Gippsland Water

Urban Water Strategy

April 2022

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Acknowledgement of Country

We acknowledge and respect the Traditional Owners of the Gippsland Water operational area, the Gunaikurnai people and the Bunurong people and all Victorian Traditional Owners. We acknowledge Traditional Owners are the original custodians of Victoria's land and waters, who have a responsibility to care for Country and have deep spiritual connection to land and water across Gippsland. We honour Elders past and present whose knowledge and wisdom has ensured the continuation of culture and traditional practice.

We are committed to genuinely partnering, and meaningfully engaging, with the Traditional Owners and Aboriginal communities within our operational area to support the protection of Country, the maintenance of spiritual and cultural practices and their broader aspirations for the future.

Figure 1 Working with our Traditional Owners

Executive summary

We supply fresh clean drinking water to more than 70,000 customers and wastewater services to more than 63,000 customers. Our Urban Water Strategy (UWS) is a key planning tool for delivering these services into the future. While we are required to prepare an UWS every five years under our Statement of Obligations and *Water for Victoria* (DELWP, 2016a), our state’s water plan, this process is also part of prudent planning as an urban water corporation. Our last UWS was developed in 2017.

Our UWS is a review of our current water resources, wastewater system capacities, and the demands for these services. This is a report on current risks to service provision and is a long-term outlook of these services to 2070. Importantly, our UWS delivers an Action Plan which identifies the priority actions to be implemented to ensure water supply, sewer capacity and demand on both of these services remain in balance.

This is our Action Plan:

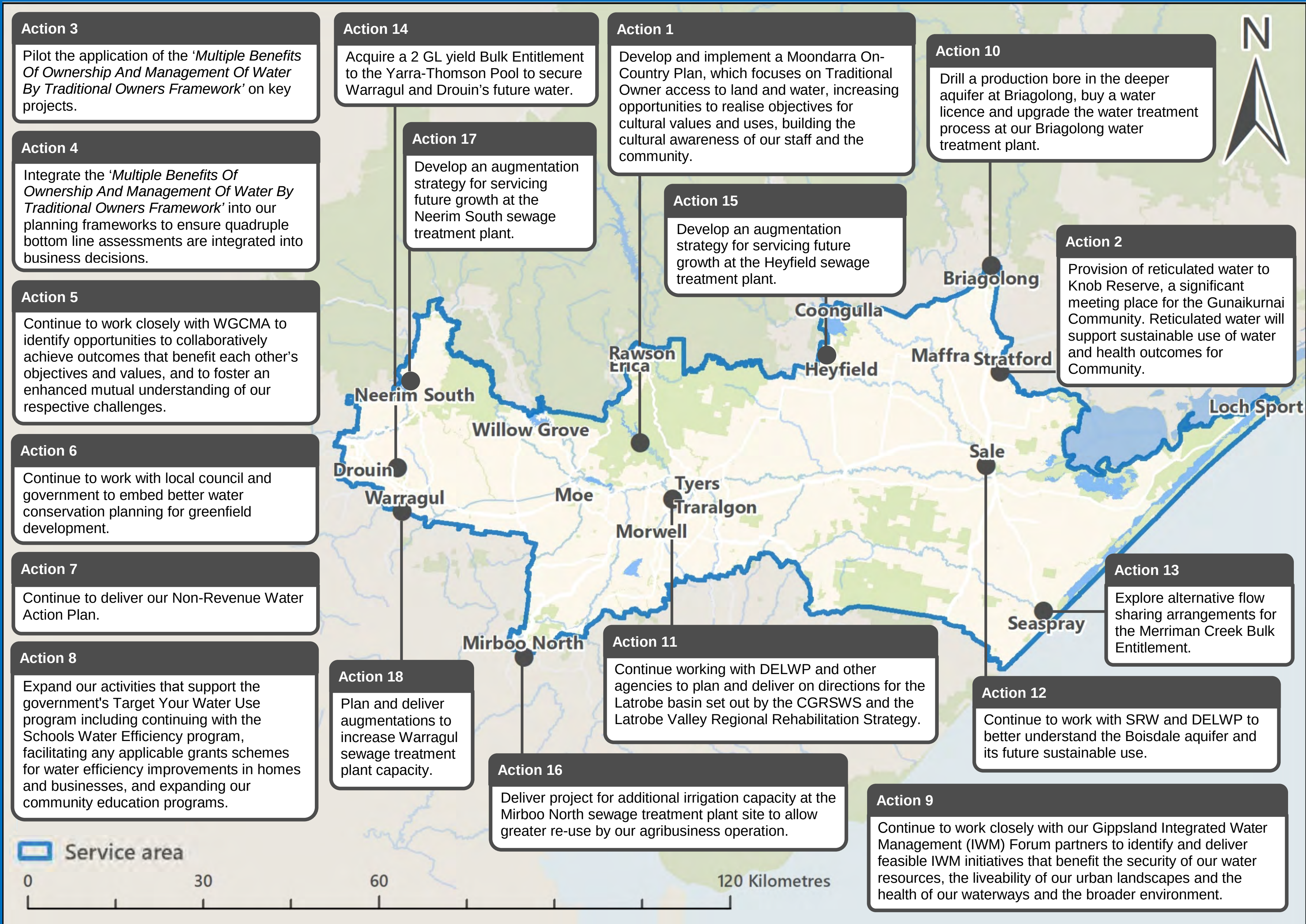

Figure 2 Our Action Plan on a map

Table 1 Our Action Plan

	Theme or System	Action	Timeframe	Page Number
Action 1	Partnering with our Traditional Owners	Develop and implement a Moondarra On-Country Plan, which focuses on Traditional Owner access to land and water, increasing opportunities to realise objectives for cultural values and uses, building the cultural awareness of our staff and the community.	To be progressed during the 2022-27 Urban Water Strategy period	Page 3
Action 2	Partnering with our Traditional Owners	Provision of reticulated water to Knob Reserve, a significant meeting place for the Gunaikurnai Community. Reticulated water will support cultural events at the site and support sustainable use of water and health outcomes for Community.	To be progressed during the 2022-27 Urban Water Strategy period	Page 3
Action 3	Partnering with our Traditional Owners	Pilot the application of the '*Multiple Benefits Of Ownership And Management Of Water By Traditional Owners Framework*'* on key projects.	To be progressed during the 2022-27 Urban Water Strategy period	Page 3
Action 4	Partnering with our Traditional Owners	Integrate the '*Multiple Benefits Of Ownership And Management Of Water By Traditional Owners Framework*'* into our planning frameworks to ensure quadruple bottom line assessments are integrated into business decisions.	To be progressed during the 2022-27 Urban Water Strategy period	Page 3

	Theme or System	Action	Timeframe	Page Number
Action 5	Engaging with our stakeholders	Build on our existing close relationship with West Gippsland Catchment Management Authority (WGCMA) to better identify opportunities to collaboratively achieve outcomes that benefit each other's objectives and values, and to foster an enhanced mutual understanding of our respective challenges.	Ongoing	Page 21
Action 6	Engaging with our stakeholders	Continue to work with local councils and government to embed better water conservation planning for greenfield development.	Ongoing	Page 21
Action 7	Water efficiency and conservation	Continue to deliver our Non-revenue Water Action Plan.	Ongoing	Page 36
Action 8	Water efficiency and conservation	Expand our activities that support the government's Target Your Water Use program including continuing with the Schools Water Efficiency program, facilitating any applicable grant schemes for water efficiency improvements in homes and businesses, and expanding our community education programs.	Ongoing	Page 36

	Theme or System	Action	Timeframe	Page Number
Action 9	Engaging with our stakeholders	Continue to work closely with our Gippsland Integrated Water Management (IWM) Forum partners to identify and deliver feasible IWM initiatives that benefit the security of our water resources, the liveability of our urban landscapes and the health of our waterways and the broader environment.	Ongoing	Page 38
Action 10	Briagolong water	Drill a production bore in the deeper aquifer at Briagolong, buy a water licence and upgrade the water treatment process at our Briagolong water treatment plant.	2023/24	Page 56
Action 11	Latrobe water	Continue working with the Department of Environment, Land, Water and Planning (DELWP) and other agencies to plan and deliver on directions for the Latrobe basin set by the *Central Gippsland Region Sustainable Water Strategy* (CGRSWS) and the Latrobe Valley Regional Rehabilitation Strategy.	Ongoing – subject to regulator timeframes	Page 64
Action 12	Sale water	Continue to work with Southern Rural Water (SRW) and DELWP to better understand the Boisdale aquifer and its future sustainable use.	Ongoing – subject to regulator timeframes	Page 81
Action 13	Seaspray water	Explore alternative flow sharing arrangements for the Merriman Creek Bulk Entitlement.	2022/23	Page 85

	Theme or System	Action	Timeframe	Page Number
Action 14	Tarago water	Acquire a 2 GL yield Bulk Entitlement to the Yarra-Thomson Pool to secure Warragul and Drouin's future water.	2023/24	Page 90
Action 15	Heyfield sewage	Develop an augmentation strategy for servicing future growth at the Heyfield sewage treatment plant.	2026/27	Page 112
Action 16	Mirboo North sewage	Deliver project for additional irrigation capacity at the Mirboo North sewage treatment plant site to allow greater re-use by our agribusiness operation.	2023/24	Page 123
Action 17	Neerim South sewage	Develop an augmentation strategy for servicing future growth at the Neerim South sewage treatment plant.	2026/27	Page 127
Action 18	Warragul sewage	Plan and deliver augmentations to increase Warragul sewage treatment plant capacity.	First stage by 2026/27	Page 141

* The *'Multiple Benefits Of Ownership And Management Of Water By Traditional Owners Framework'* was prepared for the Gunaikurnai Land and Waters Aboriginal Corporation (GLaWAC) on behalf of the *Central and Gippsland Region Sustainable Water Strategy* (CGRSWS) Traditional Owner Partnership (GLaWAC, Bunurong Land Council Aboriginal Corporation, Wadawarrung Traditional Owners Aboriginal Corporation and the Wurundjeri Woi-wurring Cultural Heritage Aboriginal Corporation).

Our Action Plan is a response to the challenges and opportunities we expect to face in the outlook period, being:

- Population growth
- Changing climate
- Extreme events
- Resilience of our systems
- Water efficiency and conservation

Our strategy report outlines how we have considered these issues in the *Challenges and opportunities* chapter (page 24). A key opportunity we have identified for action is to continue the delivery of our Action Plan for addressing water efficiency in our systems. We plan to strategically target systems where there is a small margin between supply and demand or where the unit cost of treated water production is high. Water efficiency improvements can have a significant impact on the cost and timing of system augmentations.

To plan for the future of both our water resources and our sewerage systems with these challenges and opportunities in mind, we need an outlook that takes into account the demands on our systems as well as the available water and sewage treatment capacity. For more detail see the chapter *Approach to planning in this strategy* (page 41) which covers the detail of our level of service, how we develop our demand forecasts, our water resource yield and sewage system capacity outlooks, and how we adaptively plan for an uncertain future.

We service a range of major customers whose water and wastewater needs are unique to our region both in terms of very significant volumes and water quality requirements. We provide these customers with various combinations of both raw and potable water as well as sewage treatment services. The scale of some of our major customers in terms of water usage means that changes in their operations can be significant in terms of overall demand and demand patterns. This affects the Latrobe water system and our Gippsland Water Factory in particular. The chart below shows the proportion of our water demand that is used by our major customers.

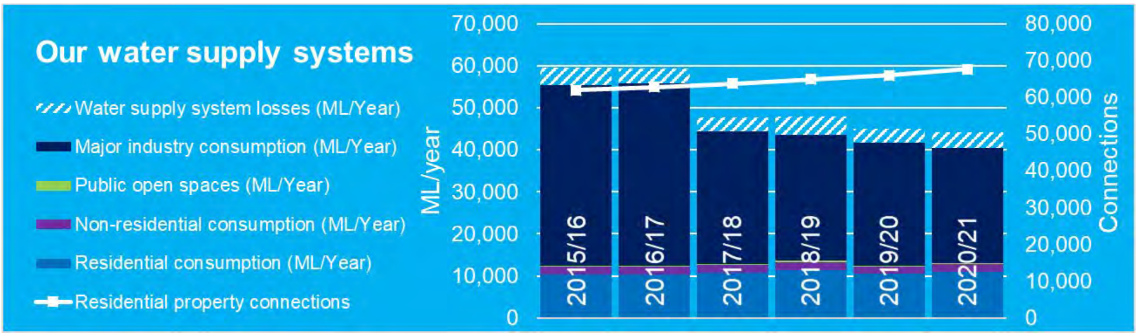

Figure 3 Previous six years demands across our water supply systems

A strategy such as this cannot be developed in isolation. During the course of the development of this strategy we have been working hard to understand the needs and expectations of our customers and community and regional partner agencies. This has included listening to and educating our customers, liaising with key stakeholder groups and working with our Traditional Owners.

