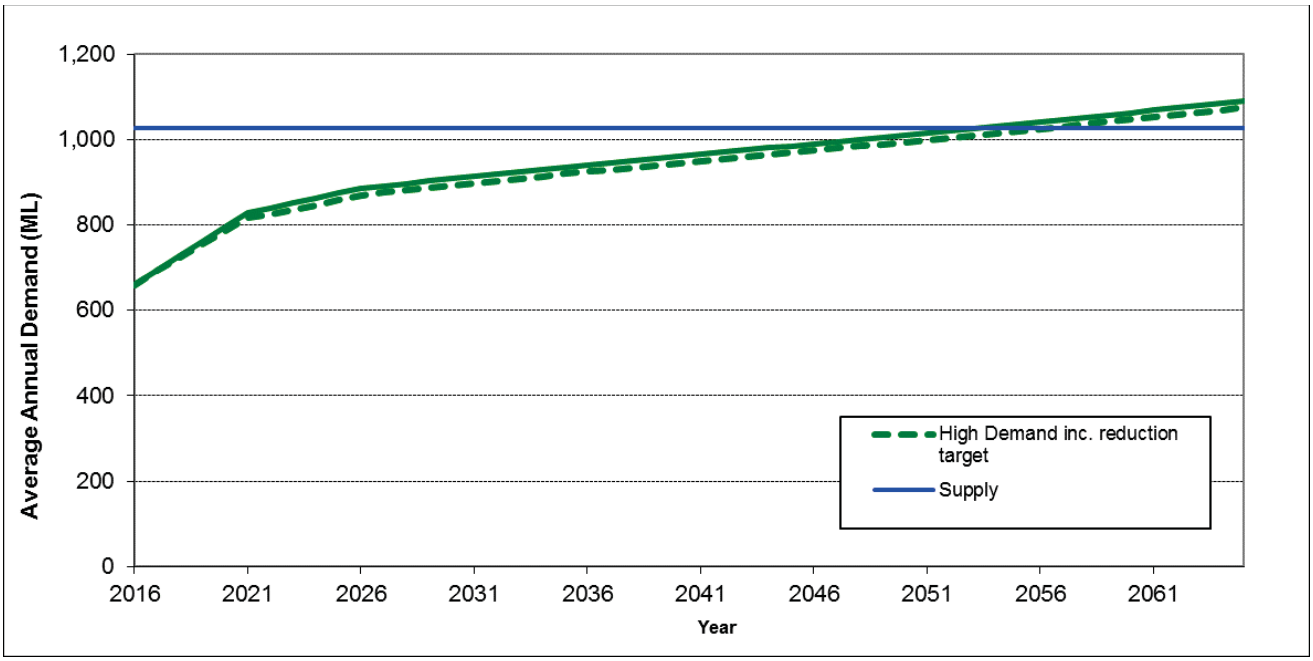
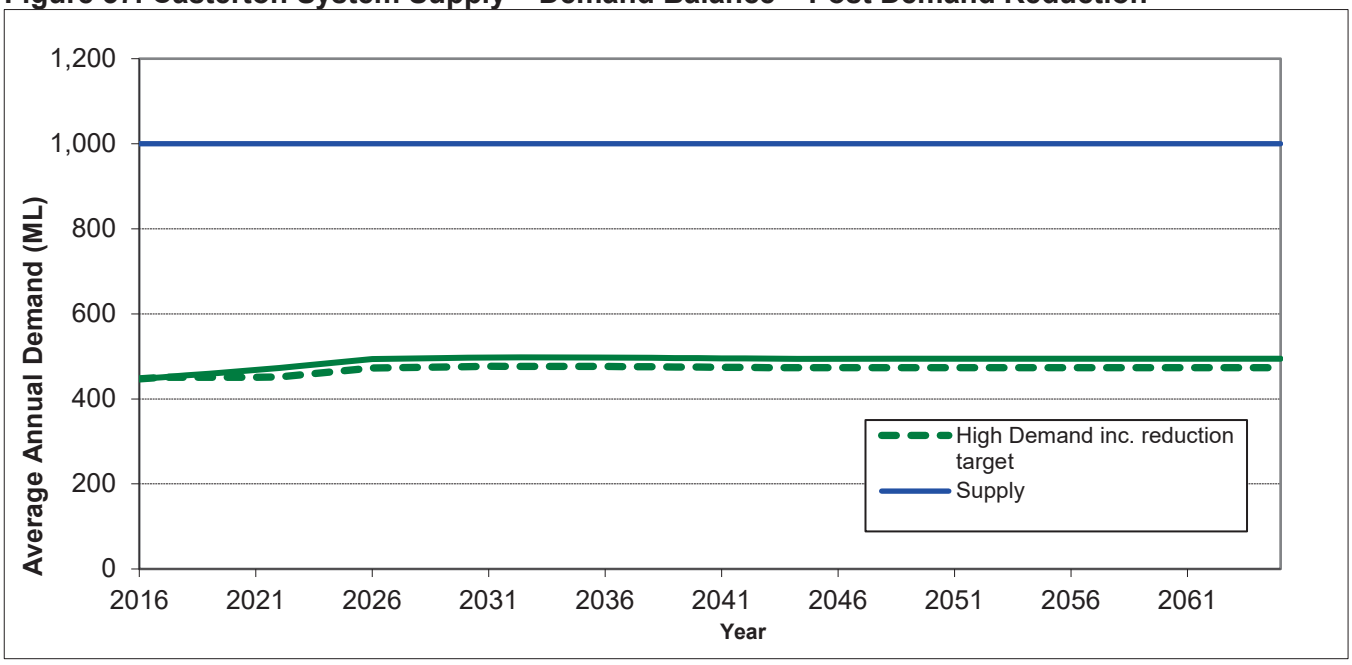


Figure 37. Casterton System Supply – Demand Balance – Post Demand Reduction



7.5 Supply Augmentation Options

The supply-demand balances described in Sections 5 and 7 indicate that Wannon Water's groundwater-supplied systems will have sufficient supply to meet projected demand up to 2065. Of the surface water systems, Glenthompson requires immediate augmentation. The Otways and Grampians systems may require augmentation as early as 2028 and 2035 respectively.

Augmentation options for the Otways, Grampians and Glenthompson supplies are described below. Augmentation options identified in the last strategy have been reviewed for relevance and, where appropriate, updated to reflect current costs. For the Otways System, the options assessment conducted in 2012 remains appropriate and only the shortlisted options are described here.

The cost of each option is expressed in $NPV/ML – net present value of option per megalitre. Net present value is a financial assessment that allows capital and operating costs over the life of the project to be expressed as a single value in current day dollars. The assessment is done over a 50-year period using a discount rate of 6.0%. The number of megalitres is the sum of all megalitres over the 50-year period.

For each of the options, purchase of 'green power' was allowed for to provide for Wannon Water being 'carbon neutral' by 2050.

The robust sustainability assessment that was completed for these options in 2007 is still considered relevant to this Strategy. The assessment of options was undertaken by an environmental sustainability panel composed of a groundwater management representative, catchment and river health representatives as well as a municipal sustainability officer, a senior EPA manager and a regional DSE manager (with minority Wannon Water officer involvement). The options were assessed against the following sustainability criteria: cost per ML, effect on regional GDP and development, greenhouse gas emissions, impact on environmental flow objectives, impact on surface water, groundwater and marine water quality, effect on terrestrial ecosystems, cultural heritage and recreational values, social acceptability, distribution of costs and benefits and confidence of success.

7.5.1 Otway System

7.5.1.1 Description of Options

Table 28 lists the shortlisted augmentation options considered for the Otway system.

Table 28: Otway System Supply Augmentation Options

Otway System - Supply Augmentation Options		Max. Yield (ML/a)	Capital $mil	CO2 emitted tonnes/ML	Costs $NPV/ ML
Roof water harvesting (Russells Creek Growth Corridor)	The Russells Creek Growth Corridor is upstream of the Brierly Water Storage before the Warrnambool Water Treatment Plant. Residential land is to be developed adjacent to and upslope from this storage. Roof water harvesting is providing 100% of the water needs for this growth corridor while not adding to catchment flood risk, thus providing significant community benefit.	460	7.3	0	$210
Curdievale Bore	Curdievale is located about 40km from Warrnambool on the South Otway pipeline. Wannon Water holds a 2150 ML/year groundwater licence from the Paaratte aquifer at this location. The existing bore is an emergency relief bore. This option would involve bringing all of this resource online as Warrnambool grows. Development of this option involves construction of a collector storage and transfer pipeline and pumping stations at Curdievale and Nullawarre.	3400	7.0	2.3	$216

Notes: The column for "$NPV/ML" includes allowing for the use of 'green power' using additional cost of 7.9 cents/kWhr. The reported "CO2 emitted" is at maximum yield. Capital cost is total over 50 years.

Full utilisation of the current Bulk Entitlement will require the North and South Otway pipelines to transfer the Bulk Entitlement volumes of 22.5 and 21.5 ML/day, respectively, and have sufficient balancing storage to meet the peak summer demands. Enlargement of Ewens Hill storage is planned in 2020 to provide the additional balancing storage.

7.5.1.2 Implementation Plan

Augmentation of the Otways System is expected to be required. Wannon Water will proceed with roof water harvesting as described above, and expand the Curdievale borefield as required, as shown in Table 29

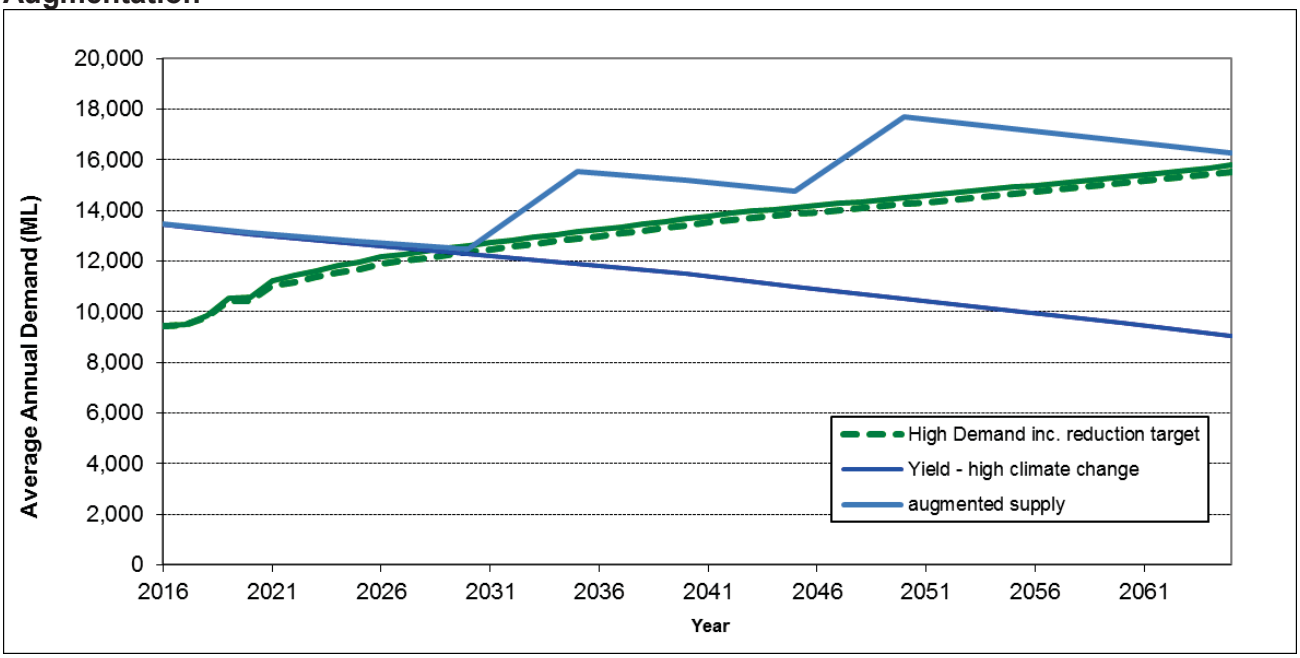
.

Table 29: Recommended Otway Augmentation Options

Option Description	Yield (ML)	Earliest Date yield required	Earliest Date to Commence Project Planning
Water harvesting from roofs in new subdivisions (Russells Creek growth corridor)	460	-	underway
Expand Curdievale borefield	3400	2030	2025
Further Expand Curdievale borefield	3400	2050	2045

Figure 38 shows the supply curve increasing with augmentation to meet the demand projection for the Otway system.

Figure 38. Otway System Supply – Demand Balance – Post Demand Reduction and Supply Augmentation



Note that under the most likely demand scenario, the need for augmentation of the Otway system is delay by approximately 5 years – to 2035.

7.5.2 Grampians System

The Grampians System had significant investment in 2010 to construct an interconnecting pipeline with Rocklands Reservoir. Given this investment, if the high-impact climate scenario eventuates the preferred augmentation option is to purchase sufficient entitlement from Rocklands Reservoir to secure enough yield to meet demand in 2065. With reference to Figure 33, this required yield is 1100ML. It is expected that an additional allocation of 5700ML will meet this yield. Additional treatment of this water is expected to be required to reduce its salinity to drinking water levels.

Purchase of allocation is dependent on there being willing sellers of allocation in the system. There is a risk that this will not be the case.

7.5.2.1 Description of Options

Table 30 lists the shortlisted augmentation option considered for the Grampians system

Table 30: Otway System Supply Augmentation Options

Grampians System - Supply Augmentation Option		Yield in 2065 (ML/a)	Capital $mil	CO2 emitted tonnes/ ML	Costs $NPV/ ML
Purchase of 5700 ML allocation in Rocklands Reservoir	To increase the Rocklands allocation held to 7800ML.	1100	11.4	0	$761

Notes: The column for "$NPV/ML" includes allowing for the use of 'green power' using additional cost of 7.9 cents/kWhr. The reported "CO2 emitted" is at maximum yield. Capital cost is total over 50 years.

7.5.2.2 Implementation Plan

Under three of the four supply scenarios, demand will not exceed supply before 2065. However, if low yield conditions eventuate, augmentation is required. Wannon Water plans to purchase an estimated additional 5700ML of allocation from Rocklands Reservoir to provide an additional required yield of 1100ML in 2065, as shown in Table 31.

Table 31: Recommended Grampians Augmentation Options

Option Description	Yield in 2065(ML)	Earliest Date yield required	Earliest Date to Commence Project Planning
Purchase of 5700ML allocation in Rocklands Reservoir	1100	2035	2030

Figure 39 shows the supply curve increasing with augmentation to meet the demand projection for the Grampians system.

Figure 39. Grampians System Supply – Demand Balance – Post Demand Reduction and Supply Augmentation

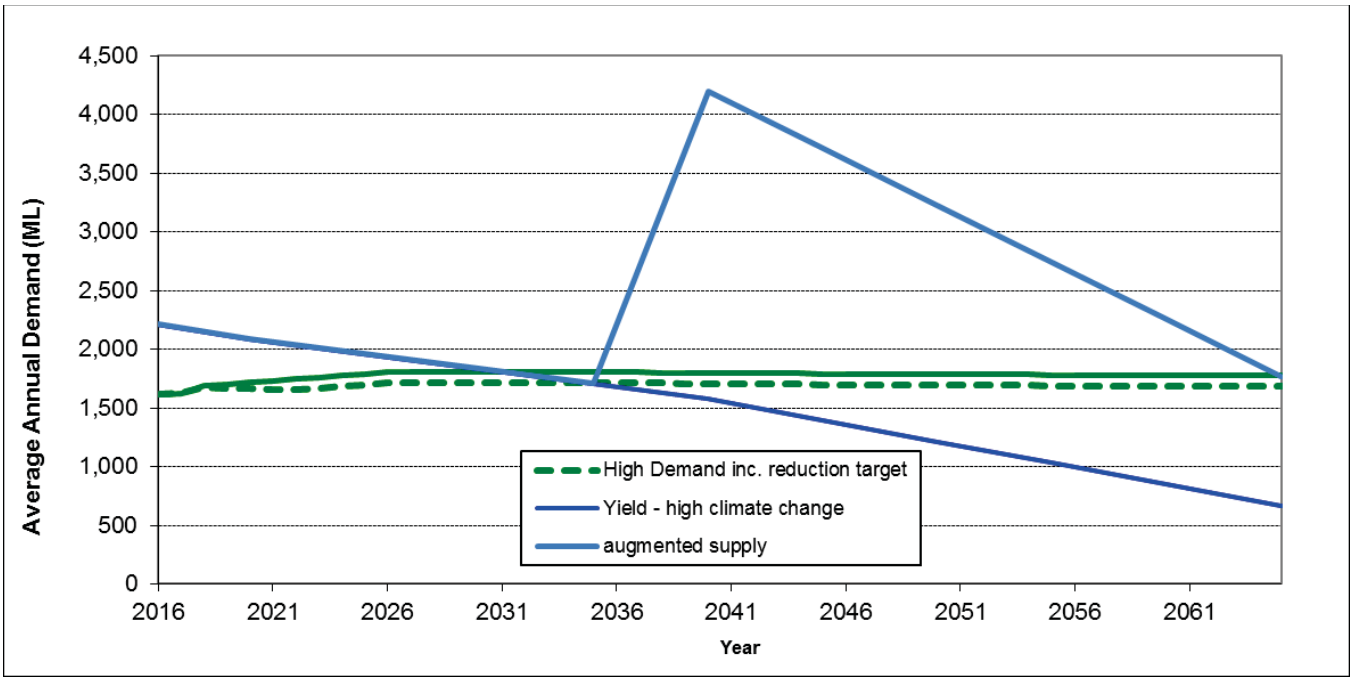


Figure 38 shows that the 2035 augmentation (purchase of an additional 5700ML allocation from Rocklands) has the potential to greatly increase the yield in the short term but (as can be seen from the last 20 years of the "augmented supply" projection) the yield from a given allocation can deteriorate rapidly over time under high climate impact. This is a potential issue for all water entitlement holders and there may be pressure to seek out climate-independent water sources.
Note that under the most likely demand scenario, the need for augmentation of the Grampians system is delayed by approximately 5 years – to 2040.

7.5.3 Glenthompson

The Glenthompson System is assessed in Section 5.5.3 as requiring immediate augmentation. As described in Section 5.5, the security of supply for Glenthompson is dependent on the access arrangements to the 58ML Bulk Entitlement in Grampians Wimmera Mallee Water's Willaura system and to water from the borefield that provides additional security to this system. These access arrangements are being negotiated.

Due to the relatively high elevation of the Glenthompson reservoir and the 24km-long 150mm diameter pipeline branch (which is smaller than the upstream pipeline of 200mm diameter), the Glenthompson Reservoir is supplied at specific times when GWMW's downstream valve at Willaura is closed. The capacity of this gravity system is limited to delivering approximately 0.5 ML/d by the pressure available from the system headworks. The maximum yield from the system is approximately 1.1 ML/d meaning that only half the available water is able to be supplied to Glenthompson. The preferred augmentation option is booster pumping of the Glenthompson pipeline branch to double the delivery capacity allowing for better access to the 58 ML bulk entitlement. This option is described in Table 23, along with two options carried forward from the 2012 strategy.

Table 32: Glenthompson System Supply Augmentation Options

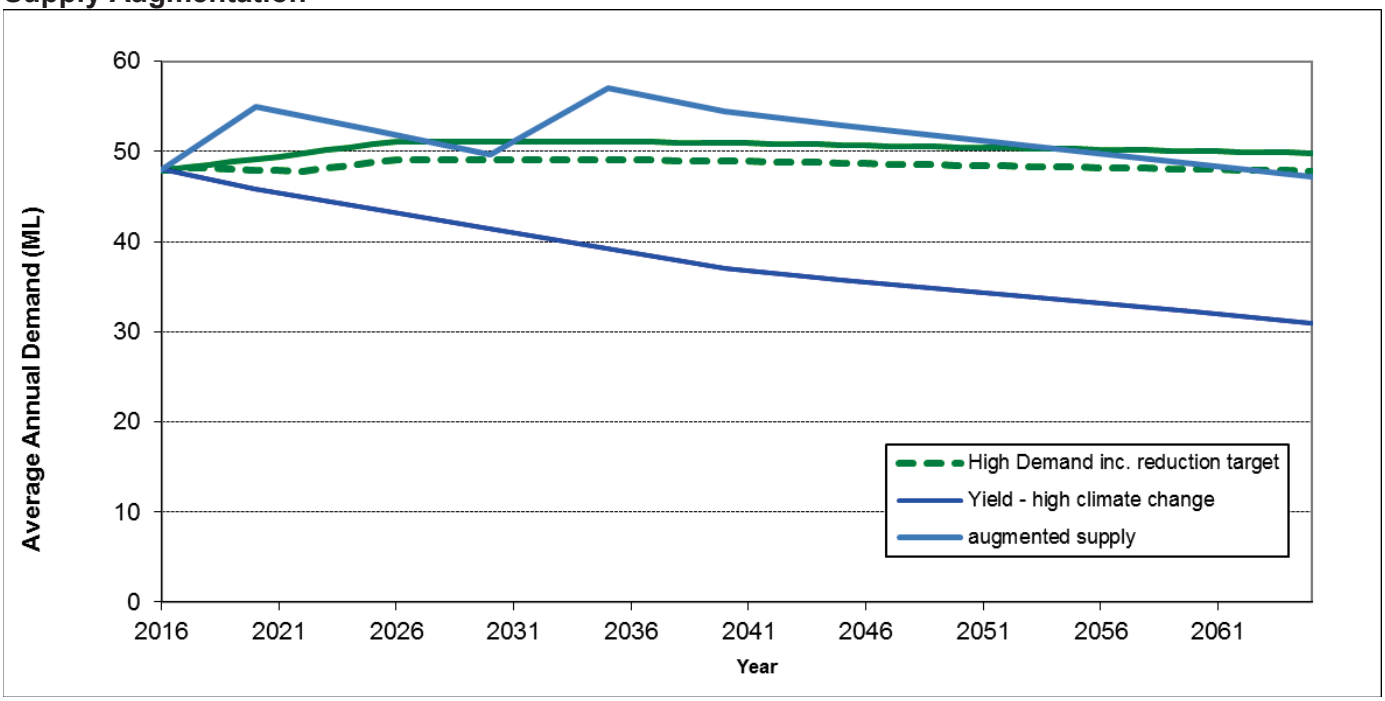
Supply Augmentation Options – Glenthompson System		Max. Yield (ML/a)	Capital $mil	CO2 emitted tonnes/ML	Costs $NPV/ ML
Booster pumping the Glenthompson branch pipeline	Supply from Willaura to the Glenthompson Reservoir is on a timed basis. Booster pumping the 24km long 150mm branch will increase supply to the reservoir.	50	0.2	0.13	$102-
Reducing evaporation from water basins (Glenthompson)	Cover Glenthompson Reservoir with suspended shadecloth. The covers need to be replaced every 15 years and the cables every 30 years.	15	4.5	0.00	$2458
Additional Groundwater Bore in the Willaura System	Construct a new bore attached to the Willaura system (operated by Grampians Wimmera Mallee Water).	15	0.4	0.07	$407

Notes: The column for "$NPV/ML" includes allowing for the use of 'green power' using additional cost of 7.9 cents/kWhr. The reported "CO2 emitted" is at maximum yield. Capital cost is total over 50 years.

7.5.3.1 Implementation Plan

Design of the booster pumping arrangement on the Glenthompson branch pipeline will be commenced in 2017 with construction planned for 2019. Under three of the four climate scenarios, this is the only augmentation that is expected to be required before 2065. However, if the high-climate change scenario eventuates, a second augmentation as early as 2030 may be required, as shown in Figure 40. An additional bore in the headworks of the Willaura system is proposed, with yield shared with Grampians Wimmera Mallee Water,

Figure 40. Glenthompson System Supply – Demand Balance – Post Demand Reduction and Supply Augmentation



SECTION 8. IMPLEMENTING THE STRATEGY

8.1 Integration with Drought Preparedness Plan

Wannon Water's Drought Preparedness Plan is linked to this Strategy in that it provides actions that may be required to be implemented during times of drought or other water shortage. The *Urban Water Strategy* provides long-term planning actions that might be needed over a 50-year planning period while the Drought Preparedness Plans provide actions that will be needed to respond to water shortages if they arise in the immediate to short-term.

Both the *Urban Water Strategy* and Drought Preparedness Plans use the same agreed levels of service to ensure consistency. These documents provide Wannon Water with the "tools" to manage the ongoing supply/demand balance. Drought Preparedness Plans are included as Appendix 2 of this Strategy.

The Drought Preparedness Plans include an action to consult with local government on priority green spaces for water during drought. Wannon Water will engage with council processes over the next five years to determine what assets are a priority and explore options to keep these green during periods of water shortage.

Annual Water Outlooks have been prepared for the Otway, Grampians, Glenthompson and Groundwater Systems operated by Wannon Water (refer to Appendix 3). The Annual Water Outlooks are published by 1 December every year and review the current status of water storage and the climate outlook over the short term (up to 18 months) to determine whether actions contained in the Drought Preparedness Plans need to be implemented.

The Annual Water Outlooks contain information on:

- Forecast water availability based on wet, average and dry scenarios;
- Seasonal rainfall outlook;
- System status (linked to the Drought Preparedness Plan);
- Uncertainty monitoring; and
- Planned actions.

Water Systems Atlases have been prepared for Warrnambool, Hamilton, Glenthompson, Portland, Port Fairy and Camperdown (refer to Appendix 1). These Atlases provide high-level information on priority green spaces, current alternative water use, location of possible future sources of alternative water and residential growth areas.

8.2 Action Plan

This Strategy has identified actions that need to be undertaken over the medium term (0-5 years) and long term (5-50 years) to ensure that the supply/demand balance is maintained. The actions to be undertaken in the medium term will be included in Wannon Water's 2018-2023 Pricing Submission and annual Corporate Plans during that period. The actions contained in the Annual Water Outlooks will also be implemented as seasonal conditions vary.
Medium-term actions are included in Table 33 and the long-term actions are included in Table 34. (Note that earliest possible dates under a high-impact climate scenario are given here.)

Table 33: Medium-Term Actions

Section 2: Strategy Development Processes			Completion Date
Section 2.5	Action 2.1	Inclusion and Diversity Plan	2017
Section 2.6	Action 2.3	Participate in Integrated Water Management Forums and help develop IWM Plans	2022
Section 3: Our Water Resources and Use Trends			
Section 3.1.1	Action 3.1	Exploring options to improve environmental flows in the Gellibrand River	2018
Section 3.1.2	Action 3.2	Actively work with stakeholders to ensure the implementation of Intensive Management Areas	ongoing
Section 3.2.4	Action 3.3	Investigate the feasibility of using water from Konongwootong reservoir for public open space watering in Coleraine	2017
Section 3.2.6	Action 3.4	Implement actions in Wannon Water's Non-Revenue Water Reduction Strategy	ongoing
Section 3.2.7	Action 3.5	Implement metering and investigations to better account for losses through Water Treatment Plants	2019
	Action 3.6	Implement metering and investigations to better account for losses upstream of Water Treatment Plants in the Otways system and in other systems	2019
Section 4: Challenges and Change			
Section 4.5	Action 4.1	Work with local government to ensure planning controls are established to protect aquifer recharge zones where appropriate	2018
Section 4.6	Action 4.2	Work to deliver improved linkages with educators across the region	On going
	Action 4.3	Share research programs and research findings	On going
Section 5: Supply Demand Equations to 2065			
Section 5.5.1	Action 5.1	Work with GWMWater to develop rules for timing of supply to Glenthompson Reservoir from Willaura	2018
Section 5.5.2	Action 5.2	Be an active stakeholder in GWMWater's assessment of Willaura system security, which affects supply to Glenthompson	2018
Section 6: Sewerage			
Section 6.1.3	Action 6.1	Upgrade Warrnambool Water Reclamation Plant	2022
Section 6.1.3	Action 6.2	Upgrade the Warrnambool Sewer Network as required	Staged
Section 6.5	Action 6.3	Construct the 12 Apostles sewerage works	2019
Section 7: Actions to Secure our Water Future			
Section 7.3	Action 7.1	Implement demand reduction options	2022
Section 7.3	Action 7.2	Achieve water reduction targets	2022

Section 7.5.1	Action 7.3	Expand the Warrnambool roof water harvesting collection network	On going
Section 7.5.3	Action 7.4	Install booster pumping on the Glenthompson pipeline	2019
Section 8: Implementing the Strategy			
Section 8.1	Action 8.1	Consult with local government regarding priority green spaces for water during drought	2022
Section 8.1	Action 8.2	Prepare Annual Water Outlooks	Annually by 1 December
Section 8.3	Action 8.3	Monitor the implementation of Strategy actions and review water outlooks	Quarterly
Section 8.4	Action 8.4	Prepare annual progress report	Annually
Section 8.5	Action 8.5	Review this *Urban Water Strategy*	2022

Table 34: Long-Term Actions

Section 7: Actions to Secure our Water Future			
Section 7.5.1	Action 7.5	Expand the Curdievale borefield	2030
Section 7.5.2	Action 7.6	Purchase additional 5700ML allocation in Rocklands reservoir	2035 - 2040
Section 7.5.3	Action 7.7	Construct a new bore in the Willaura System	2035

8.3 Monitoring Success

Essential to this Strategy is an ongoing commitment to monitor the implementation of the actions described in Section 8.2. Wannon Water's Urban Water Strategy Working Group will review progress with the implementation of the actions and assess current storage against the Annual Water Outlook at its quarterly meetings.

8.4 Reporting Against The Strategy

Wannon Water will make available to the public, and submit to the Department of Environment, Land, Water and Planning, by 1 December each year during the five-year implementation period of the *Urban Water Strategy*, a summary of the updated Annual Water Outlook and the list of priority actions contained in the Action Plan for each of its water supply systems.

Wannon Water will report annually (via its website, social media and email distribution lists) on:

- The current water resource position;
- A forward outlook over the coming year under a range of plausible climate scenarios;
- Whether agreed levels of service will be able to be met under these scenarios; and
- If not, what action/s will be undertaken to improve system performance so that these agreed levels of service can be met.

Wannon Water will report annually to the Board on the progress in implementing the *Urban Water Strategy* and identify any matters that need to be addressed as part of the development of the Corporate Plan.

8.5 Strategy Review

Wannon Water will review and update this *Urban Water Strategy* every five years to ensure that its actions remain appropriate to an ever-changing environment of climate variability and heightened customer awareness of the need to preserve this precious resource.

The picture of supply-demand balance that is presented in Section 5 is similar to that presented in the previous (2012) strategy, with the exception that one of the four potential climate scenarios (the high impact climate scenario) now shows lower water availability towards the end of the forecast period. In the 2012 strategy, it was considered that the millennium drought tested the resilience of all our supply systems and a pass mark was given to:

- The groundwater supplied systems;
- The Otways system (with planned augmentation to cater for growth); and
- The Grampians system (as augmented in 2010 by the Rocklands pipeline).

It was noted in the 2012 strategy that the security of the Glenthompson system needed review.

These assessments remain the same in this Strategy. However the high impact climate scenario in 2065 challenges these assumptions, as this scenario has lower water availability than experienced in the millennium drought. Supply augmentations would be required as noted in Section 7. Further assessment of shallower groundwater systems under high impact climate change may be warranted when this Strategy is reviewed in 2022.

SECTION 9. BIBLIOGRAPHY

Victorian Government Publications

Water for Victoria (DELWP 2016)

Guidelines for Assessing the Impact of Climate Change on Water Supplies in Victoria (DELWP 2016).

Guidelines for the development of Urban Water Strategies (DELWP 2017)

Vic guidelines for community consultation

Victoria in Future (DELWP 2015).

Western Region Sustainable Water Strategy (DSE November 2011)

Publications from Catchment Management Authorities and Southern Rural Water

Gellibrand River Streamflow Management Plan (Southern Rural Water October 1998)

Lower Tertiary Aquifer Groundwater Resource Appraisal (SKM September 2010)

Publications from Wannon Water Wannon Water – Reports for Small Towns Groundwater Resource Appraisals – Caramut, Darlington, Macarthur, Mortlake, Penshurst, and Tullich (GHD March 2012)

Wannon Water – Report for Small Towns Groundwater Resource Appraisal – Recommended Areas for the Protection of Groundwater Resources in Wannon Water Supply Catchments (GHD March 2012)

Wannon Water Statement of Obligations

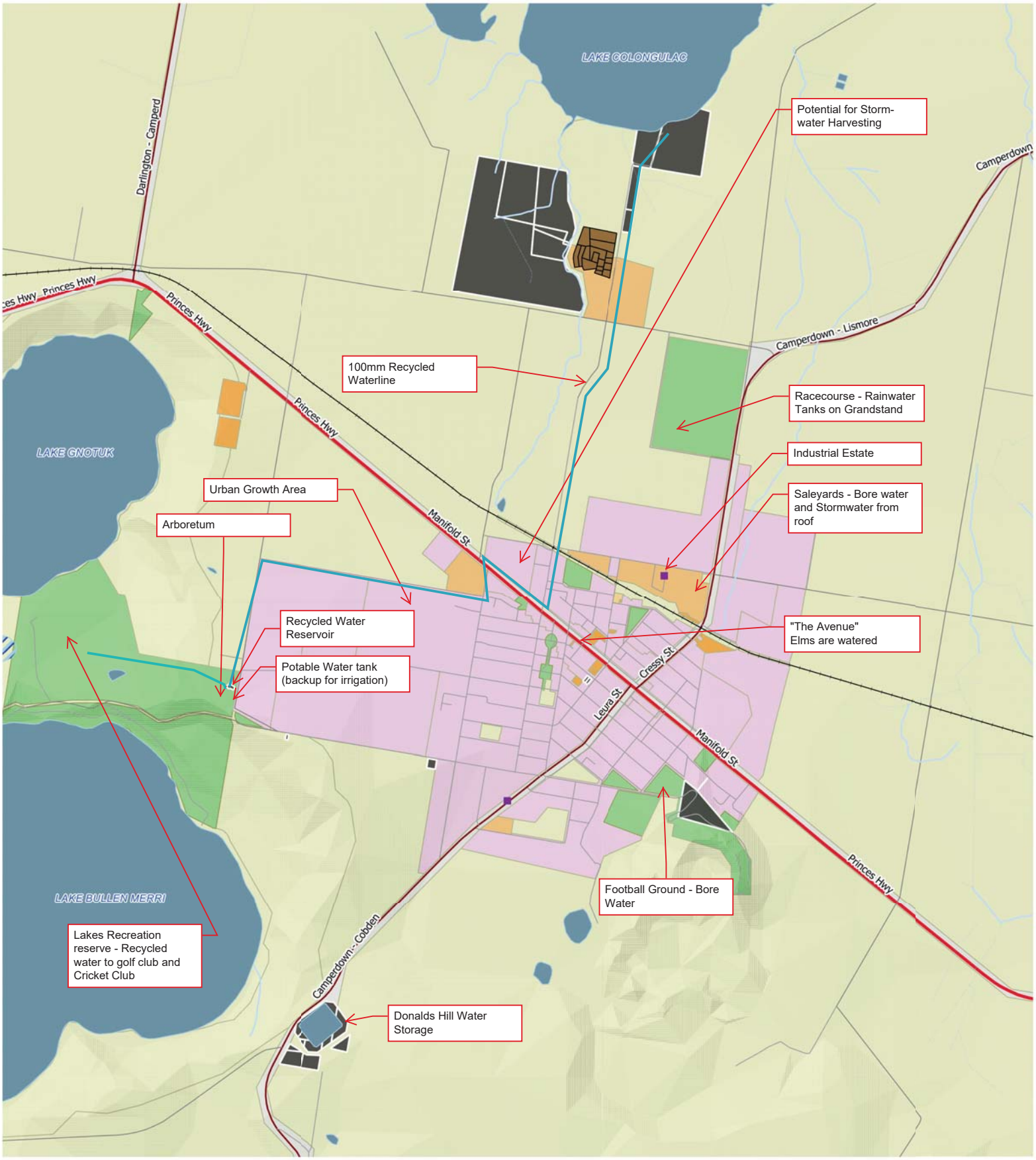
Wannon Water – Water Supply Demand Strategy 2012-2060

GHD REALM model reports and yield assessments for the Otways, Grampians and Glenthompson Systems 2017

Appendix 1 – WATER SYSTEM ATLASES

Prepared for six towns:

- Camperdown;
- Glenthompson;
- Hamilton;
- Port Fairy;
- Portland; and
- Warrnambool.