We recognise that connection to land, water, and resources on Country is integral to the health and wellbeing of Aboriginal people. Reconnecting Traditional Owners to water can revive culture and contribute to an improved sense of identity. We are privileged to work in partnership with Traditional Owners in our region and through ongoing engagement we have heard what the key priorities in relation to water are for the

Gunaikurnai Land and Waters Aboriginal Corporation (GLaWAC) at this time. Together we have identified key actions we can deliver together over the next five years. You can read more in the chapter *Partnering with our region's Traditional Owners* (page 3). We also look forward to working more closely with the Bunurong Land Council Aboriginal Corporation.

Throughout our strategy we have used the Aboriginal names of the waterways as well as the post-colonisation names to reflect the partnership and shared commitment to ensure Traditional Owners have influence in how water is managed on Country at a legislative, policy, planning, implementation and practice level.

A key deliverable and highlight of the development of our UWS has been launching our online interactive map of our service area. We have promoted our interactive map as an opportunity for customers to learn about their water supply and sewerage systems – finding out where their water comes from, where it goes and the treatment processes. You can visit our interactive map at www.gippswater.com.au/uws.

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Our online interactive map

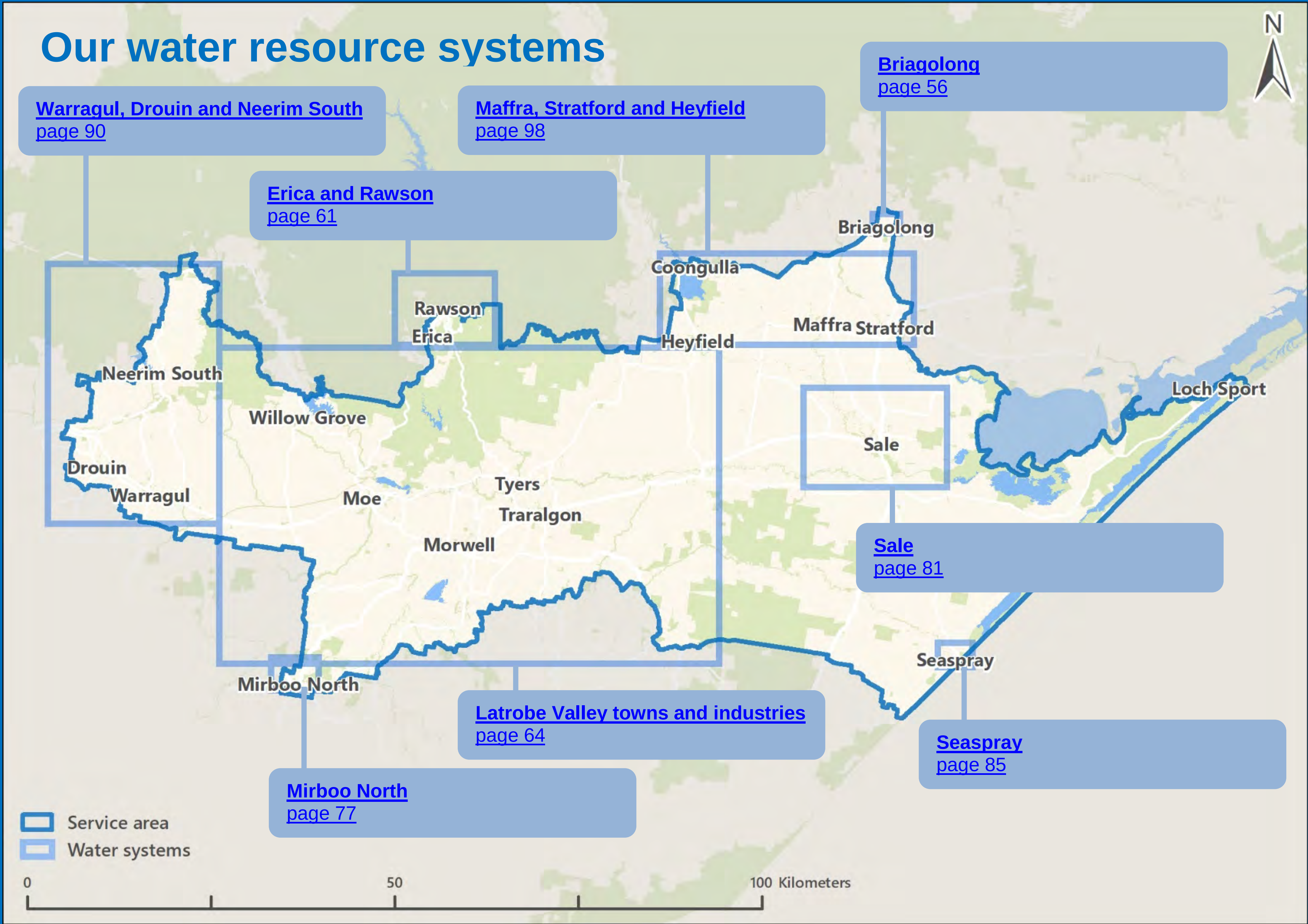
A key deliverable and highlight of the development of our UWS has been launching our online interactive map of our service area. We have promoted our interactive map as an opportunity for customers to learn about their water supply and sewerage systems – finding out where their water comes from, where it goes and the treatment processes. This report contains the detail of our UWS but the online map provides a summary of the key aspects of our strategy. The map also includes the outlooks for all of our systems and background information on key topics our outlooks consider. You can visit our interactive map at www.gippswater.com.au/uws.

Figure 4 Our online interactive map

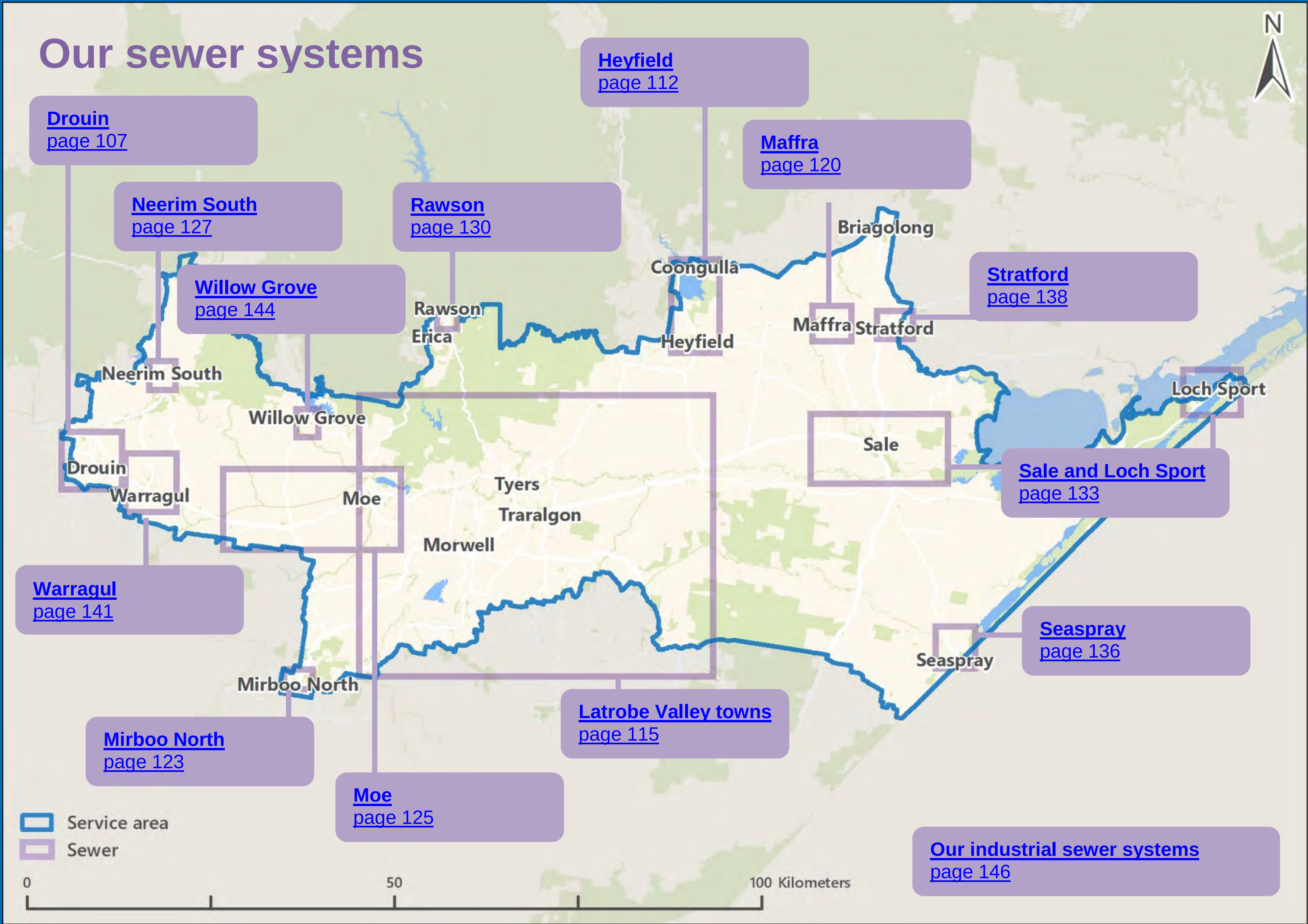
Map-based Table of Contents

Presented on the pages that follow are two maps we have prepared to assist readers to navigate this report based on the location in our region that is of interest to them. The first map shows the location of our water resource systems in our service area and includes the page numbers for the relevant section in the *Our water resources* chapter of this report (page 55). The second map shows the location of our sewer systems and likewise includes the page numbers for the relevant section in the *Our sewer systems* chapter (page 106).

Our water resource systems



Our sewer systems



Our Strategy and Victoria's water planning framework

Every five years Victoria's urban water corporations are required to prepare an Urban Water Strategy (UWS). Our UWS builds upon the work of previous strategies and is our principal water resources planning document. Its purpose is to identify the best mix of actions to provide and maintain reliable water supply and sewerage treatment capacity for the towns and cities across our region now and into the future. In developing the UWS, we consider the potential impacts on our service delivery under a range of plausible scenarios to account for and prepare for an uncertain future that is likely to be impacted by factors such as climate change and population growth.

Development of an UWS is a requirement of our Statement of Obligations, which is a directive from the Minister for Water, and also a requirement of the government's water plan *Water for Victoria* (2016). *Water for Victoria* is the state's high-level policy and strategic plan for water management. Our last UWS was developed in 2017.

Our UWS is a review of our current water resources, wastewater system capacities, and the demands for these services, reporting on current risks to service provision. It is also a long-term outlook of our water resources, waste water capacity and demands out to 2070, looking at all stages of the 50 year planning horizon. Our UWS takes into consideration climate variability and climate change, population projections, integrated water management, drought preparedness planning, and incorporates an assessment of our long-term bulk sewerage planning.

Over the past 18 months, and concurrent with the development of our UWS, the *Central and Gippsland Region Sustainable Water Strategy* (CGRSWS) has been developed by the Department of Environment, Land, Water and Planning (DELWP). Development of our UWS has been used to inform the CGRSWS, and likewise the directions and policies of the CGRSWS have guided our UWS development and align closely with our UWS Action Plan. Figure 5 overleaf shows how our UWS relates to other state and regional strategies and plans.

Victoria's Integrated Water Management (IWM) forums are a key opportunity for all organisations with an interest in the water cycle to identify, prioritise and oversee the implementation of collaborative water opportunities. Our Gippsland region IWM forum has been an integral communication channel for our UWS with our key water stakeholders and partners at both an executive and officer level. The Gippsland region IWM forum boundary extends beyond our service region. Within our region it includes representatives from Baw Baw Shire Council, Latrobe City Council, Wellington Shire Council, South Gippsland Shire Council, DELWP, Gunaikurnai Land and Waters Aboriginal Corporation, Bunurong Land Council, Parks Victoria, Southern Rural Water, and West Gippsland Catchment Management Authority. The Gippsland IWM Strategic Directions Statement is being updated and is due for release during 2022.

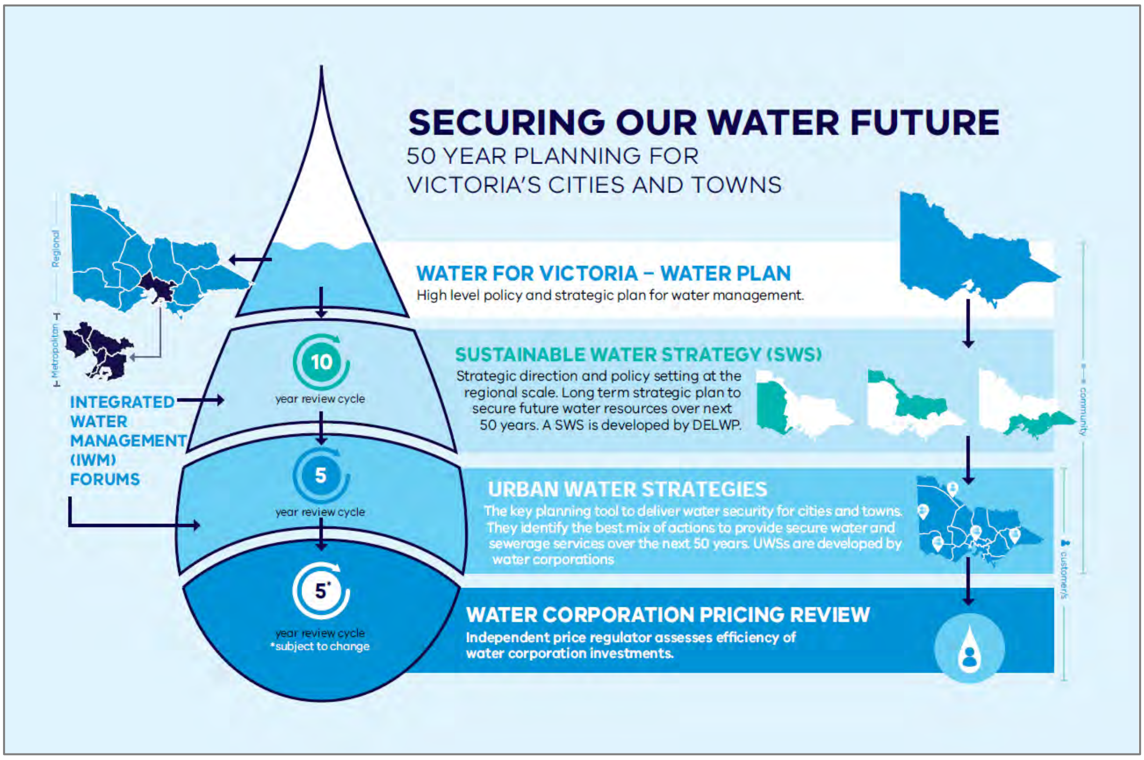


Figure 5 Victoria's urban water planning framework. Source: DELWP (2021b)

Finally, our UWS has been developed in parallel to our Price Submission 2023-2028 and our 2022-2027 Corporate Plan. Each water corporation in Victoria develops a pricing proposal for submission to the Essential Services Commission. Our Price Submission will contain our standards of service over a five-year period, as well as the cost of delivering our services and the prices we intend to charge customers. Our Corporate Plans set out our direction for the next five years. Our UWS, Price Submission and Corporate Plan must align and we took an integrated approach in community engagement, preparing our system forecasts and actions to meet the requirements of our Statement of Obligations as a water corporation.

Partnering with our region’s Traditional Owners

Context and overview

We recognise and respect that Gippsland’s Traditional Owners have deep, enduring and unique cultural, social, spiritual, and economic connection to Country – the lands, waters, skies, animals, plants, resources and all natural phenomena. Aboriginal people have the longest known living culture in the world, and have managed the Country sustainably over thousands of generations.

The connection to Country is vital to identity and belonging of Traditional Owners.

There are two recognised Registered Aboriginal Parties (RAPs) within our operational area (Figure 6): Gunaikurnai Land and Waters Aboriginal Corporation (GLaWAC) whose RAP boundaries cover approximately 95% of our operational area and the Bunurong Land Council Aboriginal Corporation, whose RAP boundaries include parts of Warragul and Drouin.

Our engagement for the UWS has been primarily with GLaWAC. We’ve engaged with Bunurong Traditional Owners primarily on individual projects to manage cultural values during the construction and operation of our assets such as soon to be constructed Warragul Western Ring Main. We remain committed to strengthening our partnership with Bunurong into the future, noting that we have assets on Bunurong Country.

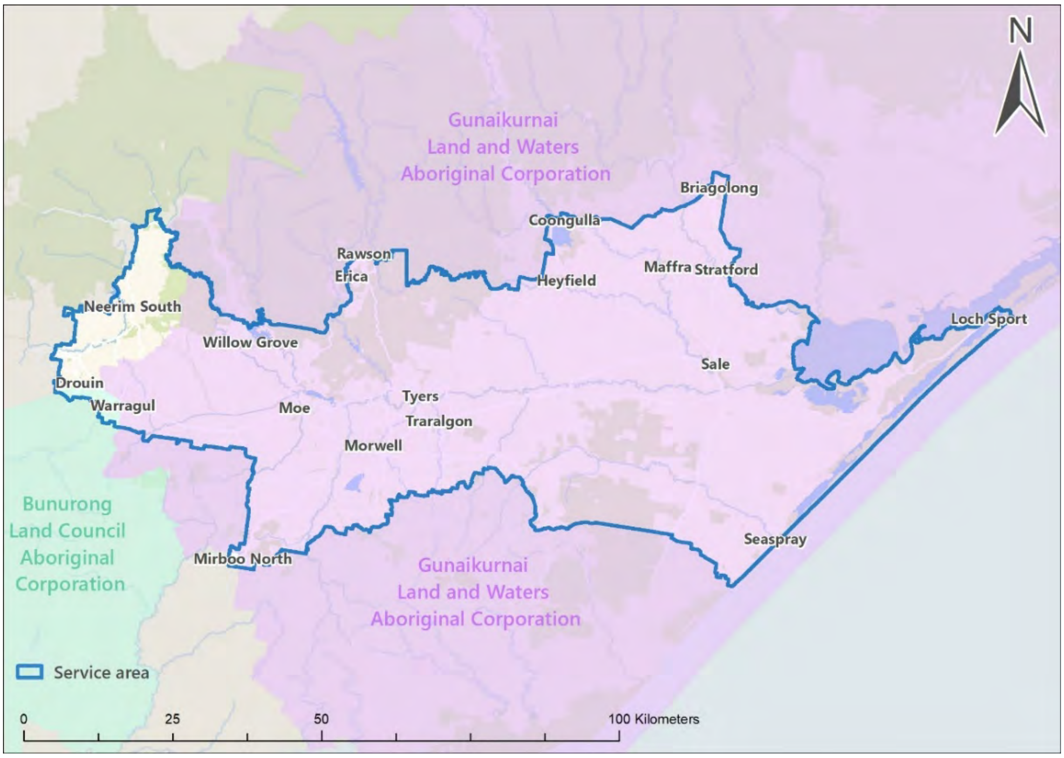


Figure 6 Location of the Registered Aboriginal Parties within our service area

Acknowledging our Traditional Owners' connection to land and waters

Caring for Country, including its waterways and water bodies, is the custodial obligation of Traditional Owners, passed down through countless generations. Managing the health of Country has been a foundational responsibility of Traditional Owners. However, these rights have been largely denied since European settlement.

Currently government – through its water corporations and catchment management authorities and other regulators – decides how and where water goes, how much, when and for how long.

Our journey to partnering for a shared future

We have been privileged to be considered a partner by the Gunaikurnai community over the last five years. We have been working closely with GLaWAC to understand how we can support achieving the goals set out in their Whole of Country Plan (GLaWAC, 2015), the strategic framework that establishes the pathway to a prosperous and healthy future for Gunaikurnai Traditional Owners.

Over the years, we have built trust and knowledge through:

1. Spending time to understand the goals and constraints GLaWAC currently have;

2. Listening to the priorities of community and what is important to them and understanding why. This included developing an executive endorsed Aboriginal Engagement Policy and supporting Engagement Plan: *Pathway to Partnership (2020 – 2022)*;

3. Becoming signatories to the Gippsland Environmental Agencies (GEA) and GLaWAC Partnership Agreement, which sets out a shared set of objectives to be delivered in partnership by the 14 signatory agencies. Implementation of this agreement occurs through a dedicated working group which meets bi-monthly and reports back to the Gippsland Environmental Agencies Executive forum;

4. Directly engaging with GLaWAC and Bunurong Land Council on our projects and programs in relation to cultural heritage management, which has developed relationships with community members and to demonstrate our intentions to implement best practice in relation to managing cultural values in our organisation; and

5. Based on the trust and strength of these relationships, we were able to support a secondment for an Aboriginal Water Officer to work at Gippsland Water for twelve months. A key outcome of this secondment was an increased understanding of Community priorities and how cultural values relate to our operations and roles. It also allowed GLaWAC to develop a detailed

understanding of the role and function of a water corporation and to identify the barriers that need addressing to inform future partnership objectives.

We continue to engage with Bunurong Land Council in relation to our assets and operations and there will be key infrastructure projects in the Warragul and Drouin areas that will be required to secure water and wastewater services to customers. All projects will have early engagement and Cultural Heritage Management Plans will be developed in partnership with the Traditional Owners.

Urban Water Strategy engagement with Traditional Owners: What we've heard

During early planning for the Victorian government's 2022 *Central and Gippsland Region Sustainable Water Strategy* (CGRSWS) and our Urban Water Strategy, it was identified that Gippsland region water policy specific engagement was required, to identify projects and implementation options.

Engagement undertaken included:

- Discussion of water priorities in the GEA – GLaWAC partnership meetings;
- Hosting a Gippsland region water-agencies workshop with representatives from our organisation, GLaWAC, East Gippsland Water, South Gippsland Water, East Gippsland Catchment Management Authority and West Gippsland Catchment Management Authority. The objective of this forum ongoing is to co-ordinate programs to deliver multi-agency projects.
- Establishing ongoing monthly meetings with our executives and GLaWAC executives to identify and work on opportunities identified through the CGRSWS, UWS and our Price Submission 2023; and
- Completing on Country field trips to inform project scopes and resourcing required to deliver projects.

The key priorities that were identified through engagement for the Gunaikurnai at this time are:

Table 2 Priorities for the Gunaikurnai identified through engagement

Gunaikurnai water management priorities	Gunaikurnai Whole of Country Plan goals
To increase Traditional Owner access to water for cultural and economic benefits to Community.	To have a strong, healthy and happy mob.
To have cultural values and outcomes taken into account in water management decision making (through the	To heal Country.

Gunaikurnai water management priorities	Gunaikurnai Whole of Country Plan goals
development and implementation of a quadruple bottom line[†] framework).	
To remove the barriers to Traditional Owners' use of water.	To protect and practice our culture.
To support partnerships between Traditional Owners and water managers.	To be respected as Traditional Owners.
To apply the principles outlined in the Sustainable Water Strategy to be applied to unallocated and unused water within Gippsland.	To have the right to use, manage and control Country.
Establish longer term goals for place based, integrated land and water management.	To be economically independent.

[†] Quadruple bottom line is a framework to assess benefits and risks across four pillars: cultural, economic, environmental and social. It is an extension of the triple bottom line accounting framework, which provided a balance of social, environmental and economic needs, to encompass cultural needs.

Key actions for partnering with our Traditional Owners

Table 3 Key actions for partnering with our Traditional Owners

	Action	Traditional Owner water outcome	Traditional Owner Whole of Country outcome
Action 1	Develop and implement a Moondarra On-Country Plan, which focuses on Traditional Owner access to land and water, increasing opportunities to realise objectives for cultural values and uses building the cultural awareness of our staff and the community.	Increased access to land and water. Strengthening partnerships between Traditional Owners and our organisation. Establish longer term goals for place based, integrated land and water management.	To have a strong, healthy and happy mob. To protect and practice our culture. To have the right to use, manage and control our Country.
Action 2	Provision of reticulated water to Knob Reserve, a significant meeting place for the Gunaikurnai Community. Reticulated water will support cultural events at the site and support sustainable use of water and health outcomes for Community.	To increase Traditional Owner access to water. To remove the barriers to Traditional Owners' use of water. To support partnerships between Traditional Owners and water managers.	To have a strong, healthy and happy mob. To protect and practice our culture. To be respected as Traditional Owners. To be economically independent. To heal country.