CAMPERDOWN

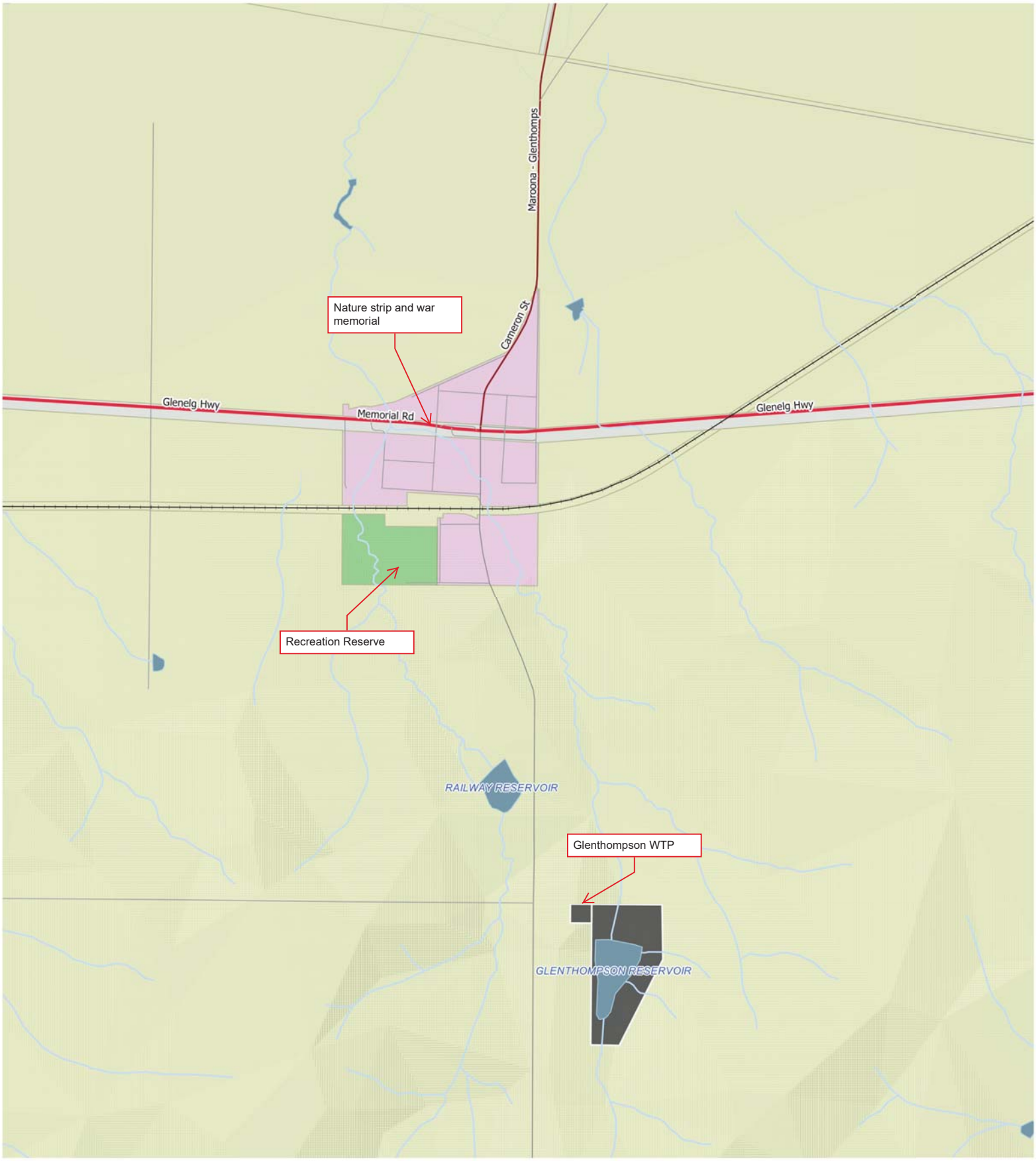
Water System Atlas

Legend

- Sewer Pump Station
- Water/Wastewater Treatment
- Connector
- Channel/Drain
- River
- Lake
- Swamp
- Rail
- Freeway
- Highway
- Local Roads
- Commercial/Industrial
- Agriculture
- Open Space
- Residential

N

wannonWATER



GLENTHOMPSON

Water System Atlas

Legend

- Sewer Pump Station
- Water/Wastewater Treatment
- Connector
- Channel/Drain
- River
- Lake
- Swamp
- Rail
- Freeway
- Highway
- Local Roads
- Commercial/Industrial

Agriculture

- Agriculture
- Open Space
- Residential

N

wannonWATER

Botanic Gardens,College oval, Melville Oval, Pedrina Park, Showgrounds - All use 'Old Reservoir' system operated by Southern Grampians

Airport
- Fire fighting use
- Roofwater harvesting reuse on site

Stadium
-Currently using roofwater harvesting for internal use

Lawn Cemetery
-Proposed irrigation from dam

Hughan Park Olympic Pool
-Uses bore water to top up swimming pool

Hamilton WTP

Pedrina park

College Bowling House

Showgrounds
- Roofwater harvesting opportunity

College Oval

Hamilton College
-Currently using roofwater harvesting for internal use

Melville Oval

Wetlands stormwater treatment

Hamilton Turf
-Currently using recycled water

Hamilton Reclaimed Water Treatment Plant
-2015/16 output = 653ML
-Volume reused: 653ML
- Major users: Iluka, Turf Farm, Golf course and irrigation

Hamilton Golf Club
-Currently using stormwater harvested from local streets and course
-Recycled water

Botanical Gardens

Kennedy Oval - currently using recycled water

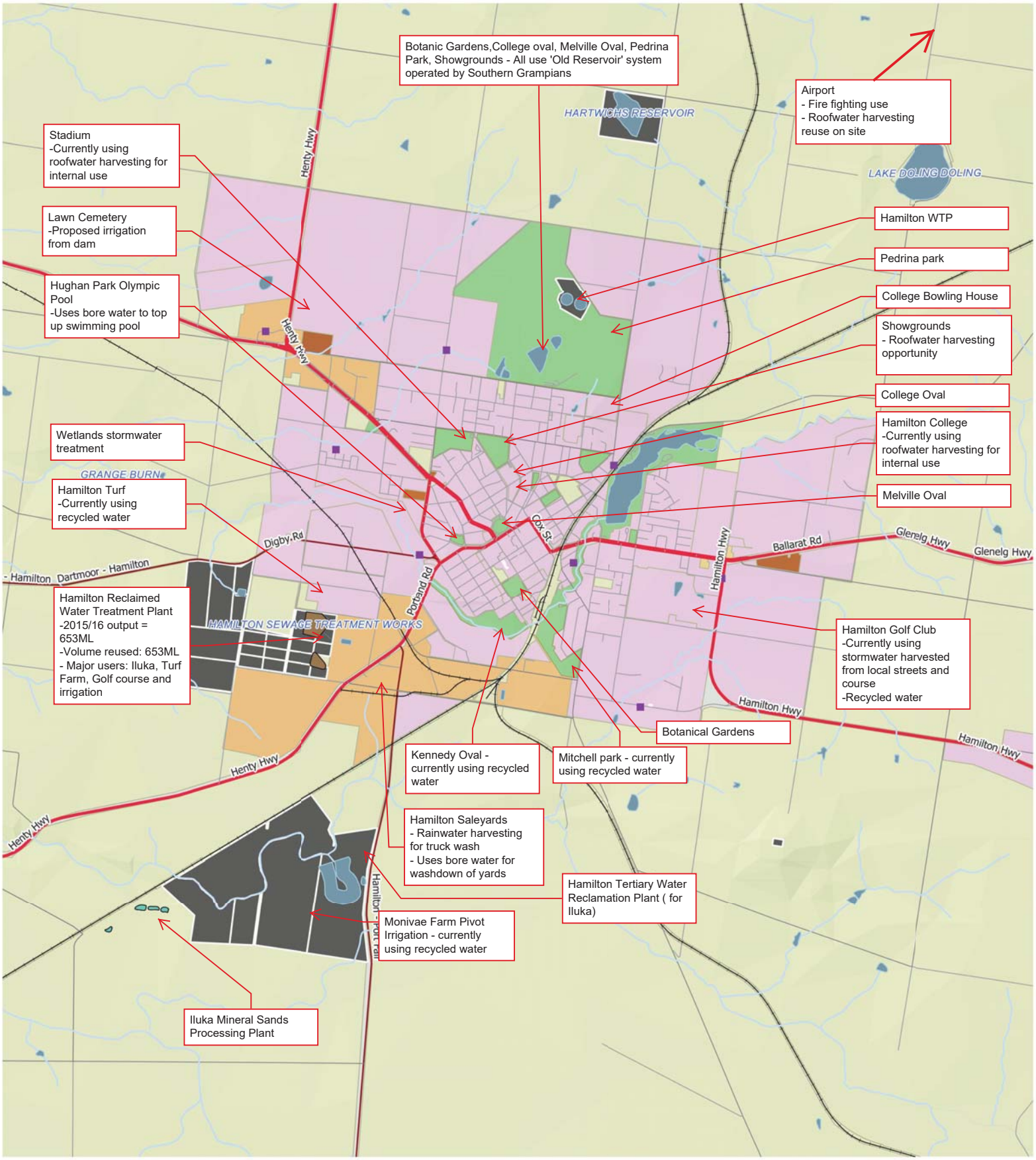
Mitchell park - currently using recycled water

Hamilton Saleyards
- Rainwater harvesting for truck wash
- Uses bore water for washdown of yards

Hamilton Tertiary Water Reclamation Plant (for Iluka)

Monivae Farm Pivot Irrigation - currently using recycled water

Iluka Mineral Sands Processing Plant



HAMILTON

Water System Atlas

Legend

- Sewer Pump Station
- Water/Wastewater Treatment
- Connector
- Channel/Drain
- River
- Lake
- Swamp
- Rail
- Freeway
- Highway
- Local Roads
- Commercial/Industrial
- Agriculture
- Open Space
- Residential

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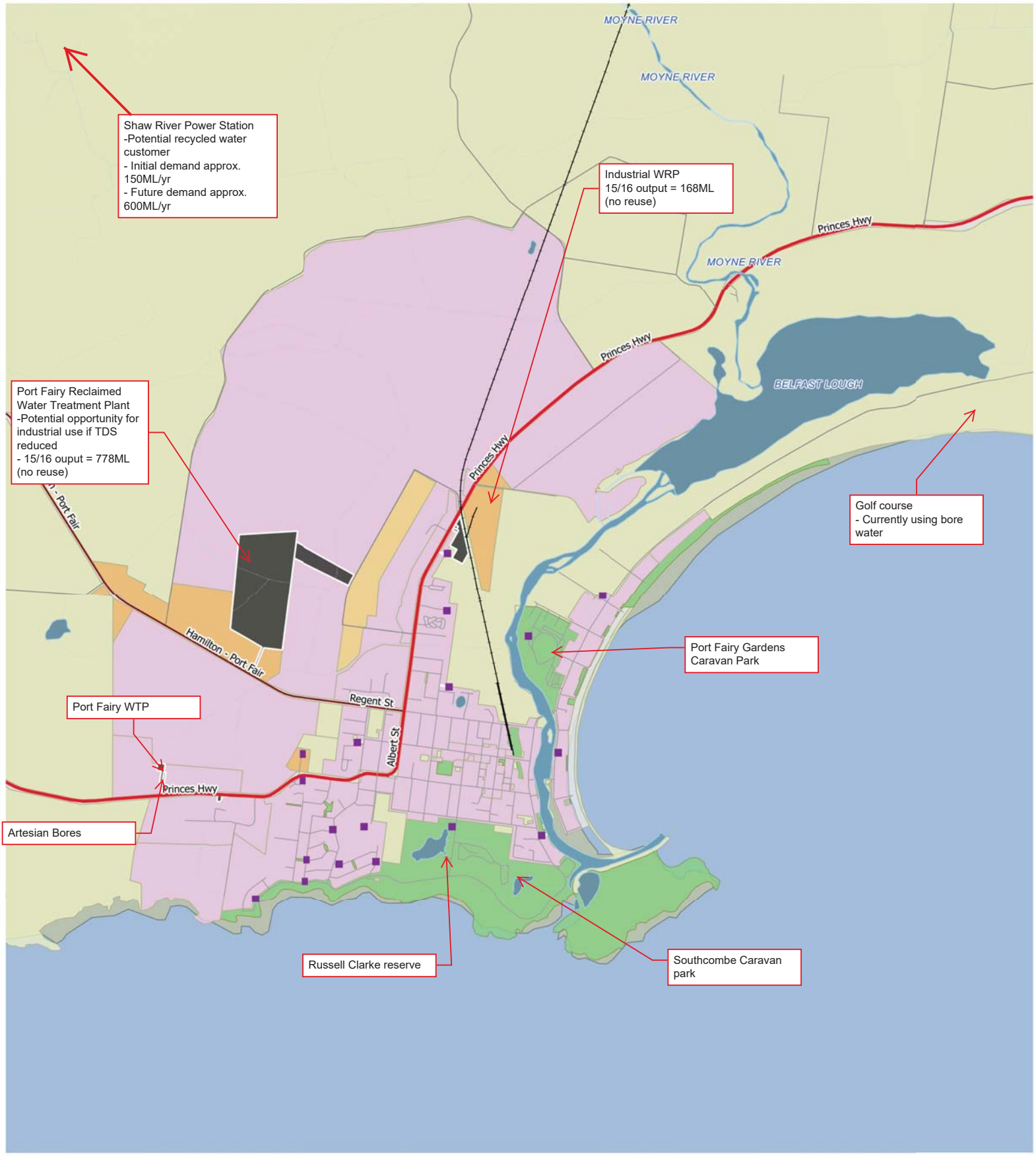
wannonWATER



PORT FAIRY

Water System Atlas

Legend

- Sewer Pump Station
- Water/Wastewater Treatment
- Connector
- Channel/Drain
- River
- Lake
- Swamp
- Rail
- Freeway
- Highway
- Local Roads
- Commercial/Industrial
- Agriculture
- Open Space
- Residential

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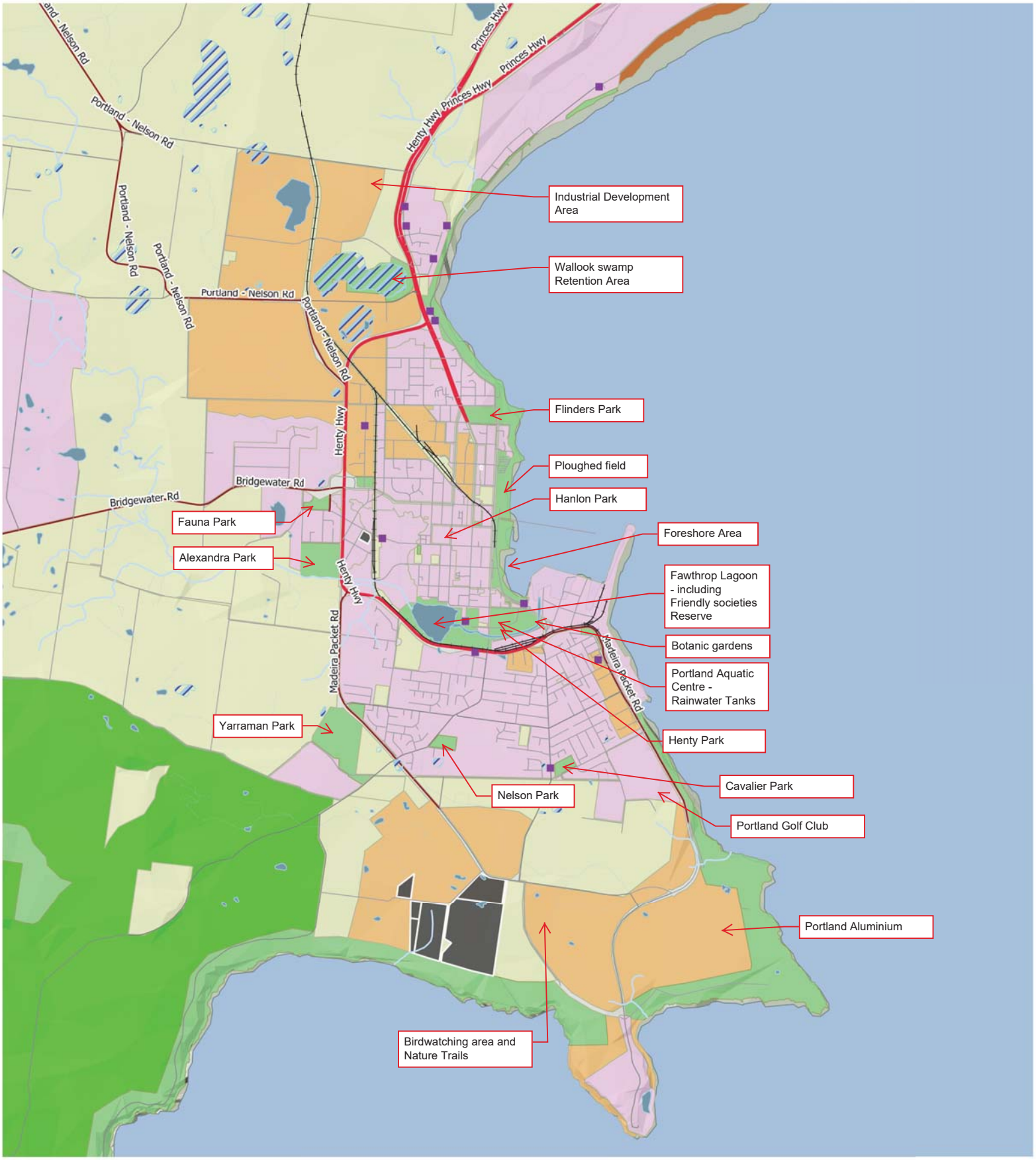

PORTLAND

Water System Atlas

Legend

- Sewer Pump Station
- Water/Wastewater Treatment
- Connector
- Channel/Drain
- River
- Lake
- Swamp
- Rail
- Freeway
- Highway
- Local Roads
- Commercial/Industrial
- Agriculture
- Open Space
- Residential

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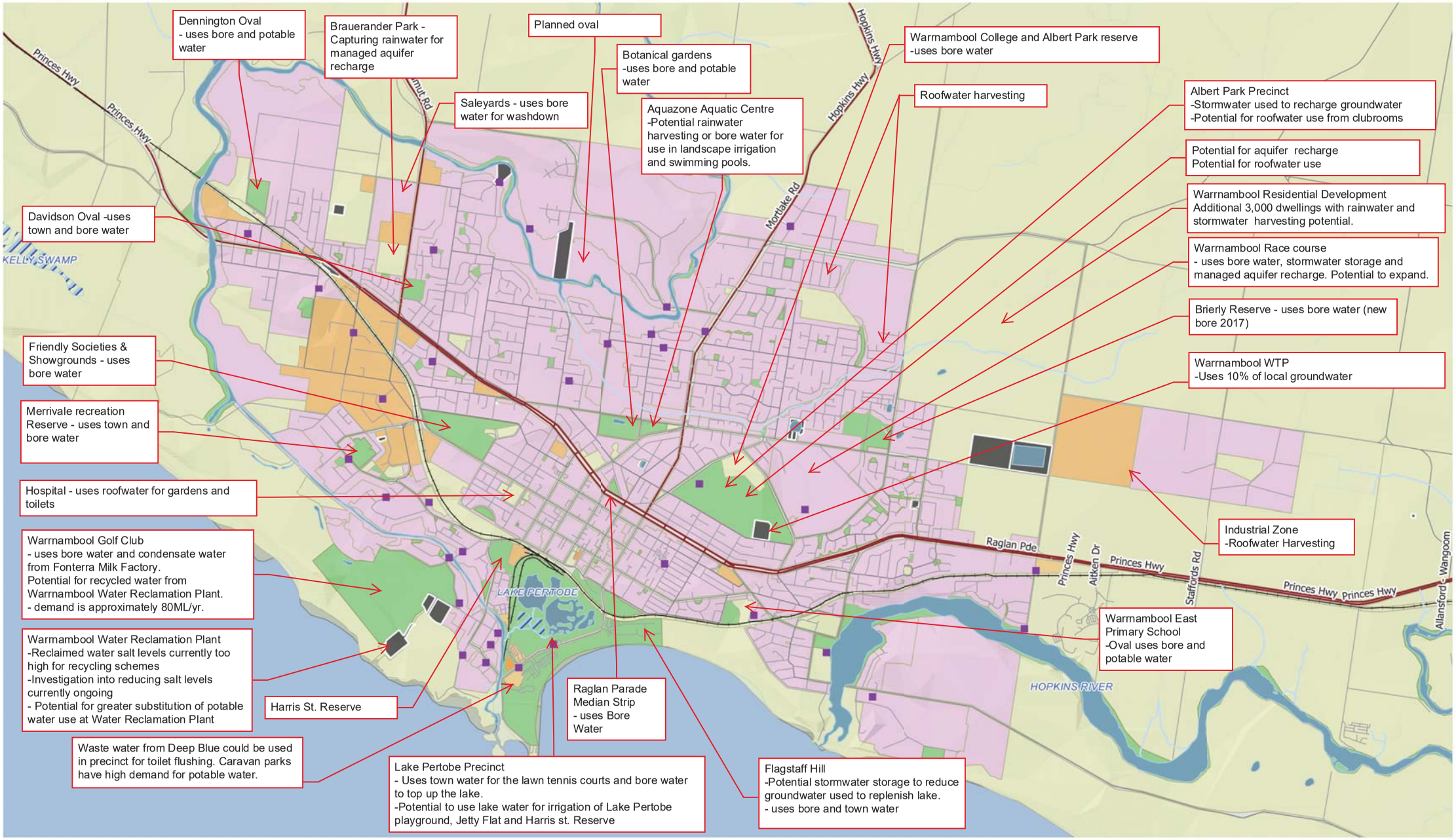
wannonWATER



Legend

- Sewer Pump Station
- Water/Wastewater Treatment
- Connector
- Channel/Drain
- River
- Lake
- Swamp
- Rail
- Freeway
- Highway
- Local Roads
- Commercial/Industrial
- Agriculture
- Open Space
- Residential

WARRNAMBOOL

Water System Atlas

N

wannonWATER

Appendix 2 – DROUGHT PREPAREDNESS PLAN

DROUGHT PREPAREDNESS PLAN

March 2017

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Part A
General

A1. Introduction

A1.1 Wannon Region Water Corporation

Wannon Region Water Corporation (Wannon Water) is a statutory corporation constituted on 1 July 2005 under the Water Act 1989. Wannon Water operates in an area of over 24,500 km^2, providing water and sewerage services to approximately 80,000 people across 34 customer districts.

Wannon Water has developed this Drought Preparedness Plan which incorporates all water supply systems across its region. The Drought Preparedness Plan represents the following systems:

- Otway Water Supply System including Warrnambool and towns and other users connected to the North Otway pipeline;
- Grampians Water Supply System including the Hamilton system and Balmoral;
- Glenthompson Water Supply System; and
- Groundwater Water Supply Systems including the Port Campbell system, the Tullich system, Caramut, Darlington, Dartmoor, Heywood, Macarthur, Penshurst, Port Fairy and Portland.

These systems are illustrated in Figure A1.

Figure A1 Wannon Water's Water Supply Systems

A1.2 Drought Response Plan

This Drought Preparedness Plan includes the Drought Response Plan referred to in Wannon Water's Water Restriction By-Law (By-Law no. 5). The Drought Response Plan is written separately for the Otways, Grampians , Glenthompson and Groundwater Systems in Parts B to E below.

A1.3 Structure of the Drought Preparedness Plan Document

The content of this Drought Preparedness Plan is summarised as follows:

PART A - General

Provides background information on Wannon Water and the water supply systems within its region, the structure of the Drought Preparedness Plan and details from previous revisions of Drought Response Plans undertaken over recent years.

Part A also provides details relating to the overall legal framework in which Wannon Water manages the water supply systems including; legal entitlements to water, permanent water saving plans, water restriction by-laws and details of reporting responsibilities.

Part A outlines gaps identified in the Drought Preparedness Plan that should be addressed progressively over the coming years.

PART B –Otway Water Supply System Drought Response Plan

Provides details of drought response activities specifically relating to the Otway Water Supply System including:

- Descriptions and details of the system, system demands, system yield and level of service objectives;
- A summary of the previously documented impacts of drought on the system and its water customers;
- Details on specific water supply options that have been assessed and could be implemented during periods of water shortage; and
- A sequential plan of action to assist Wannon Water to operate the system during periods of water shortage.

PART C –Grampians Water Supply System Drought Response Plan

Provides details of drought response activities, as summarised in Part B above, specifically relating to the water supply systems located within the Grampians System.

PART D –Glenthompson Water Supply System Drought Response Plan

Provides details of drought response activities, as summarised in Part B above, specifically relating to the Glenthompson Water Supply System.

PART E – Groundwater Supply Systems Drought Response Plan

Provides details of drought response activities, as summarised in Part B above, specifically relating to the water supply systems supplied by Groundwater.

A1.4 Revisions to Drought Preparedness Plan

This 2017 update of the Drought Preparedness Plan is based on the 2011 Drought Response Plan. Specific variations have been made to;

- General updating of system descriptions to reflect current information;
- Mention upcoming work with local government to identify priority green spaces.

Note that there has not been drought in south west Victoria since 2010, so “drought experience” has not been updated.

A1. Drought Preparedness Plan Objectives

The purpose of this Drought Preparedness Plan is to ensure a timely and effective short-term response to water shortages, with the aim of minimising the impacts (social, economic, and environmental) of such shortages.

There are two components involved in securing a water supply which provides the ability to mitigate the impacts during times of drought:

- The provision of an adequate supply system to satisfy current and future demands over a range of climatic conditions ensuring that shortfalls in supply are within 'acceptable' levels; and
- The specification of actions required when shortfalls in water supply occur as a result of drought.

The first component represents long term planning actions that determine the level of infrastructure development required to satisfy specified standards of supply.

The second component relates to management actions that are required to minimise the impacts of shortfalls in supply, which is the purpose of this Drought Preparedness Plan.

The Drought Preparedness Plan complements the long term planning process where the short term response needs to be aligned with the longer term security of supply (i.e. knowledge of the likely frequency and severity of water restrictions).

The aim of this Drought Preparedness Plan is to ensure that key strategic, planning and operational objectives are met. The strategic, planning and operational objectives are summarised in Table A1.

Table A1 Strategic, Planning and Operational Objectives

Strategic Objectives
Provide timely warning of any water shortages which might occur during future drought events and to be prepared to deal with such shortages when they occur.
Develop and implement an appropriate action plan to respond to water shortages.
Planning Objectives
Identify all the necessary steps that need to be taken through a drought including identifying clear triggers to instigate actions.
Provide a basis for regular reviews of the plan as the system develops and more information becomes available.
Give direction for reviewing the plan during and following a drought where its performance can be evaluated.
Provide clear indicators to ensure that a reliable assessment of drought status is available.
Operational Objectives
Ensure that Wannon Water is aware of what stage of drought they are in and how severe the drought is likely to be.
Ensure that Wannon Water maintains information on current levels and patterns of demand and continually assesses customer expectations in relation to desirable levels of service.
Wannon Water commits to providing its urban and rural customers (excluding customers supplied by agreement) with a reliable water supply free of water restrictions on average for 95 in every 100 years.
During times of drought or water shortage, Wannon Water aims to ensure that its urban and rural customers (excluding customers supplied by agreement) are not restricted in their use of water beyond Stage 3 water restrictions.
During times of drought or water shortage, customers supplied by agreement will be restricted in accordance with the terms of their agreement.

A2. Legal and Institutional Context

A2.1 Introduction

Wannon Water sources water from a combination of surface water and groundwater resources under the provisions of the Water Act 1989. The quantity of water that may be harvested is specified in bulk entitlements for surface water resources and in groundwater licences for groundwater resources. These entitlements are described in the following sections.

Wannon Water's Statement of Obligations imposes obligations in relation to the performance of its functions and exercise of its powers as described in the Water Industry Act 1994. In relation to drought response, Section 18 requires Wannon Water to develop and implement an effective Drought Response Plan for each water supply system and make it available to the public. In addition, Wannon Water is required to review, and if necessary amend, its drought preparedness plans as follows:

(a) at intervals of no more than five years; and

(b) within twelve months of either:

(i) the lifting of any period of restriction imposed under the Drought Preparedness Plan; or

(ii) any major change occurring to works or arrangements for conserving water for, or supplying water to, any water supply system.

A2.2 Bulk Water Entitlements (Surface Water)

Surface water diversions across the supply systems are defined in the Bulk Entitlement Conversion Orders (BEs). The BEs for the various systems define annual diversion limits as well as other operational requirements. The BEs currently held by Wannon Water are listed below and summarised in Table A2.

The relevant BEs include:

- Bulk Entitlement (Otway System) Conversion Order (1998);
- Bulk Entitlement (Hamilton) Conversion Order (1997);
- Bulk Entitlement (Wimmera and Glenelg Rivers – Wannon Water) Order 2010;
- Bulk Entitlement (Dunkeld) Conversion Order (1997);
- Bulk Entitlement (Glenthompson) Conversion Order (1997);
- Bulk Entitlement (Coleraine, Casterton & Sandford) Conversion Order (1997); and
- Bulk Entitlement (Willaura system – Wannon Water) Conversion Order 2012.

Table A2 Summary of Bulk Entitlement Conversion Orders

Supply System	Bulk Entitlement Order	Maximum Annual Diversion (ML)	Other Conditions
Otway	Bulk Entitlement (Otway System) Conversion Order (1998)	12,580 ML	◗ Subject to flow sharing rules.
Grampians (streams)	Bulk Entitlement (Hamilton) Conversion Order (1997)	3 ,435 ML	◗ Plus drought reserve of up to 520 ML/a. ◗ Passing flow requirements in tributary streams. ◗ Extraction rate not to exceed 12.8 ML/d.
Grampians (Rocklands)	Bulk Entitlement (Wimmera and Glenelg Rivers – Wannon Water) Order 2010[1]	2,120 ML	◗ Annual water availability declared by seasonal allocation. ◗ Includes ability to carryover unused allocation from year to year. ◗ Includes water available for Balmoral.
Grampians (Dunkeld)	Bulk Entitlement (Dunkeld) Conversion Order (1997)[2]	170 ML	◗ Emergency supply for Dunkeld.
Glenthompson	Bulk Entitlement (Glenthompson) Conversion Order (1997)	94 ML	◗ Extraction rate not to exceed 0.9 ML/d.
	Bulk Entitlement (Willaura system – Wannon Water) Conversion Order 2012	58 ML	◗ Extraction rate not to exceed 0.55 ML/d.
Konongwootong	Bulk Entitlement (Coleraine, Casterton & Sandford) Conversion Order (1997)[3]	855 ML	◗ Extraction rate not to exceed 4.5 ML/d.

1. Primary supply source for Balmoral and secondary supply source for Hamilton.
2. Dunkeld was connected to the Hamilton system in 1999. Resource now kept as an emergency supply.
3. Casterton and Sandford were switched to 100% groundwater in 2004. Coleraine switched to 100% groundwater in 2009. The surface water resource (Konongwootong) will be kept as an emergency supply. Merino connected to system in December 2005.

Prior to 2010, Balmoral accessed water from Rocklands Reservoir under the Bulk Entitlement (Wimmera and Glenelg Rivers – Glenelg Water) Conversion Order 2004. This entitlement has now been consolidated into the Bulk Entitlement (Wimmera and Glenelg Rivers – Wannon Water) Order 2010. This increased entitlement volume allows water to be accessed for both Balmoral and the Hamilton systems.

A2.3 Groundwater Entitlements

Existing groundwater licences for water supply bores are summarised in Table A3 below.

Table A3 Summary of Groundwater Licence Volumes

System	Location	Licence Number	Number of Bores	Licensed Annual Volume (ML)
Otway	Carlisle River	BEE029488	2	1,800
	Curdievale	BEE026252	1	2,150
	Mortlake	BEE030858	2	335
	Warrnambool	BEE024155	3	750
	Koroit	BEE029066	2	524
Grampians	Bullawin, Headworks, Geerak, McCutcheons	BEE026192	4	1,102
Groundwater	Portland	BEE026771	3	6,222
	Heywood	BEE028970	2	333
	Dartmoor	BEE032545	1	170
	Port Fairy	BEE029010	2	1,026
	Port Campbell[2]	BEE026252	2	1,009
	Casterton	BEE022551	4	1,000
	Penshurst	BEE026146	2	250
	Macarthur	BEE021944	1	130
	Caramut	BEE021943	2	50
	Darlington	BEE021827	2	10
	Merino[1]	BEE026109	2	100

1. Merino bores are no longer used.
2. A second bore at Port Campbell is being constructed in 2017.

A2.4 Permanent Water Saving Plan

In May 2006, Wannon Water introduced its Permanent Water Saving Plan designed to generate ongoing long-term water savings. The Permanent Water Saving Plan was subsequently revised and approved by the Minister for Water in August 2007. The rules in the Permanent Water Saving Plan are designed to support the commitment that Victorian communities have made to using water more efficiently.

The Permanent Water Saving Plan sets out a set of common sense rules that apply to our customers everyday use of water. The Plan aims to encourage the efficient use of water to avoid wasting this precious resource.

A copy of the Permanent Water Saving Plan is provided in Appendix A.

A2.5 Water Restriction By-Laws

Mandatory water restrictions provide an effective mechanism to reduce urban demand during times of water shortage. Water restrictions are designed to predominately impact on non-essential water uses (for example, garden watering and filling of pools), and minimise the impact on the use of water for commercial purposes, public health and essential residential use.

In accordance with section 287ZC of the Water Act, Wannon Water has made a by-law, titled Water Restriction By-law No.5, pursuant to sections 171 and 160 of the Water Act 1989. Water Restriction By-law No.5 is made using a Model Water Restriction By-law issued by the Minister for Water on 27 November 2011.

The restriction schedule has been given legal effect under By-Law No. 5. A copy of the By-Law is provided in Appendix B.

Wannon Water's adopted restriction schedule defines four successive stages of water restrictions. The anticipated water savings under each stage of restriction effects storage response and assists to maintain the required level of water security. The estimated savings for each stage and the associated trigger levels for the implementation of water restrictions are described further in each of the relevant Drought Preparedness Plans provided in the subsequent parts of this document.

A2.6 Responsibilities and Reporting

The communication of the status of each supply system leading into, during and following drought conditions forms an integral part of drought preparedness planning.

There are various communication levels and protocols mandated by Wannon Water according to three separate modes of operation, these being; General Monitoring, Heightened Awareness and Drought Response. Table A4 summarises the reporting obligations. The operational modes detailed in this table are described further in each of the Drought Response Action Plans in the following sections.

Table A4 Summary of Reporting Obligations

Mode	Communication Actions	Purpose
1	General Monitoring	

Mode	Communication Actions	Purpose
	System Status Report	Weekly report providing base information on current supply-demand balance and trends. Prepared for the Executive Management Team for briefing and endorsement of recommendations.
	Annual Water Outlook	Report prepared in November each year and published by 1 December covering current and forecast future supply status for each system. Prepared for the Executive Management Team and the Department of Sustainability and Environment.
2	Heightened Awareness	
	System Status Report	Weekly report providing base information on current supply-demand balance and trends. Prepared for the Executive Management Team for briefing and endorsement of recommendations.
	External Communications	Media advertising to increase awareness amongst customers and the community about reduced water availability and to promote water conservation behaviours/activities.
	Monthly Department of Environment, Land, Water and Planning Report	Report prepared for Department of Environment, Land, Water and Planning to advise current system status and actions being undertaken to monitor potential threats from reduced water availability.
3	Drought Response	
	System Status Report	Weekly report providing base information on current supply-demand balance and trends. Extended to project water supply status over coming 12 – 18 months. Prepared for the Executive Management Team for briefing and endorsement of recommendations.
	External Communications	Media advertising to increase awareness amongst customers and the community about reduced water availability and to promote water conservation behaviours/activities.

A2.7 Monitoring Programs

Wannon Water has comprehensive long term monitoring programs in place to collect data in each of the supply systems for operational, reporting and planning purposes. A summary of the monitoring programs is shown in Table A5 below.

Table A5 Summary of Wannon Water Monitoring Programs

Program	Details
Bulk Water Demand	Flow measurement from all major demand areas and customers. Documented in Quarterly and Annual Water Demand Reports.
Reservoir Monitoring	Storage level and quality readings at all Wannon Water storages. Data is held by Manager Operations Reporting and Projects.
Streamflow Monitoring	Monitors flow in key headworks streams. Data is held by Manager Operations Reporting and Projects.
Groundwater Bore Monitoring	Monitoring of groundwater levels in bores throughout the regions. Data is held by Manager Operations Reporting and Projects.
Climate Data	Climate data for Wannon Water sites is sourced from the Bureau of Meteorology.
Bulk Entitlement Metering Plan	The Bulk Entitlement Metering Plan has been developed for Wannon Water to measure and record compliance with the obligations of each surface water Bulk Entitlement. The Plan contains detailed information on the location and accuracy of meters and other data management information.
Annual Water Outlook	This is a document that collates information on the status of each system. The Annual Water Outlook provides key information for the preparation of weekly and monthly system status reports.

A3. Gaps in Information

A3.1 General

There are several knowledge gaps identified which have prevented the finalisation some aspects of this Drought Preparedness Plan. Wannon Water intends to progressively work on towards addressing these gaps in the coming years. The key gaps requiring further actions are detailed below:

Konongwootong System	• The Konongwootong System provides a raw water supply to rural users under a supply by agreement arrangement. This supply is also an emergency back-up supply for the Tullich groundwater system. Further work is required to understand the potential supply issues during drought periods including consideration for the development of a Drought Preparedness Plan for this system.
Glenthompson Operational Rules	• Following finalisation of the bulk entitlement for the Willaura system, operational rules which detail the conditions for transferring water to the township of Glenthompson need to be established.
Rural Customers	• Develop a restriction policy for rural customers during times of drought or water shortage.
All systems	• Develop protocols for the easing or removal of restrictions. • Work with local government to identify priority green spaces – see below.

A3.2 Priority Green Spaces

Wannon Water will work with local government to identify priority green spaces – playing fields and the like, and to explore opportunities to keep these spaces watered when other facilities are subject to water restrictions. To coordinate with other council planning processes, this work is planned for 2017 to 2022. Note that Annual Water Outlooks at the time of publication indicate that drought is not likely to occur in this timeframe.

Part B

Otway System Drought Response Plan

B1. Otway Water Supply System

B1.1 Details of the Otway Supply System

B1.1.1 System Description

The Otway Water Supply System obtains its primary supply from two pumped offtakes on the Gellibrand River and by gravity diversions from weirs on three Arkins Creek tributaries. Water is diverted westwards via two pipelines to supply the townships of:

- Simpson;
- Camperdown;
- Cobden;
- Derrinallum;
- Lismore;
- Terang;
- Noorat;
- Glenormiston;
- Mortlake;
- Purnim;
- Allansford;
- Warrnambool;
- Koroit; and
- A number of smaller townships and numerous rural properties.

A schematic of the Otway system is provided in Figure B1.

The Otway Water Supply System is supplemented from two groundwater bores at Carlisle River. Supply to Warrnambool, Koroit and Allansford is augmented by roofwater harvesting in the Russells Creek Growth Corridor and by a shallow groundwater bore field adjacent to the Warrnambool Water Treatment Plant at Albert Park contributing approximately 10% of the supplied water. The Otway supply to Mortlake is shandied with 33% groundwater from a bore in Prentices Lane Mortlake (Absaloms Bore).

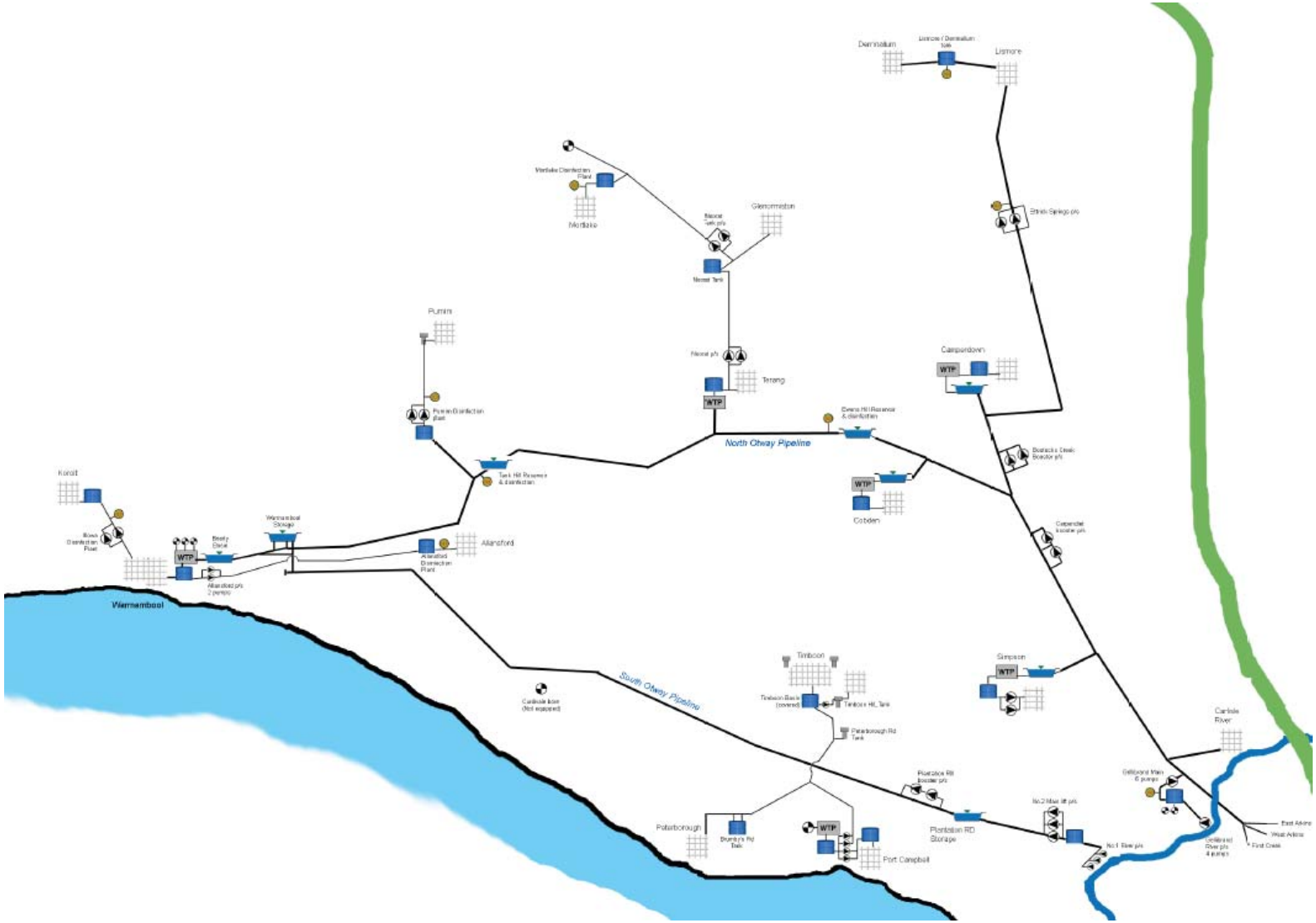
In addition to urban supplies there are close to 1,000 rural connections to the North Otway pipeline. Approximately 460 services supply farms and the small rural communities of Carlisle, Carpendeit, Cudgee and Garvoc direct from the North Otway pipeline. The Camperdown (Otway) Rural District is an area mostly to the north and west of Camperdown providing around 370 connections to domestic, stock and dairy-related customers. This reticulated system is supplied by pipeline from the Camperdown water treatment plant..

There are no permanent connections to the South Otway pipeline. Diversions from the Gellibrand River at Carlisle and extractions from the Carlisle Bores are used to supplement flows from Arkins Creek into the North Otway pipeline. The maximum capacity of the North Otway pipeline is 22.5 ML/day and the maximum capacity of the South Otway pipeline is 21.5 ML/day.

The bore field at Carlisle River is licensed for a maximum daily extraction of 6 ML/day. This enables diversions from the Gellibrand River to be partly or completely replaced by bore water during a river contamination event or diversion limitation as part of the flow sharing rules. The groundwater licence entitles Wannon Water to a maximum annual extraction of 1,800 ML.

The groundwater licence for the Albert Park borefield allows extraction of up to 750ML per annum. Current extraction is about 400ML per year, to provide 10% of the water supplied to Warrnambool. The Mortlake bore has a groundwater licence of 295ML pa, and planned extraction of about 50ML per year, to provide 33% of the water supplied to Mortlake. These blending ratios have been set for water quality reasons. Both these sources have significant spare licenced volume.

Figure B1 Otway System Schematic



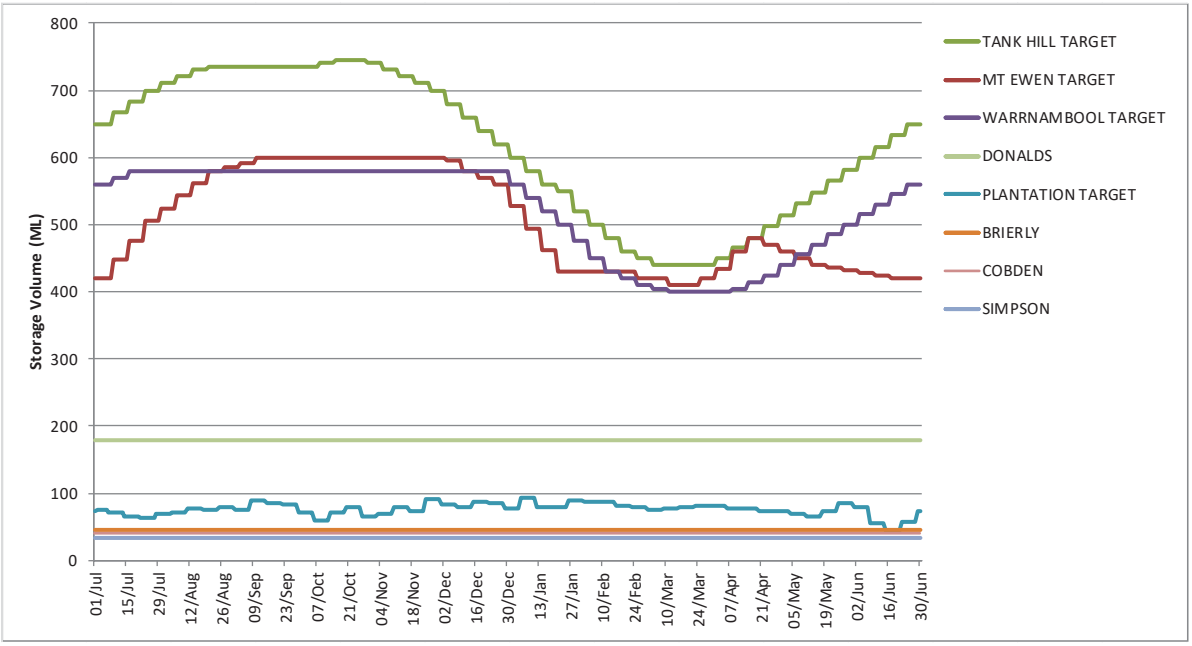
Water storages located throughout the system are used to balance supply during peak periods. The system storages are summarised in Table B1. The active on-line storage is equivalent to less than 20% of the average annual demand. Consequently, during the peak summer demand period when storages are drawn down, less than one month of unrestricted demand may be available in storage.