	Action	Traditional Owner water outcome	Traditional Owner Whole of Country outcome
Action 3	Pilot the application of the *'Multiple Benefits Of Ownership And Management Of Water By Traditional Owners Framework'** on key projects.	To have cultural values and outcomes taken into account in water management decision making (through the development and implementation of a quadruple bottom line framework). To increase traditional owner access to water. To support partnerships between Traditional Owners and water managers. To apply the principles outlined in the CGRSWS to be applied to unallocated and unused water within Gippsland.	To have a strong, healthy and happy mob. To heal country. To be respected as Traditional Owners.
Action 4	Integrate the '*Multiple Benefits Of Ownership And Management Of Water By Traditional Owners Framework'** into our planning framework to ensure quadruple bottom line assessments are integrated into business decisions.	To have cultural values and outcomes taken into account in water management decision making (through the development and implementation of a quadruple bottom line framework). To increase Traditional Owner access to water. To support partnerships between Traditional Owners and water managers. To apply the principles outlined in the CGRSWS to be applied to unallocated and unused water within Gippsland.	To have a strong, healthy and happy mob. To heal country. To be respected as Traditional Owners.

* The *'Multiple Benefits Of Ownership And Management Of Water By Traditional Owners Framework'* was prepared for the Gunaikurnai Land and Waters Aboriginal Corporation (GLaWAC) on behalf of the *Central and Gippsland Region Sustainable Water Strategy* (CGRSWS) Traditional Owner Partnership (GLaWAC, Bunurong Land Council Aboriginal Corporation, Wadawarrung Traditional Owners Aboriginal Corporation and the Wurundjeri Woi-wurring Cultural Heritage Aboriginal Corporation).

Customer engagement

Our approach

Our engagement approach for our Urban Water Strategy (UWS) involved deep and meaningful consultation with our residential and non-residential customers, as well as stakeholder groups who represent cohorts of our customer base.

Through a combined UWS / Price Submission engagement process, we also consulted other stakeholders such as local councils, our major industrial customers, local environmental groups, plumbers and community groups that work with vulnerable people (including refugees, people experiencing financial difficulties, people from cultural and linguistically diverse (CALD) backgrounds, and people with disabilities) to ensure their priorities were heard and views considered.

This approach enabled us to get the most out of our engagement and minimise duplication.

Our Customer Reference Group was involved in validating our engagement approach and learnings from our engagement activities.

We also regularly updated our Board and staff and they had the opportunity to provide feedback throughout the development of our strategy.

Our customer engagement approach had three phases:

- Education and awareness
- Initial customer insights
- In-depth focus groups

Our engagement approach was inclusive and we tried to remove barriers to participation where possible. In addition, we specifically sought input from customers experiencing financial difficulties and young people in our region through dedicated engagement sessions.

We also carried out targeted, additional engagement with the community in Briagolong during development of this strategy as their water supply has become less secure after a record drought during 2017-19.

The feedback for this report was gathered from 722 customer interactions, including:

- 114 webinar registrations
- 91 social media comments
- 223 in-depth face-to-face interviews, held at 22 pop-up events in 19 towns across our service area
- 106 responses to a hard copy feedback form included with our bills

- 53 responses to online feedback form, promoted through our channels
- 26 major customer interviews
- 13 other stakeholder interviews
- 69 participants at Price Submission focus groups
- 27 participants at Urban Water Strategy focus groups

Phase 1: Education and awareness

In the first phase of our engagement, we set out to build awareness in our community about our UWS – what it is and how it affects our customers and community.

We aimed to educate customers on some of the key topics that affect our UWS.

The focus was on:

1. Water usage
2. Climate change
3. Our water outlook
4. Water availability

We ran a campaign in local media and social media to encourage people to find out more and get involved in opportunities to participate.

Webinar

The first event that kicked off our engagement was a webinar in February 2021, where our Senior Water Resources Engineer shared our water outlook and our plans to ensure water availability for the next 50 years.

We promoted the webinar on Facebook with four posts throughout February, and paid for one of the posts to be boosted to reach more people. Our boosted post reached 6,100 people, received 166 likes and reactions, 79 comments, 22 shares and 555 link clicks.

Our three other posts reached 2,500, 1,200 and 1,200 people respectively; and received 35, six and 11 likes and reactions; two, zero and five comments; six, six and three shares; and 87, 14 and 34 link clicks each respectively.

Some of the comments expressed scepticism about climate change while others expressed the opposite. There was also some disbelief in our water outlook due to recent heavy rainfall at the time of posting. Many incorrectly tied the webinar to their belief we would raise bill prices.

There were 75 registrations for the event. We made the recording available on YouTube after the event and it has been watched an additional 42 times. You can watch it online, or download the presentation from our website.

We also held a second webinar in June 2021, where our Coordinator Environment and Sustainability shared our environmental regulatory obligations, role in recycling and the circular economy, use of renewable energy and commitment to carbon reduction, and initiatives to protect the environment.

We promoted the webinar on Facebook with a boosted post throughout late May and early June 2021. The boosted post reached 3,500 people, received 25 reactions, five comments, five shares and 136 link clicks.

Some comments were around tariffs and the scepticism that our efforts were to justify future price rises, while another comment was about willingness to pay more to limit the amount of plastic bottles going into the environment.
We shared four additional Facebook posts promoting the webinar in the lead up to the event. These posts reached 3,300, 779, 660 and 527 people respectively; and received eight, one, three and 14 likes and reactions; no comments; one, two, one and five shares; and 128, one, six and 12 link clicks each respectively.

We also promoted the webinar on LinkedIn, with the post receiving 26 reactions and three shares.

There were 39 registrations for the event. We made the recording available on YouTube after the event and it has been watched an additional 28 times. You can watch it online or download the presentation from our website.

Webpage and interactive online map
We developed a web page accessible from our Let's talk engagement page – an online hub with all projects we're currently engaging on with our community and opportunities for our customers to get involved.

The UWS web page outlines what our strategy is, our plans and the challenges we face when developing it. It also explains how the UWS fits in to water planning in Victoria.

The highlight of our UWS webpage is an innovative interactive online map (Figure 7) where customers can learn about their water supply and sewerage systems – finding out where their water comes from, where it goes and the treatment process. We promoted this tool through our subscriber newsletter and on social media, where it was received positively. There were some questions raised about its accessibility from mobile devices which is something we'll investigate in the future.

Figure 7 Our interactive online map for customers to learn about their water and sewerage

Phase 2: Initial customer insights

Our next phase involved getting initial insights from our customers. We collected information from 395 customer interactions, through methods including face-to-face interviews, online and paper feedback forms and social media comments.

In-depth customer interviews

The main way we collected feedback was through in-depth face-to-face interviews where customers were asked a series of open-ended questions and our staff members recorded the answers.

Staff from across our organisation were involved, including our executive leadership team, board members, managers and representatives from each business area.

We conducted 223 face-to-face interviews at 22 pop-up events in 19 different towns across our region (approximately 46% of the towns in our service area). The interviews were held in a range of locations, including community events, markets, shopping centres and coffee shops. A photo of one of our pop-up engagement stalls is shown in Figure 8 below.

Figure 8 One of our pop-up customer engagement stalls

The towns we conducted face-to-face interviews in were:

- Boolarra
- Churchill
- Drouin
- Heyfield
- Loch Sport
- Maffra
- Mirboo North
- Moe
- Morwell
- Neerim South
- Rosedale
- Sale
- Seaspray
- Stratford
- Thorpdale
- Traralgon
- Warragul
- Yallourn North
- Yarragon

We had planned to conduct more face-to-face sessions, however due to changing coronavirus (COVID-19) restrictions, some sessions had to be cancelled. To allow more people to participate and provide feedback, we extended the opportunity for people to provide online feedback.

Online and written feedback

Every customer had the opportunity to participate in the design of our UWS (and Price Submission) through feedback forms included with customer bills (both paper and online versions). We also promoted the online version of our feedback form to subscribers to our newsletter and our social media followers. Additionally, we accepted feedback via social media and email.

The feedback forms were a shortened version of our prompts for the in-depth customer interviews.

Results from in-depth customer interviews

The key topics we gathered insights on were:

1. Water use and water restrictions
2. Our role in conserving water
3. Preparing for future challenges

Customer water use and water restrictions

The large majority of customers we spoke to, including all of the customers in the financial difficulties cohort, said they actively tried to keep their water use down. They also indicated acceptance of water restrictions once in every 20 years, with many customers indicating that they would accept restrictions more often that.

Customers reported a wide variety of ways they saved water. Many customers reuse their grey water to water their plants and gardens, many also have tank water for garden use, take short showers, don't pre-rinse their dishes, fill the dishwasher before running it, use water saving shower heads, turn the tap off while brushing their teeth and plant water wise gardens.

There were a lot of comments suggesting that water restrictions once in every 20 years was not often enough, with some customers saying they thought people wasted water and restrictions should be in place every summer. However, it should also be noted that "water restrictions" means different things for different people and this question can't be overly relied upon.

Other customers said that there was no incentive to save water because it is cheap. A few customers suggested that the variable charge for water should be higher to act as an incentive to save water, others suggested rewards for reduced usage – for example a discount off the bill if their water usage was lower than in the previous bill.

The customers who did not accept water restrictions cited reasons such as wanting water available for gardening, and expectations that supply should be increased so that restrictions aren't necessary.

Our future customers (young people) also indicated willingness to accept water restrictions once every 20 years and almost all of them actively try to keep their water usage down.

Our role in conserving water

A lot of customers told us that we have an important role to play in educating people about responsible water use. This was by far the most common response when asked what our role is in conserving water – some people said we had a role in educating young people, others talked about the need for community campaigns and sharing water saving tips.

Other common answers related to building infrastructure (such as dams), preventing water wastage, supporting private water tanks, and recycling more water.

Preparing for future challenges

Most of the current customers and future customers we spoke to said we should be investing and planning for the future now. They recognise that demand for water is increasing and believe we should be acting now to prevent future water shortages.

We did get a diverse range of responses on what we should be doing to meet future challenges including:

1. Plan now
2. Build more dams
3. Maintain infrastructure
4. Invest in infrastructure
5. Educate the community
6. Take care of the environment
7. Be more affordable

Some customers expressed scepticism about climate change being a challenge, however they usually agreed there is increasing demand for water, with some citing population growth as a factor.

Despite concerns about the affordability of our services, most of the customers we spoke to understood that we need to plan and invest now to prevent service issues in the future. Many who expressed concerns about affordability still insisted that we should invest for the future now, while others suggested we should plan now but delay spending until we are closer to a critical point.

Major customers

We service a range of major customers whose water needs are significant by state standards. Some of these are supplied with raw water and some with potable water, others we provide wastewater treatment services. The scale of some of our major customers in terms of water usage means that changes in their operations can be significant in terms of overall demand and demand patterns. This affects the Latrobe water system and our Gippsland Water Factory in particular.

We reached out to 26 major customers to gather their future water and wastewater needs. Of the 10 that responded, four suggested their water or wastewater service needs would increase in the future and two suggested their needs would decrease. The remaining four either didn't say or said their needs will remain the same.

Some of the key issues the major customers reported were around:

- Drought and water supply
- Infrastructure
- Cost of our services

- Reliability/sustainability

Some suggested they would like to see us provide more water saving solutions to customers and others suggested they'd like to see a drought proof supply and storage. However, the majority of major customers said they'd just like to see us continue to provide our water and wastewater services with minimal change to what we're doing now.

Other groups

We interviewed 13 other stakeholders who were representatives of customers from demographics in our service area that have specific needs and/or are typically hard to reach including:

- Disadvantaged/vulnerable customers
- Refugees
- Environmental groups
- Plumbers
- Land developers
- Culturally and Linguistically Diverse customers
- Disabled customers
- Domestic violence victims

Key themes from these interviews, relating to our UWS:

1. Future water supply in light of global warming.
2. Conserving and caring for water catchment areas, the impact of logging, and the importance of wetlands.
3. Urban water needs and water efficiency.
4. Reusing fit for purpose water and reducing reliance on drinking water for use when it isn't needed.
5. Educating property owners on their responsibilities around their water supply, plumbing and connections.
6. Recreational access to facilities and water ways.

Phase 3: Customer focus groups

Based on the initial observations and feedback, we held three customer focus groups for the UWS, to build on the initial insights and allow for in-depth discussion.

Up to this point, we'd conducted UWS engagement together with our Price Submission engagement, however we needed some dedicated sessions to be able to explore the emerging issues in more depth. We did get some good insights from the Price Submission customer workshops though, as well as from the dedicated UWS focus groups.

Price Submission focus groups - August 2021
A total of 69 customers participated in our Price Submission focus groups, including 15 customers from cultural and linguistically diverse backgrounds and 14 customers who were experiencing financial difficulty.

From our customer workshops for our Price Submission, we learnt that our customers think:

- We should act as stewards of the environment to protect water for future generations.
- We should continue doing what we are currently, but have future aspirations to focus on water conservation and efficiency programs and protection of waterways and land.
- Water should be consistent in taste across locations, however they acknowledge this may not be possible because taste and aesthetics is affected by the water source.
- Water quality, safety and affordability is a priority over water taste.
- We have an important role to play in educating the community. Customers want to learn how to conserve water and find out about the environmental impacts of their water use.

UWS focus groups - October 2021
A total of 27 customers participated in our UWS focus groups. We held three focus group and they were split based on age:

- Gen Y customers (under 40 years)
- Gen X customers (40-55 years)
- Baby Boomer customers (55+ years)

We achieved a good mix of gender representation – 59% female, 33% male, 4% other and 4% unspecified. Participant ages ranged from 18-24 years to 65+, and we had representation from the following towns:

- Coongulla
- Neerim South
- Heyfield
- Yinnar
- Trafalgar
- Warragul
- Moe
- Traralgon
- Sale
- Drouin
- Morwell

The focus groups were centred on four main topics:

- Supply reliability
- Drought preparedness
- Demand management options
- Sharing water among different users

Supply reliability
Participants of the UWS focus groups were asked if it was acceptable to have severe restrictions from time to time.

A majority of participants felt that it is acceptable to have restrictions. Fairness was an important consideration when it came to restrictions. Participants wanted the restrictions to be adhered to by everyone.

Others said that we need to strike a balance between introducing restrictions and building infrastructure (at customer expense) to reduce the frequency of having to introduce restrictions. A few said that severe restrictions should be brought on only as a last resort.

Eight of 10 participants said that having stage two restrictions every two years is reasonable. A majority of participants were happy to have stage two restrictions regularly or as often as required and many felt they were not difficult to cope with.

Drought preparedness
Participants UWS focus groups were told water needs to be rationed to make the most of what is available if a drought is forecast. They were asked about their views on prioritising public green spaces such as parks, gardens and sports fields by bringing water restrictions on earlier for private residences.

Many participants wanted private residences prioritised over public green spaces. Participants also said that having water for private use is more important than for the maintenance of gardens and sporting grounds and many singled out sports fields as not worthy of special consideration.

Participants were asked whether they would prefer stage two water restrictions for a whole summer, or stage four restrictions for the second half of summer.
Most participants opted to have stage two restriction for longer as they may stop the need to have more severe restrictions in future.

Participants were asked their opinion on the best way to prepare for an unprecedented drought taking into consideration risks and cost. Eighty five percent of participants would like to bring on restrictions early as a way to prepare for an unprecedented drought.

Participants were asked whether water restrictions should apply to non-residential users, bearing in mind that these customers provide jobs and are likely to have impacts on local businesses. Some thought that restrictions should apply to non-residential users as well. While others thought it should depend on the industry and perhaps not apply to those producing essential goods.

We have taken these views into account in considering our target Level of Service provision as detailed in the section on Level of service in *Approach to future planning in this strategy* (page 41).

Demand management options

Participants UWS focus groups were asked to provide their views on the best ways to reduce customers' water usage. Their most popular methods were education on water conservation and installation of water tanks.

Sharing of water among different users

Participants UWS focus groups were asked how water should be shared among different types of users. As the demand for water increases and supply becomes less reliable, which users should have priority over others? Most participants believed that users who perform an essential function for the continuation of life should have priority. Farmers and hospitals were mentioned frequently. Others said that a 'triaging' mechanism should be used based on the need for water to operate. Some participants said that the environment should be given priority over other users as it is the basis for everything else.

Customer Reference Group

Our Customer Reference Group is a group of customers that works collaboratively with us to ensure that customer priorities, issues and expectations are understood and reflected in the decisions we make. Made up of diverse members from our community, each member of the group contributes their insight and experience.

Our Customer Reference Group played an important assurance role in this UWS by making sure customer expectations are understood and reflected in our plans for the future. They also reviewed and considered the approach we've taken to engagement to ensure it is fit for purpose, genuine, authentic and that we've properly interpreted the results.

Briagolong community engagement

Over the past two years, we've also recognised a need to engage more closely with the community of Briagolong as the town's main water source became unreliable after three years of drought. In January 2020, water restrictions were briefly introduced when the Wa De Lock aquifier, which supplies the small town, became too low.

At the time, we consulted about introducing the restrictions with the community through community engagement sessions and distributing information within the town. Importantly, we also recognised the need to address the long term water supply issue for the town and involve the community in discussions on the options.

We produced a fact sheet on the options which was distributed through the post office/general store and sent via email to a list of interested residents. Information was also provided through a dedicated page on our website. Opportunity for feedback was provided through email, online, or direct phone contacts. Coronavirus (COVID-19) restrictions prevented further community meetings.

The community confirmed a preference to investigate a new, deeper bore targeting a lower aquifer – and this option has been pursued with community updates on progress and outcomes being provided through the previously established channels.

Our exploratory bore, drilled in February 2021, has indicated the deeper ground water resource is likely a viable option and we've progressed to the next phase. We are continuing to progress this project including applications to SRW, further studies and engagement, trade of water entitlement, aquifer pump tests and planning for treatment modifications.

WSAA 2021 National Customer Perceptions study

Research coordinated by the Water Services Association of Australia (WSAA) in 2021 revealed some useful insights related to our UWS.

There is still a belief among 58% of our customers that building dams is the solution to water shortages – this belief has increased since 2015 when it was 51%. More than 80% of our customers over the age of 66 believe that dams are the answer to water shortages.

The study found that 62% of our customers agreed that climate change is a serious threat and 55% agreed that water is scarce. These figures aren't showing a clear trend in the years since 2015, and our customers are among the least likely in Australasia to think that climate change is a serious threat. However, our own research (undertaken for the UWS and Price Submission) has shown that the environment or climate change is among the top challenges our customers expect us to address.

Stakeholder engagement

Early in the development of this UWS, we prepared a stakeholder identification and mapping matrix. The purpose of this is to categorise stakeholders according to both their level of interest and level of influence in our planning. Stakeholders were then further categorised into “primary”, “secondary”, “tertiary” and “other” and we used this to help us to tailor the appropriate level of engagement for each according to the IAP2 framework (International Association for Public Participation, 2018). Table 4 details how we engaged with a selection of external stakeholders.

Table 4 How we engaged with our external stakeholders

Stakeholder	Details of engagement
Local councils	Our approach to engagement with our local councils was to use the Integrated Water Management (IWM) Forum. In conjunction with South Gippsland Water, we presented to the Gippsland IWM Forum executives in March 2021 and practitioners in May 2021. We discussed our priority concerns and sought feedback either in session or subsequent from councils on their priorities and opportunities to collaboratively pursue priorities. Further one on one meetings were held with Latrobe, Baw Baw and Wellington which covered IWM opportunities to pursue such as alternative water supplies for irrigating ovals in Morwell and stormwater management in Willow Grove and Trafalgar. We will be continuing to work collaboratively with our council IWM partners to progress these priorities through our regular IWM Forum activities in 2022 and beyond. South Gippsland Shire had not yet developed an IWM Plan to identify their priorities but the Forum has endorsed their application for state funding to do so. We also engaged with our councils as part of our role in disseminating information on the *Central and Gippsland Region Sustainable Water Strategy* (CGRSWS) regional issues and priorities, with a view to identify areas of mutual interest to support and advocate for, with presentations to executives of three councils and councillors of one.
West Gippsland Catchment Management Authority (WGCMA)	WGCMA is the authority responsible for monitoring and managing the catchments and waterways in our region. They do this through direct responsibility such as managing environmental water entitlements, as well as through partnerships with land owners and managers. We already have established relationships with WGCMA and WGCMA is also a key member of the Gippsland IWM Forum. Our engagement for the UWS utilised all of these connections and centred on key issues of mutual interest, in particular some of those being considered through the CGRSWS. Engagement topics included water recovery for environmental flows, in particular in the Latrobe basin including opportunities and challenges relating to the Tyers River, removal of barriers

Stakeholder	Details of engagement
	impeding fish passage, alternative flow sharing arrangements in Merriman Creek, use of water for mine rehabilitation.
Southern Rural Water (SRW)	SRW performs a wide range of functions that support and impact our operations, including reservoir operations and maintenance management at Blue Rock and Glenmaggie, groundwater resource management, and regulation of all groundwater licences and river diversions for individuals (e.g. farmers but not water corporations). As such, we engage regularly with SRW at an executive level and used this platform to undertake engagement on specific UWS issues as well as other water sector issues being addressed through the CGRSWS. These included our ongoing groundwater augmentation program at Briagolong, future needs for groundwater resources near Warragul, managing the costs and funding of recreation facilities at reservoirs in our region, reviewing our water entitlement rules for Seaspray, groundwater decline at Sale, and mine rehabilitation in the Latrobe Valley.
Melbourne Water (MW)	MW is the owner and operator of Tarago Reservoir and its downstream infrastructure. As we are a user of water resources in the Tarago catchment, we already engage regularly with MW at many levels of our operations and planning. Our highest priority water resource challenge is securing sufficient and affordable water for Warragul and Drouin and the CGRSWS has now set an action for this to be achieved in the short term with us to acquire a permanent share of water entitlement in the Melbourne Yarra-Thomson pool (which includes Tarago Reservoir). Getting this water to our Warragul water treatment plant at a sufficient flow rate now and into the future is critical and our engagement with MW has focused primarily on those arrangements.
Committee for Gippsland, Regional Development Victoria, Gippsland Regional Executive Forum	These organisations represent economic and social interests in our region and strive to develop opportunities for the region to prosper. As such our engagement focused on bringing to their attention the role that water and wastewater services plays in supporting the region, as well as threats to sustainable and reliable water and wastewater services, and opportunities for the future. Similar to our engagement with councils, we sought to identify common interest to collectively advocate for our region and communities.

Action 5 – Engaging with our stakeholders

Build on our existing close relationship with West Gippsland Catchment Management Authority (WGCMA) to better identify opportunities to collaboratively achieve outcomes that benefit each other's objectives and values, and to foster an enhanced mutual understanding of our respective challenges.

Action 6 – Engaging with our stakeholders

Continue to work with local councils and government to embed better water conservation planning for greenfield development.

Challenges and opportunities

Population growth

Our population is growing and changing. All of the local government areas across our service area are forecast to experience population and dwellings growth. Growth in population and dwellings increases the demand for water and sewerage services.

The Victoria Government's Victoria in Future (DELWP, 2019b) forecasts suggest that between now and 2036, population will grow by an annual average rate of 2.1% in Baw Baw Shire and 0.6% in Latrobe City and Wellington Shire.

It's forecast that by 2036 (DELWP, 2019b) there will be a 50% increase in dwellings in Warragul and Drouin, a 20% increase in Traralgon and 15% increase in Sale.

Population and dwellings growth drives increased demand for water. We've accounted for a range of future scenarios as outlined in *Approach to future planning in this strategy*.

Extreme events

Droughts

Droughts are a regular feature of a variable climate. They have always occurred and will continue to occur in the future. Researchers have identified periods over the last 1,000 years where droughts occurred that were even worse than those on instrumental records (Kiem, 2016).

As our climate continues to warm and become drier, climate modelling tells us that droughts are likely to be more frequent and harsher. The Millennium Drought of 1997-2009, a drought unprecedented in duration and intensity, has been linked in part to human induced climate change (CSIRO, 2011).

During times of drought there may not be enough water to meet normal levels of demand. Like other water corporations, we use water restrictions among other measures to manage demand during particularly harsh droughts. We're guided by our *Drought Response Plan* when making decisions on water restrictions.

To understand how resilient our water systems are to droughts, we've undertaken "stress test" modelling of each system, to see how it would respond to a range of drought events at current demand levels. We've taken a conservative approach in doing so by using the full historic record of real droughts, after making adjustments to increase the severity of droughts prior to 1997, the point at which our climate patterns and river flows changed. Further detail is provided in the chapter *Approach to future* *planning in this strategy*, the system chapters and in our *Drought Preparedness Plan and Drought Response Plan* (Appendix A).