Table B1 System Storages

Storage Name	Volume (ML)
Simpson Storage	34
Donalds Hill Storage	207
Cobden Basin	52
Ewens Hill Reservoir	625[1]
Tank Hill Reservoir	774
Warrnambool Basin	640
Plantation Road Storage	100
Brierly Basin	51
Total Storage	***2,443***

1. To be increased to 900 ML capacity in 2020.The system is operated to minimise the cost of pumping, which is defined by a set of operational curves for each of the storages described in Table B1. These operational curves provide control over the rate and magnitude of drawdown and filling, whilst providing a reserve volume in each storage for contingency purposes. The storage operating curves are provided in Figure B2 below.

Figure B2 Storage Operating Curves - Otway System



A set of storage based triggers define the severity of a water shortage event in the Otway System and are used to trigger a range of drought response actions. Further details on these actions and triggers are provided in Section B1.4.

B1.1.2 System Demands and Consumption

The total demand represents the unrestricted water usage from the headworks, inclusive of system distribution losses. The current (2016) average annual demand for the system is adopted for long term planning purposes, including the development of Wannon Water's water restriction policies.

The estimated total average annual demand (in 2016) for the Otway Water Supply System is about 10,000 ML/year. The components of demand are detailed in the table below.

Table B2 Components of the Current (2016) Average Annual Demand - Otway

Component	Total Demand (ML)	Base Demand (ML)	Restrictable Demand (ML)
Residential	3,010	2408	602
Non Residential	940	752	188
Rural	1,330		-
Major	2,180		-
Public Open Space	70		-
Total Consumption	7,530	6,740	790
Nonrevenue Water	725		-
Bulk Usage (WTP Outflow+Pipeline customers)	8,250	7,460	790
WTP Losses	380		-
System losses (upstream of WTPs)	700		-
Total Raw Water Usage	9,330	8,540	790

Note 1 – Restrictable demand was estimated at 20% of resi and nonresi use based on data collected in Hamilton over the Millenium drought.

Climate corrected water consumption in 2015/2016 for each of the towns supplied by the Otway Water Supply System is provided in Table B3. This year was chosen as the basis for establishing the average annual demand.

Table B3	Consumption by Customer District - Otways 2016 (climate corrected)							
Customer District	**Major**	**Nonresi**	**Resi**	**Rural**	**Public Open Space**	**Customer totals**	**Bulk Meter**	**NRW**
Allansford	**0**	**57**	**54**	**19**	**1**	**131**	**157**	**26**
Camperdown	**0**	**98**	**245**	**0**	**10**	**352**	**425**	**72**
Camperdown Rural	**0**	**0**	**0**	**482**	**0**	**482**	**597**	**115**
Cobden	**446**	**51**	**111**	**118**	**10**	**736**	**780**	**44**
Koroit	**116**	**23**	**107**	**1**	**1**	**248**	**270**	**22**
Lismore Rural (pre-Ettrick)	**0**	**0**	**0**	**27**	**0**	**27**	**43**	**16**
Lismore & Derrinallum	**0**	**11**	**41**	**27**	**3**	**81**	**106**	**25**
Mortlake	**0**	**48**	**84**	**15**	**2**	**148**	**161**	**13**
Noorat & Glenormiston	**0**	**18**	**28**	**62**	**1**	**110**	**120**	**10**
Purnim	**0**	**0**	**0**	**20**	**0**	**20**	**30**	**10**
Simpson	**0**	**23**	**13**	**15**	**1**	**52**	**59**	**7**
Terang	**0**	**47**	**145**	**10**	**6**	**208**	**216**	**8**
Warrnambool	**753**	**567**	**2183**	**24**	**34**	**3561**	**3933**	**372**
Camperdown Water Works	**0**	**0**	**0**	**31**	**0**	**31**	**31**	
Carlisle Water Works	**0**	**0**	**0**	**15**	**0**	**15**	**15**	
Carpendeit Water Works	**0**	**0**	**0**	**171**	**0**	**171**	**171**	
Cobden Water Works	**0**	**0**	**0**	**150**	**0**	**150**	**150**	
Terang Water Works	**0**	**0**	**0**	**72**	**0**	**72**	**72**	
Warrnambool Pipeline	**866**	**0**	**0**	**48**	**2**	**916**	**916**	
South Otway Pipeline	**0**	**0**	**0**	**19**	**0**	**19**	**19**	
Otways total	**2182**	**943**	**3009**	**1325**	**72**	**7530**	**8271**	**741**

Figures exclude WTP and system losses. Volumes in ML.

B1.1.3 System Yield and Security of Supply

The yield of a water supply system is defined as the average annual level of total (raw water) demand that can be supplied from the water supply system, subject to resource availability, operational rules, demand patterns and adopted reliability criteria.

For the Otway Water Supply System, the Average Annual Demand that can be supplied whilst meeting Wannon Water's level of service objectives is 13,440 ML/a or 140% of current average annual demand (GHD, 2017). At this level of demand, restrictions are required at a frequency of 1 in 20 years (95% of years) and the severity of restrictions is not greater than Stage 3 restrictions.

The estimated reliability of the current demand (9,330 ML/a) under historical streamflow and medium impact 2040 climate change conditions is 100%.

Table B4 illustrates the sources of supply and how the distribution varies as climatic conditions change.

Table B3 Otways Diversions from the Environment by Source (in ML)

	2011/12	2012/13	2013/14	2014/15	2015/16
Arkins Creek	3748	2657	3218	2571	1839
NOPS river water	1873	2021	1453	2034	2601
SOPS river water	3994	3593	3474	4093	4191
NOPS bore water	4	263	4	713	34
Albert Park bores	434	383	441	390	338
Absaloms bores (Mortlake)	29	31	25	22	14
Brierly Roofwater	0	8	17	11	20
Otways Raw Water	10082	8956	8633	9835	9038

B1.2 Drought Experience

Over the last 40 years the Otway Water Supply System has experienced restrictions during the following droughts: 1967/1968, 1971/1972, 1972/1973, 1973/1974, 1980/1981 and 1982/1983. The maximum restrictions applied were level two of an eight-stage policy, over a maximum duration of one month. Since the 1970s, augmentation of the supply system has included the South Otway pipeline (1976) and Warrnambool Basin (1985). During the 1982/1983 drought, restrictions were not required for the Otway system specifically, but were implemented to reflect the serious water shortages throughout most of Victoria at the time.

Water restrictions were not required during the summer of 1999/2000, although diversions from the Gellibrand River at Carlisle were reduced under the flow sharing arrangements specified in the Otway Water Supply System Bulk Entitlement Order. Flow share restrictions, reducing allowable diversions from the Gellibrand River into the North Otway system, were imposed between 5 February and 26 March 2000. This resulted in an allowable diversion 200 ML less than the maximum possible had flow share restrictions not been in place.

The reduction in allowable diversions combined with increased water usage and increased evaporation losses from storages resulted in some concern that water restrictions may have had to be imposed on customers in all districts supplied from the North Otway pipeline upstream of Tank Hill Reservoir.

Storages were however able to be maintained above minimum desirable levels. Another two weeks of flow share restrictions would probably have resulted in water restrictions being implemented in towns supplied solely from the North Otway pipeline.

Gellibrand River flow sharing rules were applied to reduce irrigator's access to water from 3 February 2001 to 16 April 2001, and Wannon Water was restricted to an allowance of 17.5 ML/d from 9 March 2001 to 15 March 2001. Southern Rural Water placed Gellibrand irrigators on level one restrictions in 2005/2006. However restrictions have not been placed on Wannon Water extractions since 2001. The Carlisle River bores were brought online in 2001, and have been used in 2001/2002, 2002/2003 and 2005/2006 to supplement supply.

Flow sharing arrangements under the bulk entitlement were implemented in 2006, although there was negligible impact on Wannon Water's ability to maintain the system storages at the desired operating levels.

In 2007, the capacity of the Warrnambool basin was increased by 320 ML providing additional off stream storage capacity. The Warrnambool Roofwater harvesting project was completed in 2011. This infrastructure has the capacity to supply up to 460 ML of additional water to Warrnambool per year.

In summary, Wannon Water has not implemented water restrictions in the Otway system since 1982/1983. Whilst annual rainfall totals in the Gellibrand River catchment have been typically low over the last decade, flows in the Gellibrand River and tributaries have been sufficient (combined with use of the Carlisle River bores) to avoid the need for water restrictions.

B1.3 Drought Response Options

B1.3.1 Introduction

Drought response options within the Otway system can be classified into two broad categories; demand management and supply augmentation. This section of the Drought Response Plan identifies and evaluates the options that are currently available to Wannon Water to mitigate the impacts of water shortages.

B1.3.2 Demand Reduction During Droughts

Summary of Options

There are a number of demand reduction options that can be employed during times of water shortage. A summary of these demand reduction options is shown in Table B5 below.

Table B4 Summary of Demand Reduction Options

Option	Details	Comments
Community Education Programs	Water efficiency awareness (showerhead rebates, information brochures), linked to ongoing State Government programs. Estimated savings are around 2-5% of total demand.	Being progressively implemented by Wannon Water.
Voluntary Demand Reduction Measures	Self regulated water conservation measures aimed at increasing effectiveness of measures within the Permanent Water Saving Plan.	Water savings from this option are expected to exceed the savings already achieved from the Permanent Water Saving Plan.
WaterMAP	The Government has implemented a voluntary program for all non-residential customers (5ML/year or greater).	Wannon Water to promote this voluntary measure during periods of heightened awareness or during drought response operating modes.
Mandatory Water Restrictions	Option available under By-Law No. 5.	See Appendix B for requirements and prohibitions on water usage.
Compliance Officer/s	Additional resources may be required during extended periods of moderate to severe restrictions to monitor the performance of targeted water savings measures.	

Wannon Water's long-term demand reduction strategies attempt to reduce both base demand and restrictable demand by encouraging more efficient water use in all circumstances.

Short term drought response strategies largely target discretionary water use. Recent experience across Wannon Water's systems has shown that short term savings can be achieved across residential, non-residential and commercial sectors.

The current unrestricted average annual demand of the Otway Water Supply System is estimated to be 9,330 ML/a (including system losses). Historical records show that demand can be quite variable from year to year. Generally, demand tends to increase during hot and dry periods when outdoor usage increases. Hence, water shortages resulting from reduced inflows during drought conditions tend to be exacerbated by increased demand levels.

Voluntary Demand Reduction Measures

Voluntary demand measures are an initial measure in the event of a drought. The importance of public awareness, understanding and involvement in meeting demand reduction objectives cannot be underestimated.

Wannon Water is committed to communicating effectively with its Otway Water Supply System customers to encourage take up of voluntary water saving measures and in turn deliver the best possible outcomes in demand reduction.

Supporting these voluntary water saving measures with initiatives including showerhead exchanges, trigger nozzles and other merchandise, Wannon Water aims to encourage its customer base to play an active role in managing their water supply and play their part in times of water shortages to ensure efficient use of their precious resource.

A broad base of local media (press and electronic) can be utilised to raise community awareness of system supply levels and encourage voluntary water saving measures.

Wannon Water will raise the profile of system levels and support the take-up of voluntary measures through extensive 'tips' and media coverage on its website, regular informative media releases, advertising, distributing publications with customer accounts and distributing information at community events throughout the service region. Wannon Water will also liaise with its Customer Engagement Committee where appropriate and consider holding community information sessions to raise awareness.

Publication of information including changes in water usage, rainfall levels, streamflows or bore performance details can assist in raising the profile of shortages and demand needs. Recent experience has shown that in combination, all of the above communication tools have been effective in heightened public awareness and consciousness of water efficiency measures, particularly over summer months.

As well as engaging the community in voluntary demand reduction measures Wannon Water can liaise with major consumption customers to work out strategies to reduce consumption. Major customers include the local shire, community groups, industrial and rural water users.

WaterMAP

WaterMAP is a voluntary water management action plan for non-residential customers using 5 ML of potable (drinking) water or more per year at any one site from an urban water supply. A WaterMAP allows eligible non-residential water customers to:

- Assess their current water use;
- Identify inefficiencies and opportunities for water savings;
- Prepare an action plan to implement water conservation actions; and
- Report on implementation of water conservation actions.

Wannon Water will continue working with its major customers to encourage and implement water saving measures.

Mandatory Water Restrictions

As mentioned in Part A of this document, Wannon Water applies a four-stage water restriction policy in accordance with the Victorian Uniform Drought Water Restriction Guidelines (VicWater, 2005). The policy defines trigger levels corresponding to the total volume of water held in system storages (refer Table B1). The current restriction triggers for the system are provided in the Drought Response Plan Action Plan.

The anticipated water savings for each level of restriction is shown in Table B6. These savings have been tested by comparing residential KL per connection over the period 2005/2006 to 2010/2011 for

Hamilton against other towns not subject to water restrictions. The residential consumption rates shown in Table B6 provide guidance on the level of consumption which should be targeted to achieve the stated water savings.

Table B5 Anticipated Water Savings from Water Restrictions for the Otway System

Restriction Level	Estimated Water Saving			Target Residential Consumption Rate	
	% of Restrictable Demand[1]	Volume (ML)	% of Total Raw Water Use[2]	KL/ connection/ yr	L/ person/ day
PWSM				160	190
Stage 1	13% - 16%	90-110	1%	156	185
Stage 2	40% - 50%	300-350	3%	146	173
Stage 3	60% - 75%	420-520	5%	140	166
Stage 4	95% -100%	700	7%	130	154

1. Ranges adopted from VicWater, 2005.
2. Total raw water extracted from the environment.

B1.3.3 Supply Augmentation Options During Drought

Options to augment the supply system during extended low rainfall periods are limited to some extent due to lead times required to implement these alternatives. It is therefore essential to consider the larger scale options as part of longer term water supply planning. However, there are several options available to augment supply during drought. The feasibility of each option depends to a large extent on the size of the population being serviced, the physical characteristics of the supply system and, ultimately, on the severity of the drought. A summary of the short term supply augmentation options for the Otway Water Supply System is shown in Table B7.

Table B6 Supply Augmentation Options During Drought

Option	Details	Available Supply
Emergency Groundwater Bores[1]	Curdievale Bore – 30 year old bore pump tested to 8 ML/day available for use during an emergency. Delivery to W'bool Storage to reduce impact of higher salinity and temperature.	2,150 ML/year
	Koroit – two existing bores in railway reserve still equipped but power disconnected. Would need to reinstall disinfection system, connect power and replace pumps (likely to be unusable). Higher salinity water may be of concern to customers especially Murray Goulburn.	524 ML/yr
	Lismore and Camperdown	To be determined[3]
	Albert Park Bores	250 ML/yr[2]
	Mortlake	250 ML/yr[2]
Reservoir Dead Storage	Measures may need to be taken to access water below pipe offtakes. Water quality in reservoirs generally deteriorates when water falls below offtake levels.	50 ML Tank Hill 200 ML Ewens Hill 40 ML Donalds Hill 80 ML Warrnambool
Water Cartage	Not a viable option for large towns such as Warrnambool, but could be used to supply many of the smaller satellite towns across the system.	
Qualification of Rights	Apply to the Minister to increase surface and/or groundwater extractions beyond the conditions of our entitlements.	

1. Emergency groundwater bores are not brought online until Action 4 under the Drought Response Mode (refer Table B10).
2. These volumes are in addition to current usage of 500 ML/yr at Albert Park and 45 ML/yr at Mortlake.
3. Further assessment required to determine available supply.

B1.4 Drought Response Actions

System monitoring is undertaken to assess the status of the supply system according to one of the following three operational modes:

Mode 1 – General Monitoring

Mode 2 – Heightened Awareness

Mode 3 – Drought Response

B1.4.1 Mode 1 – General Monitoring (Pre-Drought Phase Activities)

The zone for the General Monitoring mode is defined by the system storage capacity as the upper bound and a trigger which is set just below the system operating curve, as the lower bound.

There are a number of important factors in pre drought monitoring and planning which will influence the decision to declare the system as being in the General Monitoring mode. These include:

- Storage contents, river flows and bore performance data to monitor availability of supply;
- Climatic trends and seasonal outlooks as indicators of the possible onset of drought;
- Consumption trends to indicate changes in Customer's usage of water; and
- Forecasting storage behaviour over a 6-12 month period.

The Annual Water Outlook tool is used to monitor supply and demand side aspects of the system. During the General Monitoring mode, the system status is updated on a weekly basis and a report prepared weekly. A summary of the key system performance indicators for the Otway Water Supply System which should be included in the Annual Water Outlook and System Status Report is provided in Table B8.

Table B7 Requirements for Annual Water Outlook and System Status Monitoring and Reporting

Item	Requirements
Rainfall, seasonal climate outlook	Information accessed from Bureau of Meteorology website.
State-wide status	Bureau of Meteorology and Department of Environment, Land, Water and Planning websites provide status reports on rainfall, streamflow, storage levels, groundwater and urban water restrictions across Victoria on a monthly basis.
System storage contents	Monitored at least weekly and recorded in an operational database. Data recorded for all towns.
Gellibrand River gauging stations downstream of both the pump offtakes.	Monitoring of passing flow level and flow details are provided by telemetered data loggers. Two models have been developed to facilitate prediction of demand trends and storage contents.
Water levels in shallow ground water supply systems are monitored at least monthly and are able to be compared against pump depths.	The frequency of monitoring should be increased to weekly or daily if a decline in water level raises concern on the security of the system.
System Demands (bulk meter consumption)	All towns monitored at least weekly and recorded in an operational database.

The trigger mechanism for actions is the total system storage volume for the Otway system storages, using the Drought Response Triggers shown in Appendix C1.

Forward look projections of storage response forms an integral part of the short term planning during a drought. Projections assist to anticipate the “likely” response based on current climatic conditions. At a minimum, Wannon Water makes projections over the next 3-12 months based on its experience in previous droughts. However, seasonal forecasting over three month, six month and 12 month periods, incorporating information from low-frequency climate signals such as the El Nino Southern Oscillation Index and sea surface temperatures, may also be useful in this assessment.

The Annual Water Outlook tool has been set up to enable system monitoring including forecasts to be completed.

The drought response triggers are an informative guideline, and are not used as rigid bands or triggers that guarantee the implementation of the specified action, such as the implementation of water restrictions.

B1.4.1 Mode 2 – Heightened Awareness

The zone for the Heightened Awareness mode is designed to provide early warning of a pending water shortage. The Heightened Awareness mode is triggered following consideration of:

- Storage contents, river flows and bore performance data to monitor availability of supply;
- Climatic trends and seasonal outlooks;
- Consumption trends to indicate changes in Customer's usage of water; and
- Forecasting storage behaviour over a 3-6 month period.

The key actions are summarised in Table B9 (in order of increasing impact from water shortages).

Table B8 Otway Water Supply System Action Plan for Mode 2 – Heightened Awareness

Action	Trigger	Response
Action 1	High likelihood that total storage contents cannot be maintained above the System Operating Curves	1. Reconvene the Drought Response Monitoring Committee
Action 2	Moderate to high likelihood that total storage contents cannot be maintained above the Level 1 Drought Response Trigger	2. Provide weekly updates of the System Status Report 3. Implement demand reduction options such as Community Education Programs, Voluntary Demand Reduction Measures via increased media advertising,
Action 3	High likelihood that storage contents cannot be maintained above the Level 1 Drought Response Trigger	4. Alert public to the imminent water shortages and possible need for restrictions in the future. 5. Promote “voluntary restrictions” via media advertising campaigns to inform consumers about water conservation programs. 6. Declare operational mode as Mode 3 - Drought Response.

B1.4.2 Mode 3 - Drought Response

Mode 3 defines an active drought response period where supply and/or demand side measures are required to maintain supply security. Restriction rule curves are used to trigger an increase in the severity of the water shortage. Actions during each level of restriction are summarised in Table B10.

Table B9 Otway Water Supply System Action Plan for Mode 3 – Drought Response

Action	Trigger	Response
Action 4	Total storage contents unable to be maintained above Level 1 Drought Response Trigger.	7. Consider implementation of Stage 1 Restrictions. 8. Introduce advertising campaign using all appropriate forms of media. 9. Monitor storage volume response and perform regular forward look storage volume projections. 10. Make standby arrangements to bring Curdievale bore into service. 11. Advise major users of Otway system that Curdievale groundwater supply may have to be introduced.
Action 5	Total storage contents unable to be maintained above Level 2 Drought Response Trigger	12. Consider implementation of Stage 2 Restrictions. 13. Continue media advertising. 14. Daily monitoring of storages. 15. Bring Curdievale bore pumping infrastructure into service. 16. Monitor storage volume response and perform regular forward look storage volume projections.
Action 6	Total storage contents unable to be maintained above Level 3 Drought Response Trigger	17. Consider implementation of Stage 3 Restrictions. 18. Continue media advertising. 19. Daily monitoring of storages. 20. Monitor storage volume response and perform regular forward look storage volume projections. 21. Identify and plan for implementation of emergency options.
Action 7	Total storage contents unable to be maintained above Level 4 Drought Response Trigger (Emergency Level)	22. Consider implementation of Stage 4 Restrictions. 23. Continue media advertising. 24. Daily monitoring of storages. 25. Monitor storage volume response and perform regular forward look storage volume projections. 26. Implement other emergency supply options. 27. Tankering water to areas of critical shortage.

B1.5 Post Drought Assessments

Actions to be considered after a drought has occurred are summarised in Table B11. These include evaluating the appropriateness of the actions within each of the operational models and the associated triggers, the effectiveness of demand reduction and emergency supply augmentation options and the effectiveness of each level of restriction.

Table B10 Evaluate Operational Modes Trigger Levels and Associated Actions

Operational Mode	Action Sequence	Description	Assessment Procedure
General Monitoring	NA	Monitoring and evaluation	Were the indicators being used to monitor system performance appropriate?
Heightened Awareness	Actions 1-6	Planning	Was there adequate time to undertake the activities detailed in Actions 1-3.
		Voluntary Demand Reduction	Was the community responsive? Was there a significant reduction in demand? Was the trigger level appropriate?
Drought Response	Actions 7-27	Water Restrictions	Was the expected reduction in demand achieved for each stage? Were the trigger levels appropriate? Were policing methods effective, if so, how?
		Groundwater pumping	Was groundwater effective at this stage or should it be started earlier? Was timing of groundwater input appropriate? Were pumps and equipment available? Was water quality acceptable to customers, particularly for industrial customers? Were any problems identified with the specific flow sharing arrangements with the Gellibrand River with Southern Rural Water?
		Implement other emergency supply options	To what level was demand reduced? What was the cost and practicality of carting water if undertaken? Were individual emergency options implemented too late? Did other options arise; if so, what other options were available?

Table B12 summarises the assessment procedure for evaluating the impact of water restrictions on customers, authority staff and supply systems. The intention is to learn from the methodologies that have been applied in order to minimise any future incidents of this nature.

Table B11 Evaluate the Impact of Restrictions

Stakeholders	Assessment Procedure
Domestic Users	Were the restrictions too severe? Was the right mix of media used to disseminate information? Was there enough warning of impending drought? If not, how could this be improved?
Diverters	Were flow sharing arrangements appropriate? What was the irrigator's reaction to restrictions?
Environmental	Were flow triggers appropriate? Should environmental flows be reassessed? What were the effects upon the aquifer and other users of pumping? What methods have been put into place to rectify any environmental effects? Effects upon identified groundwater dependent ecosystems?
Wannon Water Staff	Were many instances reported of restriction violations? Was it possible to effectively enforce the restriction policy? Were sufficient staff available to monitor system performance?
Supply Systems	Did restrictions achieve expected levels of water savings? Have supply systems been replenished? If so, how long did it take to achieve this level? What procedures were put in place to achieve this?

Table B13 summarises the assessment procedure for establishing the effectiveness of pumping groundwater to replenish the supply systems during drought.

Table B12 Evaluate Effectiveness of Groundwater Pumping

Action	Assessment Procedure
Evaluate effectiveness of ground water pumping	Did water quality problems occur? Should groundwater supplies have been introduced prior to where programmed in the Drought Response Plan? Did the volume of water extracted stay within the groundwater licence limits (daily volumes and annual volumes)? Review predictive models / bore performance / water quality and recalibrate predictive models / water balances / assessment tools?

Part C

Grampians System Drought Response Plan

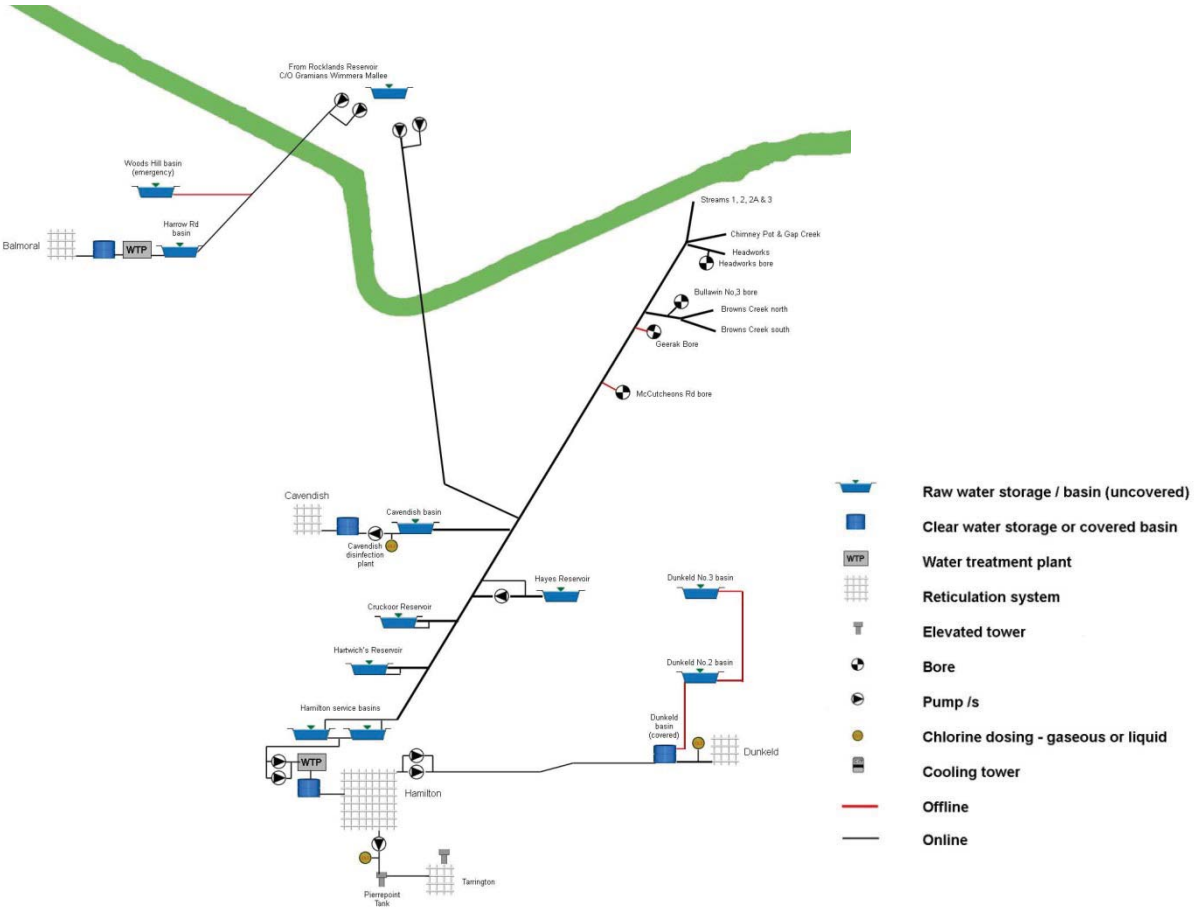
C1. Grampians Water Supply System

C1.1 Details of the Grampians Water Supply System

C1.1.1 System Description

The Grampians water supply system provides water to the five urban zones of Balmoral, Cavendish, Hamilton, Tarrington and Dunkeld, and also to a number of rural customers located along the main supply pipelines. A schematic of the Grampians Water Supply System is provided in Figure C1.

Figure C1 Grampians Water Supply System



Water from Rocklands Reservoir is supplied to Balmoral via a 10km pipeline constructed in 1964 and to the southern part of the system via a 52km pipeline constructed in 2009/2010.

The main supply for Hamilton is obtained from the western slopes of the Victoria Range in the southern part of the Grampians National Park. Water is diverted from eight small streams and the Headworks bore. The first diversion, on Headworks Creek, has been in place since 1904 and the most recent diversions, on No's 2 and 3 streams, since 1960. The Bulk Entitlement specifies passing flow requirements in five of these streams. The water flows by gravity through 47.4km of pipeline to storages north of Hamilton. The maximum capacity of the supply system is approximately 12.8ML/d.

A 52km pipeline was completed in 2010 providing a connection between Rocklands Reservoir and the Hamilton System. Wannon Water has a 2,120 ML bulk entitlement from the Wimmera-Glenelg system and receives an annual allocation, which is subject to the flow sharing arrangements in the bulk entitlement. Water available under this bulk entitlement is also used to supply the township of Balmoral via a separate pipeline. Wannon Water can carryover its unused entitlement from year to year, with carryover occurring on 1 October, subject to a 15% reduction for evaporation. The accumulation of water above 2,120 ML will help provide for years when the allocation is less than 100%. In dry years the allocation can be low. For example, in 2015/2016 the allocation was only 5%.

For security of supply purposes, the storage volume available in the Grampians Water Supply System is considered to be equal to the 2,120 ML bulk entitlement, plus the capacity of the local storages that are upstream of the Hamilton Water Treatment Plant. Water brought to Hamilton is stored in five main storages located along the pipeline to the north of Hamilton. The total capacity of the local storages is approximately 2,652 ML. These storages are summarised in Table C1.

Table C1 System Storages

Storage Name	Volume (ML)
Hayes Reservoir	1,200
Cruckoor Reservoir	990
Hartwichs Reservoir	330
No. 1 and 2 storages	132
Total Storage	**2,652**

Hartwichs Reservoir was constructed in 1950 and is located approximately 2 km north of Hamilton. It was constructed with a capacity of 381ML but the FSL has since been revised downwards to 330ML. Cruckoor Reservoir was constructed in 1969, with a capacity of 990 ML, and is located approximately 4.5 km north of Hamilton. The most recent storage constructed is Hayes Reservoir which was constructed in 1993, with a capacity of 1,200 ML and is located approximately 11.5 km north of Hamilton.

Nos. 1 and 2 storages are located on high ground on the northern outskirts of Hamilton and serve the city as raw water balancing basins. The basins are interconnected and have a combined capacity of 132 ML (66 ML each).

The five storages are filled by gravity and all, with the exception of Hayes Reservoir, are emptied by gravity. Treated water is delivered to an 11 ML clear water storage tank before being supplied to the reticulation system.

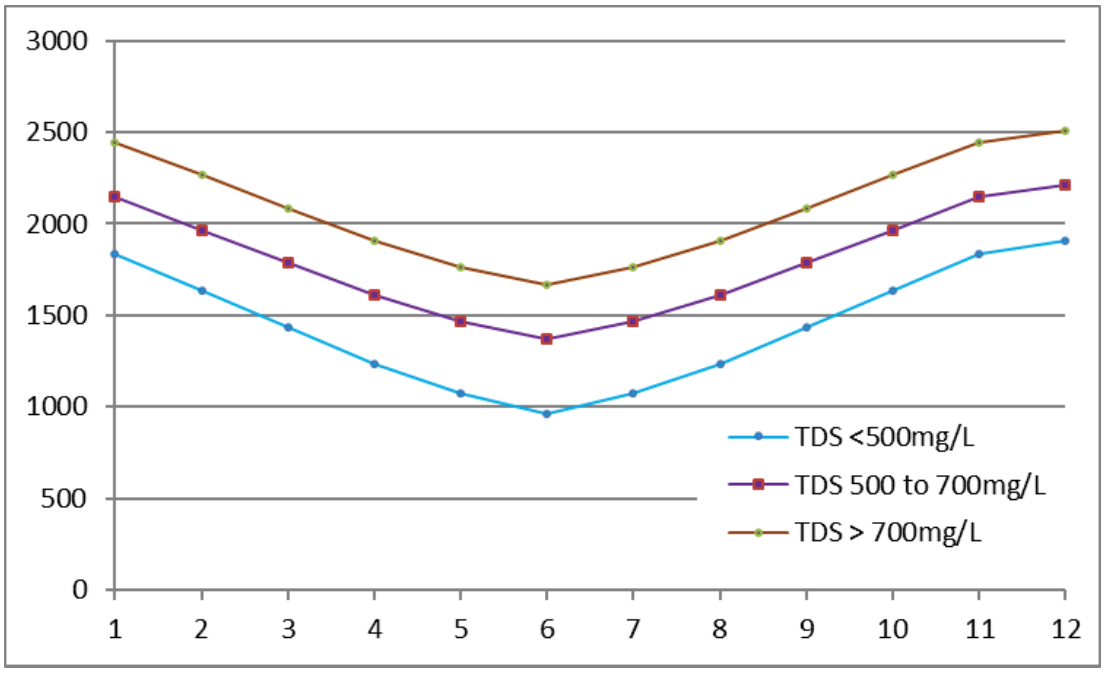
The township of Tarrington was connected to the Hamilton system in 1972 and is supplied via a pumped rising main to a 1ML tank located on the top of Mount Pierrepoint. Water then gravitates from this storage to a small elevated tower in Tarrington and then by gravity to the township.

The township of Cavendish was connected to the Hamilton system in 1970 via a 100 mm diameter diversion pipeline from the main Grampians pipeline serving Hamilton. Water is supplied by gravity to a 2.25ML shadecloth-covered storage on high ground to the east of the township. Water gravitates from the reservoir to the township. During summer low flow periods, when all the stream flow is used to meet the environmental flow requirements, the Headworks bore is used to supply the town.

The township of Dunkeld was connected to the Hamilton system in 1998 via a 33 km pipeline to a new clear water (lined and covered) storage (6.3 ML). Prior to connection to the Hamilton system, the Dunkeld system consisted of three storages, being the No. 1 Service Basin (36 ML), the No. 2 Service Basin (36 ML) and the No. 3 Reservoir (110 ML). A weir on Waterfall Creek supplies water to the No. 3 and No. 2 storages. Although not treated, this system could be used as an emergency supply as was the case in the 2006 bushfires.

Operating rules have been developed which aim to maximise the yield from the combined supply sources, whilst mitigating water quality risks associated with the higher salinity supply from Rocklands Reservoir. Storage operating curves have been developed which define usage of the total available resource according to the quality of water in Rocklands Reservoir. When the quality of water in Rocklands Reservoir is less than 500 mg/L TDS, the risk that the resource will become unsuitable for use is relatively low, therefore water is preferentially retained in Rocklands Reservoir and use of the local storages is maximised. When the quality of water in Rocklands Reservoir increases above 500 mg/L TDS, then a larger reserve volume is required in local storages to facilitate blending which prolongs the use of the Rocklands resource. Storage operating curves were developed in 2010 to allow for this. These curves are revised here to allow some airspace in the local storages to maximise the potential to harvest from the local streams. The adopted storage operating curves are illustrated in Figure C2.

Figure C2 Operating Curves for Hamilton System Storages



The system operating rules specify the usage of the available resource in the following priority order:

- Streamflow is diverted from the Grampians Headworks streams, subject to individual passing flow requirements with a total diversion up to 12.8 ML/d;
- Water transferred from Rocklands Reservoir up to 8 ML/d with transfers limited to the allocation held in Wannon Water's allocation bank account (including water held as carryover). Allocations are based on 2,120 ML/a bulk entitlement volume;
- Diversion from the Grampians Bores, up to 400 ML/a;
- The local storage are filled in the following priority order, Hartwichs Reservoir ; Cruckoor Reservoir then Hayes Reservoir, noting that for water quality purposes water from Rocklands Reservoir is never stored in Cruckoor Reservoir; and
- Hartwichs Reservoir is used for blending purposes.

The Balmoral township sources its water directly from Rocklands Reservoir. The Rocklands Reservoir was constructed in 1953 and Balmoral was connected to it in 1966. Water is pumped from Rocklands to a service basin in Harrow Road, which is located adjacent to the High School. The capacity of this basin is 0.54 ML. The reticulation system is pressurised by a multi-stage booster pump station.

C1.1.2 System Demands and Consumption

The total demand represents the unrestricted water usage from the headworks, inclusive of system distribution losses. The current (2016) average annual demand for the system is adopted for long term planning purposes.

Table C2 Components of the Current (2016) Average Annual Demand - Grampians

Component	Total Demand (ML)	Base Demand (ML)	Restrictable Demand (ML)
Residential	790	632	158
Non Residential	200	160	40
Rural	95		-
Major	25		-
Public Open Space	15		-
Total Consumption	**1,125**	**927**	**198**
Nonrevenue Water	230		-
Bulk Usage (WTP Outflow+Pipeline customers)	1,353	**1,155**	**198**
WTP Losses	40		-
System losses (upstream of WTPs)	221		-
Total Raw Water Usage	**1,614**	**1,416**	**198**

Note 1 – Restrictable demand was estimated at 20% of resi and nonresi use based on data collected in Hamilton over the Millenium drought.

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Climate corrected water consumption in 2015/2016 for each of the towns supplied by the Grampians Water Supply System is provided in Table C3.

Table C3	**Consumption by Customer District - Grampians 2016 (climate corrected)**							
Customer District	**Major**	**Nonresi**	**Resi**	**Rural**	**Public Open Space**	**Customer totals**	**Bulk Meter**	**NRW**
Balmoral	**0**	**4**	**15**	**11**	**1**	**32**	**33**	**2**
Cavendish	**0**	**2**	**8**	**1**	**1**	**12**	**17**	**5**
Hamilton	**24**	**174**	**691**	**38**	**9**	**936**	**1127**	**192**
Tarrington	**0**	**1**	**23**	**5**	**0**	**29**	**37**	**8**
Dunkeld	**0**	**18**	**56**	**12**	**0**	**86**	**107**	**21**
Hamilton pipeline	**0**	**0**	**0**	**23**	**0**	**23**	**23**	
Balmoral Pipeline	**0**	**0**	**0**	**5**	**4**	**8**	**8**	
Grampians system total	**24**	**200**	**794**	**94**	**15**	**1127**	**1353**	**227**
Figures exclude WTP and headworks losses. Volumes in ML.								

C1.1.3 System Yield and Security of Supply

For the Grampians System, the average annual demand that can be supplied at the adopted 95% annual reliability is 2,260 ML/a or 140% of current average annual demand (GHD, 2017). The frequency of Stage 1 restrictions is adopted by Wannon Water as the measurement of system reliability. A 95% annual reliability target equates to a 1 in 20 year frequency for restrictions.

The estimated reliability of the current demand (1,614 ML/a) under historical streamflow and medium impact 2040 climate change conditions is 100%.

Table C4 shows the sources of supply.

Table C3 Diversions from the Environment by Source (in ML)

	2011/12	2012/13	2013/14	2014/15	2015/16
Balmoral @ Rocklands	**46**	**57**	**48**	**47**	**49**
Hamilton - Rocklands	**67**	**13**	**58**	**0.4**	**24**
Grampians streams	**1234**	**1163**	**2093**	**1165**	**1372**
Grampians bores	**3.0**	**4**	**3**	**0**	**1.8**
Dunkeld headworks weir	**0**	**8**	**27**	**0.3**	**0**
Grampians Raw Water	**1350**	**1245**	**2228**	**1213**	**1447**

C1.2 Drought Experience

C1.2.1 Brief Analysis of Historic Droughts

Prior to, and including the 1982/1983 drought, restrictions on water use were regularly imposed. The 1982/1983 drought was the most severe drought experienced in the area in recent years. Water restrictions were imposed on consumers, limiting garden watering to a hand held hose for one hour on alternate days.

To meet water demands during the 1982/1983 drought the then Hamilton Water Board supplemented the system by operating its groundwater bores in the headworks catchment.

Bullawin Bore was re-commissioned on 2 November 1982, (this bore had been constructed during the 1967/1968 drought) and operated until 22 March 1983 producing a total flow of 182 ML (1.3 ML/day). Headworks Bore was commissioned on 19 January 1983 and operated intermittently until 23 February 1983. When operating, this bore produced approximately 0.7 ML/day. When both bores were operating they contributed 2 ML/day to the supply system.

After the drought the Hamilton Water Board embarked on a 10 year program to increase the harvest of winter flows and to increase the storage capacity. Over 30 km of pipeline duplications and replacements have seen the pipeline capacity increase from 7 ML/day to 12.8 ML/day (only 12.8 ML/day when filling Hayes Reservoir). Water can be pumped from Hayes Reservoir at the rate of 15 ML/day. Hayes Reservoir, with a capacity of 1 200 ML, was commissioned in 1993.

Hamilton also had water restrictions for two weeks during February 1990 but this was due to the last section of mainline to Nos. 1 and 2 not being capable of supplying enough water to meet the demand. This section of main was duplicated in 1991 and the entire pipeline system now has a capacity of 12.8 ML/day under gravity feed.