Bushfires

Climate change is projected to lead to hotter and drier conditions. The following section, *Changing climate*, outlines the science that supports this outlook for our region. A warmer atmosphere also contains more energy which then has the potential to produce more extreme weather such as strong windstorms. Such conditions are likely to lead to drier forests in our catchments with more frequent and severe bushfires. More frequent and intense windstorms may also increase forest fuel loads, further contributing to more severe bushfires.

With climate change already occurring, we've been observing these effects already with an increase in the frequency and severity of bushfires since the beginning of the Millennium Drought in 1997 and in the years since. Examples in our region include the Great Divide Fires of 2006/07, Black Saturday of 2009 and the Aberfeldy Fire of 2013.

Some of our catchments have been subjected to multiple bushfires, including areas such as the Thomson River catchment that have been burnt repeatedly within a relatively short period of time. This has been observed to result in an ongoing degradation of the landscape in terms of soil conditions and vegetation diversity, and this can lead to negative water resource outcomes, both in terms of water quality and yield.

The impact of bushfires on water resources depends on a range of factors such as the scale and intensity of fires which in turn can depend on the extent of prior bushfire prevention measures undertaken by forest managers and the preparedness of fire agencies. Other influencing factors include landscape fire history, percentage of the overall catchment burnt, the forest type and age, the soil type and typical rainfall patterns. Typically, in forested catchments, rainfall runoff will increase immediately after a bushfire. This is largely due to the immediate loss of vegetation that normally uses that water. This initial increase in runoff will typically last a few years.

In the ash forest catchments of our region such as around Mt Baw Baw, trees are usually killed by fire and as the forest regrows as a thicket of vegetation, the water used by the regrowth vegetation significantly impacts runoff for an extended period of time. In mixed species catchments, such as Merriman Creek and Macalister River, the vegetation recovers faster, most trees are not killed by the fire and rainfall runoff recovers to the pre-fire condition much sooner. However mixed species forests tend to grow in areas of more variable and lower rainfall than ash, and are more prone to bushfires, including repeated fire events in relatively short periods of time.

As our source water catchments are a mix of public and private land, our ability to control or influence land management varies from place to place and relies on working with relevant stakeholders including the Country Fire Authority (CFA), the Department of Environment, Land, Water and Planning (DELWP), forest managers, private property owners and local councils.

Increased rainfall intensity and flooding

Changing climate not only presents the challenges of hotter, drier weather but also extreme weather events such as storms and intense rainfalls. As we experience more variable rainfall patterns across Australia, for some regions this means increases to rainfall intensity of individual rainfall events and associated flooding. The impact of flooding, particularly after drought, can be very significant for water utilities in terms of water security and management operations (WSAA, 2021).

A 2012 publication from the National Water Commission identified the following list of impacts of increased rainfall intensity and flooding on the urban water industry, some of which we are already experiencing in our region:

- Soil erosion, causing an increase in suspended solids. This turbidity can affect water supply by interfering with disinfection processes, increasing the need for coagulant use, and increasing handling costs. It can also lead to sedimentation of reservoirs and reduced water storage capacity.
- Drinking water storage capacity decrease, because of the need to maintain more flood storage capacity (i.e. keeping dams less than full).
- Increased pollution loading to groundwater.
- Decrease in groundwater recharge, as heavy precipitation exceeds soil infiltration capacity and increases surface runoff.
- Flooding of water intake and treatment facilities causing contamination and damage, due to being often located on floodplains.
- Capacity overload of water treatment plants and wastewater treatment plants.
- Erosion of pipelines due to heavy rainfall.
- Sewer and stormwater overflows, causing urban flooding and increased discharge to the environment.

Responding to the effects of increased rainfall intensity and flooding needs to be both proactive in monitoring the performance of our systems and taking these risks into account in the long term planning of our water and sewer systems, as well as reactive through our established emergency management practices.

Changing climate

Our climate is changing. The world is getting hotter as a response to increasing levels of greenhouse gases in our atmosphere. We can see in the charts below how Victoria's temperature has changed over the last 100 years compared to the 1961-1990 average (Figure 9) as the concentration of greenhouse gases in the atmosphere has increased (Figure 10).

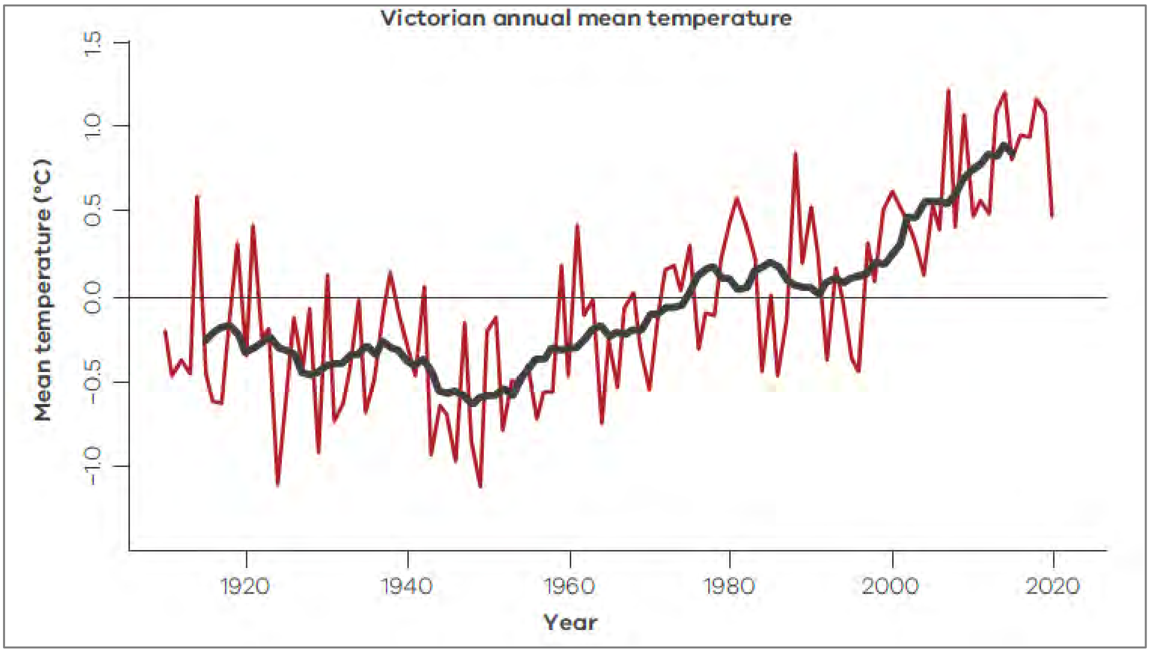


Figure 9 Increase in Victoria's temperature over the last 100 years compared to the 1961-1990 average Source: DELWP et al (2020)

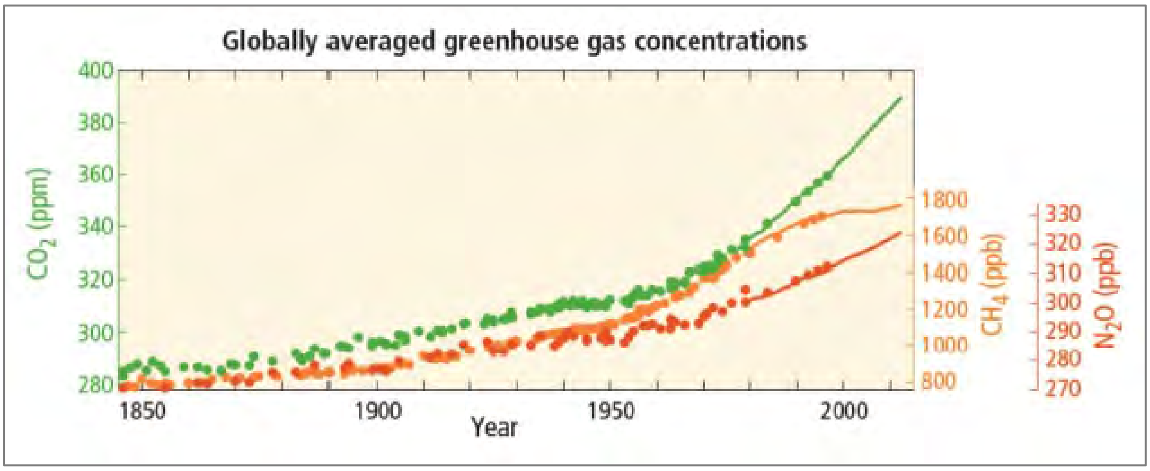


Figure 10 Increase in concentration of greenhouse gases in the atmosphere globally over time Source: DELWP (2016a)

A warming atmosphere is changing the way air circulates around the earth. Figure 11 below shows typical prevailing winds both on the earth’s surface and also upward into the atmosphere. Most of the sun’s energy lands around the equator and warms the air there, causing it to rise and move towards the poles. In the southern hemisphere, this air falls back to the surface at latitudes equivalent to about Sydney/Brisbane. Falling air creates high pressure at ground level and this can be seen in the diagram with a “ridge” of high pressure zones extending across Australia, denoted by “H” with wind circulating anticlockwise.

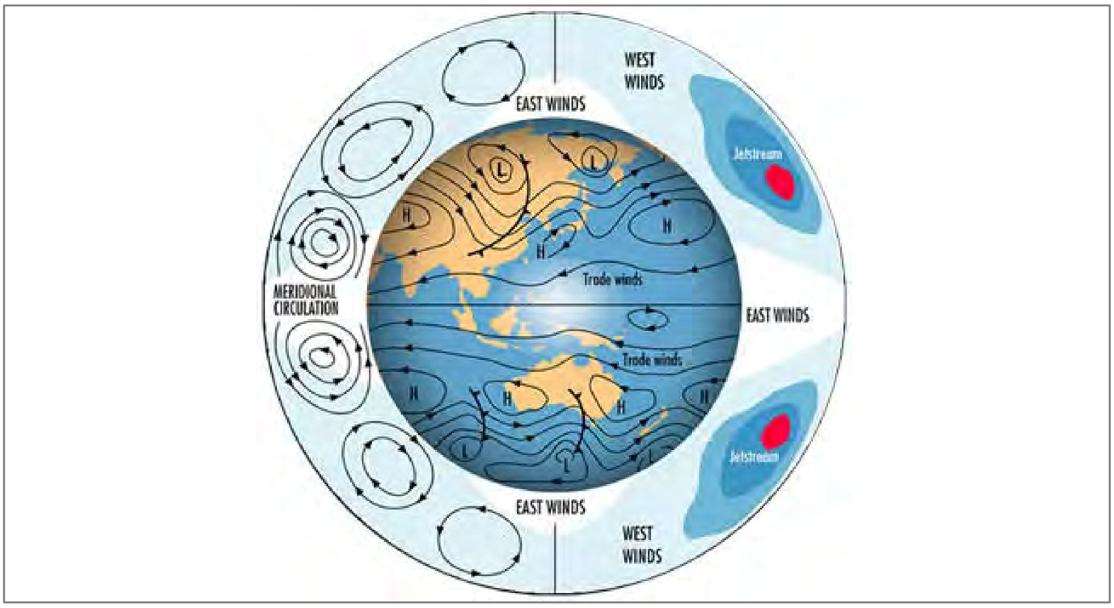


Figure 11 Typical prevailing winds at the earth's surface and in the atmosphere Source: BOM (2008)

This circulation pattern can also be visualised as a cross section (Figure 12) showing the air rising at the equator and falling on Australia at about 30°S latitude. This circulation is known as the Hadley Cell. The Hadley Cell moves from north to south depending on the season. In summer, it moves south bringing the high pressure weather patterns into Victoria. High pressure weather brings stable, dry conditions like we expect in summer. In winter, the cell moves north (with the sun) and the high pressure ridge follows, allowing the westerly winds and rain bearing cold fronts into Victoria as we expect in winter.

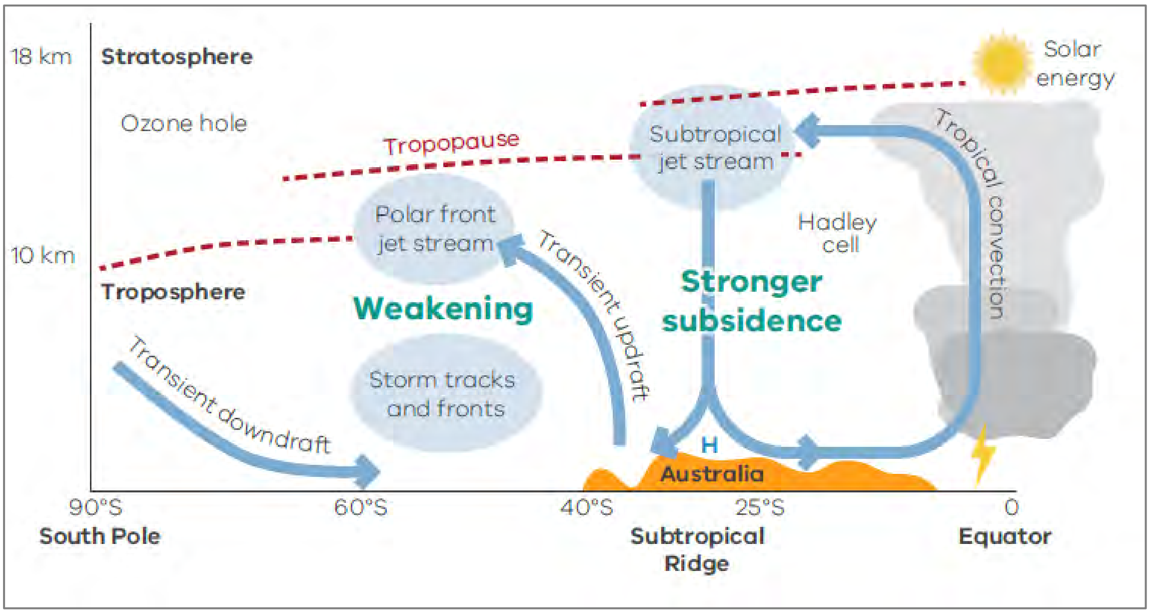


Figure 12 Visualisation of Hadley Cell air circulation patterns over Australia Source: DELWP et al (2020)

This is where climate change comes in. As the atmosphere warms globally, the Hadley Cell gains more energy, with more rising air at the equator, pushing the air further south towards the south pole, and then descending further south, more often on to Victoria. This can be thought of as an expansion of the tropics, and the more frequent occurrence of high pressure weather in Victoria, especially in winter, is forecast to result in more dry, stable weather, with the Southern Ocean's winter storm fronts weakened and pushed further south.

The changing climate poses a considerable challenge for maintaining reliable water supplies. Rainfall during the cooler months provides a greater contribution to runoff and streamflow than at other times of year. Catchment soils are cooler and stay damper, absorbing less rainfall, and trees transpire less moisture to the atmosphere, leaving more of the rain to run off to our rivers and storages. So a reduction in rainfall, especially at this time of year, is likely to have a big effect on river flows.

We've already been seeing this with a significant reduction in the number of very wet months since 1997, particularly during the cooler part of the year. Figure 13 shows how rainfall has changed across Victoria when comparing the last 30 years to the long term record. This pattern clearly shows the effect of an expanding tropics with tropical summer rains extending south into northern Victoria, but winter rains declining right across the state. Gippsland is suffering reduced winter and summer rainfall. Even if summer rainfall increases eventually extend into Gippsland, it's unlikely to make up for the declining winter rainfall.

Observed rainfall change in Victoria for the last 30 years (1989–2018/19)

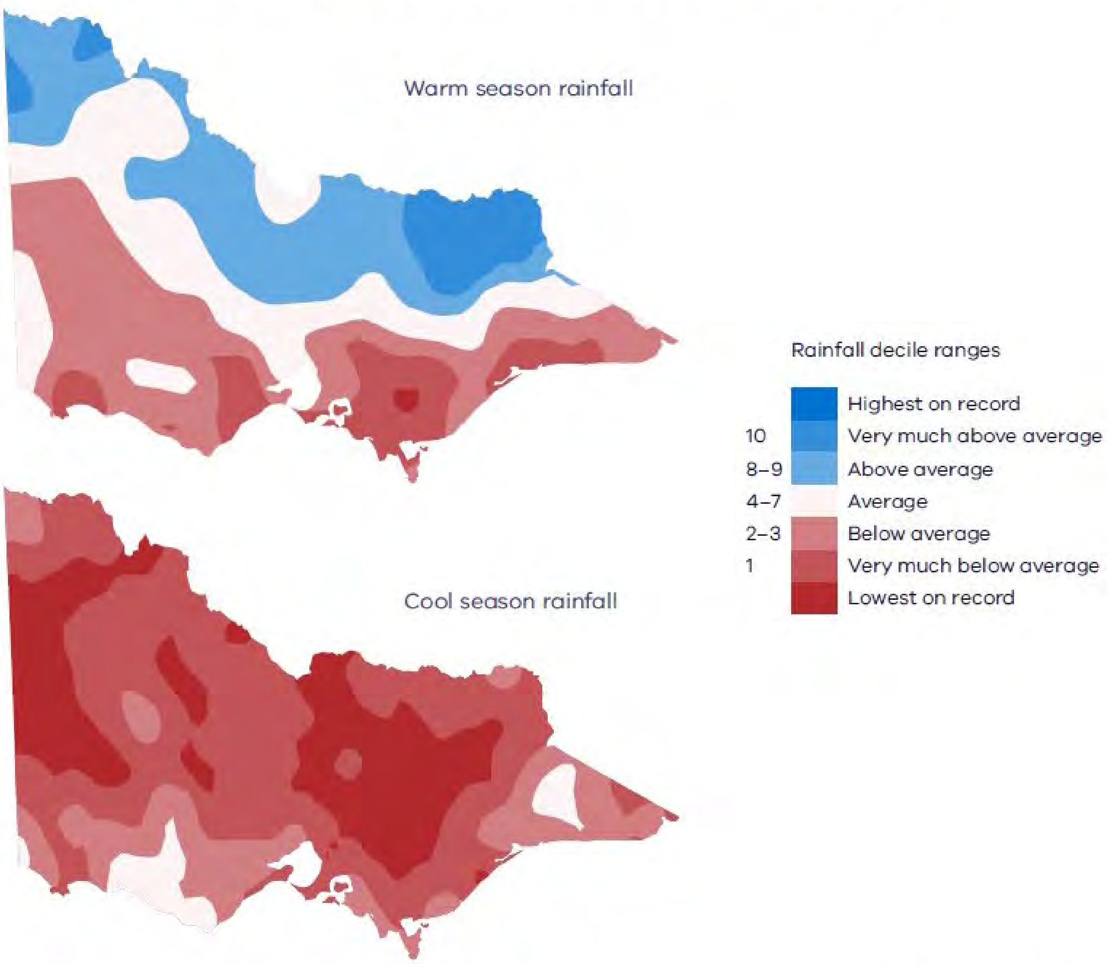


Figure 6: Maps showing warm season (November–March) and cool season (April–October) rainfall deciles. The maps show how the rainfall total over the past 30 years (1989–2019) for the given months compares to every 30-year period in the historical record. For example, decile 1 (very much below average) shows areas where rainfall over the past 30 years is in the lowest 10% of all such 30-year periods in the full range of long-term records back to 1900 (BoM, 2019).

Figure 13 Observed rainfall change in Victoria for the last 30 years (1989 -2018/19) Source: DELWP (2019c)

Changes to our climate also have the potential to introduce more short, intense storm events. A warmer atmosphere contains more energy, and this increased energy can drive greater convection and more intense thunderstorms. This will impact the quality of the rainfall runoff we harvest as well as put pressure on our sewer systems. Our sewer systems have been designed to mostly cater for historic weather patterns and we are likely to see changes in how our systems respond into the future.

Figure 14 shows how streamflow in the Latrobe River has changed over the last 100 years. This section of the Latrobe River is upstream of major offtakes for towns, industry and power stations, and therefore is a good indicator of changes due to climate. Streamflow has always varied but climate scientists tell us that Victoria's climate prior to 1975 is no longer a reliable indicator of what we should expect in the present or future. Further changes in our climate since 1997, the year the 12 year Millennium Drought commenced, suggest that a step change may already have occurred.

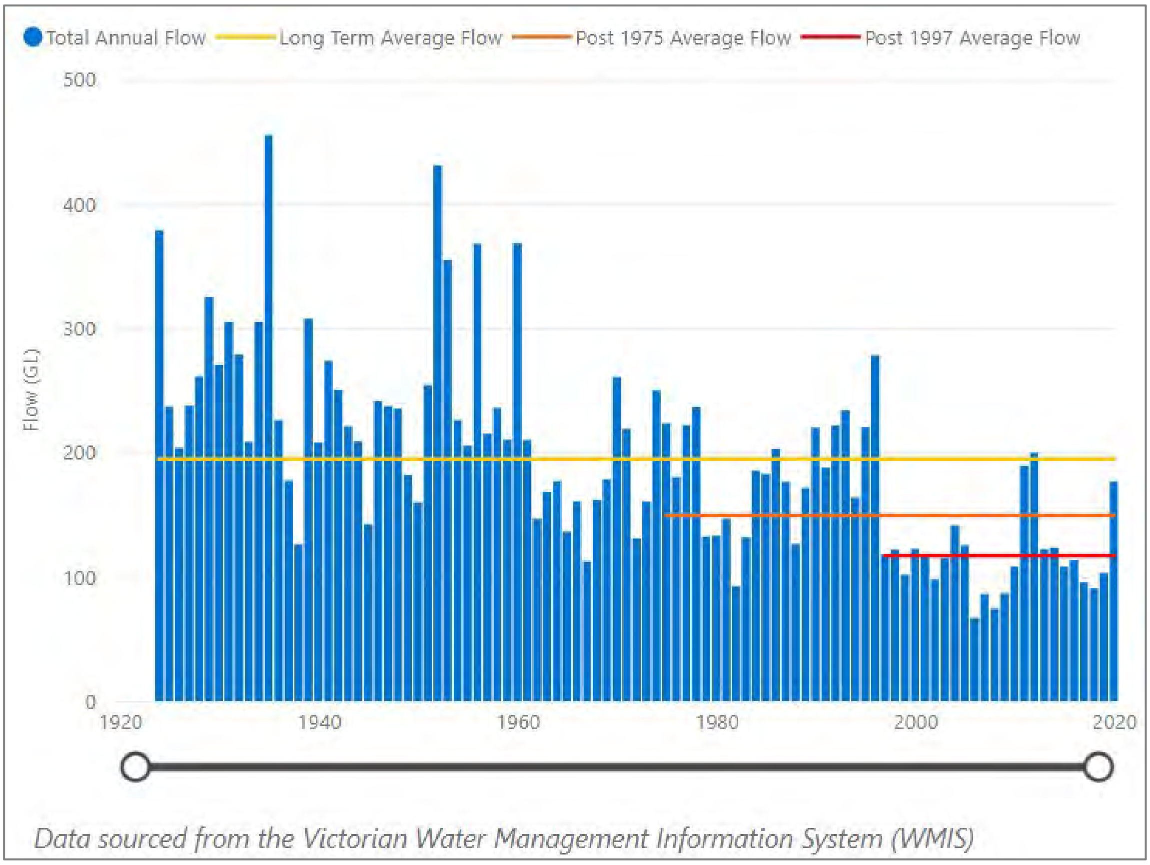


Figure 14 Annual streamflow in the Latrobe River at Willow Grove

These rainfall and streamflow trends support the forecasts being made by climate modelling and science. In particular the shift of us experiencing more stable weather with the rain bearing winter weather moving further away from us, resulting in less winter runoff for our catchments.

Most climate models are forecasting a drier future for our part of the world. This also includes impacts to the behaviour of snow falls.

Two of our main catchments, the Tyers and Tanjil River catchments, both originate on the Mount Baw Baw Plateau. The plateau is high enough not only to experience snow fall but also retain snow during the winter months and into early spring. Snow forms a water storage, with precipitation that would otherwise contribute to runoff immediately, instead being held on the plateau in the form of snow. That snow then melts, typically during spring, contributing to runoff then.

We have observed that in some years, this process acts somewhat as an extension to reservoir storage with snow runoff providing ongoing steady streamflows during dry periods in spring and thus delaying the reservoir drawdown. Climate change in Gippsland is likely to lead to a range of outcomes that may reduce the effectiveness of this process. Warmer temperatures mean less precipitation falls as snow. Less precipitation and in particular less cool season precipitation, leads to less snow. We undertook analysis during the development of our 2017 UWS to better understand the risks to water yield should the future bring a reduced snow accumulation at Mount Baw Baw.