Restrictions were regularly imposed for the Dunkeld Water Supply System during the 1990s. The level of water in this system dropped to a point in 1998 and the township was in danger of running out of water. Stage 3 restrictions were applied and a pipeline was constructed from Hamilton, culminating in restrictions being lifted in April 1999. Dunkeld is now permanently connected to the Hamilton system and the original Dunkeld system is maintained as an emergency supply. This emergency supply was used, for the first time, during the 2006 Australia Day bush fire and from December 2006 to September 2007 to conserve the supply in the Hamilton reservoirs for the Hamilton and Tarrington systems.

The Hamilton system had restrictions imposed during 2000 and 2001. Restrictions were again re-introduced in January 2006, following a relatively dry spring inflow period. By late 2006, storages fell to critically low levels following the driest spring period in recent history. By December 2006, Stage 4 restrictions were introduced and remained in place until November 2007 when they were replaced with Stage 3 restrictions. The level of restriction was further reduced to Stage 2 in November 2009.

In 2007, planning work commenced to augment the system via a 52km pipeline connection to Rocklands Reservoir. This pipeline was commissioned in 2010. The groundwater bores in the Grampians headworks were operated during the times that restrictions were in place (two additional bores, Geerak and McCutcheons, were constructed during this period). Stage 2 restrictions were lifted in August 2010.

During the 1967/1968 drought, the level of the Rocklands Reservoir was very low. While there was adequate water to meet normal demands the State Rivers & Water Supply Commission requested that water restrictions be implemented in Balmoral. Restrictions were applied from 1 December 1967 and were not lifted until 1 July 1968.

It was necessary to extend the pump suction line in the Reservoir in order to maintain supply.

In March of 1988 the State Rivers & Water Supply Commission advised that in future droughts the level of Rocklands would not be allowed to fall below 5 000 acre feet (6 200 ML) with such water being reserved for Balmoral and landholders along the Glenelg River.

Consumers were informed of the need for restrictions by circular.

In the 1982/1983 drought restrictions were implemented on the 1 April 1983 and lifted in October the same year. No other operational measures were necessary.

Stage 1 restrictions were imposed in January 2003 as a result of the recent ongoing drought. The restrictions moved to Stage 2 in April 2006 and to Stage 4 in October 2006. Stage 4 restrictions remained in place until they were lifted in October 2009.

A summary of water restrictions since 1995 is provided in Table C5.

Table C4 Recent History of Restrictions

Date	System	Stage	Action
4/03/1995	Dunkeld[1]	2	Introduced
17/06/1995	Dunkeld [1]	2	Lifted
13/09/1997	Dunkeld[1]	1	Introduced
26/02/1998	Dunkeld[1]	2	Introduced
29/08/1998	Dunkeld[1]	3	Introduced
17/04/1999	Dunkeld	3	Lifted
5/02/2000	Hamilton	1	Introduced
11/03/2000	Hamilton	2	Introduced
21/09/2000	Hamilton	1	Reduced from Stage 2
14/10/2000	Hamilton	1	Lifted
27/01/2001	Hamilton	1	Introduced
10/03/2001	Hamilton	2	Introduced
8/09/2001	Hamilton	2 & 1	Lifted
18/01/2003	Balmoral	1	Introduced
21/01/2006	Hamilton	1	Introduced
01/04/2006	Hamilton, Balmoral	2	Introduced
14/10/2006	Balmoral	4	Introduced
4/11/2006	Hamilton	3	Introduced
5/12/2006	Hamilton	4	Introduced
3/11/2007	Hamilton	3	Reduced from Stage 4
04/10/2009	Balmoral	PWSR	Stage 4 Lifted – returned to PWSR
1/11/2009	Hamilton	2	Reduced from Stage 3
1/08/2010	Hamilton	PWSR	Stage 2 Lifted – returned to PWSR

1. Operated as an independent system prior to 1999.

C1.3 Drought Response Options

C1.3.1 Introduction

Response options in the Grampians System can be classified into two broad categories; demand management and supply enhancement. In this section of the Drought Response Plan, potential demand management and supply enhancement options for the Wannon Water are identified.

C1.3.2 Demand Reduction During Droughts

Summary of Options

There are a number of demand reduction options that can be employed during times of water shortage. A summary of demand reduction options is shown in Table C6 below.

Table C5 Summary of Demand Reduction Options

Option	Details	Comments
Community Education Programs	Water efficiency awareness (showerhead rebates, information brochures), linked to ongoing State Government programs. Estimated savings are of 2-5% of total demand over next 2 years.	Being progressively implemented by Wannon Water.
Voluntary Demand Reduction Measures	Self regulated water conservation measures aimed at increasing effectiveness of measures within the Permanent Water Saving Plan, and potential savings if water restrictions are implemented.	Water savings from this option are expected to exceed the savings already achieved from the Permanent Water Saving Plan.
WaterMAP	The Government has implemented a voluntary program for all non-residential customers (5ML/year or greater).	Wannon Water to promote this voluntary measure during periods of heightened awareness or during drought response operating modes.
Mandatory Water Restrictions	Option available under By-Law No. 5.	See Appendix B for requirements and prohibitions on water usage.
Compliance Officer/s	Additional resources may be required during extended periods of moderate to severe restrictions to monitor the performance of targeted water savings measures.	
Restrict Supply to Rural Customers	Possible under agreement only.	A restriction policy for rural customers requires further development.

Voluntary Demand Reduction Measures

Voluntary demand measures are an initial measure in the event of a drought. The importance of public awareness, understanding and involvement in meeting demand reduction objectives cannot be underestimated.

Wannon Water is committed to communicating effectively with its Grampians System customers to encourage take up of voluntary water saving measures and in turn deliver the best possible outcomes in demand reduction.

Supporting these voluntary water saving measures with initiatives including showerhead exchanges, trigger nozzles and other merchandise, Wannon Water aims to encourage its customer base to play an active role in managing their water supply and play their part in times of water shortages to ensure efficient use of their precious resource.

A broad base of local media (press and electronic) can be utilised to raise community awareness of system supply levels and encourage voluntary water saving measures.

Wannon Water will raise the profile of system levels and support the take-up of voluntary measures through extensive 'tips' and media coverage on its website, regular informative media releases, advertising, distributing publications with customer accounts and distributing information at community events throughout the service region. Wannon Water will also liaise with its Customer Engagement Committee where appropriate and consider holding community information sessions to raise awareness.

Publication of information including changes in water usage, rainfall levels, streamflows or bore performance details can assist in raising the profile of shortages and demand needs. Recent experience has shown that in combination, all of the above communication tools have been effective in heightened public awareness and consciousness of water efficiency measures, particularly over summer months.

As well as engaging the community in voluntary demand reduction measures Wannon Water can liaise with major consumption customers to work out strategies to reduce consumption. Major customers include the local shire, community groups, industrial and rural water users.

Mandatory Water Restrictions

The main purpose of water restrictions is to conserve dwindling supplies during drought periods.

Drought response triggers have been revised following augmentation of the system in 2010 with the completion of the pipeline from Rocklands Reservoir. The revised drought response triggers are related to the total volume of water available in the local Hamilton storages and water held by Wannon Water in the Available Bank Account from the Wimmera/Glenelg system.

The anticipated water savings for each level of restriction is shown in Table C7. These savings have been tested by comparing residential KL per connection over the period 2005/2006 to 2010/2011 for Hamilton against other towns not subject to water restrictions. The residential consumption rates shown in Table C7 provide guidance on the level of consumption which should be targeted to achieve the stated water savings.

Table B6 Anticipated Water Savings from Water Restrictions for the Hamilton System

Restriction Level	Estimated Water Saving			Target Residential Consumption Rate	
	% of Restrictable Demand[1]	Volume (ML)	% of Total Raw Water Use[2]	KL/ connection/ yr	L/ person/ day
PWSM				167	200
Stage 1	13% - 16%	30-35	2%	156	185
Stage 2	40% - 50%	90-110	5-6%	146	173
Stage 3	60% - 75%	130-160	8-9%	140	166
Stage 4	95% -100%	220	13%	130	154

1. Ranges adopted from VicWater, 2005.
2. Total raw water use inclusive of distribution, treatment and systems losses.

C1.3.3 Supply Augmentation Options During Drought

A summary of the short term supply augmentation options for the Grampians System is shown in Table C8 .

Table C7 Supply Augmentation Options During Drought

Option	Details	Available Supply / Notes
Groundwater Pumping	Headworks , Bullawin , Geerak and McCutcheons	• Pumps are remote from Hamilton and are powered using diesel motors and hence need checking on a daily basis. • Geerak bore cannot be used until emergency trigger levels (ie Stage 4 restrictions) are in place.
Dunkeld Storages	Accessing water from unused supplies held in Dunkeld storages	• 146 ML/yr (total). • Low reliability and variable water quality. • Possible emergency supply for Dunkeld.
Purchase Additional Water	Purchase additional allocation from Wimmera-Glenelg System	• Early warning of intent to trade may be necessary to ensure storage operator reserves water in Rocklands Reservoir.
Qualification of Rights	Apply to the Minister to increase surface and/or groundwater extractions beyond the conditions of the entitlements.	

Wannon Water is able to carry-over unused allocation in the Glenelg/Wimmera system from year to year. Water that is carried over is held in a spillable water account, which can accumulate from year to year. Water which is carried over is effectively stored in what would otherwise have been “air space” in the reservoir. However, this means that if the storages spill, then all water held in the spillable water account is lost.

For Wannon Water, carryover provides an effective method to mitigate the impacts of low allocation years which may occur in the Glenelg/Wimmera system. That is, when base allocations are low, Wannon Water may be able to call on water which has been carried over, to maintain minimum supply requirements.

C1.4 Drought Response Actions

System monitoring is undertaken to assess the status of the supply system according to one of the following three operational modes:

Mode 1 – General Monitoring

Mode 2 – Heightened Awareness

Mode 3 – Drought Response

C1.4.1 Mode 1 – General Monitoring (Pre-Drought Phase Activities)

The zone for the General Monitoring mode is defined by the system storage capacity as the upper bound and a trigger which is set just above the system operating curve, as the lower bound.

There are a number of important factors in pre drought monitoring and planning which will influence the decision to declare the system as being in the General Monitoring mode. These include:

- Storage contents, stream flows and bore performance data to monitor availability of supply;
- Climatic trends and seasonal outlooks as indicators of the possible onset of drought;
- Consumption trends to indicate changes in Customer's usage of water; and
- Forecasting storage behaviour over a 6-12 month period.

The Annual Water Outlook tool is used to monitor supply and demand side aspects of the system. During the General Monitoring mode, the system status is updated on a weekly basis and a report prepared weekly. A summary of the key system performance indicators for the Grampians Supply System which should be included in the Annual Water Outlook and System Status Report is provided in Table C9.

Table C8 Requirements for Annual Water Outlook and System Status Monitoring and Reporting

Item	Requirements
Rainfall, seasonal climate outlook	Information accessed from Bureau of Meteorology website.
State-wide status	Bureau of Meteorology and Department of Environment, Land, Water and Planning websites provide status reports on rainfall, streamflow, storage levels, groundwater and urban water restrictions across Victoria on a monthly basis.
System storage contents	Monitored at least weekly and recorded in an operational database. Data recorded for all towns.
Inflows from Headworks streams	Monitored at least weekly and recorded in an operational database. Data recorded for all towns.
Allocation Forecasts	Seeking updates on allocations within the Wimmera/Glenelg system and information on likely increases during low allocation periods.
Water levels in ground water supply systems are monitored at least monthly and are able to be compared against pump depths.	The frequency of monitoring should be increased to weekly or daily if a decline in water level raises concern on the security of the system.
System Demands (bulk meter consumption)	Monitored at least weekly and recorded in an operational database. Data recorded for all towns.

The trigger mechanism for actions is the total system resource volume, using the Drought Response Triggers shown in Appendix C2.

Forward look projections of storage response forms an integral part of the short term planning during a drought. Projections assist to anticipate the “likely” response based on current climatic conditions. At a minimum, Wannon Water makes projections over the next 3-12 months based on its experience in previous droughts. However, seasonal forecasting over three month, six month and 12 month periods, incorporating information from low-frequency climate signals such as the El Nino Southern Oscillation Index and sea surface temperatures, may also be useful in this assessment. System modelling tools such as REALM can also be utilised when undertaking forward look projections, as they can account for antecedent conditions such as soil moisture levels, and can translate rainfall and demand projections into changes in storage levels.

C1.4.2 Mode 2 – Heightened Awareness

The zone for the Heightened Awareness mode is designed to provide early warning of a pending water shortage. The Heightened Awareness mode is triggered following consideration of:

- Storage contents, stream flows and bore performance data to monitor availability of supply;
- Climatic trends and seasonal outlooks;
- Consumption trends to indicate changes in Customer's usage of water; and
- Forecasting storage behaviour over a 3-6 month period.

The key actions are summarised in Table C10 (in order of increasing impact from water shortages).

Table C9 Grampians System Action Plan for Mode 2 – Heightened Awareness

Action	Trigger	Response
Action 1	High likelihood that total storage contents cannot be maintained above the System Operating Curves	1. Reconvene the Drought Response Monitoring Committee
Action 2	Moderate to high likelihood that total storage contents cannot be maintained above the Level 1 Drought Response Trigger	2. Provide weekly updates of the System Status Report 3. Implement demand reduction options such as Community Education Programs, Voluntary Demand Reduction Measures via increased media,
Action 3	High likelihood that storage contents cannot be maintained above the Level 1 Drought Response Trigger	4. Alert public to the imminent water shortages and possible need for restrictions in the future. 5. Promote “voluntary restrictions” via media advertising campaigns to inform consumers about water conservation programs. 6. Declare operational mode as Mode 3 - Drought Response.

C1.4.3 Mode 3 - Drought Response

Mode 3 defines an active drought response period where supply and/or demand side measures are required to maintain supply security. Restriction rule curves are used to trigger an increase in the severity of the water shortage. Management actions during each level of restriction are summarised in Table C11.

Table C10 Grampians System Action Plan for Mode 3 – Drought Response

Action	Trigger	Response
Action 4	Total storage contents unable to be maintained above Level 1 Drought Response Trigger.	7. Consider implementation Stage 1 restrictions. 8. Monitor storage volume response and perform regular forward look storage projections. 9. Initiate an intensive advertising campaign and issue relevant leaflets.
Action 5	Total storage contents unable to be maintained above Level 2 Drought Response Trigger	10. Consider implementation Stage 2 restrictions, water patrols etc. 11. Monitor storage volume response and perform regular forward look storage projections. 12. Commence pumping from groundwater bores.
Action 6	Total storage contents unable to be maintained above Level 3 Drought Response Trigger	13. Consider implementation Stage 3 restrictions. 14. Monitor storage volume response and perform regular forward look storage projections. 15. Utilise Dunkeld resources 16. Implement preparatory steps for emergency action, including initial contact with water tanker contractors.
Action 7	Total storage contents unable to be maintained above Level 4 Drought Response Trigger (Emergency Level)	17. Consider implementation Stage 4 restrictions. 18. Monitor storage volume response and perform regular forward look storage projections.

C1.5 Post Drought Phase

Actions to be considered after a drought has occurred are summarised in Table C12. These include evaluating the appropriateness of the actions within each of the operational models and the associated triggers, the effectiveness of demand reduction and emergency supply augmentation options and the effectiveness of each level of restriction.

Table C11 Evaluate Operational Modes Trigger Levels and Associated Actions

Operational Mode	Action Sequence	Description	Assessment Procedure
General Monitoring	NA	Monitoring and evaluation	Were the indicators being used to monitor of system performance appropriate?
Heightened Awareness	Actions 1-6	Planning	Was there adequate time to undertake the activities detailed in Actions 1-3.
		Voluntary Demand Reduction	Was the community responsive? Was there a significant reduction in demand? Was the trigger level appropriate?
Drought Response	Actions 7-18	Water Restrictions	Was the expected reduction in demand achieved for each stage? Were the trigger levels appropriate? Were policing methods effective, if so, how?
		Groundwater pumping	Was groundwater effective at this stage or should it be started earlier? Was timing of groundwater input appropriate? Were pumps and equipment available? Was water quality acceptable to customers, particularly for industrial customers?
		Implement other emergency supply options	To what level was demand reduced? What was the cost and practicality of carting water if undertaken? Were individual emergency options implemented too late? Did other options arise; if so, what other options were available?

Table C13 summarises the assessment procedure for evaluating the impact of restrictions applied to customers, authority staff and supply systems. The intention is to learn from the methodologies that have been applied in order to minimise any future incidents of this nature.

Table C12 Evaluate the Impact of Restrictions

Stakeholders	Assessment Procedure
Domestic Users	Were the restrictions too severe? Was the right mix of media used to disseminate information? Was there enough warning of impending drought? If not, how could this be improved?
Environmental	Were flow triggers appropriate? What were the effects upon the aquifer and other users of pumping? What methods have been put into place to rectify any environmental effects?
Wannon Water Staff	Were many instances reported of restriction violations? Was it possible to effectively enforce the restriction policy? Was sufficient staff available to monitor system performance?
Supply Systems	Did restrictions achieve expected levels of water savings? Have supply systems been replenished? If so, how long did it take to achieve this level? What procedures were put in place to achieve this?

Table C14 summarises the assessment procedure for establishing the effectiveness of pumping groundwater to replenish the supply systems during drought.

Table C13 Evaluate Effectiveness of Groundwater Pumping

Action	Assessment Procedure
Evaluate effectiveness of ground water pumping	Did water quality problems occur? Should groundwater supplies have been introduced prior to where programmed in the Drought Response Plan? Did the volume of water extracted stay within the groundwater licence limit.

Part D
Glenthompson System Drought Response Plan

D1. Glenthompson Water Supply System

D1.1 Details of the Glenthompson Water Supply System

D1.1.1 System Description

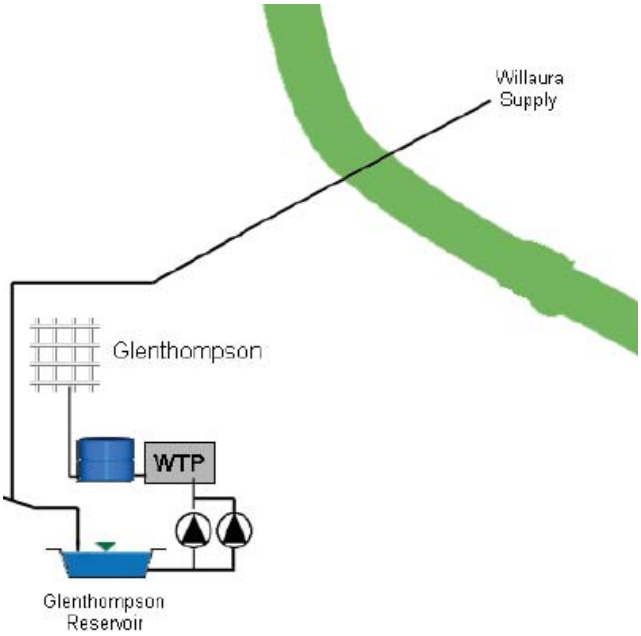
The Glenthompson Reservoir has a capacity of 110 ML, is located close to the township and has a small surface catchment. Infrastructure to harvest water from a nearby catchment (Railway Reservoir) was decommissioned in 2015 following cost-benefit analysis that identified its use did not substantially improve system security but required significant works. The Willaura pipeline is used to supply rural customers and supply the reservoir when it becomes low and draws water from Grampians Wimmera Mallee Water's Willaura system. The source for this is surface run-off from offtakes on Mount William Creek and Masons Creek in the Grampians National Park, supplemented by supply from a borefield on Mount William Creek. The borefield capacity was increased significantly to 1 ML/d in the Millennium drought.

An important feature of the system is that approximately half of the demand on the system is from the rural users along the Willaura pipeline, before the pipeline reaches the Glenthompson reservoir. These customers have similar access to water as Grampians Wimmera Mallee Water's (GWMW) rural customers on the upstream pipeline. However, due to the relatively high elevation of the Glenthompson storage and the associated hydraulics, Glenthompson storage is only supplied for limited periods requiring GWMW to isolate part of its system. Wannon Water liaises with GWMW in respect of the timing of delivery from the Willaura pipeline to Glenthompson Reservoir. The security of the town supply is heavily reliant on this delivery because the local catchment for Glenthompson reservoir does not produce runoff in dry years.

The Willaura System is managed by GWMW. The Glenthompson township and our pipeline customers only constitute a small proportion (15%) of the overall demand on the Willaura System.

A schematic of the proportion of the supply system managed by Wannon Water is shown in Figure D1. Connections for the rural properties are provided along the 24km pipeline.

Figure D1 Glenthompson Water Supply System



Water is treated and stored in a 0.15ML tank on elevated land adjacent to the reservoirs. Water is supplied to the town by gravity from this tank.

D1.1.2 System Demands and Consumption

The total demand represents the unrestricted water usage from the headworks, inclusive of system distribution losses. The current (2016) average annual demand for the system is adopted for long term planning purposes, including the development of Wannon Water's water restriction policies.

The estimated total average annual demand for the Glenthompson Water Supply System is 48 ML/year. The components of this demand are presented in Table D1.

Table D1 Components of the 2015/16 Average Annual Demand Estimate

Component	Total Demand (ML)	Base Demand (ML)	Restrictable Demand (ML)
Residential	8.7	7.0	1.7
Non Residential	1.2	1.0	0.2
Rural	25		-
Major	0		-
Public Open Space	0		-

Total Consumption	35	33	2
Nonrevenue Water	4		-
Bulk Usage (WTP Outflow+Pipeline customers)	39	37	2
WTP Losses	3		-
System losses (upstream of WTPs)	6		-
Total Raw Water Usage	48	46	2

D1.1.3 System Yield and Security of Supply

For the Glenthompson Water Supply System, the average annual demand that can be supplied at the adopted 95% annual reliability is close to current demand. Booster pumping of the pipeline from Willaura is being implemented in 2017 and is expected to secure this supply in the medium term.

D1.2 Drought Experience

During the 1982/1983 drought the Glenthompson Reservoir was full (110 ML) at the beginning of September, 1981, and did not receive any runoff for the period through to mid April, 1983, a period of 21 months. The storage was rapidly depleted and by 1 April, 1982, held only 17 ML. From that time until the drought ended the Glenthompson system was almost totally reliant on the Willaura pipeline. An estimated 3 ML was held in the storage just prior to the drought breaking.

Since 1995, restrictions have been implemented frequently as the reliability of inflows to the local storage has been low. Water restrictions were required continuously over the period 1995 to 2009, including a 12 month period of Stage 4 restrictions from October 2006. Whilst water restrictions only impacted the residential customers, demand from the rural customers taking raw water from the system was also lower as de-stocking occurred from 2007/2008 onwards.

Following customer concerns about the severity of the supply situation, exemptions were made under the Stage 4 restrictions allowing bucket watering of gardens. Restrictions were lifted in October 2009.

A summary of the restrictions since 1995 is provided in Table D3.

Table D2 Glenthompson System Recent History of Restrictions

Date	Stage	Action
18/02/1995	2	Introduced
17/06/1995	2	Lifted
17/01/1998	1	Introduced
11/07/1998	1	Lifted
12/09/1998	1	Introduced
12/12/1998	2	Introduced
21/09/2000	1	Reduced from Stage 2
14/10/2000	1	Lifted
12/11/2005	1	Introduced
01/04/2006	2	Introduced
14/10/2006	4	Introduced
3/11/2007	2	Reduced from Stage 4
4/10/2009	PWSR	Stage 2 Lifted – returned to PWSR

D1.3 Drought Response Options

D1.3.1 Introduction

There are two methods which can be applied in the event of a drought or water shortage, these being demand reduction and supply augmentation.

On the basis of the performance of existing systems during past droughts it is considered that demand management should form the first stage in this drought response program. Supply augmentation would be considered if this stage failed to achieve the response or if the severity of the drought necessitates it.

A condition of the Glenthompson bulk entitlement (subject to current application) will be the requirement to restrict urban demands in the system when GWMWater imposes water restrictions in their supply systems which source water from the Willaura system or reduce the maximum daily rate of taking water from the Willaura headworks to a rate agreed to by GWMWater.

Options for both these measures are detailed below.

D1.3.2 Demand Reduction During Droughts

There are a number of demand reduction options that can be employed during times of water shortage. A summary of demand reduction options is shown in Table D4.

Table D3 Summary of Demand Reduction Options

Option	Details	Comments
Community Education Programs	Water efficiency awareness (showerhead rebates, information brochures), linked to ongoing State Government programs. Estimated savings are of 2-5% of total demand over next 2 years.	Being progressively implemented by Wannon Water.
Voluntary Demand Reduction Measures	Self regulated water conservation measures aimed at increasing effectiveness of measures within the Permanent Water Saving Plan, and potential savings if water restrictions are implemented.	Water savings from this option are expected to exceed the savings already achieved from the Permanent Water Saving Plan.
Mandatory Water Restrictions	Option available under By-Law No. 5.	See Appendix B for requirements and prohibitions on water usage.
Compliance Officer/s	Additional resources may be required during extended periods of moderate to severe restrictions to monitor the performance of targeted water savings measures.	
Restrict Supply to Rural Customers	Possible under agreement only.	A restriction policy for rural customers requires further development.

Monitoring of the Glenthompson system is important due to reliance on surface supplies and limited access to supplementary sources. Accordingly, demand reduction forms the basis of the Drought Response Plan for Glenthompson and needs to be implemented early to be effective.

As with the Grampians System, it is proposed that the first phase of demand reduction should involve a request to the consumers for voluntary reduction in water usage.

Half of Glenthompson's demand is from supply-by-agreement rural users on the pipeline from Willaura. If supply from the Willaura system failed, supply to these users would not be guaranteed. For the Glenthompson township, voluntary and mandatory restrictions combined with community education programs would be the main tools used to manage demand.

The anticipated water savings for each level of restriction is shown in Table D5. These savings have been tested by comparing residential KL per connection over the period 2005/2006 to 2010/2011 for Hamilton against other towns not subject to water restrictions. The residential consumption rates shown in Table D5 provide guidance on the level of consumption which should be targeted to achieve the stated water savings.

Table D5 Anticipated Water Savings from Water Restrictions for Glenthompson

Restriction Level	Estimated Water Saving			Target Residential Consumption Rate	
	% of Restrictable Demand[1]	Volume (ML)	% of Total Raw Water Use[2]	KL/ connection/ yr	L/ person/ day
PWSM				167	200
Stage 1	13% - 16%	0.3	1%	156	185
Stage 2	40% - 50%	1	3%	146	173
Stage 3	60% - 75%	1.5	4%	140	166
Stage 4	95% -100%	2	6%	130	154

1. Ranges adopted from VicWater, 2005.
2. Total raw water use inclusive of distribution, treatment and headworks losses.

D1.3.3 Supply Augmentation Options During Drought

A summary of the range of short-term supply augmentation options for Glenthompson is shown in Table D6.

Table D6 Supply Augmentation Options During Drought

Option	Details	Available Supply
Existing Groundwater Bores	Willaura System bores operated by GWMWater.	Delivered via the Willaura pipeline, this resource is managed by GWMWater.
Water Cartage	From Dunkeld, Mortlake or Penshurst.	

D1.4 Drought Response Actions

System monitoring is undertaken to assess the status of the supply system according to one of the following three operational modes:

Mode 1 – General Monitoring

Mode 2 – Heightened Awareness

Mode 3 – Drought Response

The trigger mechanism for actions is the storage volume in Glenthompson Reservoir, using the Drought Response Triggers shown in Appendix C3.

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D1.4.1 Mode 1 – General Monitoring (Pre-Drought Phase Activities)

The zone for the General Monitoring mode is defined by the system storage capacity as the upper bound and a trigger which is set just above the system operating curve, as the lower bound.

There are a number of important factors in pre drought monitoring and planning which will influence the decision to declare the system as being in the General Monitoring mode. These include:

- Storage contents, stream flows and bore performance data to monitor availability of supply;
- Climatic trends and seasonal outlooks as indicators of the possible onset of drought;
- Consumption trends to indicate changes in Customer's usage of water;
- Forecasting storage behaviour over a 6-12 month period;
- Regular consultation with GWMWater regarding the supply status for the Willaura System.

The Annual Water Outlook tool is used to monitor supply and demand side aspects of the system. During the General Monitoring mode, the system status is updated on a weekly basis and a report prepared weekly. A summary of the key system performance indicators for the Glenthompson Supply System which should be included in the Annual Water Outlook and System Status Report is provided in Table D7.

Table D7 Requirements for Annual Water Outlook and System Status Monitoring and Reporting

Item	Requirements
Rainfall, seasonal climate outlook	Information accessed from Bureau of Meteorology website.
State-wide status	Bureau of Meteorology and Department of Environment, Land, Water and Planning websites provide status reports on rainfall, streamflow, storage levels, groundwater and urban water restrictions across Victoria on a monthly basis.
System storage contents	Monitored at least weekly and recorded in an operational database. Data recorded for all towns.
Inflows Willaura System	Monitored by GWMWater.
Water levels in ground water supply systems are monitored at least monthly and are able to be compared against pump depths.	The frequency of monitoring should be increased to weekly or daily if a decline in water level raises concern on the security of the system.
System Demands (bulk meter consumption)	Monitored at least weekly and recorded in an operational database. Data recorded for all towns.

D1.4.2 Mode 2 – Heightened Awareness

The zone for the Heightened Awareness mode is designed to provide early warning of a pending water shortage. The Heightened Awareness mode is triggered following consideration of:

- Storage contents, stream flows and bore performance data to monitor availability of supply;
- Climatic trends and seasonal outlooks;
- Consumption trends to indicate changes in customer's usage of water; and
- Forecasting storage behaviour over a 3-6 month period.

The key actions are summarised in Table D8 (in order of increasing impact from water shortages).

Table D8 Glenthompson System Action Plan for Mode 2 – Heightened Awareness

Action	Trigger	Response
Action 1	High likelihood that total storage contents cannot be maintained above the System Operating Curves	1. Reconvene the Drought Response Monitoring Committee
Action 2	Moderate to high likelihood that total storage contents cannot be maintained above the Level 1 Drought Response Trigger	2. Provide weekly updates of the System Status Report 3. Implement demand reduction options such as Community Education Programs, Voluntary Demand Reduction Measures via increased media advertising,
Action 3	High likelihood that storage contents cannot be maintained above the Level 1 Drought Response Trigger	4. Alert public to the imminent water shortages and possible need for restrictions in the future. 5. Promote “voluntary restrictions” via media advertising campaigns to inform consumers about water conservation programs. 6. Declare operational mode as Mode 3 - Drought Response.

D1.4.3 Mode 3 - Drought Response

Mode 3 defines an active drought response period where supply and/or demand side measures are required to maintain supply security. Restriction rule curves are used to trigger an increase in the severity of the water shortage. Management actions during each level of restriction are summarised in Table D9.

Table D9 Glenthompson System Action Plan for Mode 3 – Drought Response

Action	Trigger	Response
Action 4	Total storage contents unable to be maintained above Level 1 Drought Response Trigger.	7. Consider implementation Stage 1 restrictions. 8. Monitor storage volume response and perform regular forward look storage projections. 9. Initiate an intensive advertising campaign and issue relevant leaflets.
Action 5	Total storage contents unable to be maintained above Level 2 Drought Response Trigger	10. Consider implementation Stage 2 restrictions, water patrols etc. 11. Monitor storage volume response and perform regular forward look storage projections.
Action 6	Total storage contents unable to be maintained above Level 3 Drought Response Trigger	12. Consider implementation Stage 3 restrictions. 13. Monitor storage volume response and perform regular forward look storage projections. 14. Implement preparatory steps for emergency action, including initial contact with water tanker contractors.
Action 7	Total storage contents unable to be maintained above Level 4 Drought Response Trigger (Emergency Level)	15. Consider implementation Stage 4 restrictions. 16. Monitor storage volume response and perform regular forward look storage projections. 17. Tanker water to Glenthompson

D1.5 Post Drought Phase

Actions to be considered after a drought has occurred are summarised in Table D10. These include evaluating the appropriateness of the actions within each of the operational models and the associated triggers, the effectiveness of demand reduction and emergency supply augmentation options and the effectiveness of each level of restriction.

Table D10 Evaluate Operational Modes Trigger Levels and Associated Actions

Operational Mode	Action Sequence	Description	Assessment Procedure
General Monitoring	NA	Monitoring and evaluation	Were the indicators being used to monitor of system performance appropriate?
Heightened Awareness	Actions 1-6	Planning	Was there adequate time to undertake the activities detailed in Actions 1-3.
		Voluntary Demand Reduction	Was the community responsive? Was there a significant reduction in demand? Was the trigger level appropriate?
Drought Response	Actions 7-17	Water Restrictions	Was the expected reduction in demand achieved for each stage? Were the trigger levels appropriate? Were policing methods effective, if so, how?
		Implement other emergency supply options	To what level was demand reduced? What was the cost and practicality of carting water if undertaken? Were individual emergency options implemented too late? Did other options arise; if so, what other options were available?

Table D11 summarises the assessment procedure for evaluating the impact of restrictions applied to customers, authority staff and supply systems. The intention is to learn from the methodologies that have been applied in order to minimise any future incidents of this nature.

Table D11 Evaluate the Impact of Restrictions

Stakeholders	Assessment Procedure
Domestic Users	Were the restrictions too severe? Was the right mix of media used to disseminate information? Was there enough warning of impending drought? If not, how could this be improved?
Rural Customers	What was the rural customers' reaction to restrictions?
Environmental	Were flow triggers appropriate? Should environmental flows be reassessed? What were the effects upon the aquifer and other users of pumping? What methods have been put into place to rectify any environmental effects?
Wannon Water Staff	Were many instances reported of restriction violations? Was it possible to effectively enforce the restriction policy? Were sufficient staff available to monitor system performance?
Supply Systems	Did restrictions achieve expected levels of water savings? Have supply systems been replenished? If so, how long did it take to achieve this level? What procedures were put in place to achieve this?

Part E

Groundwater Systems Drought Response Plan

E1. Groundwater Supply Systems

E1.1 Details of Groundwater Supply Systems

E1.1.1 System Descriptions

Wannon Water manages 10 water supply systems that use groundwater as the primary source of water. Whilst most of these systems typically supply one township, two have been set up to supply multiple townships via a piped distribution network. There are also distinct hydrogeologic regions which water is extracted from to supply these towns, these being from either shallower groundwater sources or from a deeper groundwater resource referred to as the Dilwyn Aquifer. The towns supplied from groundwater resources are shown in Tables E1 and E2.

Table E1 Shallow Groundwater Supply Systems

System	Towns Supplied and Other Users	Sources of Supply	Entitlements (ML)
Tullich	Casterton, Sandford, Merino, Coleraine	4 bores west of Casterton Konongwootong Reservoir[1]	1000
Penshurst	Penshurst	2 bores	250
Caramut	Caramut	2 bores	50
Darlington	Darlington	2 bores	10

Note 1 Kept as an emergency backup supply for the Tullich System

Table E2 Deep Groundwater Supply Systems

System	Towns Supplied and Other Users	Sources of Supply	Entitlements (ML)
Dartmoor	Dartmoor	1 bore	170
Heywood	Heywood	2 bores	333
Portland	Portland	3 bores	6222
Port Fairy	Port Fairy	2 bores	1026
Port Campbell	Port Campbell, Peterborough, Timboon	1 bore	1009
Macarthur	Macarthur	1 bore	130

Further details for each of the supply systems are provided in the following sections.

E1.1.2 Shallow Groundwater Systems

Tullich Groundwater System

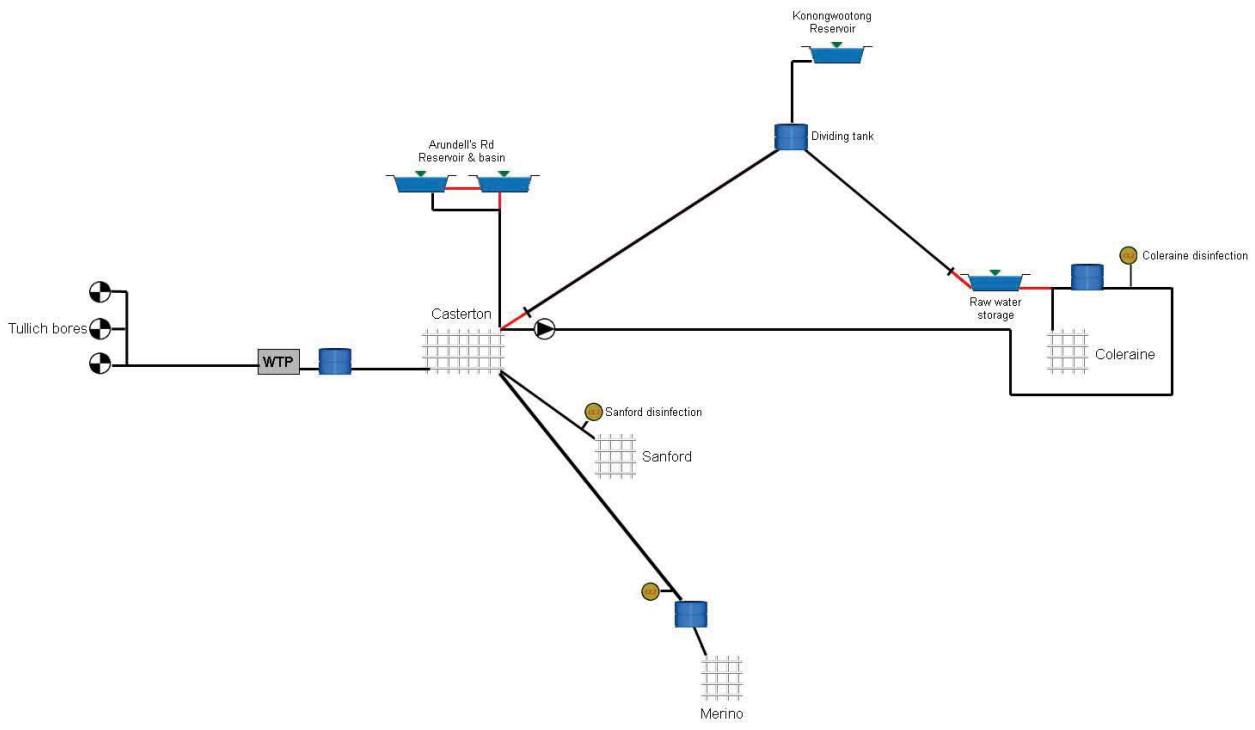
The Tullich Borefield consists of four production bores all of which are equipped. There are also two observation bores. Two production bores were constructed in 1989 and the other two in 2004. The observation bores were constructed in 2004.

Water from the Tullich Borefield is pumped to the treatment plant which is located on the western side of Casterton. The treated water is then fed into the Casterton, Coleraine, Sandford and Merino systems.

Merino was previously supplied with groundwater from the Mocamboro borefield but has been supplied from Casterton since December 2005. Water is pumped via a 14 km, 100 mm diameter rising main from Casterton via Sandford to the Merino service basin.

Coleraine has been supplied from the Tullich system since 2009.

Figure E1 Tullich Groundwater System

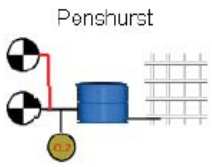


Penshurst Groundwater System

This water supply system consists of a main production bore located on the flanks of Mount Rouse adjacent to two service basins to the south of the township. The service basins have a combined capacity of 2 ML and act as a balancing storage.

A second emergency bore is located adjacent to the Hawkesdale Road to the south of the township and can be connected into the feeder main that supplies the town from the main Mount Rouse production bore.

Figure E2 Penshurst Groundwater System



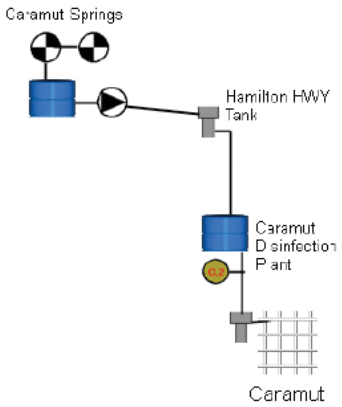
Caramut Groundwater System

The original supply to this small rural community was sourced from spring water which was collected in a small concrete basin and then pumped 11 km to a 45 kL elevated tank. Overflow from the elevated tank was then piped into an adjacent 15.5 ML service basin. Water then gravitated through a further 8.5 km of pipeline to a 45 kL elevated tank supplying the township.

In 1999 a 0.6 ML concrete tank was constructed adjacent to the service basin and the basin was taken out of service. The spring is no longer in use and two production bores have been installed at the spring site.

The transfer pump from the bores to the Caramut Tank has a design capacity of 30 000 L/hour.

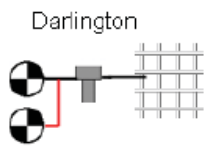
Figure E3 Caramut Groundwater System



Darlington Groundwater System

Two bores at Darlington provide a non potable water supply to 21 customers. The bores are both shallow (less than 40 m deep) and located adjacent to the Darlington CFA station. Construction of both bores is poorly understood. The newer of the two bores (58343) is used preferentially, and the second bore is retained as an emergency backup.

Figure E4 Darlington Groundwater System



E1.1.3 Deep Groundwater Systems

Portland, Heywood, Port Fairy & Dartmoor Groundwater Systems

Deep bores extracting water from the Dilwyn Aquifer provide 100% of water supply for the towns of Portland, Heywood, Dartmoor and Port Fairy. The bore characteristics for the four towns are shown in Table E3.

Table E3 Bore Details for Portland, Heywood, Dartmoor and Port Fairy

Location	Depth (m)	Year Installed	Storage Available
Portland			
Bald Hill 3	1242	2008	36 ML Basin
Bald Hill 4	1241	2008	
Wyatt Street	1400	2016	4.5 ML Basin
Heywood			
No. 4	494	2004	4.5 ML Basin
No. 5	503	2016	0.3 ML Tower
Dartmoor			
No. 1	104	2004	0.4 ML Tower
Port Fairy			
No. 3	786	2001	2.27 ML Tower
No. 4	771	2004	

Figure E5 Portland Groundwater System

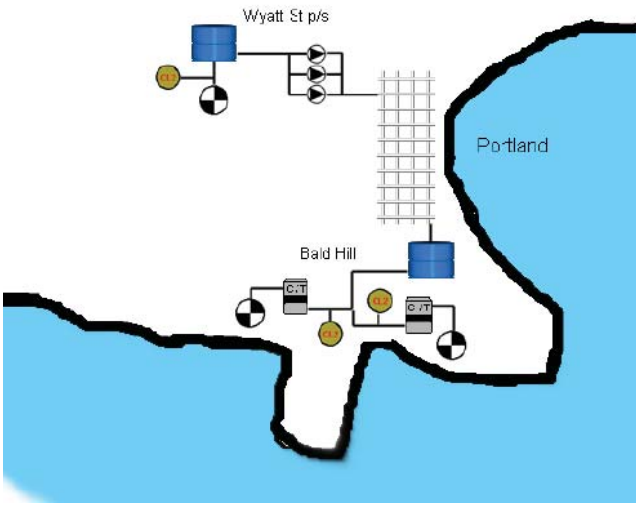


Figure E6 Port Fairy Groundwater System

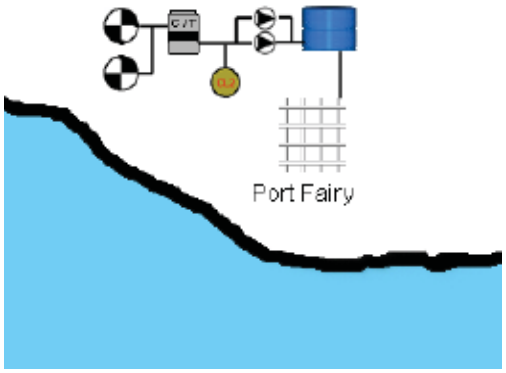


Figure E7 Heywood Groundwater System

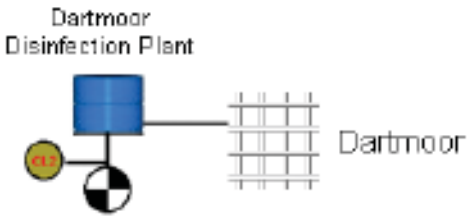
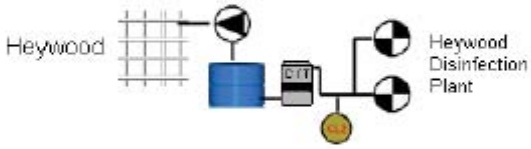


Figure E8 Dartmoor Groundwater System



Port Campbell Groundwater Systems

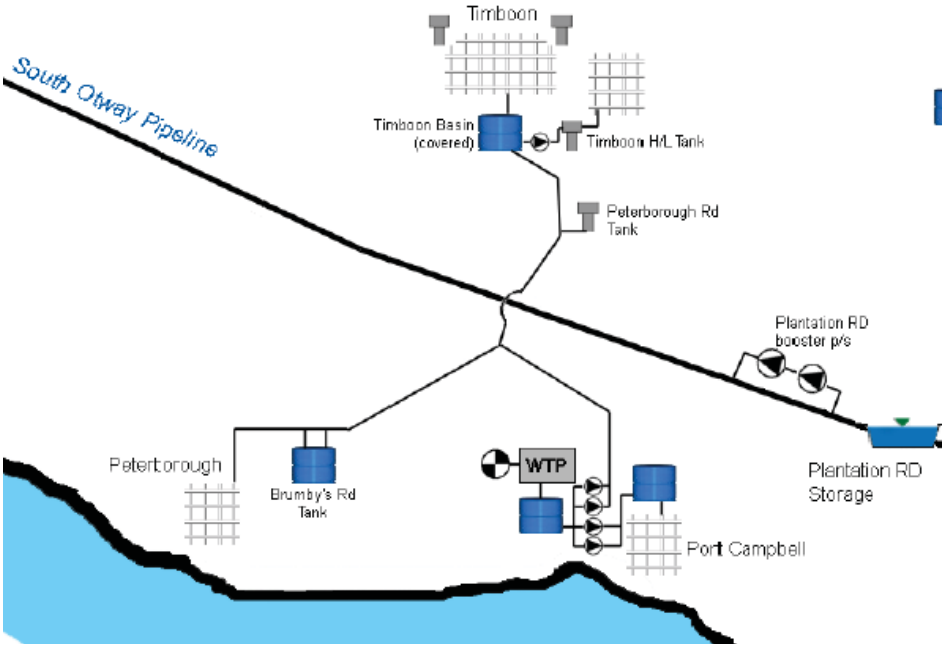
The townships of Port Campbell, Timboon and Peterborough are supplied from an artesian bore harvesting water from the Port Campbell sub formation of the Dilwyn aquifer.

The supply bore was constructed at Port Campbell in 1998, originally supplying only Port Campbell and Timboon. The bore is 520 metres deep, has a small artesian flow and can be pumped at rates up to 40 litres/sec. Following the completion of a new supply system Peterborough was connected to the Port Campbell bore in December 1998.

Storage within this supply system includes a service basin, three ground level tanks, an elevated tank and several water towers

Demand for water at Port Campbell and Peterborough varies seasonally due to the high tourist population during summer. Some 40 rural users also draw water direct from the rising main supplying Peterborough and Timboon.

Figure E9 Port Campbell Groundwater System

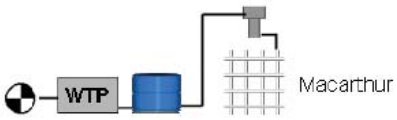


Macarthur Groundwater System

The Macarthur water supply system was commissioned in 1994 and is supplied with groundwater from one production bore, referred to as Macarthur No.1, which is located approximately 1 km to the north of the township.

Water from the bore is pumped to a treatment plant and then stored in a 500 kL clear water storage tank prior to being gravity fed to the township.

Figure E10 Macarthur Groundwater System



E1.1.4 System Demand

Table E4 shows demand in 2015/2016 for each of the Groundwater systems.

Components of the Current (2016) Annual Demand - Portland	
Component	Total Demand (ML)
Residential	**720**
Non Residential	**230**
Rural	**2**
Major	**385**
Public Open Space	**90**
Total Consumption	1,427
Nonrevenue Water	**295**
Bulk Usage (WTP Outflow)	**1,722**
WTP Losses	**157**
Total Raw Water Usage	1,879
Components of the Current (2016) Annual Demand - Port Fairy	

Component	Total Demand (ML)
Residential	**270**
Non Residential	**115**
Rural	**0.2**
Major	**155**
Public Open Space	**10**
Total Consumption	550
Nonrevenue Water	**66**
Bulk Usage (WTP Outflow)	**616**
WTP Losses	**48**
Total Raw Water Usage	664
Components of the Current (2016) Annual Demand - Tullich System	
Component	Total Demand (ML)
Residential	**195**
Non Residential	**70**
Rural	**90**
Major	**0**
Public Open Space	**10**
Total Consumption	365
Nonrevenue Water	**82**
Bulk Usage (WTP Outflow)	**447**
WTP Losses	**0**
Total Raw Water Usage	447
Components of the Current (2016) Annual Demand - Pt Campbell System	

Component	Total Demand (ML)
Residential	**110**
Non Residential	**80**
Rural	**90**
Major	**0**
Public Open Space	**5**
Total Consumption	285
Nonrevenue Water	**38**
Bulk Usage (WTP Outflow)	**323**
WTP Losses	**44**
Total Raw Water Usage	366
Components of the Current (2016) Annual Demand - Heywood	
Component	Total Demand (ML)
Residential	**92**
Non Residential	**28**
Rural	**3**
Major	**0**
Public Open Space	**1**
Total Consumption	124
Nonrevenue Water	**19**
Bulk Usage (WTP Outflow)	**143**
WTP Losses	**11**
Total Raw Water Usage	153
Components of the Current (2016) Annual Demand - Dartmoor	

Component	Total Demand (ML)
Residential	**13**
Non Residential	**2.0**
Rural	**0**
Major	**0**
Public Open Space	**0**
Total Consumption	15
Nonrevenue Water	**6**
Bulk Usage (WTP Outflow)	**21**
WTP Losses	**0**
Total Raw Water Usage	22
Components of the Current (2016) Annual Demand - Penshurst	
Component	Total Demand (ML)
Residential	**41**
Non Residential	**12**
Rural	**0**
Major	**0**
Public Open Space	**3**
Total Consumption	56
Nonrevenue Water	**36**
Bulk Usage (WTP Outflow)	**92**
WTP Losses	**1**
Total Raw Water Usage	94
Components of the Current (2016) Annual Demand - Caramut	

Component	Total Demand (ML)
Residential	**7**
Non Residential	**4**
Rural	**7**
Major	**0**
Public Open Space	**2**
Total Consumption	20
Nonrevenue Water	**4**
Bulk Usage (WTP Outflow)	**24**
WTP Losses	**7**
Total Raw Water Usage	31
Components of the Current (2016) Annual Demand - Darlington	
Component	Total Demand (ML)
Residential	**3**
Non Residential	**1**
Rural	**0**
Major	**0**
Public Open Space	**0.2**
Total Consumption	4
Nonrevenue Water	**0.4**
Bulk Usage (WTP Outflow)	**4.2**
WTP Losses	**0.2**
Total Raw Water Usage	4.4
Components of the Current (2016) Annual Demand - Macarthur	

Component	Total Demand (ML)
Residential	**13**
Non Residential	**3**
Rural	**1**
Major	**0**
Public Open Space	**0.6**
Total Consumption	18
Nonrevenue Water	**3**
Bulk Usage (WTP Outflow)	**21**
WTP Losses	**3**
Total Raw Water Usage	24

E1.1.5 System Yields and Security of Supply

For the systems supplied from groundwater, the yield of the system is assumed to be equivalent to the current licensed volume (or entitlement). This yield estimate is currently not linked to reliability measures such as the frequency of restrictions. The adopted yield for each groundwater supplied system is summarised in Table E5.

Table E4 Estimated System Yield for Groundwater Systems

	Yield (ML/a)
Shallow Groundwater System	
Tullich	1,000
Penshurst	100
Caramut	50
Darlington	10
Deep Groundwater Systems	
West Dilwyn	
Dartmoor	170
Heywood	333
Portland	6,222
Port Fairy	1,026
East Dilwyn	
Port Campbell	1,009
Other	
Macarthur	130

The yield in all groundwater systems exceeds estimated demand.

Analysis has shown that all groundwater systems are currently reliable at the current level of development and are quite resilient to the impacts from climate change. The shallow groundwater systems have also been shown to be highly reliable at the full licence volume level of development. There is uncertainty about the reliability of the deeper groundwater systems at levels of demand which are higher than present.

E1.2 Drought Experience

Records indicate that all towns supplied by groundwater have not had water supply concerns as a result of drought, except for Caramut and Merino. Since 2006, water restrictions have not been required for any of Wannon Water's towns that are supplied with groundwater. Coleraine had Stage 1 restrictions in force from December 2006 to June 2007 while still supplied from the Konongwootong Reservoir water supply system.

Caramut

The Caramut water supply system was constructed in 1977. The spring supply proved to be totally inadequate during a drought. Severe water restrictions were imposed during 1982 and maintained until the drought broke in April 1983.

A bore was constructed adjacent to the spring in 1983 and a second bore was drilled in 1999. Whilst the spring ceased to flow over the summer of 2000 the bores maintained supply within acceptable drawdown limits. No water restrictions at Caramut have been required since 1983.

Merino

The Merino system was constructed during 1976 and so did not experience the 1967/1968 drought.

During the 1982/1983 drought restrictions were applied during January 1983 and remained in force until the end of the drought. With these in place the Merino system adequately catered for demand and had reasonable reserves at the end of the drought. It is noted that there was considerable demand for water from the Merino standpipe by people from outside the waterworks district.

In 2005 Merino was connected to the Casterton system and the Merino bores (Mocamboro borefield) were taken off-line.

Casterton, Coleraine and Sandford

The Konongwootong Reservoir did not receive any run-off during the winter of 1967 and accordingly the storage level was low. Restrictions were applied in September of 1967 for both Casterton and Coleraine and all of the rural consumers along the supply lines. The restrictions were up-graded in October 1967 to severe levels which banned the use of hoses. At the same time a series of investigations were commenced on alternative sources of supply.

In January of 1968 preliminary arrangements were made to facilitate pumping of water from the Konongwootong Reservoir from below the outlet level and these were subsequently implemented.

Restrictions were lifted in May of 1968 at the end of the drought.

The Tullich Borefield was identified as a supplementary water source for Casterton and brought on line in 1969 after the drought ended.

During the 1982/1983 drought the Tullich Borefield was used to provide as much water as possible for the Casterton Supply. As water levels at Konongwootong were somewhat higher at the end of the 1982 winter than they had been in 1967 and with the dual benefit of the Tullich supply and restrictions, the system catered for demands with the Konongwootong Reservoir dropping to a low of 3.4 m just prior to the end of the drought.

Restrictions were applied in early January of 1983 and remained in place until the end of the drought.

Some problems have been experienced at Tullich due to pumpset failures and diminished output from the bores. The bore problems were associated with clogging of the screens and not reduced output from the aquifer. This resulted in the construction of two new bores with improved construction materials in 1989.

For Casterton, Sandford and Coleraine Stage 1 restrictions were imposed in February 2000 and lifted in October 2000. Also Stage 1 restrictions were imposed in January 2001 and lifted in September 2001.

Coleraine, Sandford and two-thirds of Casterton were supplied from Konongwootong until March 2004 requiring the restrictions in 2000 and 2001.

A third and forth production bore were constructed in 2005, however only one of the new bores (Bore No.4) was equipped. In 2010, the remaining bore (Bore No.3) was equipped. . The expanded Tullich borefield has successfully supplied Casterton, Sandford and Merino since 2005. Stage 1 restrictions were introduced on 16 December 2006 and remained for approximately 6 months until they were removed on 9 July 2007.

A pipeline was constructed from Casterton to Coleraine with Coleraine being supplied from the Tullich system from 2009.

The Konongwootong Reservoir is maintained as the supply for rural customers and as an emergency supply for the Tullich system.

E1.3 Drought Response Options

E1.3.1 Introduction

For the shallower groundwater systems, reducing the extraction rate (through the implementation of restrictions) may have an impact on the rate of drawdown of the resource, however in most circumstances, the pressures placed on the resource by other groundwater users and a lack of recharge (considered in a more regional context), may be having a greater influence on drawdown.

Preceding climatic conditions will be the major factor associated with the decline in the resource, and therefore alternative supply arrangements should be considered as the primary method for responding to short term water shortages.

For deeper groundwater systems, resource drawdown is influenced by events which have significant lead times, and response to drought conditions is often suppressed by these lag times. Therefore, reducing demand in unlikely to be an effective method of mitigating supply shortfalls. Furthermore, bores tapping the deeper groundwater systems, e.g., Lower Tertiary Aquifer, have a greater capacity to accommodate deepening of pumps to ensure continued extraction.

Further details on demand and supply side options during drought are provided in the following tables.

E1.3.2 Demand Reduction During Droughts

There are a number of demand reduction options that can be employed during times of water shortage. A summary of demand reduction options is shown in Table E6.

Table E5 Summary of Demand Reduction Options

Option	Details	Comments
Community Education Programs	Water efficiency awareness (showerhead rebates, information brochures), linked to ongoing State Government programs. Estimated savings are of 2-5% of total demand over next 2 years.	Being progressively implemented by Wannon Water.
Voluntary Demand Reduction Measures	Self regulated water conservation measures aimed at increasing effectiveness of measures within the Permanent Water Saving Plan, and potential savings if water restrictions are implemented.	Water savings from this option are expected to exceed the savings already achieved from the Permanent Water Saving Plan.
Mandatory Water Restrictions	Option available under By-Law No. 5.	See Appendix B for requirements and prohibitions on water usage.
Compliance Officer/s	Additional resources may be required during extended periods of moderate to severe restrictions to monitor the performance of targeted water savings measures.	
Restrict Supply to Rural Customers	Possible under agreement only.	A restriction policy for rural customers requires further development.

E1.3.3 Supply Augmentation Options During Drought

A summary of the range of short-term supply augmentation options for (shallow) groundwater systems is shown in Table E7.

Table E6 Supply Augmentation Options During Drought

Option	Details	Available Supply
Water Cartage	Cartage from adjacent system where surplus exists.	Available as either raw water or potable water. Supplied under Stage 4 restrictions to reduce supply volume.
Construct Emergency bores	Reduce demand pressure on existing bores	Lead times may be significant.

E1.4 Drought Response Actions

System monitoring is undertaken to assess the status of the supply system according to one of the following three operational modes:

Mode 1 – General Monitoring

Mode 2 – Heightened Awareness

Mode 3 – Drought Response

E1.4.1 Mode 1 – General Monitoring (Pre-Drought Phase Activities)

The zone for the General Monitoring mode is defined by the groundwater level as the upper bound and a trigger which is set above pump level, as the lower bound.

There are a number of important factors in pre drought monitoring and planning which will influence the decision to declare the system as being in the General Monitoring mode. These include:

- Short and longer term trends in the groundwater level;
- Climatic trends and seasonal outlooks as indicators of the possible onset of drought;
- Consumption trends to indicate changes in customer's usage of water; and
- Forecasting groundwater levels over a 6-12 month period.

The Annual Water Outlook tool is used to monitor supply and demand side aspects of the system. During the General Monitoring mode, the system status is updated on a weekly basis and a report prepared weekly. A summary of the key system performance indicators for all groundwater systems which should be included in the Annual Water Outlook and System Status Report is provided in Table E8.

Table E7 Requirements for Annual Water Outlook and System Status Monitoring and Reporting

Item	Requirements
Rainfall, seasonal climate outlook	Information accessed from Bureau of Meteorology website.
State-wide status	Bureau of Meteorology and Department of Environment, Land, Water and Planning websites provide status reports on rainfall, streamflow, storage levels, groundwater and urban water restrictions across Victoria on a monthly basis. Review of observation bore data (remote from borefield) for seasonal trends. Review of Groundwater Management Area monitoring documents prepared by Southern Rural Water to assess monitoring trends and use trends.
Water levels in ground water supply systems are monitored at least monthly and are able to be compared against pump depths[1].	The frequency of monitoring should be increased to weekly or daily if a decline in water level raises concern on the security of the system.
System Demands (bulk meter consumption)	Monitored at least weekly and recorded in an operational database. Data recorded for all towns.

Note: 1. Enables determination of available drawdown, i.e. the amount of water above the pump intake

E1.4.2 Mode 2 – Heightened Awareness

The zone for the Heightened Awareness mode is designed to provide early warning of a pending water shortage. The Heightened Awareness mode is triggered following consideration of:

- Short term trend in the groundwater level;
- Climatic trends and seasonal outlooks;
- Consumption trends to indicate changes in Customer's usage of water; and
- Forecasting groundwater levels over a 3-6 month period.

The key actions are summarised in Table E9 (in order of increasing impact from water shortages).

Table E8 Groundwater Systems Action Plan for Mode 2 – Heightened Awareness

Action	Trigger	Response
Action 1	Moderate likelihood that groundwater levels will fall below the Mode 3 Trigger	1. Provide weekly updates of the System Status Report 2. Implement demand reduction options such as Community Education Programs, Voluntary Demand Reduction Measures via increased media advertising,
Action 2	High likelihood that groundwater levels will fall below the Mode 3 Trigger	3. Alert public to the imminent water shortages and possible need for restrictions in the future. 4. Promote “voluntary restrictions” via media advertising campaigns to inform consumers about water conservation programs. 5. Develop contingency plans for alternative supplies if water levels were to fall below pump levels. 6. Declare operational mode as Mode 3 - Drought Response.

E1.4.3 Mode 3 - Drought Response

Mode 3 defines an active drought response period where supply and/or demand side measures are required to maintain supply security. Water restrictions may be used to reduce demand to reduce the requirements from alternative supplies. Management actions for consideration during Mode 3 are summarised in Table E10.

Table E9 Groundwater Systems Action Plan for Mode 3 – Drought Response

Action	Trigger	Response
Action 3	Moderate likelihood that groundwater levels will fall below the pump level	7. Consider implementation of mild restrictions such as Stage 2, as preparedness for making alternative supply arrangements; 8. Progress contingency plans for alternative supplies to an implementation ready status, including obtaining any necessary permits or approvals. 9. Monitor bore condition and water quality. 10. Review and maximise pump depth setting' or if such capacity exists, install additional pump rising main and switch to hi-lift pump
Action 4	High likelihood that groundwater levels will fall below the pump level	11. Monitor groundwater levels and perform regular forward look storage projections. 12. Consider implementation Stage 3 restrictions, as preparedness for making alternative supply arrangements; 13. Communicate to customers the potential future impacts to supply their arrangements; 14. Implement contingency plans for alternative supplies.
Action 5	Groundwater levels fall below the pump level	15. Implementation Stage 4 water restrictions. 16. Communicate to customers the altered supply arrangements; 17. Commence alternative supplies. 18. Commence tankering water where required

Note that when there is a likelihood of water levels approaching pump intakes, there is an increased likelihood of damage to the pumps and possibly the bore i.e. increased maintenance, and water quality issues

It is therefore appropriate to continually review and maximise pump depth setting' or if such capacity exists, install additional pump rising main and switch to hi-lift pump. Permanently setting pumps at too great a depth results in higher operational costs outside of the drought periods.

E1.4.4 Drought Response Triggers

Shallow Groundwater Systems

The shallow groundwater systems developed by Wannon Water are mostly unconfined to semi-confined aquifers which are directly recharged by infiltrating rainfall. Therefore aquifer storage, groundwater use and water levels are affected by changes and in climate and dry conditions.

Water levels in the production bores can be used as a trigger to indicate the appropriate drought management regime. The current pump depth settings are indicated in Table E11. All elevations are approximate and in some cases pump depth setting was estimated and requires confirmation.

A water level at the pump intake will result in inability to extract water from the bore, additional drought response action must be taken if this occurs.

A level of 3 m above the pump will risk ability to extract water. A water level within 3 m of the pump, or the lowest pump for town supplied by multiple bores, indicate that drought response actions would have been implemented. The relevant drought response water level for each system is indicated in Table E11.

It is desirable that pre drought (Mode 2) actions be considered some time before drought action is required. An antecedence of 3 months is desirable from a management perspective, however in some cases water levels fluctuate widely and there is insufficient drawdown available to allow for a 3 month lag until drought response action is required. In these cases a lesser antecedence has been adopted to ensure that pre-drought actions are not considered too frequently. Drought response actions are ineffective if they need to be adopted every year.

As noted previously water quality (and bore maintenance) issues can occur if water levels fall below the top of the uppermost screen interval. It is suspected that this has occurred at the Tullich borefield, evidenced by an increase in iron precipitation. For this reason, the pre drought response trigger is considered to be the top of screen. Whilst extraction can continue to occur when water levels fall within the screen interval addition actions may be required:

- Increased frequency of water quality monitoring;
- Increased frequency of bore and infrastructure maintenances, e.g. bore development, pipe pigging, sludge removal; and,
- Consideration of post drought treatments:
  - Bore condition assessment;
  - Pump replacement / rebuild.

Table E11 includes a time lag to provide a response horizon for management. Modelling has been completed for some of the borefields and the time lag is calculated based on the average rate of drawdown in the worst year modelled. Where model data was not available, historic monitoring data has been used. The time lag is considered conservative as the modelled and recorded groundwater levels for the borefields in Table E11 typically do not approach the drought response trigger under both current demands, and historic climate. Where the time lag approaches 6 months or greater, it is likely that the real lag is greater than 1 year as the system will recover in winter before potentially continuing to decline.

Figure E11 Groundwater Systems Drought Reponse Triggers

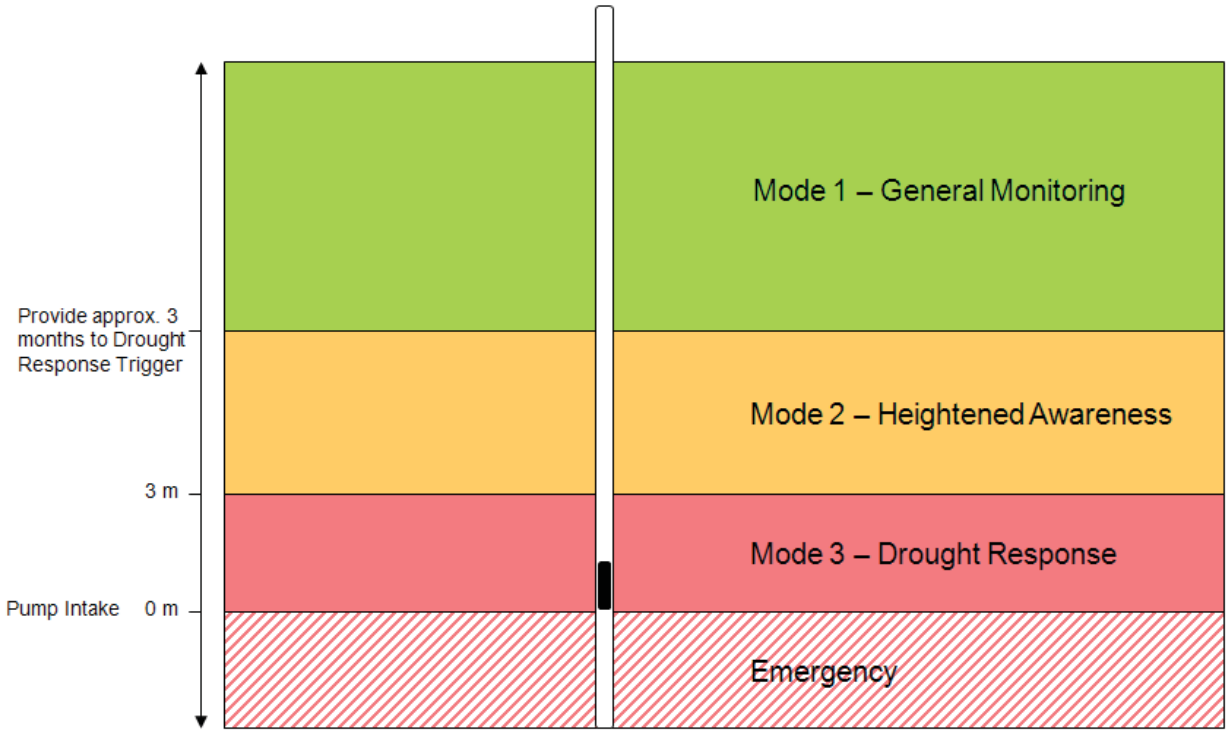


Table E10 Drought Response Action Triggers for Shallow Groundwater Systems

	Pump depth (depth to top of casing)	Mode 3 Trigger depth to top of casing)	Mode 2 Trigger (depth to top of casing)	Estimated Time Lag[1]
Caramut (No. 1)	43 m	40 m	22.6 m	3 months
Darlington (No. 1)	30 m	27 m	17 m	1 month[2]
Mortlake	22 m	19 m	17.5 m	< 1 month
Penshurst (No 2)	101 m	98 m	95 m	Unknown[3]
Tullich (no 2)	34.7 m	31.7 m	22 m	6 months

Note 1 – Time lag between Pre-drought response and drought response triggers in historic design drought (historic climate with current demand)

Note 2 – Darlington does nor respond to drought under model conditions, so only based on a historic drawdown over 2 weeks.

Note 3 – Water levels at the Penshurst bores need to be investigated, levels indicated an unexpected potentiometric gradient thus drought action triggers solely based on pump depth setting not draw down.

Deep Groundwater Systems

The coastal systems of Port Campbell, Portland, Heywood and Port Fairy are deeply confined and would not be affected by relatively short term drought conditions. A similar drought mode response regime to that developed for the shallow systems could be adopted, if water pressures in the deep confined aquifers were to drop for any reason.

The Dartmoor borefield, whilst behaving as a confined aquifer local to the bore, is located close to an interpreted intake area for the Lower Tertiary Aquifer system, i.e. where the Lower Tertiary Aquifer changes from confined through to unconfined conditions up basin. The Carlisle River borefield (part of the Otway Supply System) is also interpreted as having connection with surface water flows in the Gellibrand River. Under these conditions, both of these borefields are potentially susceptible to drought conditions as there may be a shortened lag time between drought and affects at the bore headworks.

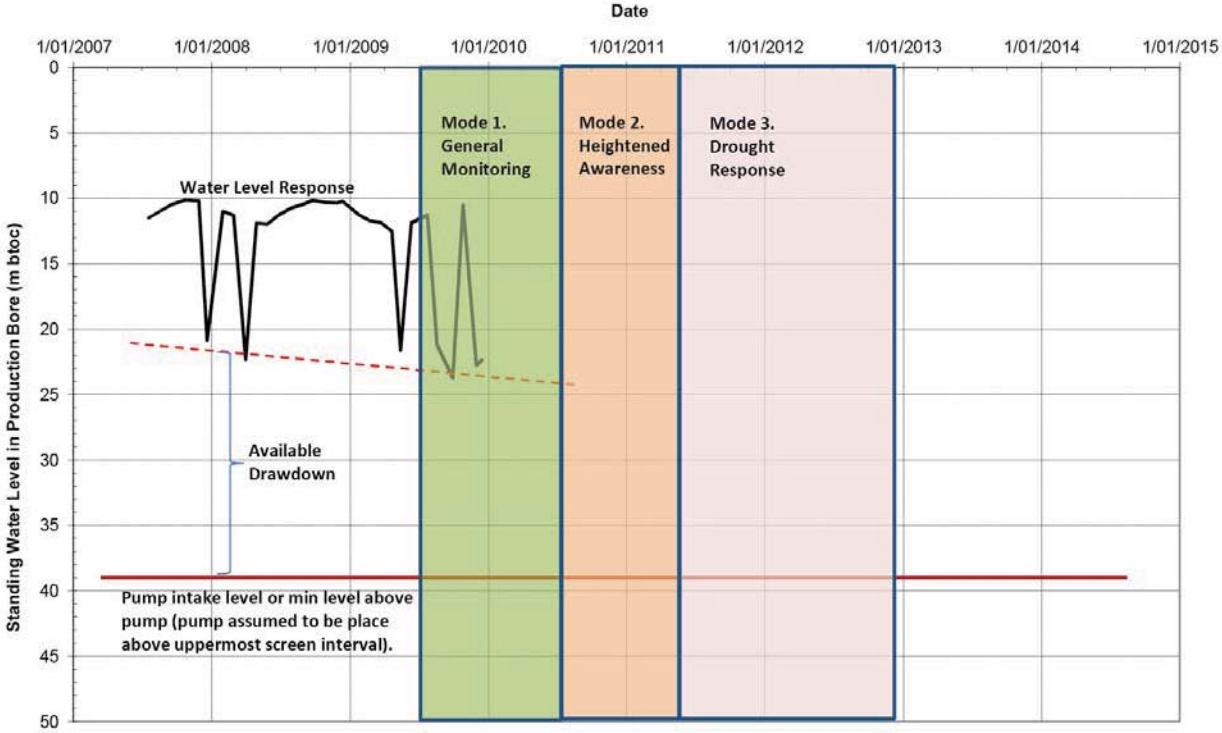
An issue with the bores developing the Lower Tertiary Aquifer, and the Macarthur production bore that develops the Clifton Formation, is that both of these aquifers have an underlying declining water level trend. Under these conditions, excluding the impact of a drought which may or may not be significant, the available drawdown in a production bore is being steadily eroded over time. This decline in available drawdown would be accelerated by changes in demand, which could be seasonal, or through growth. The establishment of a drought mode response using a trigger based solely on maintaining a minimum head above a production pump may not provide sufficient time for management intervention. A process that could be considered as been proposed below:

- The pumping water level response is monitored for each production bore in operation mode 1 – General Monitoring. Production bore hydrographs are prepared to identify seasonal response through the Annual Water Outlook Tool;
- Monitoring in a pumping bore can provide a 'noisy' response owing to the variable operation of production pumps. Therefore, filtering of the water level data is required. If the seasonal minimum is greater than 10% of the 95% confidence limit, operation mode 2 – Heightened Awareness is implemented. More frequent water level monitoring is implemented to characterise the rate of decline (and thus management planning horizon).
- Drought response (mode 3) is implemented based on the level of drawdown remaining in the bore.

This is shown schematically in Figure E12, and takes into account the potential for available drawdown to be eroded over time. This should provide management sufficient time to consider the need to replace or lower production pumps before available drawdown is reduced to supply threatening levels. A blanket approach adopted a minimum head above a production pump may limit time, particularly for cases where available drawdown can be eroded rapidly, e.g. under extreme conditions, interference effects may occur at Portland if sufficient recovery time between pumping events of individual production bores is not allowed for.

This is particularly useful as the deep groundwater systems tend to have limited surface storage, i.e. are not suited to long pumping stand-downs, and replacement pumps (owing to high yield and groundwater temperature requirements) can have significant procurement lead times. It is noted that for most deep groundwater supplies, underlying regional water level declines may be more significant than increased usage affected by drought conditions.

Figure E12 Deep Groundwater Systems Drought Reponse Triggers



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Glossary of Terms

AAD	Average Annual Demand The AAD represents the total (unrestricted) water usage from the headworks, inclusive of system distribution losses.
Action	A management response undertaken by Wannon Water as part of the Drought Response Plan when a trigger has been reached.
BE	Bulk Entitlement A bulk entitlement is a right to use and supply water which may be granted to water corporations, the Minister for Environment and other specified bodies under the *Water Act* (1989).
BE Metering Plan	The Bulk Entitlement Metering Plan has been developed to enable Wannon Water to demonstrate compliance with the obligations of each of it's surface water Bulk Entitlements.
DRMC	Drought Response Monitoring Committee
GWMWater	Grampians Wimmera Mallee Water
LTA	Lower Tertiary Aquifer system. Generally a deeply buried, regionally extensive aquifer system encompassing a number of geological formations, including the Dilwyn Formtion.
Mode	Wannon Water has three modes of operation: General Monitoring, Heightened Awareness and Drought Response Mode. A shift in operation mode will trigger a management response from Wannon Water, e.g. management responsibilities, communications and obligations.
REALM	REsource ALlocation Model – a software tool used to model harvesting and bulk distribution of surface water resources.
Reliability (of supply)	The ability to maintain a water supply free of water restrictions. Wannon Water has an objective of achieving a 95% reliability, i.e., restriction free on average for 95 in every 100 years.
Restrictions (water)	By Laws prepared by Wannon Water that are used to prevent or limit the use of water. The restrictions are consistent with the Victorian Uniform Drought Water Restriction Guidelines (VicWater, 2005)
Restricted (demand)	Demand for water (volume rate) with water restrictions implemented.
Stage (restrictions)	Wannon Water defines four stages of water restrictions (Stage 1 to 4) which influence domestic garden watering, vehicle washing, swimming pool topping etc.
System (water supply)	Linked networks of water sources (surface water, groundwater), storages, treatment and delivery pipelines. Wannon Water WSDS defines the following supply systems: Otway System (North and South Otway Pipelines), Hamilton System, Glenthompson System, and the Groundwater Systems.
TDS	Total Dissolved Solids A measure of groundwater salinity.
Trigger	Generally related to the total storage volume and the ability to maintain such a volume with specified restrictions in place. When triggers are reached, Wannon Water implements specified actions.
WaterMAP	WaterMAP is a voluntary water management action plan for non-residential customers using 5 ML of potable (drinking) water or more per year at any one site from an urban water supply. A WaterMAP encourages water conservation.
Annual Water Outlook	A process undertaken by Wannon Water to manage water supply and demands. It includes current and forecast water supply issues.

Appendix A Permanent Water Saving Plan

Permanent Water Saving Plan

for

Wannon Region Water Corporation

CONTENTS

PERMANENT WATER SAVING PLAN

PREAMBLE

The community recognises that water is a precious resource and should not be wasted. This Permanent Water Saving Plan reflects the value that the community places on water and sets out a set of common sense rules to encourage the efficient use of water and avoid wasting this precious resource.

The rules in this Plan are designed to support the commitment that Victorian communities have made to using water more efficiently. Many households and businesses are harvesting their own water through rainwater tanks, have installed water-efficient appliances, are adopting water-wise practices and are choosing to turn off their taps whenever possible. The rules in this Plan support this collective commitment by requiring the community to use common sense and best practices as part of their everyday use of water.

Wannon Water will continue to work with its community to support individual efforts to use water more efficiently. This will help to ensure there is enough water to sustain liveable and prosperous communities into the future.

The rules in this Plan are also supported by the provisions of the *Water Act 1989* which require that water must not be wasted. Allowing water to run off into a gutter, ditch, or drain or failing to repair a controllable leak from equipment or infrastructure is considered by Wannon Water to be wastage of water.

Water is an essential resource for maintaining life. This Plan therefore does not restrict the use of water for domestic, indoor purposes such as drinking, washing, cleaning or sanitation. Also, despite any rules in this Plan, water can be used at any time:

- for human health requirements;
- for watering of stock and animals;
- for fire fighting;
- for the safety, but not the cleaning, of vehicles and equipment; or
- for cleaning required as a result of an accident, fire, health hazard, safety hazard or other emergency (in accordance with the permitted methods).

1. AUTHORISING PROVISION AND COMMENCEMENT

This Permanent Water Saving Plan is varied under section 170B of the *Water Act 1989*.

2. PURPOSES

The purposes of this Plan are to:

(a) set out the permanent water savings rules which guide the efficient use of Water on an ongoing and permanent basis in each district serviced by Wannon Water; and

(b) specify principles for considering applications for exemption from particular permanent water saving rules.

3. DEFINITIONS AND INTERPRETATION

3.1 Definitions

The following definitions apply in this Plan:

"approved Water Use Plan" means a Water Use Plan approved by Wannon Water

"construction or renovation" means construction or renovation works on any building or structure including:

(a) erecting, altering (including painting or other protection works), repairing, demolishing or removing any building or structure;

(b) civil engineering;

(c) any preparatory works for the purposes of construction or renovation; and

(d) any directly associated on-site or off-site activity.

"Council" means a council under the *Local Government Act* 1989.

"district" means a district serviced by Wannon Water or part of any such district.

"fountain or water feature" means any (indoor or outdoor) ornamental fountain or water feature of any capacity that projects, circulates or moves water, or otherwise causes water to flow, for an aesthetic or decorative purpose.

"garden area" means any land upon which vegetation of any kind, including trees, other than lawn, grows or is cultivated, for other than commercial purposes. (*See "Lawn area"*).

"greywater" means household waste water from bath tubs, showers, laundry troughs and clothes washing machines, but excludes water from kitchens, dishwashing machines and toilets.

"hand-held hose" means a hose that is held by hand when it is used.

"hard surface" includes any courtyard, decking, footpath, driveway or other external area, with a concrete, asphalt, brick, tile, bitumen, timber or similar impervious surface.

"high pressure water cleaning device" means a machine which has a pump to increase the pressure of water delivered from a trigger nozzle, at a rate of no greater than 9 litres per minute, forming part of the device, but does not include a hand-held hose.

"lawn area" means any land, grassed or sown with grass seed but excludes any playing surface. *See "garden area".*

"permanent water saving rule" means a restriction or prohibition on the use of Water contained in Schedule 1 of this Permanent Water Saving Plan.

"playing surface" means any outdoor area used or capable of being used for any organised sport or recreation.

"public garden area" means any:

(a) garden area at any park, reserve or other outdoor area, used or available for public recreation or amenity;

(b) garden area at any cemetery, crematorium, central road area or roundabout under the management or control of a public authority; or

(c) trees located in a nature strip,

but does not include any:

(d) residential or commercial garden area; or

(e) playing surface; or

(f) nature strip.

"public garden or lawn area" means any public garden area or any public lawn area.

"public lawn area" means any lawn area:

(a) at any park, reserve or other outdoor area, used or available for public recreation or amenity; or

(b) at any cemetery, crematorium, central road area or roundabout under the management or control of a public authority,

but does not include:

(c) any residential or commercial lawn area;

(d) any playing surface; or

(e) any nature strip.

"reclaimed water" means water supplied by Wannon Water that is neither potable water nor recycled water, but is recovered from sources such as stormwater.

"recycled water" means treated sewage or trade waste, supplied by Wannon Water.

"residential or commercial garden area" means any garden area associated with any residential, commercial or industrial premises and includes any garden area associated with any:

(a) dwelling;

(b) commercial or industrial building;

(c) hospital or nursing home;

(d) sporting club;

(e) religious facility; or

(f) day-care centre, kindergarten, school, university or other educational facility or research institute,

and also includes any garden area on an adjacent nature strip in a road adjoining the premises, but does not include:

(g) any commercial market garden; or

(h) any commercial or Council plant nursery.

"residential or commercial garden or lawn area" means any residential or commercial garden area or any residential or commercial lawn area.

"residential or commercial lawn area" means any lawn area associated with any residential, commercial or industrial premises and includes any lawn area associated with any:

(a) dwelling;

(b) commercial or industrial building;

(c) hospital or nursing home;

(d) sporting club;

(e) religious facility; or

(f) day-care centre, kindergarten, school, university or other educational facility or research institute,

and also includes any lawn area on an adjacent nature strip in a road adjoining the premises, but does not include any lawn area associated with:

(g) any commercial market garden; or

(h) any commercial or Council plant nursery.

"restriction" includes prohibition.

"season" means summer, autumn, winter or spring.

"stock and animal health requirements" means the provision of a reasonable quantity of water for drinking by, or cleaning of, domestic or commercial stock or animals, to maintain their health and wellbeing.

"stormwater" means water sourced from the stormwater drainage network of Wannon Water or any other water corporation or a Council.

"trigger nozzle" means a nozzle controlled by:

(a) a trigger which must be depressed continuously, or locked in the "on" position, by hand for water to flow; or

(b) a discreet switch which can be turned on and off by hand, with a single movement.

"**Wannon Water**" means Wannon Region Water Corporation.

"warm season grass" means Buffalo, Couch or Kikuyo grass varieties that are appropriate for use in a lawn area.

"Water" means:

(a) water supplied by the works of Wannon Water or any other water corporation (including reticulated systems, stand pipes, hydrants, fireplugs and aqueducts) whether or not that water is delivered directly to the location of its use via those works or is delivered by alternative means including a water tanker; and

(b) a mix of:

(i) the water described in paragraph (a); and

(ii) any other water, including the water described in paragraphs (c)-(f),

but does <u>not</u> include:

(c) recycled or reclaimed water;

(d) greywater;

(e) stormwater; or

(f) rainwater collected by an occupier of land in a rainwater tank from the roof of a building on that land, provided that rainwater within in the tank is not supplemented in anyway by Water (defined in paragraphs (a) and (b) above).

"water corporation" means a water corporation as defined in the *Water Act* 1989 or a licensee as defined in the *Water Industry Act* 1994.

"water tanker" means any vehicle, including a trailer, configured to transport a volume of water at least one cubic metre or greater.

"Water Use Plan" means a document, in writing **[***or by plans***]**, prepared to the satisfaction of Wannon Water which governs the use of Water for specified purposes, and for the specified stage of restrictions.

"watering system" means a watering system that is:

(a) an automatic watering system that is set to turn on and off automatically, at pre-determined times, without human intervention and, in the case of use for a public lawn or garden or playing surface, is also fitted with a rain or soil moisture sensor;

(b) an automatic watering system, operated manually, rather than automatically; or

(c) a manual watering system.

3.2 **Interpretation**

(a) A reference to:

(i) legislation (including subordinate legislation) is to that legislation as amended, re-enacted or replaced, and includes any subordinate legislation issued under it;

(ii) a document or agreement, or provision of a document or agreement, is to that document, agreement or provision as amended, supplemented, replaced or novated;

(iii) a party to any document or agreement includes a permitted substitute or permitted assign of that party;

(iv) a person includes any type of entity or body of persons, whether or not it is incorporated or has a separate legal identity and any executor, administrator or successor in law of the person; and

(v) anything (including a right, obligation or concept) includes each part of it.

(b) A singular word includes the plural and vice versa.

(c) If a word is defined, another part of speech has a corresponding meaning.

(d) If an example is given of anything (including a right, obligation or concept) such as by saying it includes something else, the example does not limit the scope of that thing.

(e) An interpretation that would promote the efficient use of water must be preferred to an interpretation that would not promote such use.

4. APPLICATION AND GENERAL PRINCIPLES

4.1 Water Supplied by Wannon Water

This Plan applies to Water supplied by Wannon Water in each district serviced by Wannon Water.

4.2 Application to Water - General Principles

This Plan applies to **Water** as defined in clause 3.1. Without limiting the meaning of that definition, this means that:

(a) The permanent water saving rules in Schedule 1 **do** apply to Water supplied by the works of *Wannon Water* or any other water corporation (including reticulated systems, stand pipes, hydrants, fireplugs and aqueducts) whether or not:

(i) that water is delivered directly to the location of its use via those works or is delivered by alternative means including a water tanker; and

(ii) whether or not that Water is mixed with any other water.

(b) The permanent water saving rules in Schedule 1 **do not** apply to recycled or reclaimed water supplied by Wannon Water.

(c) The permanent water saving rules in Schedule 1 **do not** apply to greywater.

(d) The permanent water saving rules in Schedule 1 **do not** apply to stormwater.

(e) The permanent water saving rules in Schedule 1 **do not** apply to rainwater collected by an occupier of land in a rainwater tank from the roof of a building on that land, provided that rainwater within the tank is not supplemented in any way by Water.

5. GENERAL EXEMPTIONS

5.1 Health and Safety Exclusion

Despite any provision of this Plan (including the permanent water savings rules in Schedule 1) Water can be used at any time for:

(a) human health requirements;

(b) stock and animal health requirements;

(c) fire fighting; or

(d) the safety of, but not the cleaning of, vehicles or equipment.

5.2 General Exemptions

(a) *Wannon Water* may, in relation to a specified district or districts:

(i) prepare, adopt and publish; and

(ii) amend or revoke at any time,

general exemptions which specify generally applicable exemptions from permanent water saving rules set out in Schedule 1.

(b) Without limiting paragraph 5.2(a), the general exemptions may set out:

(i) permissible uses of Water which are exempted from a permanent water saving rule set out in Schedule 1, without an application being made under clause 6; and

(ii) the conditions upon which any such exemption is granted.

(c) Exemptions adopted under paragraph (a) must be published on Wannon Water's website and notice of any adoption, amendment or revocation of exemptions must be published in a newspaper circulating generally in the relevant district and on the website of Wannon Water.

(d) An exemption, or an amendment to an exemption under this clause will apply from the date on which a notice of the exemption is published in a newspaper circulating generally in the relevant district and will cease to apply in accordance with the terms of the

exemption or when notice of the revocation is published in a newspaper circulating generally in the relevant district.

(e) Wannon Water may prepare and publish general exemptions in co-operation with other water corporations.

6. PARTICULAR EXEMPTIONS

6.1 Guidelines regarding Particular Exemptions

(a) Wannon Water may:

(i) prepare, adopt and publish; and

(ii) amend or revoke at any time,

guidelines about applying for exemptions under this clause.

(b) Guidelines adopted under paragraph (a) must be published on Wannon Water's website and notice of any adoption, amendment or revocation of guidelines must be published in a newspaper circulating generally in each district and on the website of Wannon Water.

6.2 Applications for Particular Exemptions

(a) A person may apply to Wannon Water for temporary or permanent exemption from a permanent water saving rule imposed by this Plan.

(b) An application must be in a form approved by Wannon Water.

(c) Wannon Water:

(i) must consider an application for exemption within a reasonable period;

(ii) must have regard to any adopted information or adopted guidelines referred to in sub-clause 6.1; and

(iii) subject to this clause:

(A) may grant the exemption in full or in part and subject to such conditions as Wannon Water considers appropriate; or

(B) may refuse the application.

(d) Wannon Water may revoke any exemption at any time, by giving written notice to the applicant.

(e) An exemption ends at any time specified in the exemption or when any stage of restrictions are imposed by Wannon Water.

6.3 **Approval of Particular Exemptions**

Wannon Water must not grant an application for exemption under this clause unless Wannon Water is reasonably satisfied that the exemption:

(a) is necessary to avoid an inequitable and disproportionately adverse impact upon the livelihood of the applicant, which would be caused by that particular rule, and is consistent with the water policy of the government; or

(b) is necessary to avoid any adverse effect on public health or safety.

6.4 **Particular Exemptions for Warm Season Grasses**

Despite paragraph 6.2(c) and sub-clause 6.3:

(a) if a person makes an application to Wannon Water for an exemption to establish a warm season grass area at a specified property; and

(b) an exemption under this sub-clause for the property to which the application relates has not been made in the past 12 months,

the person will, unless and until notified otherwise, be deemed to have been granted the exemption from the date the application is posted or sent by electronic mail to the correct address of Wannon Water, subject to the following conditions:

(c) the exemption allows Watering solely for the establishment of warm season grass; and

(d) the exemption expires 28 days after the exemption is deemed to have been granted.

7. **WATER USE PLANS**

7.1 **Guidelines regarding Water Use Plans**

(a) Wannon Water may:

(i) prepare, adopt and publish; and

(ii) amend or revoke at any time,

guidelines about approval of Water Use Plans under this clause.

(b) Guidelines adopted under paragraph (a) must be published on Wannon Water's website and notice of any adoption, amendment or revocation of guidelines must be published in a newspaper circulating generally in each district and on the website of Wannon Water.

7.2 **Applications for Water Use Plans**

(a) A person may make an application under this clause where a permanent water savings rule in Schedule 1 permits Water use in accordance with an approved Water Use Plan:

(b) An application for approval of a Water Use Plan must be in a form approved by Wannon Water.

(c) Wannon Water:

(i) must consider an application for approval of a Water Use Plan within a reasonable period;

(ii) must have regard to any adopted guidelines referred to in clause 7.1; and

(iii) subject to this clause:

(A) may grant the application for approval, subject to such conditions as Wannon Water considers appropriate; or

(B) refuse the application for approval.

7.3 **Approval of Water Use Plans**

An Wannon Water must not approve a Water Use Plan unless:

(a) the Water Use Plan sets out:

(i) the person(s) and property (where applicable) to which the Water Use Plan applies;

(ii) the use(s) to which the Water Use Plan applies; and

(iii) when the Water Use Plan expires or ceases to apply; and

(b) Wannon Water is reasonably satisfied that the use of Water in accordance with the Water Use Plan:

(i) would result in Water savings commensurable to the Water savings that would result from Water use in accordance with the restrictions (other than a Water Use Plan) for that use of Water under the permanent water saving rule contained in Schedule 1 that is relevant to that use; **OR**

(ii) would not, in combination with the use of Water in accordance with Water Use Plans approved or reasonably anticipated by Wannon Water to be approved for similar uses of Water, have a significant impact on the total daily demand for Water by Wannon Water's customers or the security of available Water supplies in the district where the use will occur; **OR**

(iii) would, in the opinion of Wannon Water, be generally supported by other Wannon Water customers who are affected by the permanent water saving rule; **OR**

(iv) would, in the opinion of Wannon Water, be considered to demonstrate a best practice or highly efficient use of Water for that purpose; **OR**

(v) would provide a broader public benefit.

7.4 Failure to comply with a Water Use Plan

For the avoidance of doubt, if an approved Water Use Plan is in place in relation to a use of Water, but the use of Water is not carried out in accordance with the approved Water Use Plan, that use of Water is subject to the permanent water savings rule contained in Schedule 1 that is relevant to that use .

8. PENALTIES FOR NON-COMPLIANCE

8.1 Offences under the legislation

The *Water Act 1989* makes it an offence:

(a) to contravene a permanent water saving rule on the use of water imposed under this Plan; and

(b) to waste, misuse or excessively consume water.

8.2 Penalties under the legislation

(a) The *Water Act 1989* also imposes **substantial penalties** for particular offences, which may include Penalty Infringement Notices or one or more of fines, imprisonment and daily penalties or disconnection of services to a property.

(b) The value of each penalty increases each year under the *Monetary Units Act 2004*. The current value of each penalty for contravening a particular permanent water saving rule is set out on Wannon Water's website *www.wannonwater.com.au*

SCHEDULE 1: PERMANENT WATER SAVING RULES

USE	PERMANENT WATER SAVING RULES
1. Hand-Held Hose	Water from a hand-held hose must not be used for any purpose (whether or not the use is subject to a permanent water saving rule) at any time unless the hose : • is fitted with a trigger nozzle; and • is leak-free.
2. Residential or Commercial Gardens and Lawns	A residential or commercial garden or lawn area cannot be Watered except: • with a hand-held hose, bucket or watering can at any time; or • by means of a watering system between the hours of 6pm and 10am on any day.
3. Public Gardens and Lawns and Playing Surfaces	A public garden or lawn area or a playing surface cannot be Watered except: • with a hand-held hose, bucket or watering can at any time; or • by means of a watering system fitted with a rain or soil moisture sensor between the hours of 6pm and 10am on any day; or • in accordance with an approved Water Use Plan.
4. Fountains and Water Features	Water cannot be used in a fountain or a water feature unless the fountain or water feature recirculates the Water.
5. Cleaning of Hard Surfaces	Water cannot be used to clean hard surfaces (including, driveways, paths, concrete, tiles, timber decking) except: • where cleaning is required as a result of an accident, fire, health hazard, safety hazard or other emergency; or • if staining to the surface has developed and then only once a season; or • in the course of construction or renovation, and then only by means of:

USE	PERMANENT WATER SAVING RULES
	• a high pressure water cleaning device; • or if such a device is not available, a hand-held hose or a bucket.

Appendix B By-Law No 5

Water Restriction By-Law No.5

CONTENTS

WATER RESTRICTION BY-LAW

PREAMBLE

The community understands there may be a need to change water-use behaviours in times of drought or other water shortage. This Water Restriction By-law sets out four stages of restrictions and prohibitions on the use of water that can be mandated by Wannon Water when it is considered necessary to conserve water.

The restrictions in this By-law apply to water that is supplied by the main water supply works of Wannon Water , regardless of how that water is delivered. The restrictions also apply to any water that is a mix of this “mains” water and other water, for example, if a tank of rain water is topped up with mains water, the restrictions apply to the use of all of the mixed water in the tank. The restrictions do not apply in relation to recycled or reclaimed water, greywater or stormwater whether or not that water is supplied by the works of Wannon Water.

Water is an essential resource for maintaining life. The restrictions in this By-law therefore do not restrict the use of water for indoor purposes such as drinking, washing, cleaning or sanitation. Also, despite any restrictions in this By-law, water can be used at any time:

- for human health requirements;
- for watering of stock and animals;
- for fire fighting;
- for the safety, but not the cleaning, of vehicles and equipment; and
- for cleaning required as a result of an accident, fire, health hazard, safety hazard or other emergency (in accordance with the permitted methods).

Where a restriction relates to a specific use of water, that restriction applies regardless of whether the use is indoors or outdoors. For example, indoor pools and fountains and undercover nurseries are covered by the same restrictions as equivalent outdoor facilities. However, water cannot be used outdoors for any purpose except in accordance with the restrictions in this By-law or with the written permission of Wannon Water. This means that unless the restrictions in this By-law specify rules about the way in which water can be used outdoors for a particular purpose, then water cannot be used for that purpose.

Wherever possible, the restrictions in this By-law are designed to be simple, easy to understand and straightforward to follow. For example, outdoor watering is restricted to "alternate days", which means odd numbered properties can be watered on odd numbered dates and even numbered (or no numbered) properties can be watered on even numbered dates. Everyone gets to water on the 31st of any month and the 29th of February.

The restrictions in this By-law are also designed to build upon the common sense rules set out in the Permanent Water Saving Plan of Wannon Water, which encourage the efficient use of water on an ongoing basis. For example, wherever restrictions in this By-law allow for water to be used from a hand-held hose for any purpose, that hose must be leak-free and used with a trigger nozzle, consistent with the permanent water saving rules.

Contravention of this By-law is an offence under the *Water Act 1989*, and so penalties may apply.

Exemptions from the restrictions in this By-law may be granted in certain circumstances. This By-law sets out the principles that Wannon Water will take into account when considering applications for exemptions from particular restrictions.

This By-law also provides for water to be used in accordance with a Water Use Plan approved by Wannon Water, despite the restrictions under the prevailing stage of restrictions. Water Use Plans will only be approved where the use of a Plan is expressly permitted for the particular use of water under the relevant stage of restrictions, or where it is required as part of an application for an exemption.

Wannon Water makes the following By-law:

1. AUTHORISING PROVISIONS

This By-law is made under sections 160, 171(1)(a), (ba), (bb), (bc), (e) and (j) and 287ZC of the Act.

2. PURPOSES

The purposes of this By-law are to:

(a) promote the efficient use and conservation of water; and

(b) set out four stages of restrictions on the use of water; and

(c) specify things which must not be done while each stage of restriction persists; and

(d) specify principles for considering applications for exemptions from particular restrictions; and

(e) prescribe offences and penalties for the contravention of this By-law, including for which an infringement notice may be served; and

(f) prescribe classes of persons for the purpose of issuing infringement notices.

3. DEFINITIONS AND INTERPRETATION

3.1 Definitions

The definitions set out in Part A of Schedule 1, apply in this By-law, unless the contrary intention appears.

3.2 Interpretation

(a) A reference to:

(i) legislation (including subordinate legislation) is to that legislation as amended, re-enacted or replaced, and includes any subordinate legislation issued under it;

(ii) a document or agreement, or provision of a document or agreement, is to that document, agreement or provision as amended, supplemented, replaced or novated;

(iii) a party to any document or agreement includes a permitted substitute or permitted assign of that party;

(iv) a person includes any type of entity or body of persons, whether or not it is incorporated or has a separate legal identity and any executor, administrator or successor in law of the person; and

(v) anything (including a right, obligation or concept) includes each part of it.

(b) A singular word includes the plural and vice versa.

(c) If a word is defined, another part of speech has a corresponding meaning.

(d) If an example is given of anything (including a right, obligation or concept) such as by saying it includes something else, the example does not limit the scope of that thing.

(e) An interpretation that would promote the efficient use of water must be preferred to an interpretation that would not promote such use.

4. STAGES OF RESTRICTIONS

4.1 Stages of Restrictions

Wannon Water may impose:

Stage 1 Restrictions (Alert); or
Stage 2 Restrictions (Save); or
Stage 3 Restrictions (Just Enough); or
Stage 4 Restrictions (Critical),

as the case requires, in any district, by publishing a notice to that effect in a newspaper circulating generally in the relevant district and on the website of Wannon Water.

4.2 Imposing stages of restrictions

Wannon Water may impose a stage of restriction in a district:

(a) in accordance with the process specified in its drought response plan; or

(b) if it reasonably concludes that:

(i) because of the failure or limitation of a major pipeline, pumping station, treatment plant or other key water supply work, Wannon Water will temporarily be unable to meet the demands of its customers; or

(ii) because of a major water quality issue arising from the failure of a key water supply work referred to in sub-paragraph (i), or from a bushfire or other emergency, Wannon Water will temporarily be unable to meet the demands of its customers; or

(iii) the prevailing stage of restriction has failed to provide the reductions in demand required by Wannon Water for that stage, in accordance with its drought response plan.

4.3 Application of restrictions

When a stage of restriction is imposed in a district under sub-clause 4.2, the relevant restrictions on water use designated for that stage in Schedule 1 apply in that district.

4.4 **Declining to impose a stage of restrictions**

Without limiting sub-clause 4.2, Wannon Water may decline to impose a stage of restriction in a district if it reasonably concludes that the circumstances indicating the need for that stage are likely to be so temporary that the public inconvenience caused by imposing that stage of restriction would outweigh the water conservation benefits to be gained from imposing that stage.

5. **GENERAL EXEMPTIONS**

5.1 **Health and Safety Exclusion**

Despite any provision of this By-law, including the restrictions set out in Schedule 1, Water can be used at any time for:

(a) human health requirements;

(b) stock and animal health requirements;

(c) fire fighting; and

(d) the safety, but not the cleaning, of vehicles or equipment.

5.2 **General Exemptions**

(a) Wannon Water may, in relation to a specified district or districts:

(i) prepare, adopt and publish; and

(ii) amend or revoke at any time,

general exemptions which specify generally applicable exemptions (from a particular use or for particular users of Water) from any restrictions in Schedule 1.

(b) In deciding whether or not to grant a general exemption under this sub-clause, Wannon Water will have regard to:

(i) the security of available Water supplies in the district; and

(ii) recent climate patterns and prevailing seasonal forecasts; and

(iii) any anticipated change in demand attributable to the prevailing stage of restriction; and

(iv) any other relevant matter which Wannon Water thinks fit to have regard to.

(c) Without limiting paragraph 5.2(a), the general exemptions may set out:

(i) permissible uses of Water which are exempted from a restriction set out in Schedule 1, without an application being made under clause 6; and

(ii) the conditions upon which any such exemption is granted.

(d) Exemptions adopted under paragraph (a) must be published on Wannon Water 's website and notice of any adoption, amendment or revocation of exemptions must be published in a newspaper circulating generally in the relevant district and on the website of Wannon Water.

(e) An exemption, or an amendment to an exemption under this clause will apply from the date on which a notice of the exemption is published in a newspaper circulating generally in the relevant district and will cease to apply in accordance with the terms of the exemption or when notice of the revocation is published in a newspaper circulating generally in the relevant district.

(f) Wannon Water may prepare and publish general exemptions in co-operation with other water corporations.

6. PARTICULAR EXEMPTIONS

6.1 Guidelines regarding Particular Exemptions

(a) Wannon Water may:

(i) prepare, adopt and publish; and

(ii) amend or revoke at any time,

guidelines about applying for exemptions under this clause.

(b) Guidelines adopted under paragraph (a) must be published on Wannon Water 's website and notice of any adoption, amendment or revocation of guidelines must be published in a newspaper circulating generally in each district and on the website of Wannon Water.

6.2 Applications for Particular Exemptions

(a) A person may apply to Wannon Water for an exemption from a stage of restriction which has been, or which may in future be, imposed under clause 4.

(b) An application for exemption must be in a form approved by Wannon Water.

(c) Wannon Water:

(i) must consider an application for exemption within a reasonable period; and

(ii) must have regard to any adopted guidelines referred to in sub-clause 6.1; and

(iii) subject to this clause:

(A) may grant the application in full or in part and subject to such conditions as Wannon Water considers appropriate; or

(B) may refuse the application.

(d) Wannon Water may revoke any exemption at any time, by giving written notice to the applicant.

(e) An exemption ends at any time specified in the exemption, or when:

(i) the stage of restriction to which the exemption relates is lifted; or

(ii) a more severe stage of restriction is imposed.

6.3 **Approval of Particular Exemptions**

Subject to this clause, Wannon Water must not grant an application for exemption in relation to a particular stage of restriction, unless Wannon Water is reasonably satisfied that the proposed exemption:

(a) is necessary to avoid an inequitable and disproportionately adverse impact upon the livelihood of the applicant which would be caused by the level of restriction; **OR**

(b) would result in less Water being used by the applicant than the lesser amount of the Water that the applicant would otherwise:

(i) have been allowed by Wannon Water to use; or

(ii) based on prior consumption, is likely to have used for the same purpose under that stage of restriction; **OR**

(c) is necessary because of the special needs of the applicant; **OR**

(d) would avoid or minimise appreciable physical damage to a building or other structure owned or occupied by the applicant during that stage of restriction; **OR**

(e) is necessary to avoid any adverse effect on public health or safety;

AND

(f) would not, in combination with the use of Water in accordance with other exemptions granted or reasonably anticipated by Wannon Water to be granted for similar uses of Water, have a significant impact on the total daily demand for Water by Wannon Water 's customers or the security of available Water supplies in the district where the use will occur;

AND

(g) would, in the opinion of Wannon Water, be generally supported by other Wannon Water customers who are affected by that stage of restriction.

6.4 **Particular Exemptions for Public Garden Areas**

Despite sub-clause 6.3, Wannon Water may grant an application for exemption to Water a public garden area during a period of stage 4 restrictions if:

(a) the application is accompanied by an approved Water Use Plan for the public garden area; and

(b) Wannon Water is reasonably satisfied that, if the garden is Watered in accordance with the Water Use Plan, the exemption would not, in combination with the use of Water in accordance with other exemptions granted, or reasonably anticipated by Wannon Water to be granted, under this clause, have a significant impact on the total daily demand for

Water by Wannon Water 's customers or the security of available Water supplies in the district where the use will occur.

6.5 **Particular Exemptions for Certain Playing Surfaces**

(a) Despite sub-clause 6.3, Wannon Water may grant an application for exemption to Water any playing surface during a period of any stage of restriction if:

(i) the application is accompanied by an approved Water Use Plan; and

(ii) the application relates to a playing surface which is to be used for an inter-State, national or international professional sporting competition, or in support of such a competition; and

(iii) the exemption is granted for a finite period, which includes the dates during which the competition is to be held, determined after consulting the applicant; and

(iv) Wannon Water is reasonably satisfied that, if the playing surface is Watered in accordance with the Water Use Plan during the relevant stage of restrictions, the exemption would not, in combination with the use of Water in accordance with other exemptions granted, or reasonably anticipated by Wannon Water to be granted, under this clause, have a significant impact on the total daily demand for Water by Wannon Water 's customers or the security of available Water supplies in the district where the use will occur.

(b) Despite sub-clause 6.3 and paragraph 6.5(a), Wannon Water may grant an application for exemption to Water a particular playing surface during a period of stage 4 restrictions if:

(i) the application is accompanied by an approved Water Use Plan for the particular playing surface that has been prepared for the purpose of stage 4 restrictions; and

(ii) Wannon Water is reasonably satisfied that, if the playing surface is Watered in accordance with the Water Use Plan during the relevant stage of restrictions, the exemption would not, in combination with the use of Water in accordance with other exemptions granted, or reasonably anticipated by Wannon Water to be granted, under this clause, have a significant impact on the total daily demand for Water by Wannon Water 's customers or the security of available Water supplies in the district where the use will occur.

6.6 **Particular Exemptions for Warm Season Grasses**

Despite paragraph 6.2(c) and sub-clause 6.3:

(a) if a person makes an application to Wannon Water for an exemption to establish a warm season grass area at a specified property during a period of stage 1 or 2 restrictions; and

(b) an exemption under this sub-clause for the property to which the application relates has not been made in the past 12 months,

the person will, unless and until notified otherwise, be deemed to have been granted the exemption from the date the application is posted or sent by electronic mail to the correct address of Wannon Water, subject to the following conditions:

(c) the exemption allows Watering solely for the establishment of warm season grass; and

(d) the exemption expires 28 days after the exemption is deemed to have been granted.

7. WATER USE PLANS

7.1 Guidelines Regarding Water Use Plans

(a) Wannon Water may:

(i) prepare, adopt and publish; and

(ii) amend or revoke at any time,

guidelines about approval of Water Use Plans under this clause.

(b) Guidelines adopted under paragraph (a) must be published on Wannon Water 's website and notice of any adoption, amendment or revocation of guidelines must be published in a newspaper circulating generally in each district and on the website of Wannon Water.

7.2 Applications for Water Use Plans

(a) A person may make an application under this clause where:

(i) a restriction on the use of Water contained in Schedule 1 permits Water use in accordance with an approved Water Use Plan; or

(ii) where an application for an exemption under clause 6 must be accompanied by an approved Water Use Plan.

(b) An application for approval of a Water Use Plan must be in a form approved by Wannon Water.

(c) Wannon Water*:*

(i) must consider an application for approval of a Water Use Plan within a reasonable period;

(ii) must have regard to any adopted guidelines referred to in sub-clause 7.1; and

(iii) subject to this clause:

(A) may grant the application for approval, subject to such conditions as Wannon Water considers appropriate; or

(B) refuse the application for approval.

7.3 Approval of Water Use Plans

Wannon Water must not approve a Water Use Plan unless:

(a) the Water Use Plan sets out:

(i) the person(s) and property (where applicable) to which the Water Use Plan applies;

(ii) the use(s) to which the Water Use Plan applies;

(iii) the stage(s) of restrictions during which the Water Use Plan applies; and

(iv) when the Water Use Plan expires or ceases to apply; and

(b) in the case of an application under clause 7.2(a)(i), Wannon Water is reasonably satisfied that the use of Water in accordance with the Water Use Plan:

(i) would result in Water savings commensurable to the Water savings that would result from Water use in accordance with the restrictions (other than a Water Use Plan) for that use of Water under the prevailing stage of restrictions; **OR**

(ii) would not, in combination with the use of Water in accordance with Water Use Plans approved or reasonably anticipated by Wannon Water to be approved for similar uses of Water, have a significant impact on the total daily demand for Water by Wannon Water 's customers or the security of available Water supplies in the district where the use will occur; **OR**

(iii) would, in the opinion of Wannon Water, be generally supported by other Wannon Water customers who are affected by the relevant stage of restriction; **OR**

(iv) would, in the opinion of Wannon Water*]*, be considered to demonstrate a best practice or highly efficient use of Water for that purpose; **OR**

(v) would provide a broader public benefit.

7.4 **Failure to Comply with a Water Use Plan**

For the avoidance of doubt, if an approved Water Use Plan is in place in relation to a use of Water, but the use of Water is not carried out in accordance with the approved Water Use Plan that use of Water is subject to the restrictions for that use contained in Schedule 1.

8. **LIFTING A STAGE OF RESTRICTION**

8.1 **Lifting a stage**

Subject to sub-clause 8.2, Wannon Water may:

(a) lift a prevailing stage of restriction and substitute a lesser stage of restriction; or

(b) lift a prevailing stage of restriction,

whenever Wannon Water reasonably concludes, in accordance with the considerations specified in its drought response plan, that the relevant circumstances which led Wannon Water to impose the prevailing stage of restriction in a district no longer exist, or are about to change, by publishing a notice to that effect in a newspaper circulating generally in the relevant district and on the website of Wannon Water.

8.2 **Declining to lift a stage of restrictions**

Despite sub-clause 8.1, Wannon Water may decline to lift a prevailing stage of restriction if it reasonably concludes that either:

(a) continuing that stage of restriction is necessary or desirable to increase or conserve available Water supplies; or

(b) the change in circumstances which would otherwise justify Wannon Water in lifting the stage of restriction is likely to be so temporary that the public inconvenience caused by lifting and subsequently re-imposing a stage of restriction would outweigh the benefits to Wannon Water 's customers of temporarily lifting the prevailing stage of restriction.

9. **EMERGENCY MEASURES**

If it is considered by Wannon Water that stage 4 restrictions are insufficient to reduce consumption to a level adequate to meet future demands at that level of restriction, Wannon Water may declare emergency measures to further restrict water consumption in the specified area.

10. **OFFENCES AND PENALTIES**

10.1 **Contravention of the By-law is an offence**

A person who receives a supply of Water from Wannon Water must not contravene any restriction or prohibition on the use of that Water imposed by or under this By-law.

10.2 **Penalties**

The penalty for any offence referred to in sub-clause 10.1 during a stage of restriction set out in a column of the Table is:

(a) for a first offence, the relevant number of penalty units or the period of imprisonment set out in that column for a first offence;

(b) for a subsequent offence, the relevant number of penalty units or the period of imprisonment set out in that column for a subsequent offence; and

(c) for a continuing offence, an additional penalty of 5 penalty units for each day on which the offence continues (up to a maximum of 20 additional penalty units):

(i) after service of a notice of contravention on the person, under section 151 of the Act; or

(ii) if no notice of contravention is served, after conviction of the person for the offence.

	Stage 1	**Stage 2**	**Stage 3**	**Stage 4**
First offence	15	20	30	40 or 3 months' imprisonment
Subsequent offence	30	40	60 or 3 months' imprisonment	80 or 6 months' imprisonment

10.3 **Infringement notices**

An infringement notice may be served on any person who receives a supply of Water from Wannon Water and contravenes any restriction or prohibition on the use of that water imposed by or under this By-law (other than an offence against an emergency measure imposed under sub-clause 9.1).

10.4 **Penalties**

The infringement penalty for any offence referred to in sub-clause 10.3 during a stage of restriction set out in Column 1 of the Table is the relevant penalty set out in Column 2 in respect of that Stage of restriction.

COLUMN 1	COLUMN 2
STAGE OF RESTRICTION	**PENALTY UNITS**
1	2
2	3
3	4
4	5

Notes:

1 *In this By-law "**penalty unit**" has the same meaning as in section 110 of the* Sentencing Act 1991*. The value of a penalty increases each year under the* Monetary Units Act 2004*. The current value of each penalty for contravening a restriction or prohibition is set out on Wannon Water 's website* (www.wannonwater.com.au).

2 *The Act also makes it an offence to waste, misuse or excessively consume water and imposes **substantial penalties** which include one or more of fines, imprisonment and daily penalties.*

3 *Wannon Water has further power to reduce, restrict or discontinue the supply of water to a person who contravenes the Act, regulations or a by-law in relation to misuse or taking of water. Wannon Water can also disconnect the supply of water to a property in relation to which a notice of contravention has been issued and not complied with.*

11. **ISSUING PENALTY INFRINGEMENT NOTICES**

An authorised water officer appointed under section 291A of the Act by Wannon Water may serve an infringement notice on another person in respect of an offence against sub-clause 10.3 if the authorised water officer reasonably believes that the person has committed the offence.

12. **REPEAL**

Water Restriction By-Law No.4 is repealed.

13. AUTHORISATION BY WANNON WATER

This By-law is made by Wannon Water on 16th December 2011.

The COMMON SEAL of WANNON REGION)

WATER CORPORATION 2007 was hereunto affixed)

in the presence of:)

_____ Director

Steven Kearns _____ Secretary

SCHEDULE 1

SCHEDULE OF WATER RESTRICTIONS

PART A – DEFINITIONS

"Act" means the *Water Act 1989*.

"alternate day" means:

(a) in the case of a property with an odd street number, each odd-numbered day of any month;

(b) in the case of a property:

(i) with an even street number; or

(ii) without a street number,

each even-numbered day of any month; and

(c) in the case of any property, the 31st day of any month or the 29th day of February.

"animal husbandry" includes keeping, raising or breeding any animals or birds either:

(a) for commercial purposes; or

(b) on such a scale, or in such a manner, as could reasonably be considered to be comparable to a commercial undertaking.

"approved Water Use Plan" means a Water Use Plan approved by Wannon Water.

"Automatic Water Top Up Device" means any automatic top up device with appropriate backflow protection that maintains a water level at the minimum level required for the safe and efficient operation of, and to maintain the integrity of, the equipment which the device is servicing.

"building façade or window" means any external surface of, or attached to, a building, including any roof, wall, window or blind of that building.

"commercial car wash" means any commercial facility for washing vehicles.

"commercial market garden" means an area (indoors or outdoors) used wholly or primarily to propagate, cultivate or harvest fruit, vegetables, vines or other edible plants for sale (retail or wholesale) or distribution for profit.

"commercial or Council plant nursery" means an area (indoors or outdoors) used wholly or primarily to propagate, cultivate or harvest plants (including seed stock, turf and flowers):

(a) for sale (retail or wholesale) or distribution for profit; or

(b) for any Council use.

"construction or renovation" means construction or renovation works on any building or structure including:

(a) erecting, altering (including painting or other protection works), repairing, demolishing or removing any building or structure;

(b) civil engineering;

(c) any preparatory works for the purposes of construction or renovation; and

(d) any directly associated on-site or off-site activity.

"Council" means a council under the *Local Government Act* 1989.

"dam or tank" does not include any pond or lake.

"district" means one of the following districts serviced by Wannon Water or part of any such district as specified by Wannon Water:

Balmoral Waterworks
Caramut Rural
Caramut Water Supply
Casterton Urban
Cavendish Urban
Coleraine and Casterton Waterworks
Coleraine Urban
Dartmoor Water
Derrinallum Urban
Dunkeld Urban
Glenthompson Urban
Hamilton Urban
Hamilton Waterworks
Heywood Urban
Heywood Waterworks
Koroit Water
Lismore and Derrinallum Waterworks
Lismore Rural
Lismore Urban
Macarthur Water District
Merino Urban
Mortlake Water
Otway Rural
Otway Urban
Otway Waterworks
Penshurst Urban
Peterborough Water
Port Campbell Urban
Port Fairy Urban
Port Fairy Waterworks
Portland Urban
Portland Waterworks
Purnim Urban
Sandford Urban
Shire of Dundas Waterworks
Shire of Glenelg Waterworks
Shire of Heytesbury Waterworks
Shire of Mt Rouse Waterworks
Tarrington Urban
Timboon Urban
Town of Camperdown Water Supply
Warrnambool and Urban Environs Water

"dripper watering system" means:

(a) a watering system (automatic or manual) which drips water on the root zone of plants, by drippers at a fixed rate of flow, not exceeding 9 litres per hour for every linear metre of the watering system; or

(b) a “non-dripper” watering system (automatic or manual) which to the satisfaction of Wannon Water is of equal efficiency to or greater efficiency than a dripper water system described in paragraph (a).

"drought response plan" means a plan developed by Wannon Water, for the purpose of responding to drought or other water shortage, as required under its Statement of Obligation issued under section 4I of the *Water Industry Act 1994*.

"edible plants" includes plants that can eaten, imbibed or used to flavour food or drinks.

"existing " means in existence at the time when the prevailing stage of restriction was declared.

"fill" means adding water to the current volume, if the relevant receptacle is less than 75% full.

"fountain or water feature" means any (indoor or outdoor) ornamental fountain or water feature of any capacity that projects, circulates or moves water, or otherwise causes water to flow, for an aesthetic or decorative purpose.

"garden area" means any land upon which vegetation of any kind, including trees, other than lawn, grows or is cultivated, for other than commercial purposes. (*See "Lawn area"*).

"general playing surface" means any playing surface that is not a particular playing surface.

"general or particular playing surface" means a general playing surface or a particular playing surface.

"greywater" means waste water from bath tubs, showers, laundry troughs and clothes washing machines, but excludes water from kitchens, dishwashing machines and toilets.

"hand-held hose" means a leak free hose that is held by hand, when it is used, which:

(a) in the case of commercial and construction activities, has an internal diameter of no more than 50mm; or

(b) in the case of any other activities, has an internal diameter of no more than 25mm,

and which is fitted and used with a trigger nozzle.

"hard surface" includes any courtyard, decking, footpath, driveway or other external area, with a concrete, asphalt, brick, tile, bitumen, timber or similar impervious surface.

"high pressure water cleaning device" means a machine which has a pump to increase the pressure of water delivered from a trigger nozzle, at a rate of no greater than 9 litres per minute, forming part of the device, but does not include a hand-held hose.

"hose-connected water toy" means any toy that is operated by running water, supplied through a hose.

"lawn area" means any land, grassed or sown with grass seed but excludes any playing surface. *See "garden area".*

"mobile spa" means any spa that is capable of being moved for use in different locations.

"mobile water tanker permit" means a valid permit issued by Wannon Water for the filling or topping up of a water tanker with Water from hydrants and fireplugs in accordance with the conditions of the permit.

"motor vehicle dealer, repairer or detailer" means a commercial operator that either sells, trades or repairs motor vehicles and/or is required to clean motor vehicles as part of its operation but excludes a commercial car wash.

"new" means not existing (as defined).

"Other Use" means any use or purpose for which water may be used outside a building, which is not a use or purpose expressly referred to in this document.

"particular playing surface" means:

(a) a turf wicket for competition cricket;

(b) a turf practice wicket for cricket but only if an alternative practice wicket that does not require watering (such as a synthetic wicket) is not available;

(c) a lawn or other type of running track (whether for use by humans or animals);

(d) a lawn, en tous cas, or other type of tennis court other than a concrete, bitumen or asphalt tennis court;

(e) a baseball or softball diamond, including the infield and any en tout cas running area;

(f) a hockey or lacrosse pitch;

(g) a green for lawn bowls or croquet or similar sport; or

(h) the penalty areas of a soccer pitch; or

(i) a golfing tee or green (but not fairways or approaches),

at a sporting or recreational facility that is:

(i) for public, commercial or general community use; or

(ii) associated with a university, school or other educational institution, and

(j) a soft-fall area at a child-care facility or public playground,

but does not include any part of a sporting or recreational facility associated with a private club or similar private organisation.

"permanent water saving rule" means a restriction or prohibition on the use of Water contained in Wannon Water's Permanent Water Saving Plan (available at www.wannonwater.com.au) or from Wannon Water.

"playing surface" means any outdoor area used or capable of being used for any organised sport or recreation.

"pond or lake" includes any collection of water (indoors or outdoors) for ornamental or urban drainage retention purposes, but does not include a fountain or water feature or a tank that is used to house fish or other aquatic life.

"public authority" means any body:

a) constituted by or under an Act; or

b) exercising powers under an Act,

for a public purpose and includes a Council.

"public garden area" means any:

(a) garden area at any park, reserve or other outdoor area, used or available for public recreation or amenity;

(b) garden area at any cemetery, crematorium, central road area or roundabout under the management or control of a public authority; or

(c) trees located in a nature strip,

but does not include any:

(d) residential or commercial garden area; or

(e) playing surface; or

(f) nature strip.

"public lawn area" means any lawn area:

(a) at any park, reserve or other outdoor area, used or available for public recreation or amenity; or

(b) at any cemetery, crematorium, central road area or roundabout under the management or control of a public authority,

but does not include:

(c) any residential or commercial lawn area;

(d) any playing surface; or

(e) any nature strip.

"public garden or lawn area" means any public garden area or any public lawn area.

"public pool or spa" means a swimming pool or spa (indoors or outdoors):

(a) for public use, which is operated by, or on behalf of, a public authority;

(b) for limited public use, which is operated by, or on behalf of, a school or educational facility; or

(c) for limited public use for the purposes of physical rehabilitation, which may be operated by, or on behalf of, a public authority or a private enterprise.

"reclaimed water" means water supplied by Wannon Water that is neither potable water nor recycled water, but is recovered from sources such as stormwater.

"recycled water" means treated sewage or trade waste, supplied by Wannon Water.

"residential or commercial garden area" means any garden area associated with any residential, commercial or industrial premises and includes any garden area associated with any:

(a) dwelling;

(b) commercial or industrial building;

(c) hospital or nursing home;

(d) sporting club;

(e) religious facility; or

(f) day-care centre, kindergarten, school, university or other educational facility or research institute,

and also includes any garden area on an adjacent nature strip in a road adjoining the premises, but does not include:

(g) any commercial market garden; or

(h) any commercial or Council plant nursery.

"residential or commercial garden or lawn area" means any residential or commercial garden area or any residential or commercial lawn area.

"residential or commercial lawn area" means any lawn area associated with any residential, commercial or industrial premises and includes any lawn area associated with any:

(a) dwelling;

(b) commercial or industrial building;

(c) hospital or nursing home;

(d) sporting club;

(e) religious facility; or

(f) day-care centre, kindergarten, school, university or other educational facility or research institute,

and also includes any lawn area on an adjacent nature strip in a road adjoining the premises, but does not include any lawn area associated with:

(g) any commercial market garden; or

(h) any commercial or Council plant nursery.

"residential or commercial pool or spa" means a swimming pool or spa (indoors or outdoors), operated for private use or commercial purposes, or in conjunction with any commercial premises (including any hotel), other than a public pool or spa.

"restriction" includes prohibition.

"season" means summer, autumn, winter or spring.

"stock and animal health requirements" means the provision of a reasonable quantity of water for drinking by, or cleaning of, domestic or commercial stock or animals, to maintain their health and wellbeing.

"stormwater" means water sourced from the stormwater drainage network of Wannon Water or any other water corporation or a Council.

"top up" means adding any water to the current volume, if the relevant receptacle is at least 75% full.

"trigger nozzle" means a nozzle controlled by:

(a) a trigger which must be depressed continuously, or locked in the "on" position, by hand for water to flow; or

(b) a discreet switch which can be turned on and off by hand, with a single movement.

"vehicle" includes a car, van, truck, boat, tram or train, aircraft and any other vehicle whatsoever, however it is propelled or moved.

"vehicle for mass transportation" means a bus, tram, train, aircraft, ferry or other vehicle however it is propelled or moved, that transports people en masse, but does not include:

(a) taxis (whether cars or vans);

(b) cars;

(c) buses or vans used for private purposes.

"Wannon Water" means Wannon Region Water Corporation.

"warm season grass" means Buffalo, Couch or Kikuyu grass varieties that are appropriate for use in a lawn area.

"Water" means:

(a) water supplied by the works of Wannon Water or any other water corporation (including reticulated systems, stand pipes, hydrants, fireplugs and aqueducts) whether or not that water is delivered directly to the location of its use via those works or is delivered by alternative means including a water tanker; and

(b) a mix of:

(i) the water described in paragraph (a); and

(ii) any other water, including the water described in paragraphs (c)-(f),

but does not include:

(c) recycled or reclaimed water;

(d) greywater;

(e) stormwater; or

(f) rainwater collected by an occupier of land in a rainwater tank from the roof of a building on that land, provided that rainwater within in the tank is not supplemented in anyway by Water (defined in paragraphs (a) and (b) above).

"water corporation" means a water corporation as defined in the Act or a licensee as defined in the *Water Industry Act* 1994.

"Water Use Plan" means a document, in writing or by plans, prepared to the satisfaction of Wannon Water which governs the use of Water for specified purposes, and for the specified stage of restrictions.

"watering system" means a watering system that is:

(a) an automatic watering system that is set to turn on and off automatically, at pre-determined times, without human intervention and, in the case of use for a public lawn or garden or playing surface, is also fitted with a rain or soil moisture sensor;

(b) an automatic watering system, operated manually, rather than automatically; or

(c) a manual watering system.

"water tanker" means any vehicle, including a trailer, configured to transport a volume of water at least one cubic metre or greater.

PART B – SCHEDULE OF RESTRICTIONS

	Stage 1 (Alert)	Stage 2 (Save)	Stage 3 (Just Enough)	Stage 4 (Critical)
1. Watering Gardens, Lawns and Playing Surfaces	(a) A: • residential or commercial garden or lawn area; or • public garden or lawn area; or • general or particular playing surface, cannot be Watered except as required and then only : • with a hand-held hose, bucket or watering can at any time; or • by means of a watering system but only on alternate days between the hours of 6am and 10am **and** 6pm and 10pm.	(a) A: • residential or commercial lawn area; or • public lawn area; or • general playing surface, cannot be Watered at any time.	(a) A: • residential or commercial lawn area; or • public lawn area; or • general playing surface, cannot be Watered at any time.	(a) A: • residential or commercial garden or lawn area; or • public garden or lawn area; or • general or particular playing surface, cannot be Watered at any time.
	(b) *Not used.*	(b) A: • residential or commercial garden area; or • public garden area; or • a particular playing surface, cannot be Watered except as required and then only: • with a hand-held hose, bucket or watering can any time; or • using a watering system but only on alternate days between the hours of 6am and 8am **and** 6pm and 8pm.	(b) A: • residential or commercial garden area; or • public garden area; or • particular playing surface, cannot be Watered except as required and then only on alternate days between the hours of 6am and 8am: • with a hand-held hose, bucket or watering can; or • using a dripper watering system.	
	(c) Notwithstanding paragraph (a): • a public garden or lawn area; or • a general or particular playing surface, can be Watered as required but only in accordance with an approved Water Use Plan.	(c) Notwithstanding paragraphs (a) and (b): • a public garden or lawn area; or • a general or particular playing surface, can be Watered as required but only in accordance with an approved Water Use Plan.	(c) Notwithstanding paragraphs (a) and (b): • a public garden or lawn area; or • a general or particular playing surface, can be Watered as required but only in accordance with an approved Water Use Plan.	
2. Using Water for Aesthetic Purposes	(a) Water cannot be used to fill or top up a fountain or water feature unless the fountain or water feature recirculates the Water and then only by means of: • a hand-held hose, bucket or watering can; or • an Automatic Water Top Up Device.	(a) Water cannot be used to fill or top up a fountain or water feature at any time.	(a) Water cannot be used to fill or top up a fountain or water feature at any time.	(a) Water cannot be used to fill or top up a fountain or water feature at any time.

	Stage 1 (Alert)	Stage 2 (Save)	Stage 3 (Just Enough)	Stage 4 (Critical)
	(b) Water cannot be used to fill or top up a new or existing pond or lake with a capacity of 2,000 litres or less except by means of a hand-held hose, watering can or bucket.	(b) Water cannot be used to fill or top up a new pond or lake, regardless of capacity, at any time.	(b) Water cannot be used to fill or top up a new pond or lake, regardless of capacity, at any time.	(b) Water cannot be used to fill or top up a new pond or lake, regardless of capacity, at any time.
	(c) Water cannot be used to fill or top up a new or existing pond or lake with a capacity of greater than 2,000 litres except in accordance with an approved Water Use Plan.	(c) Water cannot be used to fill or top up an existing pond or lake, regardless of capacity, unless the relevant pond or lake sustains aquatic fauna or bird life, and then only accordance with an approved Water Use Plan.	(c) Water cannot be used to fill or top up an existing pond or lake, regardless of capacity, unless the relevant pond or lake sustains aquatic fauna or bird life, and then only in accordance with an approved Water Use Plan.	(c) Water cannot be used to fill or top up an existing pond or lake, regardless of capacity, unless the relevant pond or lake sustains aquatic fauna or bird life, and then only in accordance with an approved Water Use Plan.
3. Using Water in Swimming Pools and Toys	(a) Water cannot be used to **fill** a new or existing: • residential or commercial pool or spa; or • public pool or spa, with a capacity of **2,000 litres or less**, except by means of: • a hand-held hose, bucket or watering can; or • an Automatic Water Top Up Device.	(a) Water cannot be used to **fill** a new or existing: • residential or commercial pool or spa;, or • public pool or spa, with a capacity of **2,000 litres or less**, except by means of: • a hand-held hose, bucket or watering can; or • an Automatic Water Top Up Device.	(a) Water cannot be used to **fill** a new or existing residential or commercial pool or spa of any capacity.	(a) Water cannot be used to **fill** a new or existing residential or commercial pool or spa of any capacity.
	(b) Water cannot be used to **fill** a new or existing: • residential or commercial pool or spa; or • public pool or spa, with a capacity of **greater than 2,000 litres**, except in accordance with an approved Water Use Plan.	(b) Water cannot be used to **fill** a new or existing: • residential or commercial pool or spa; or • public pool or spa, with a capacity of **greater than 2,000 litres**, except in accordance with an approved Water Use Plan.	(b) Water cannot be used to **fill** a new or existing public pool or spa, of any capacity, except in accordance with an approved Water Use Plan.	(b) Water cannot be used to **fill or top up** a new or existing public pool or spa, of any capacity, except in accordance with an approved Water Use Plan.
	(c) Water cannot be used to **top up** a new or existing: • residential or commercial pool or spa; or • public pool or spa, of any capacity, except by means of: • a hand-held hose, bucket or watering can; or • an Automatic Water Top Up Device.	(c) Water cannot be used to **top up** a new or existing: • residential or commercial pool or spa; or • public pool or spa, of any capacity, except: • between the hours of 6am and 8am **and** 6pm and 8pm on alternate days by means of a hand-held hose, bucket or watering can; or • by use of an Automatic Water Top Up Device at any time; or • in accordance with an approved Water Use Plan.	(c) Water cannot be used to **top up**: • an existing residential or commercial pool or spa; or • a new or existing public pool or spa, of any capacity, except: • between the hours of 6am and 8am on alternate days by means of a hand-held hose, bucket or watering can; or • by use of an Automatic Water Top Up Device at any time; or • in accordance with an approved Water Use Plan.	(c)Water cannot be used to **top up** an existing residential or commercial pool or spa of any capacity, except by means of a bucket or watering can.

	Stage 1 (Alert)	Stage 2 (Save)	Stage 3 (Just Enough)	Stage 4 (Critical)
	(d) Water cannot be used to fill or top up a mobile spa except in accordance with an approved Water Use Plan that is obtained by the owner of the mobile spa.	(d) Water cannot be used to fill or top up a mobile spa except in accordance with an approved Water Use Plan that is obtained by the owner of the mobile spa.	(d) Water cannot be used to fill or top up a mobile spa at any time.	(d) Water cannot be used to fill or top up a mobile spa at any time.
	(e) Water cannot be used in or for the use of a hose-connected water toy at any time.	(e) Water cannot be used in or for the use of a hose-connected water toy at any time.	(e) Water cannot be used in or for the use of a hose-connected water toy at any time.	(e) Water cannot be used in or for the use of a hose-connected water toy at any time.
4. Storing or Transporting Water	(a) Water cannot be used to fill or top up a dam or tank except: • where the Water in the dam or tank is to be used : - for fire fighting, stock watering or other public health purposes but then only to the extent which it is reasonably necessary for those purposes; or - for domestic purposes inside a dwelling; or - for any other use of Water permitted by means of a hand-held hose under stage 1 restrictions; or • in accordance with an approved Water Use Plan.	(a) Water cannot be used to fill or top up a dam or tank except: • where the Water in the dam or tank is to be used: - for fire fighting, stock watering or other public health purposes but then only to the extent which it is reasonably necessary for those purposes; or - for domestic purposes inside a dwelling; or - for any other use of Water permitted by means of a hand-held hose under stage 2 restrictions; or • in accordance with an approved Water Use Plan.	(a) Water cannot be used to fill or top up a dam or tank except: • where the Water in the dam or tank is to be used: - for fire fighting, stock watering or other public health purposes but then only to the extent which it is reasonably necessary for those purposes; or - for domestic purposes inside a dwelling; or - for any other use of Water permitted by means of a hand-held hose under stage 3 restrictions; or • in accordance with an approved Water Use Plan.	(a) Water cannot be used to fill or top up a dam or tank except: • where the Water in the dam or tank is to be used: - for fire fighting, stock watering or other public health purposes but then only to the extent which it is reasonably necessary for those purposes; or - for domestic purposes inside a dwelling; or - for any other use of Water permitted by means of a hand-held hose under stage 4 restrictions; or • in accordance with an approved Water Use Plan.
	(b) Water cannot be used to fill or top up a water tanker unless: • Wannon Water has granted a mobile water tanker permit to the operator of that tanker; and • the tanker is supplying the Water to be used for : - for fire fighting, stock watering or other public health purposes but then only to the extent which it is reasonably necessary for those purposes; or - for domestic purposes inside a dwelling; or - for any other use of Water permitted by means of a hand-held hose under stage 1 restrictions.	(b) Water cannot be used to fill or top up a water tanker unless: • Wannon Water has granted a mobile water tanker permit to the operator of that tanker; and • the tanker is supplying the Water to be used for: - for fire fighting, stock watering or other public health purposes but then only to the extent which it is reasonably necessary for those purposes; or - for domestic purposes inside a dwelling; or - for any other use of Water permitted by means of a hand-held hose under stage 2 restrictions.	(b) Water cannot be used to fill or top up a water tanker unless: • Wannon Water has granted a mobile water tanker permit to the operator of that tanker; and • the tanker is supplying the Water to be used for: - for fire fighting, stock watering or other public health purposes but then only to the extent which it is reasonably necessary for those purposes; or - for domestic purposes inside a dwelling; or - for any other use of Water permitted by means of a hand-held hose under stage 3 restrictions.	(b) Water cannot be used to fill or top up a water tanker unless: • Wannon Water has granted a mobile water tanker permit to the operator of that tanker; and • the tanker is supplying the Water to be used for: - for fire fighting, stock watering or other public health purposes but then only to the extent which it is reasonably necessary for those purposes; or - for domestic purposes inside a dwelling; or - for any other use of Water permitted by means of a hand-held hose under stage 4 restrictions.

	Stage 1 (Alert)	Stage 2 (Save)	Stage 3 (Just Enough)	Stage 4 (Critical)
5. Cleaning Vehicles with Water	(a) Water cannot be used to clean a vehicle, except: • in the case of a vehicle being cleaned at the premises of or by a motor vehicle dealer, repairer or detailer, only in accordance with paragraph (c); or • in any other case by means of: - a high pressure water cleaning device; or - if such a device is not available, a hand-held hose, bucket or watering can; or • at a commercial car wash in accordance with paragraph (d); or • in the case of a vehicle for mass transportation, in accordance with an approved Water Use Plan.	(a) Water cannot be used to clean a vehicle except: • in the case of a vehicle being cleaned at the premises of or by a motor vehicle dealer, repairer or detailer, only in accordance with paragraph (c); or • in any other case by means of: - a high pressure water cleaning device; or - if such a device is not available, a hand-held hose, bucket or watering can; or • at a commercial car wash in accordance with paragraph (d); or • in the case of a vehicle for mass transportation, in accordance with an approved Water Use Plan.	(a) Water cannot be used to clean a vehicle except: • in the case of a vehicle being cleaned at the premises of or by a motor vehicle dealer, repairer or detailer, only in accordance with paragraph (c); or • in any other case by means of a bucket or watering can and even then only to the extent it is necessary for: - health and safety reasons; or - cleaning vehicle windows, mirrors, lights and registration plates; or - spot-removing corrosive substances, or • at a commercial car wash in accordance with paragraph (d); or • in the case of a vehicle that is used for mass transportation, in accordance with an approved Water Use Plan.	(a) Water cannot be used to clean a vehicle except: • by means of a bucket or watering can and even then only to the extent it is necessary for: - health and safety reasons; or - cleaning vehicle windows, mirrors, lights and registration plates; or - spot-removing corrosive substances; or • at a commercial car wash in accordance with paragraph (d); or • in the case of a vehicle for mass transportation, in accordance with an approved Water Use Plan.
	(b) Notwithstanding paragraph (a), Water can be used to clean inside a food transport vehicle if it is necessary, either to avoid contamination of the vehicle's contents or to ensure public health or safety, but only by means of a: • a high pressure water cleaning device; or • a hand-held hose, bucket or watering can.	(b) Notwithstanding paragraph (a), Water can be used to clean inside a food transport vehicle if it is necessary, either to avoid contamination of the vehicle's contents or to ensure public health or safety, but only by means of a: • a high pressure water cleaning device; or • a hand-held hose, bucket or watering can.	(b) Notwithstanding paragraph (a), Water can be used to clean inside a food transport vehicle if it is necessary, either to avoid contamination of the vehicle's contents or to ensure public health or safety, but only by means of a: • a high pressure water cleaning device; or • a hand-held hose, bucket or watering can.	(b) Notwithstanding paragraph (a), Water can be used to clean inside a food transport vehicle if it is necessary, either to avoid contamination of the vehicle's contents, or to ensure public health or safety, but only by means of a: • a high pressure water cleaning device; or • a hand-held hose, bucket or watering can.
	(c) Water cannot be used at the premises of or by a motor vehicle dealer, repairer or detailer to clean a vehicle except: • by means of: - a high pressure water cleaning device; - a commercial car wash in accordance with paragraph (d); or - a bucket or watering can; or • in accordance with an approved Water Use Plan.	(c) Water cannot be used at the premises of or by a motor vehicle dealer, repairer or detailer to clean a vehicle except: • by means of: - a high pressure water cleaning device; - a commercial car wash in accordance with paragraph (d); or - a bucket or watering can; or • in accordance with an approved Water Use Plan.	(c) Water cannot be used at the premises of or by a motor vehicle dealer, repairer or detailer to clean a vehicle except: • by means of: - a high pressure water cleaning device; - a commercial car wash in accordance with paragraph (d); or - a bucket or watering can; or • in accordance with an approved Water Use Plan.	(c) *Not used*.

	Stage 1 **(Alert)**	**Stage 2** **(Save)**	**Stage 3** **(Just Enough)**	**Stage 4** **(Critical)**
	(d) Water cannot be used to wash vehicles at a commercial car wash unless: • for those car washes built prior to 1 July 2012, no more than 100 litres of water is used for each vehicle washed; and • for those car washes built on or after 1 July 2012, no more than 70 litres of water is used for each vehicle washed; or • the use is in accordance with an approved Water Use Plan.	(d) Water cannot be used to wash vehicles at a commercial car wash unless: • for those car washes built prior to 1 July 2012, no more than 100 litres of water is used for each vehicle washed; and • for those car washes built on or after 1 July 2012, no more than 70 litres of water is used for each vehicle washed; or • the use is in accordance with an approved Water Use Plan.	(d) Water cannot be used to wash vehicles at a commercial car wash unless: • the car wash uses no more than 70 litres of water, for each vehicle washed; or • the use is in accordance with an approved Water Use Plan.	(d) Water cannot be used to wash vehicles at a commercial car wash except by means of a bucket or watering can and even then only to the extent it is necessary for: - health and safety reasons; or - cleaning vehicle windows, mirrors, lights and registration plates; or - spot-removing corrosive substances
	(e) Water cannot be used to flush the inboard or outboard motor of a boat or other vessel unless: • a suitable receptacle filled by a hand-held hose is used; or • a flushing device, connected to a hose is used, and the tap is turned off immediately after flushing is complete.	(e) Water cannot be used to flush the inboard or outboard motor of a boat or other vessel unless: • a suitable receptacle filled by a hand-held hose is used; or • a flushing device, connected to a hose is used, and the tap is turned off immediately after flushing is complete.	(e) Water cannot be used to flush the inboard or outboard motor of a boat or other vessel unless: • a suitable receptacle filled by a hand-held hose is used; or • a flushing device, connected to a hose is used, and the tap is turned off immediately after flushing is complete.	(e) Water cannot be used to flush the inboard or outboard motor of a boat or other vessel unless: • a suitable receptacle filled by a hand-held hose is used; or • a flushing device, connected to a hose is used, and the tap is turned off immediately after flushing is complete.
6. Using Water for Other Cleaning or Maintenance Purposes	(a) Water cannot be used on hard surfaces or building facades (including windows), except: • in the course of construction or renovation but only as permitted under paragraph (c); or • for cleaning required as a result of an accident, fire, health hazard, safety hazard or other emergency and then only by means of: - a high pressure water cleaning device; or - if such a device is not available, a hand-held hose, bucket or watering can, or • in the case of building facades (including windows), for any other type of cleaning (not referred to above) and then only by means of a bucket or watering can.	(a) Water cannot be used on hard surfaces or building facades (including windows), except: • in the course of construction or renovation but only as permitted under paragraph (c); or • for cleaning required as a result of an accident, fire, health hazard, safety hazard or other emergency and then only by means of: - a high pressure water cleaning device; or - if such a device is not available, a hand-held hose, bucket or watering can, or • In the case of building facades (including windows), for any other type of cleaning and then only by means of a bucket or watering can.	(a) Water cannot be used on hard surfaces or building facades (including windows), except: • in the course of construction or renovation but only as permitted under paragraph (c); or • for cleaning required as a result of an accident, fire, health hazard, safety hazard or other emergency and then only by means of: - a high pressure water cleaning device; or - if such a device is not available, a hand-held hose, bucket or watering can.	(a) Water cannot be used on hard surfaces or building facades (including windows), except: • in the course of construction or renovation but only as permitted under paragraph (c); or • for cleaning required as a result of an accident, fire, health hazard, safety hazard or other emergency and then only by means of: - a high pressure water cleaning device; - if such a device is not available, a hand-held hose, bucket or watering can.

	Stage 1 **(Alert)**	**Stage 2** **(Save)**	**Stage 3** **(Just Enough)**	**Stage 4** **(Critical)**
	(b) Water cannot be used to suppress dust unless the dust is causing or is likely to cause a health or environmental hazard, and then only: • by means of a hand-held hose, bucket or watering can; or • with Water from a water tanker filled or topped up in accordance with restriction 4(b); or • in accordance with an approved Water Use Plan.	(b) Water cannot be used to suppress dust unless the dust is causing or is likely to cause a health or environmental hazard, and then only: • by means of a hand-held hose, bucket or watering can; or • with Water from a water tanker filled or topped up in accordance with restriction 4(b); or • in accordance with an approved Water Use Plan.	(b) Water cannot be used to suppress dust unless the dust is causing or is likely to cause a health or environmental hazard, and then only : • by means of a hand-held hose, bucket or watering can; or • with Water from a water tanker filled or topped up in accordance with restriction 4(b); or • in accordance with an approved Water Use Plan.	(b) Water cannot be used to suppress dust unless: • there is no suitable alternative source of water available for use; and • the dust is causing or is likely to cause a health or environmental hazard, and then only: • by means of a hand-held hose, bucket or watering can; or • with Water from a water tanker filled or topped up in accordance with restriction 4(b); or • in accordance with an approved Water Use Plan.
	(c) Water cannot be used in the course of construction or renovation except: • by means of a high pressure cleaning device, hand-held hose, bucket or watering can; or • for the suppression of dust in accordance with paragraph (b); or • for construction equipment which requires a water supply for its safe and efficient operation; or • if required in the normal course of initial testing or flushing of: pipes; or other works.	(c) Water cannot be used in the course of construction or renovation except: • by means of a high pressure cleaning device, hand-held hose, bucket or watering can; or • for the suppression of dust in accordance with paragraph (b); or • for construction equipment which requires a water supply for its safe and efficient operation; or • if required in the normal course of initial testing or flushing of: pipes; or other works.	(c) Water cannot be used in the course of construction or renovation except: • by means of a high pressure cleaning device, hand-held hose, bucket or watering can; or • for the suppression of dust in accordance with paragraph (b); or • for construction equipment which requires a water supply for its safe and efficient operation; or • if required in the normal course of initial testing or flushing of: pipes; or other works.	(c) Water cannot be used, in the course of construction or renovation except: • by means of a high pressure cleaning device, hand-held hose, bucket or watering can; or • for the suppression of dust in accordance with paragraph (b); or • for construction equipment which requires a water supply for its safe and efficient operation; or • if required in the normal course of initial testing or flushing of: pipes; or other works.
7. Using Water for Commercial Production of Plants and/or Animals:	(a) Water cannot be used at: • a commercial or Council plant nursery; or • a commercial market garden, except as required and then only by means of: • a hand-held hose, bucket or watering can at any time; or • a watering system at any time.	(a) Water cannot be used at: • a commercial or Council plant nursery; or • a commercial market garden, except as required and then only by means of: • a hand-held hose, bucket or watering can at any time; or • a watering system at any time.	(a) Water cannot be used at a commercial or Council plant nursery, except as required and then only: • by means of a hand-held hose, bucket or watering can at any time; or • in accordance with an approved Water Use Plan.	(a) Water cannot be used at a commercial or Council plant nursery, except as required and then only: • by means of a hand-held hose, bucket or watering can at any time; or • in accordance with an approved Water Use Plan.
	(b) *Not used.*	(b) *Not used.*	(b) Water cannot be used at a commercial market garden except as required and then only in accordance with an approved Water Use Plan.	(b) Water cannot be used at a commercial market garden except as required and then only in accordance with an approved Water Use Plan

	Stage 1 (Alert)	**Stage 2 (Save)**	**Stage 3 (Just Enough)**	**Stage 4 (Critical)**
	(c) Water cannot be used for animal husbandry except for: • drinking by animals or birds; or • cleaning animals or birds; or • cleaning pens, yards and cages, and then only if cleaning is done by means of a hand-held hose or bucket.	(c) Water cannot be used for animal husbandry except for: • drinking by animals or birds; or • cleaning animals or birds; or • cleaning pens, yards and cages, and then only if cleaning is done by means of a hand-held hose or bucket.	(c) Water cannot be used for animal husbandry except for: • drinking by animals or birds; or • cleaning animals or birds; or • cleaning pens, yards and cages, and then only if cleaning is done by means of a hand-held hose or bucket.	(c) Water cannot be used for animal husbandry except for: • drinking by animals or birds; or • cleaning animals or birds; or • cleaning pens, yards and cages, and then only if cleaning is done by means of a hand-held hose or bucket.
	(d) Water cannot be used for cooling a shed on a commercial poultry farm except by means of: • sprinklers used only for cooling and then only between the hours of 6am and 9pm when the inside temperature of the shed is 30°C or higher; and • fogging systems and cooling pads, which may be used at any time.	(d) Water cannot be used for cooling a shed on a commercial poultry farm except by means of: • sprinklers used only for cooling and then only between the hours of 6am and 9pm when the inside temperature of the shed is 30°C or higher; and • fogging systems and cooling pads, which may be used at any time.	(d) Water cannot be used for cooling a shed on a commercial poultry farm except by means of: • sprinklers used only for cooling and then only between the hours of 6am and 9pm when the inside temperature of the shed is 30°C or higher ; and • fogging systems and cooling pads, which may be used at any time.	(d) Water cannot be used for cooling a shed on a commercial poultry farm except by means of: • sprinklers used only for cooling and then only between the hours of 6am and 9pm when the inside temperature of the shed is 30°C or higher; and • fogging systems and cooling pads, which may be used at any time.
8. Other Uses	Water must not be used for any Other Use without the prior written permission of Wannon Water.	Water must not be used for any Other Use without the prior written permission of Wannon Water.	Water must not be used for any Other Use without the prior written permission of Wannon Water.	Water must not be used for any Other Use without the prior written permission of Wannon Water.

PART C – INDEX

Emergency	*Using Water for Other Cleaning or Maintenance Purposes*	6
Farm	*Using Water for Commercial Production of Plants and / or Animals*	7
Food transport vehicle	*Cleaning Vehicles with Water*	5
Fountain	*Using Water for Aesthetic Purposes*	2
Garden	*Watering Gardens, Lawns and Playing Surfaces*	1
	Using Water for Commercial Production of Plants and / or Animals	7
Grass	*Watering Gardens, Lawns and Playing Surfaces*	1
	Using Water for Commercial Production of Plants and / or Animals	7
Hard surface	*Using Water for Other Cleaning or Maintenance Purposes*	6
Hazard	*Using water for Other Cleaning or Maintenance Purposes*	6
Lake	*Using Water for Aesthetic Purposes*	2
Lawn	*Watering Gardens, Lawns and Playing Surfaces*	1
	Using Water for Commercial Production of Plants and / or Animals	7
Market garden	*Using Water for Commercial Production of Plants and / or Animals*	7
Mobile spa	*Using Water in Swimming Pools and Toys*	3
Motor vehicle	*Cleaning Vehicles with Water*	5
Motor vehicle dealer	*Cleaning Vehicles with Water*	
Municipal pool	*Using Water in Swimming Pools and Toys*	3
Nursery	*Watering Gardens, Lawns and Playing Surfaces*	1
	Using Water for Commercial Production of Plants and / or Animals	7
Ornamental pool	*Using Water for Aesthetic Purposes*	2
Oval	*Watering Gardens, Lawns and Playing Surfaces*	1
Park	*Watering Gardens, Lawns and Playing Surfaces*	1
	Using Water for Aesthetic Purposes	2
Paving	*Using Water for Other Cleaning or Maintenance Purposes*	6
Playing surface	*Watering Gardens, Lawns and Playing surfaces*	1
Pond	*Using Water for Aesthetic Purposes*	2

Pool	*Using Water for Aesthetic Purposes*	2
	Using Water in Swimming Pools and Toys	3
	Storing or Transporting Water	4
Poultry farm	*Using Water for Commercial Production of Plants and/ or Animals*	7
Public garden	*Watering Gardens, Lawns and Playing Surfaces*	1
Public lawn	*Watering Gardens, Lawns and Playing Surfaces*	1
Residential garden	*Watering Gardens, Lawns and Playing Surfaces*	1
Residential lawn	*Watering Gardens, Lawns and Playing Surfaces*	1
Roof	*Using Water for Other Cleaning or Maintenance Purposes*	6
School	*Watering Gardens, Lawns and Playing Surfaces*	1
	Using Water in Swimming Pools and Toys	3
Spa	*Using Water in Swimming Pools and Toys*	3
Sportsground	*Watering Gardens, Lawns and Playing Surfaces*	1
Sporting club	*Watering Gardens, Lawns and Playing Surfaces*	1
	Using Water in Swimming Pools and Toys	3
Swimming pool	*Using Water in Swimming Pools and Toys*	3
	Storing or Transporting Water	4
Tank	*Storing or Transporting Water*	
Tanker	*Storing or Transporting Water*	4
	Cleaning Vehicles With Water	5
Toy	*Using Water in Swimming Pools and Toys*	3
Vehicle	*Cleaning Vehicles with Water*	5
Wading pool	*Using Water in Swimming Pools and Spas*	3
Wall	*Using Water for Other Cleaning or Maintenance Purposes*	6
Water feature	*Using Water for Aesthetic Purposes*	2
Water toy	*Using Water in Swimming Pools and Toys*	3
Window	*Using Water for Other Cleaning or Maintenance Purposes*	6

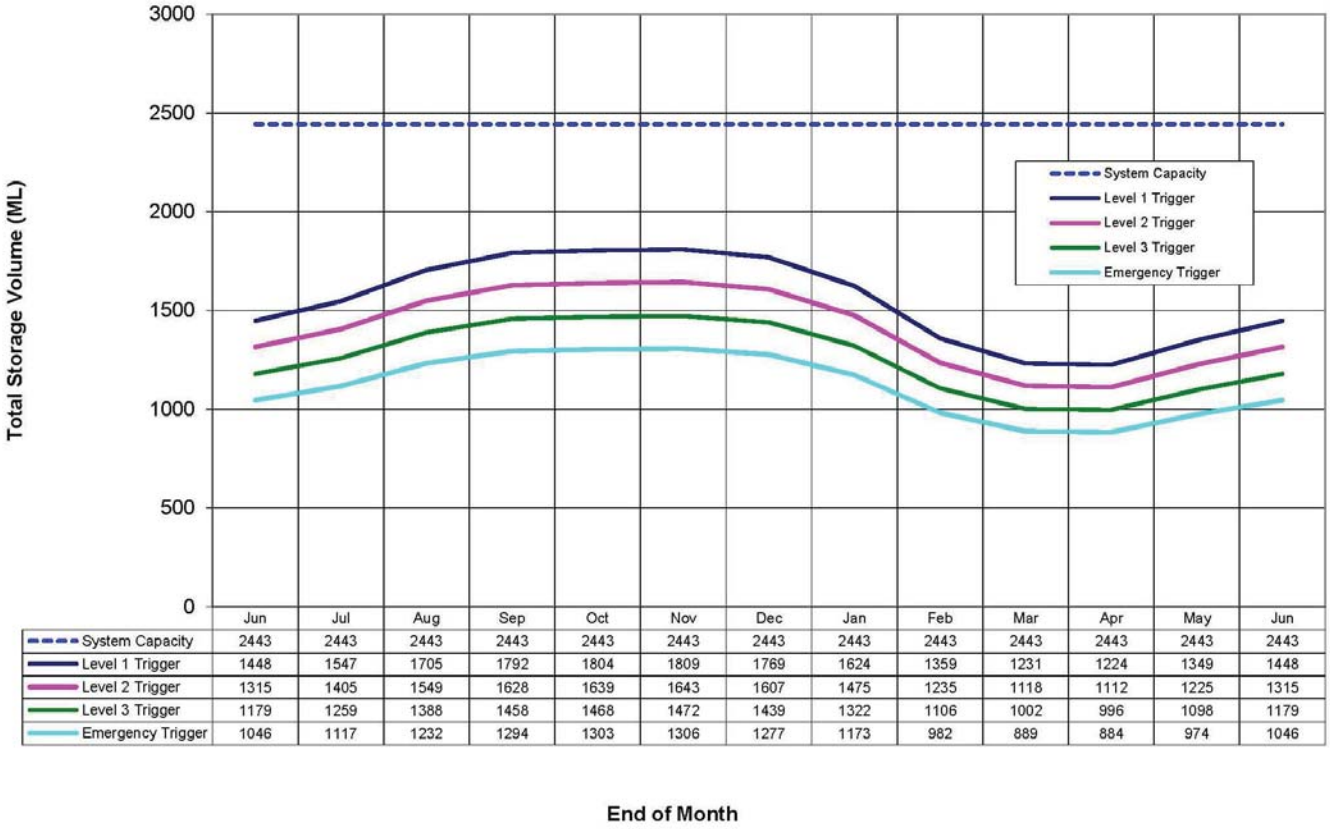
Appendix C Drought Response Triggers

C1 Otway System

C2 Grampians System

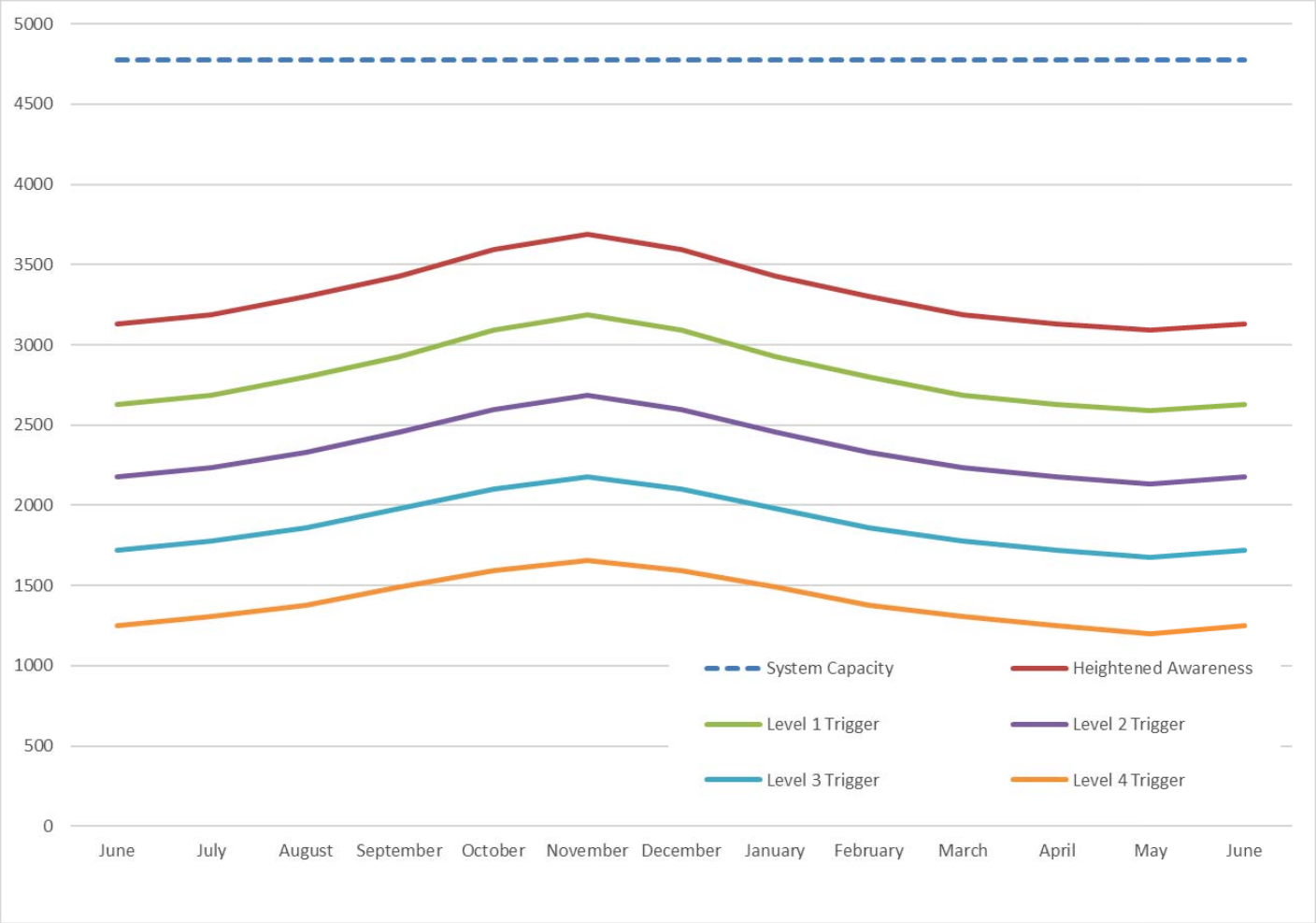
C3 Glenthompson System

APPENDIX C1. Otway System Drought Response Triggers



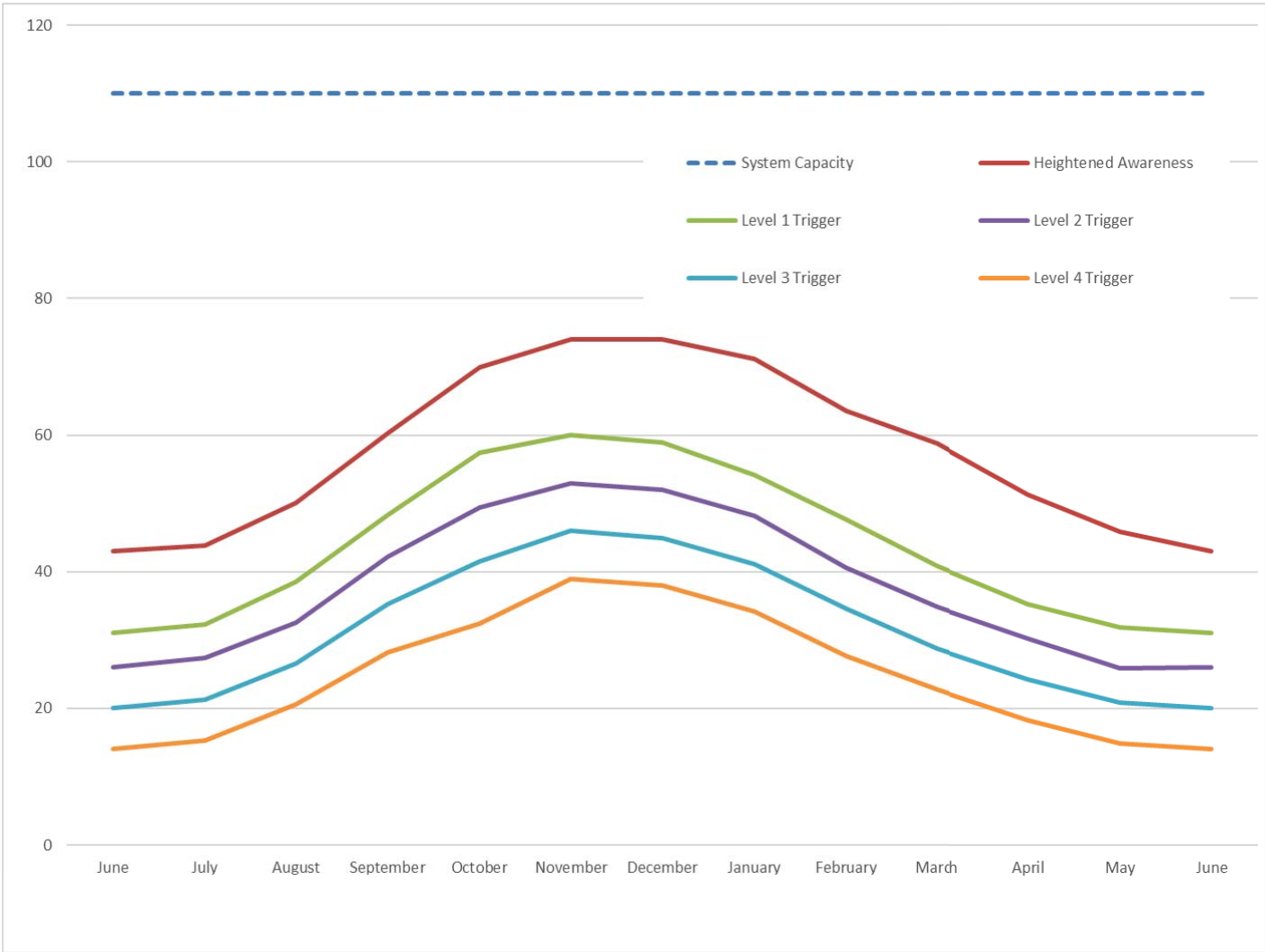
	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
System Capacity	2443	2443	2443	2443	2443	2443	2443	2443	2443	2443	2443	2443	2443
Level 1 Trigger	1448	1547	1705	1792	1804	1809	1769	1624	1359	1231	1224	1349	1448
Level 2 Trigger	1315	1405	1549	1628	1639	1643	1607	1475	1235	1118	1112	1225	1315
Level 3 Trigger	1179	1259	1388	1458	1468	1472	1439	1322	1106	1002	996	1098	1179
Emergency Trigger	1046	1117	1232	1294	1303	1306	1277	1173	982	889	884	974	1046

APPENDIX C2. Grampians System Drought Response Triggers



	June	July	August	Septembe	October	November	December	January	February	March	April	May	June
System Capacity	4772	4772	4772	4772	4772	4772	4772	4772	4772	4772	4772	4772	4772
Heightened Awareness	3130	3188	3301	3430	3594	3690	3594	3430	3301	3188	3130	3091	3130
Level 1 Trigger	2630	2688	2801	2930	3094	3190	3094	2930	2801	2688	2630	2591	2630
Level 2 Trigger	2175	2232	2331	2456	2598	2685	2598	2456	2331	2232	2175	2132	2175
Level 3 Trigger	1720	1776	1862	1982	2102	2180	2102	1982	1862	1776	1720	1673	1720
Level 4 Trigger	1251	1306	1378	1493	1591	1659	1591	1493	1378	1306	1251	1200	1251

APPENDIX C3. Glenthompson System Drought Response Triggers



	June	July	August	Septembe	October	November	December	January	February	March	April	May	June
System Capacity	110	110	110	110	110	110	110	110	110	110	110	110	110
Heightened Awareness	43	44	50	60	70	74	74	71	64	59	51	46	43
Level 1 Trigger	31	32	39	48	57	60	59	54	48	41	35	32	31
Level 2 Trigger	26	27	33	42	49	53	52	48	41	35	30	26	26
Level 3 Trigger	20	21	27	35	41	46	45	41	35	29	24	21	20
Level 4 Trigger	14	15	21	28	32	39	38	34	28	23	18	15	14

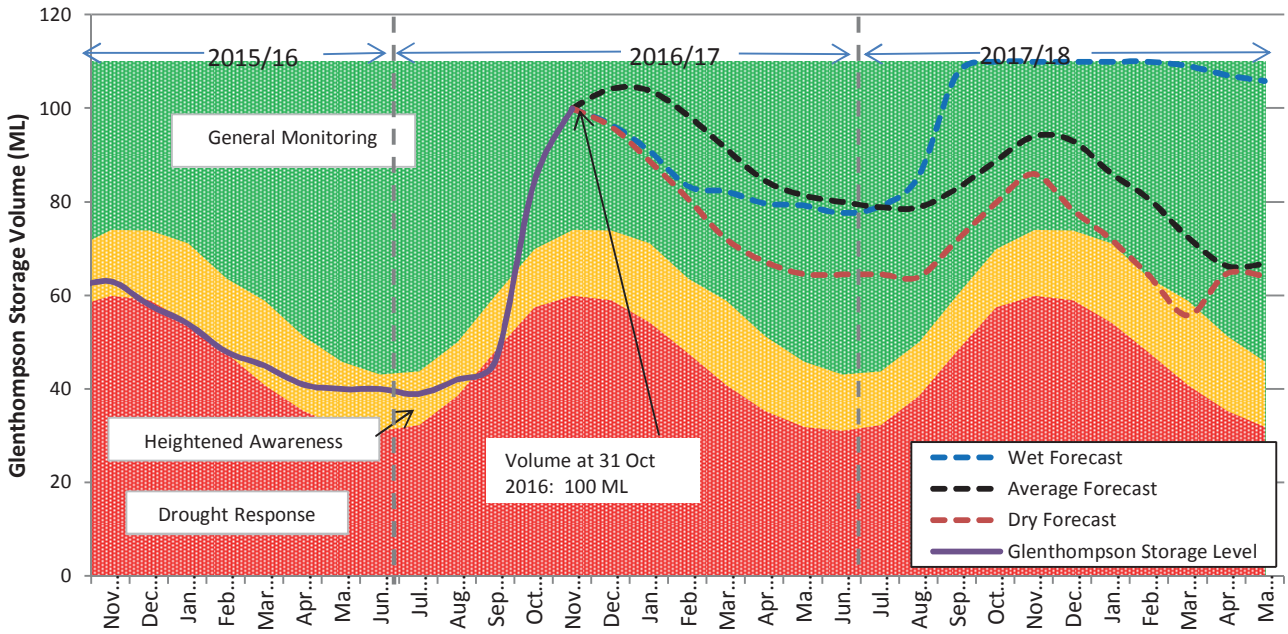
Appendix 3 – ANNUAL WATER OUTLOOKS

Prepared for:

- Glenthompson System;
- Grampians System;
- Groundwater Systems including Portland, Port Fairy, Tullich (Casterton), Port Campbell, Macarthur, Caramut, Darlington, Dartmoor, Heywood and Penshurst; and
- Otways System.

Glenthompson System Annual Water Outlook - November 2016

Forecast Water Availability



Forecast Assumptions:

Dry Forecast: 29 ML Glenthompson Town Demand, Inflows Nov 1981 - Apr 1983 (Low inflows), storage inflow from Willaura = 30ML in August-October 2017.

Average Forecast: 27 ML Glenthompson Town Demand, Inflows Nov 1978 - Apr 1980 (Average inflows), storage inflow from Willaura = 0ML in August-December 2017.

Wet Forecast: 25 ML Glenthompson Town Demand, Inflows Nov 2009 - Apr 2011 (High inflows), storage inflow from Willaura = 0ML in August-December 2017.

All forecasts assume an additional 25 ML/yr demand from rural customers upstream of the storage is met from the Willaura system.

Seasonal Climate Outlook - November 2016

The chance of above median rainfall in southwest Victoria in November is 35-40%. The outlook for December and January is for average rainfall. Climate influences include a northerly shift in high pressure systems (causing the expected dry end to spring), an end to the recent negative phase of the Indian Ocean dipole, and an ENSO-neutral tropical Pacific.

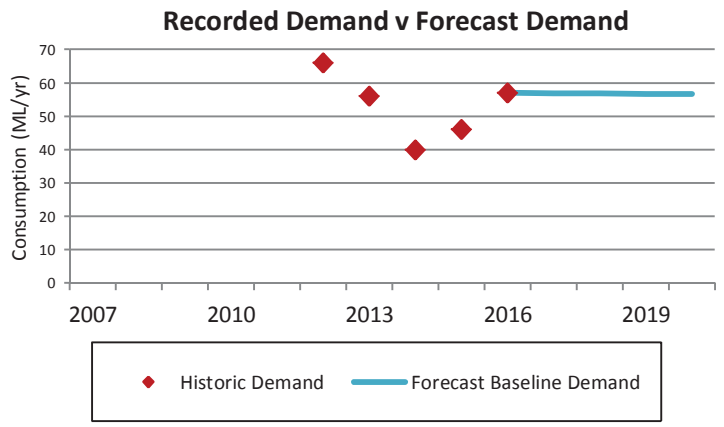
Further details: http://www.bom.gov.au/climate/outlooks.

System Status - November 2016

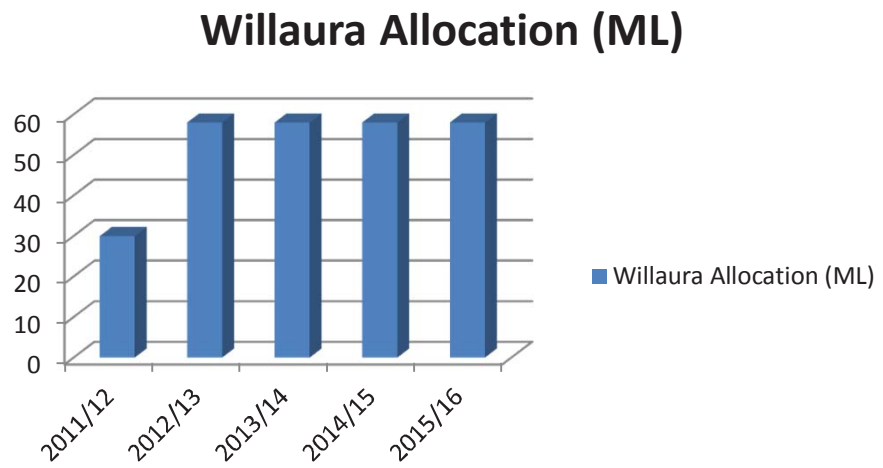
Mode 1: General Monitoring

As of November 2016, the Glenthompson storage level is 100ML, a recovery of 50ML over the months of September and October. Due to this recovery in storage level, no transfer from Willaura will be required before winter 2017.

Glenthompson System Annual Water Outlook - November 2016



System Demand
Demand is measured as raw water extraction less change in storage and includes water supplied to the town and rural customers, water treatment plant losses, storage losses, and other system losses.



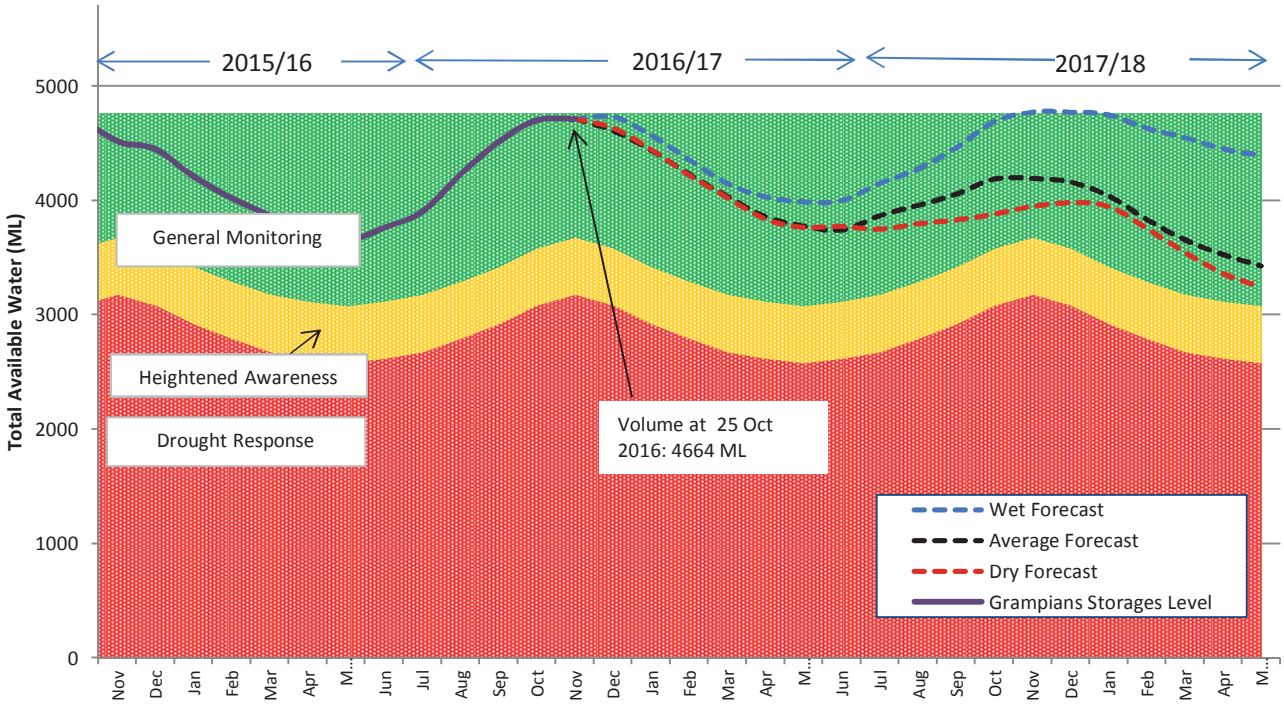
Willaura Supply Volume
As of April 2012, Wannon Water has a Bulk entitlement of 58ML in the Willaura system.

Glenthompson System Action Plan

Action	Timing	Responsibility
Continue working with Grampians Wimmera Mallee Water to establish the reliability of the Willaura supply, including arrangements to access groundwater.	2017	
Ongoing system monitoring as detailed under Mode 1: General Monitoring	2017	
Update Annual Water Outlook	Nov 2017	
Continue Demand Management activities	2017	

Grampians System Annual Water Outlook - November 2016

Forecast Water Availability



Forecast Assumptions:
No quality constraints with water used from Rocklands Reservoir (i.e. TDS remains less than 500 mg/L). "System Storage Capacity" is the capacity of local storages plus the Rocklands Bulk Entitlement of 2,120 ML.

Forecast Rocklands Usage:
(September 2016 - February 2018)
Wet Forecast: 0 ML
Average Forecast: 0 ML
Dry Forecast: 680 ML

Headworks Inflow Scenarios:
Wet Forecast: Nov 2000 - April 2002 inflows
Average Forecast: Nov 1997 - April 1999 inflows
Dry Forecast: Nov 2005 - April 2007 inflows.

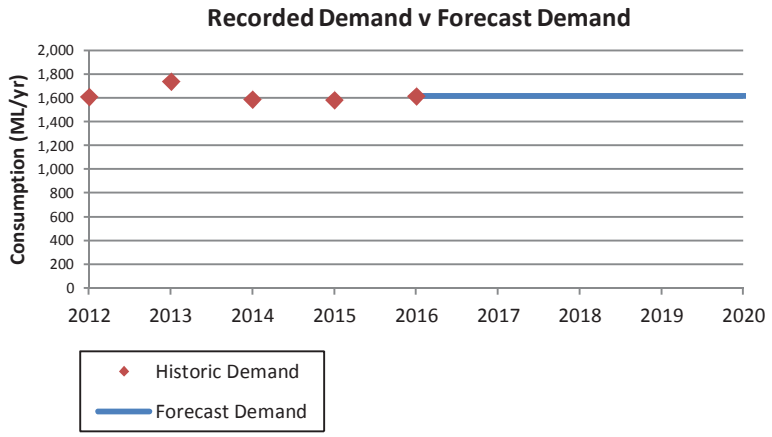
Seasonal Climate Outlook - November 2016
The chance of above median rainfall in southwest Victoria in November is 35-40%. The outlook for December and January is for average rainfall. Climate influences include a northerly shift in high pressure systems (causing the expected dry end to spring), an end to the recent negative phase of the Indian Ocean dipole, and an ENSO-neutral tropical Pacific.
Further details: http://www.bom.gov.au/climate/outlooks..

System Status - November 2016

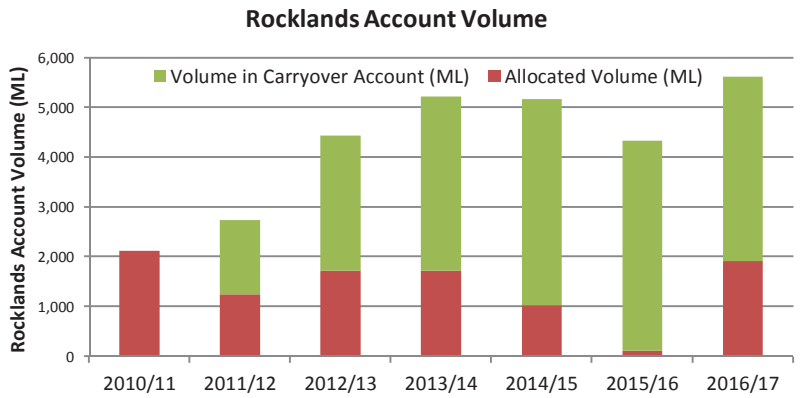
Mode 1: General Monitoring

Local system storages are currently full following excellent inflows over spring.
The 12 month forecasts indicate that under a range of inflow scenarios , water availability will remain within the General Monitoring operating mode.

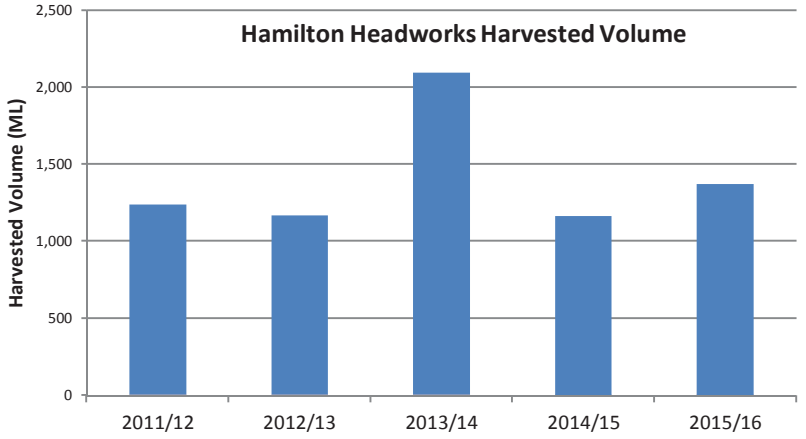
Grampians System Annual Water Outlook - November 2016



System Demand
Demand is measured as raw water extraction less change in storage and includes bulk water supplied to towns and rural customers, water treatment plant losses, storage losses, and other system losses.



Rocklands Account Volumes
This chart shows the volume held by Wannon Water in Rocklands Reservoir (allocations as of 1 October; carryover as of 1 October less 15% for evaporation). Wannon Water has a Bulk Entitlement of 2,120 ML a year. The accumulation of water above 2,120 ML will help provide for years when the allocation is less than 100%.

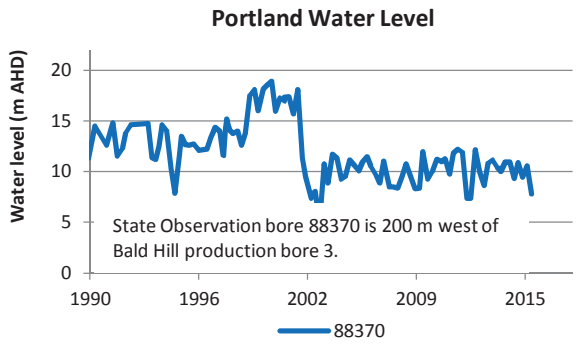


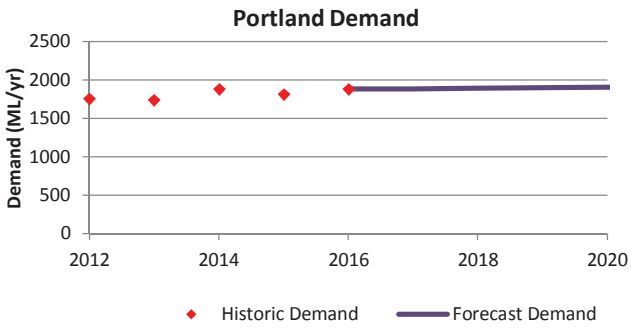
Local Streams
Harvested volume from Grampians streams and bores in the Hamilton Headworks has been high over the last five years, and reliable over summer. The bores have not been required to supply more than 4 ML in any of these years.

Grampians System Action Plan

Action	Timing	Responsibility
Ongoing system monitoring as detailed under Mode 1: General Monitoring operating mode	2017	
Maintain communication with Grampians Wimmera Mallee Water regarding future Rockland Allocation volumes	2017	
Continue to monitor consumption	2017	
Update Annual Water Outlook	Nov 2017	

Portland Groundwater System Annual Water Outlook - November 2016



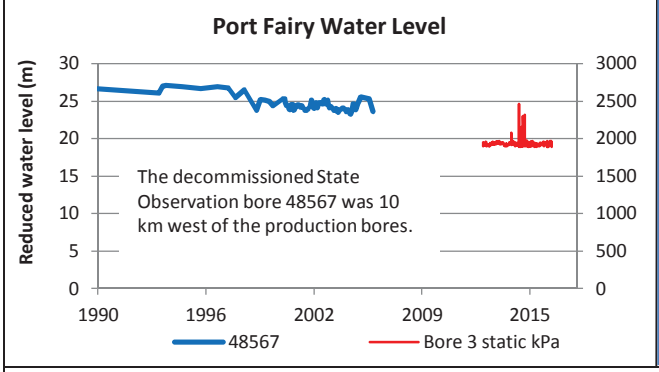


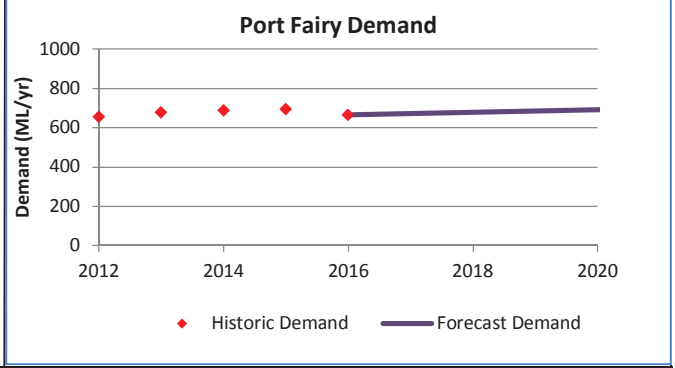
System Status: **Mode 1 - General Monitoring**

The deep groundwater resource accessed by this bore (the Dilwyn aquifer) is considered to be very reliable.

Uncertainty	Action	Timing	Responsibility
Resilience of aquifer water levels	Continue bore water level monitoring.	2017	
Future water demand	Continue tracking demand against forecasts.	2017	

Port Fairy Groundwater System Annual Water Outlook - November 2016



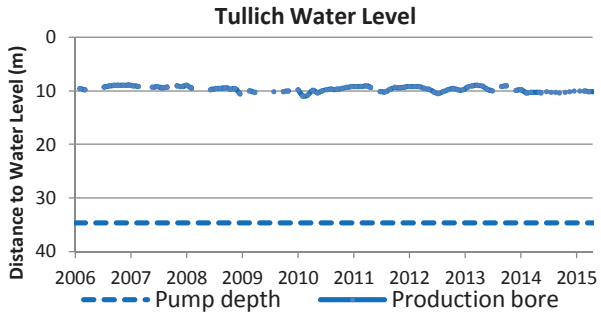


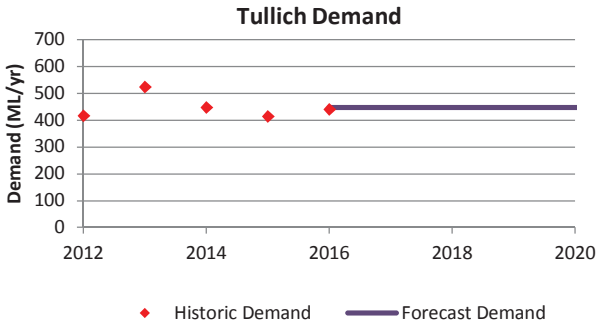
System Status: **Mode 1 - General Monitoring**

The deep groundwater resource accessed by this bore (the Dilwyn aquifer) is considered to be very reliable.

Uncertainty	Action	Timing	Responsibility
Resilience of aquifer water levels	The bore is artesian. Conduct review if artesian flow rate changes. Continue monitoring the pressure at the borehead.	2017	
Future water demand	Continue tracking demand against forecasts.	2017	

Tullich Groundwater System Annual Water Outlook - November 2016



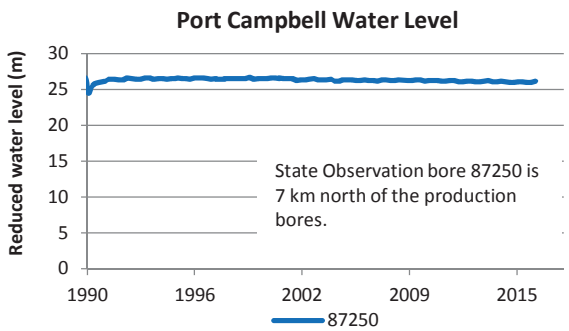


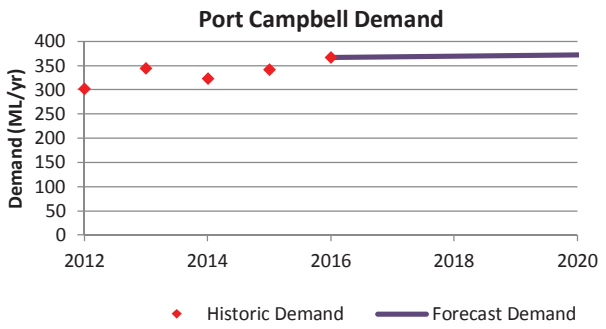
System Status: **Mode 1 - General Monitoring**

Water levels at the Tullich borefield have remained steady and well above the bore pump level since pumping began in 1989.

Uncertainty	Action	Timing	Responsibility
Resilience of aquifer water levels	Continue bore water level monitoring.	2017	
Future water demand	Continue tracking demand against forecasts.	2017	

Port Campbell Groundwater System Annual Water Outlook - November 2016



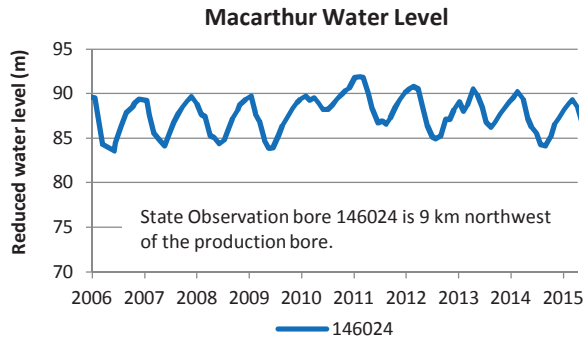


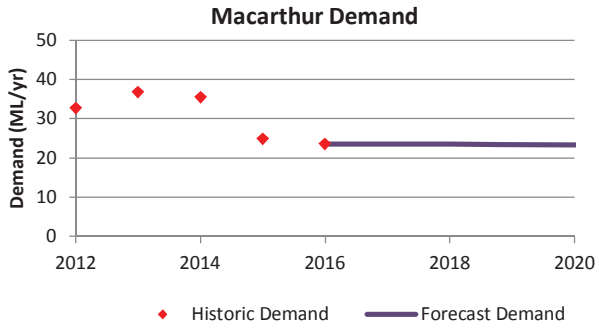
System Status: **Mode 1 - General Monitoring**

The deep groundwater resource accessed by this bore (the Dilwyn Aquifer) is considered to be very reliable.

Uncertainty	Action	Timing	Responsibility
Resilience of aquifer water levels	The bore is artesian. Conduct a review if artesian flow rate changes.	2017	
Future water demand	Continue tracking demand against forecasts.	2017	

Macarthur Groundwater System Annual Water Outlook - November 2016



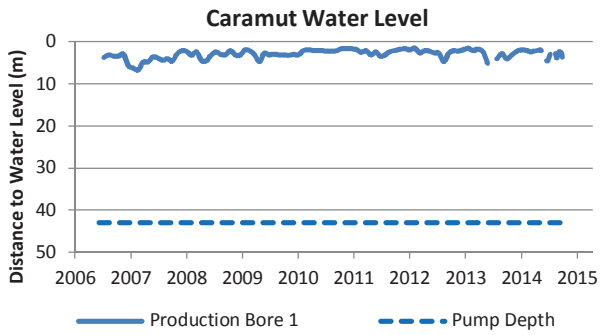


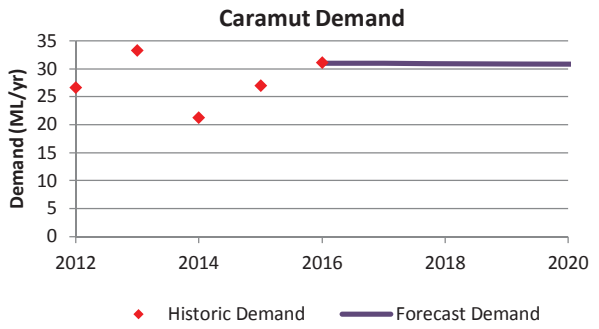
System Status: **Mode 1 - General Monitoring**

The borefield extracts from the Clifton Formation Aquifer and is located within the locally managed Condah Water Supply Protection Area. While the overall resource is constrained and allocations may be impacted by climate variability in the future, risk to the security of urban supply is low due to the large allocation held.

Uncertainty	Action	Timing	Responsibility
Resilience of aquifer water levels	Continue bore water level monitoring.	2017	
Future water demand	Continue tracking demand against forecasts.	2017	

Caramut Groundwater System Annual Water Outlook - November 2016



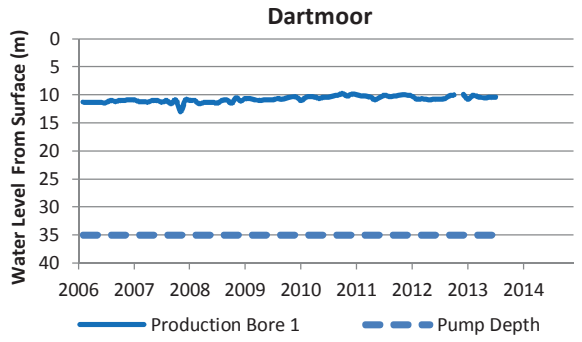


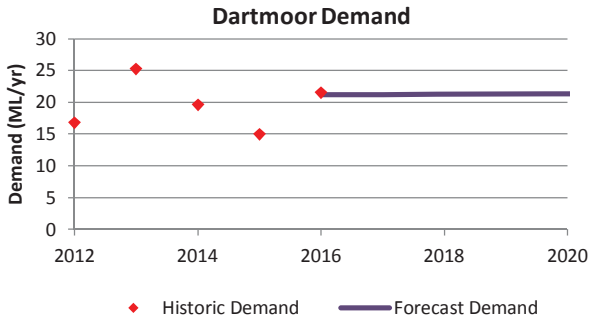
System Status: **Mode 1 - General Monitoring**

Water levels at the Caramut borefield (which accesses the Newer Volcanics Aquifer) remain well above the bore pump level. The supply is considered reliable.

Uncertainty	Action	Timing	Responsibility
Resilience of aquifer water levels	Continue bore water level monitoring.	2017	
Future water demand	Continue tracking demand against forecasts.	2017	

Dartmoor Groundwater System Annual Water Outlook - November 2016



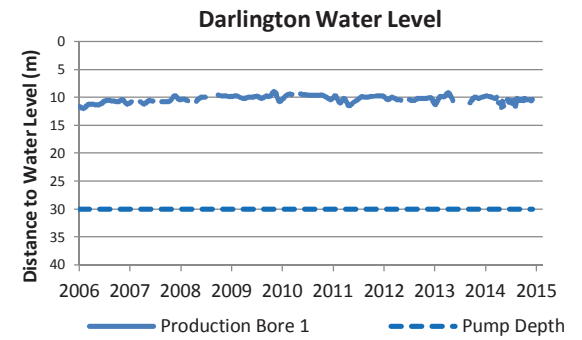


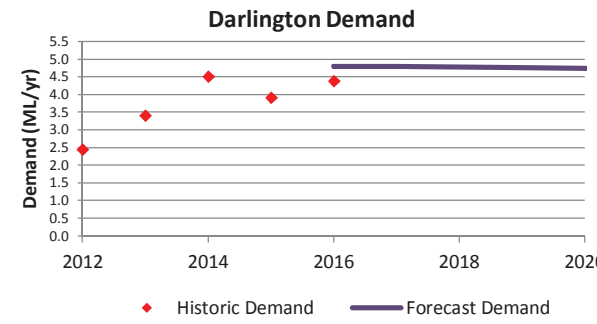
System Status: **Mode 1 - General Monitoring**

Water levels remain well above the bore pump level. The supply (which comes from the Dilwyn Aquifer) is considered reliable.

Uncertainty	Action	Timing	Responsibility
Resilience of aquifer water levels	Continue bore water level monitoring.	2017	
Future water demand	Continue tracking demand against forecasts.	2017	

Darlington Groundwater System Annual Water Outlook - November 2016



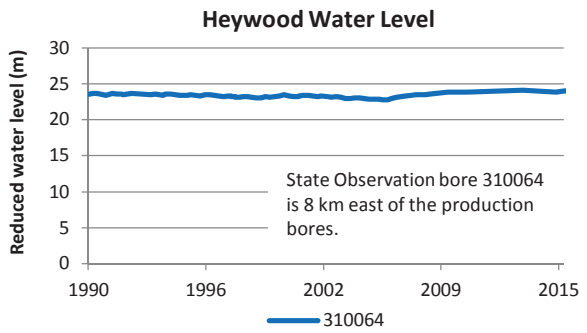


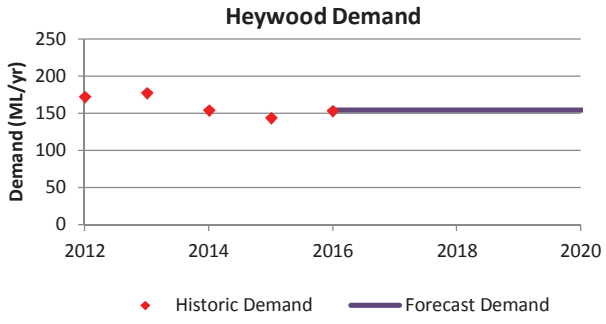
System Status: **Mode 1 - General Monitoring**

Water levels at the Darlington borefield (which extracts from the Uppter Tertiary Aquifer) have remained steady and well above the bore pump level for a number of years. The supply is considered reliable.

Uncertainty	Action	Timing	Responsibility
Resilience of aquifer water levels	Continue bore water level monitoring.	2017	
Future water demand	Continue tracking demand against forecasts.	2017	

Heywood Groundwater System Annual Water Outlook - November 2016



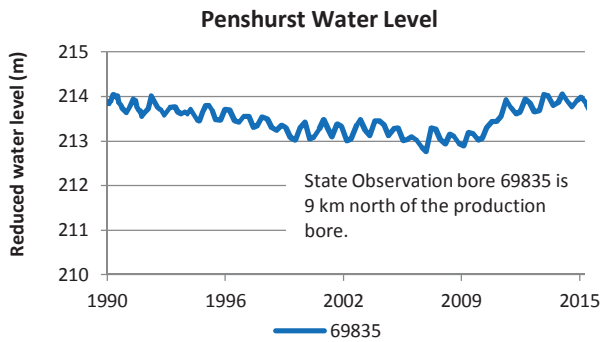


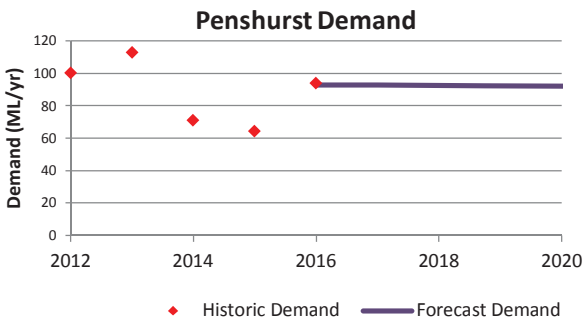
System Status: **Mode 1 - General Monitoring**

The deep groundwater resource accessed by this bore (the Dilwyn Aquifer) is considered to be very reliable.

Uncertainty	Action	Timing	Responsibility
Resilience of aquifer water levels	Monitor bore water levels.	2017	
Future water demand	Continue tracking demand against forecasts.	2017	

Penshurst Groundwater System Annual Water Outlook - November 2016





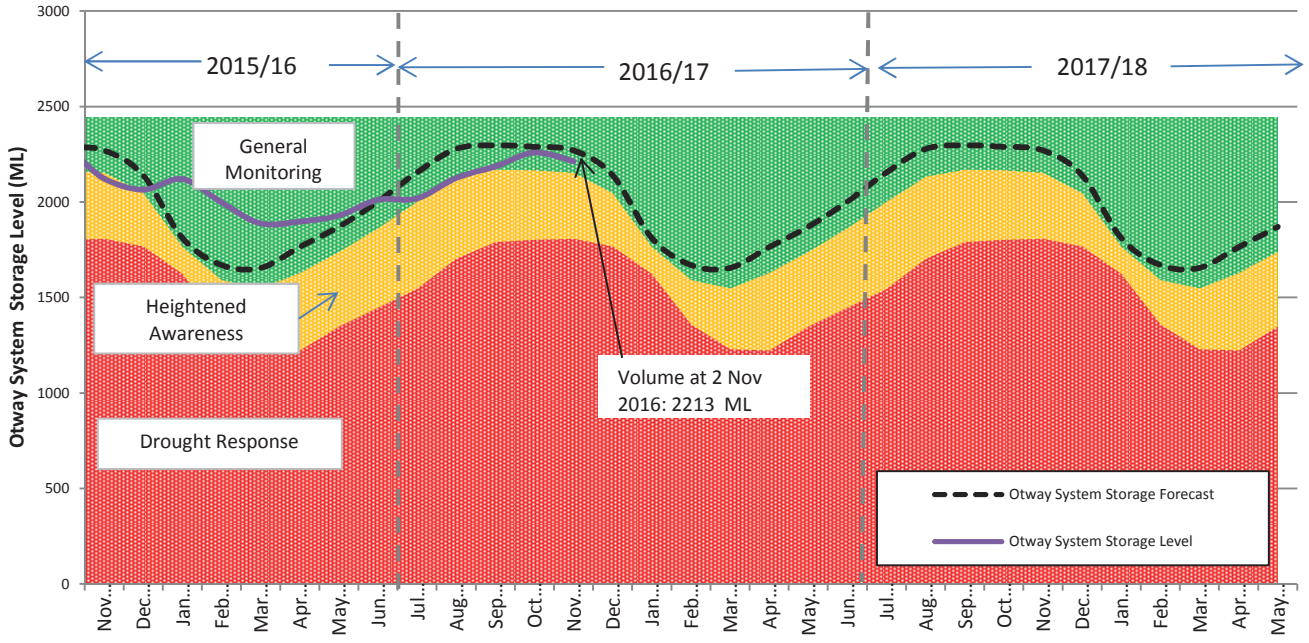
System Status: **Mode 1 - General Monitoring**

The Penshurst borefield (which extracts from the Newer Volcanics Aquifer) adequately coped with the 2000 -2009 drought conditions and is expected to continue to be reliable into the future.

Uncertainty	Action	Timing	Responsibility
Resilience of aquifer water levels	Monitor bore water levels.	2017	
Future water demand	Continue tracking demand against forecasts.	2017	

Otway System Annual Water Outlook - November 2016

Forecast Water Availability



Forecast Assumptions:
The forecast for the Otway System assumes that the streamflow in the Gellibrand River combined with the Carlisle river bores will continue to enable the system storages to be operated according to the storage target curves. This has been the case for the last 40 years.

Seasonal Climate Outlook - November 2016
The chance of above median rainfall in southwest Victoria in November is 35-40%. The outlook for December and January is for average rainfall. Climate influences include a northerly shift in high pressure systems (causing the expected dry end to spring), an end to the recent negative phase of the Indian Ocean dipole, and an ENSO-neutral tropical Pacific.
Further details: http://www.bom.gov.au/climate/outlooks.

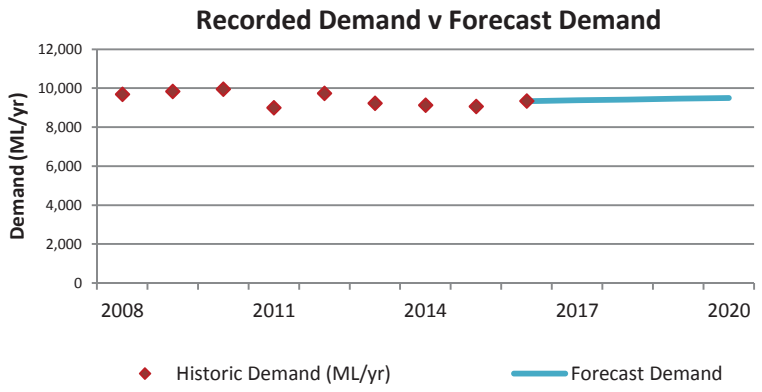
Otways System Status - November 2016

Mode 1: General Monitoring

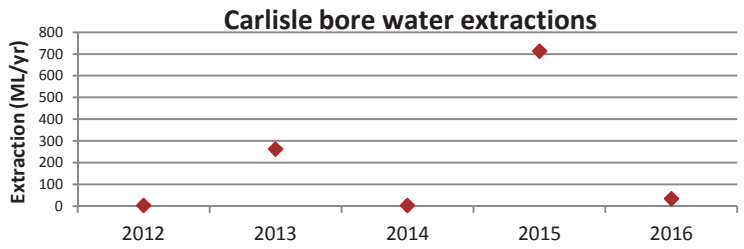
Otways system storages were close to target levels as of 2 November 2016. Storage levels are expected to follow the target curve without any need for drought response.

Water availability is expected to remain within the General Monitoring operating mode.

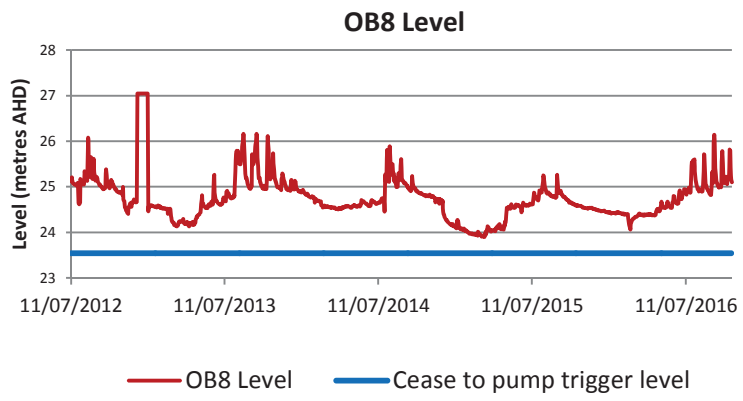
Otway System Annual Water Outlook - November 2016



System Demand
Demand is measured as raw water extraction less change in storage and includes bulk water supplied to towns and rural customers, water treatment plant losses, storage losses, and other system losses.



Carlisle Bore Water Extractions:
The bore is used (at 6ML/d) when streamflow falls below diversion thresholds. Streamflow fell slightly below diversion thresholds in March and April 2013. The extraction in 2015 was due to operational trials.



Carlisle Bore Water Level:
For the last five years, the water level in the Carlisle River Observation Bore (OB8) has remained well above the trigger to cease pumping from the bore.

Otways System Action Plan

Action	Timing	Responsibility
Ongoing system monitoring as detailed under Mode 1: General Monitoring operating mode	2017	
Continue demand reduction activities	2017	
Continue to expand the roof water harvesting scheme	2017	
Update Annual Water Outlook	Nov 2017	