That analysis concluded that while less snow on Mount Baw Baw in future may intuitively be associated with an adverse water resource outcome, and while we have observed years in which thick snow packs have bolstered storage well into dry springs, such as 2015, the overall impact of reduced snow accumulation on the yield of the Latrobe System is likely to be small, if not negligible. For more detail of this analysis refer to our 2017 UWS.

Water sharing in our region

Urban and industrial water consumption is just one of many important water demands across our region and its catchments, both upstream and downstream of our reservoirs and weirs, as well as our region's aquifers.

Irrigated agriculture is a large user of both surface and groundwater in our region. While significant gains have been made in efficiency of irrigation, opportunities for expansion of irrigation in our region are being considered and overall demand may increase, especially in a drying climate.

Rehabilitation of Latrobe Valley coal mines is an emerging potentially significant user of surface water and groundwater. Actual demand for this use is dependent on mine owner plans and regulator approvals.

Adequate flows in our rivers and streams, in terms of both volume and flow patterns, are critical for supporting the complex ecologies in waterways as well as the adjacent riparian environment. The benefits of healthy waterways and catchments are far reaching, underpinning a wide range of important outcomes such as supporting Traditional Owner values, human health, agriculture and recreation. In a drying climate, provision of sufficient water for these needs becomes more critical.

Climate change is likely to reduce the overall amount of water available to support all of these needs, as well as increasing the demand for water for some. A further complication that has been identified is that as streamflows decline, the proportional share of water resources available for these different needs can be affected. With less inflow, reservoirs may spill less often, with downstream users and waterways potentially disadvantaged.

The Long Term Water Resource Assessment for Southern Victoria was completed by DELWP and released by the Minister for Water in 2020 and found that in our region a review of water sharing arrangements is required for the Latrobe and Thomson river basins. The Minister directed that this be undertaken through the *Central and Gippsland Region Sustainable Water Strategy* (CGRSWS) adopting a quadruple bottom line approach in consideration of economic, environmental, social and cultural values.

Our region is unique compared with much of Victoria in that there are presently large volumes of unused water entitlement within the Latrobe basin (an historic reservation for future power generation), as well as entitlements that currently provide power station cooling water that could be repurposed in the future when that need ceases. Furthermore, there are opportunities to consider changes to the region's water infrastructure configuration to enable these water resources to provide benefits in areas where there are presently significant constraints in doing so, such as the Tyers River.

As shown in Figure 5 (page 2), the CGRSWS sets the regional long term policy and actions to secure a sustainable supply of water for all needs. For our region, this includes direction for how the broader Latrobe basin's water resources and infrastructure will be utilised and potentially reconfigured to help meet all needs.

System resilience

Our service area covers more than 5,000 square kilometres and our catchments extend much further, however our customers are not uniformly spread across this area with some distance between the towns we service. We have a few interconnected supply systems, such as our Warragul and Moe systems, though many of our systems rely on discrete water sources specific to the system location. Some of our water systems rely on a single water source while others can be supplied by multiple sources. The details of supply for our water resource systems are presented in the *Our water resources* section of this report (page 55). Table 5 below briefly describes the water sources available for each of our water supply systems.

Table 5 Our water supply systems with a single water source

Single source	
Briagolong	Two bores access the Wa De Lock aquifer. We are planning for an additional bore into the deeper Rosedale aquifer. Water can be carted to a system with demand of this size. This would be as a temporary measure and incurs a high cost.
Erica Rawson	Single diversion weir on Trigger Creek. Water can be carted to a system with demand of this size. This would be as a temporary measure and incurs a high cost.
Traralgon, Morwell and Tyers	Pipeline from Moondarra Reservoir. Pipeline for transfer of water from Blue Rock Reservoir but via Moondarra Reservoir. The Tyers and Latrobe pumping stations can also meet some of the demand in these systems, but the Latrobe pumping station draws from much poorer water quality. Supplementary water can be carted to a system with

Single source	
	demand the size of Tyers, however may need to be done in conjunction with water restrictions. This would be a temporary measure and incurs a high cost.
Willow Grove	Pipeline from Blue Rock Reservoir. Water can be carted to a system with demand of this size. This would be as a temporary measure and incurs a high cost.
Mirboo North	Single diversion weir on Little Morwell River. Water can be carted to a system with demand of this size. This would be as a temporary measure and incurs a high cost.
Maffra	Single offtake structure on Macalister River downstream of Lake Glenmaggie. It is not possible to cart water to a system with demand of this size.
Heyfield and Coongulla	Single offtake structure on Thomson River. Supplementary water can be carted to a system with demand the size of Heyfield and Coongulla, however may need to be done in conjunction with water restrictions. This would be a temporary measure and incurs a high cost.
Sale	Four bores access the Sale aquifer. It is not possible to cart water to a system with demand of this size.
Seaspray	Single offtake structure on Merriman Creek, with redundancy of 30 ML raw water basin. Water can be carted to a system with demand of this size. This would be as a temporary measure and incurs a high cost.

Table 6 Our water supply systems with multiple water sources

Multiple sources	
High quality raw water supply to Opal Australian Paper and Loy Yang power station	Pipeline from Moondarra Reservoir. Pipeline for transfer of water from Blue Rock Reservoir but via Moondarra Reservoir. The Tyers and Latrobe pumping stations can also meet some of the demand in these systems, but the Latrobe pumping station draws from much poorer water quality. Gippsland Water Factory can also supply recycled wastewater.

Multiple sources	
Moe	Diversion weir at Narracan Creek and pump station on Tanjil River downstream of Blue Rock Reservoir. Redundancy also through interconnection to the Warragul water supply system. It is not possible to cart water to a system with demand of this size.
Neerim South	Typically water is sourced from Tarago Reservoir with alternative supply infrastructure to source water from Pederson Weir. Water can be carted to a system with demand of this size. This would be as a temporary measure and incurs a high cost.
Warragul and Drouin	Pederson Weir upstream of Tarago Reservoir and Rokeby raw water pump station downstream of Tarago Reservoir. Agreement with Melbourne water retailers to purchase up to 400 ML from Tarago Reservoir (accessed from Rokeby raw water pump station). Redundancy also through interconnection to the Moe water supply system. It is not possible to cart water to a system with demand of this size.

Of the systems that rely on a single water source, many of these have good redundancy relative to the population they serve. Some of our systems are more complex with multiple sources of water available. Operational decisions about when to utilise different water sources usually take into consideration availability of water at different times of the year, raw water quality and cost to convey. Our System Plans capture much of these supply and delivery considerations.

Our System Plans document the long term planning for the development of each of our systems and include the improvements and future capital and operational works. The plans are developed following asset condition and system performance assessment. These plans make use of our water supply and sewer network models, where we have them. These models assist in planning the operation of our systems and are calibrated to data collected during operation and verified to real conditions. Our sewer models incorporate the best practice for modelling storm events by adopting the guidance contained in the *Australian Rainfall and Runoff Guidelines* (Ball et al, 2016).

Complementary to our long term planning, we have emergency management processes in place. Our 'All Hazards Incident Management Plan' details the agreed arrangements for our response to incidents or emergencies. Incident management procedures are in place that allow us to rapidly and effectively deploy resources to control any given emergency. We also have a dedicated room activated during incidents. Our incident management systems also consider the risk and management of cyber-attacks on our systems, with planning and procedures for response to such incidents documented in our ‘ICT Security Risk Management Plan’.

Actions to address unacceptable system resilience risks are outlined in the system specific chapters and action list.

Water efficiency and conservation

Water efficiency measures and conservation are an important demand-side management aspect of balancing the demand and supply in our water systems, and further, capacity of our sewage systems. As demands increase, system networks grow and as our infrastructure ages the importance of our focus on water efficiency is reinforced. Water efficiency can be managed by water corporations within our networks and treatment as well as by the end customer. Importantly, water efficiency improvements can have a significant impact on the cost and timing of system augmentations.

We have undertaken analysis as part of this strategy to understand trends in residential water use and it was found that water consumption of newer residential connections was considerably lower than the system average for some of our systems. It is thought that this lower water use observed in newer houses could be attributed to smaller blocks, more efficient fixtures and appliances, drought tolerant gardens and rainwater tanks. You can read more about how we prepared our demand forecast for this strategy in *Approach to future planning in this strategy* (page 41).

We have an established non-revenue water (NRW) action plan for reducing water losses in our systems. We plan to strategically target systems where there is not a lot of margin between supply and demand or where the unit cost of treated water production is high. The development of the action plan was preceded by an assessment of our systems to identify the likely major contributors to NRW. Systems identified as having consistently high NRW, and where avoidable NRW costs are of most value to customers, are Mirboo North, Briagolong and Moondarra (Morwell, Traralgon and Tyers) systems.

The priority actions we have developed to address NRW in our systems are:

<u>Action 1 – Non-revenue water reporting dashboards</u>
The objective of this action is to deliver reporting at a finer resolution than the current annual reporting. Reporting at a system or sub system level, as well as improved data sharing across our business, will assist whole of business asset management decision making.

<u>Action 2 – Accounting for water</u>
This action will deliver a central reporting location for our staff to report, estimate and account for water used during maintenance, project activities or water main bursts.

Action 3 – Bulk metering asset class plan
Our bulk supply meters are located at water treatment plants or other critical locations for recording flow data. This action will work towards verifying the accuracy of these meters and plan for replacement if required. This will improve the data used to determine NRW statistics.

Action 4 – Direct intervention trials
The objective of this action is to trial and evaluate available or emerging direct intervention techniques that could be utilised to target NRW reductions.

Action 7 – Water efficiency and conservation

Continue to deliver our Non-revenue Water Action Plan.

Water for Victoria places a particular importance on community-based water efficiency programs. Action 5.3 from Water for Victoria is to 'reinvigorate water efficiency programs'. This includes the Target Your Water Use program for regional areas and the Schools Water Efficiency Program. The *Central and Gippsland Region Sustainable Water Strategy* (CGRSWS) also places an importance on water efficiency and conservation for supply and demand management.

We continue to promote water conservation and efficiency under the Target Your Water Use program. We do this by creating and sharing social media and other content that supports the Victorian Government's Target Your Water Use campaign. These messages include water saving tips adapted from Smart Approved WaterMark advice; promotion of the Permanent Water Saving Rules; and promotion of online tools, such as a household water use calculator. Other education activities we undertake include continuing to work with schools to support their ongoing commitment to improving water efficiency. There are 35 schools in our region actively involved in the Schools Water Efficiency Program and we are forging closer partnerships with our regional education partners.

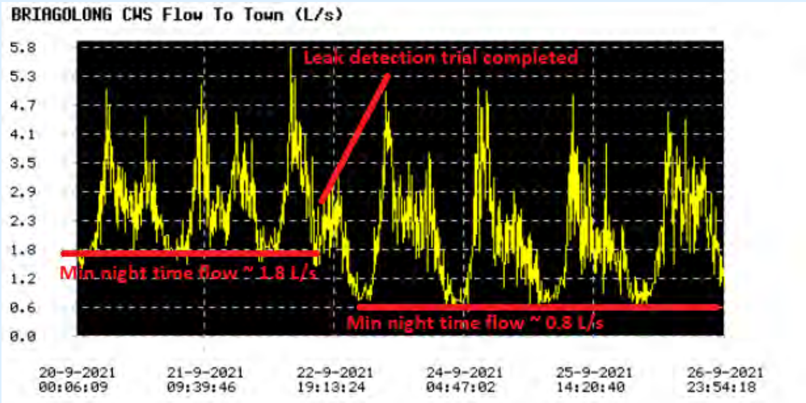
Action 8 – Water efficiency and conservation

Expand our activities that support the government's Target Your Water Use program including continuing with the Schools Water Efficiency Program, facilitating any applicable grant schemes for water efficiency improvements in homes and businesses, and expanding our community education programs.

Case study – Leak detection in action for Briagolong water system

We have commenced trialing of direct intervention techniques for reducing NRW.

In mid-2021, we identified a leak within the Briagolong reticulation network. The leak was first identified by our Supervisory Control and Data Acquisition (SCADA) system, which collects flow data for Briagolong (and our other systems) in real time. It recorded a step change in night time flows, which indicated the presence of a new leak or leaks from the reticulation network.



The first trial commenced in Briagolong in late September 2021, taking place over a two day period. The particular style of leak detection trialed utilises acoustic monitoring (listening devices) to pinpoint the location of leaks. Rectification of the leak locations has reduced minimum night time flows from around 1.8 liters per second to about 0.8 liters per second, equating to a saving of approximately 31.5 megaliters per year.

Integrated Water Management (IWM)

Water corporations have historically sought to provide for all water needs across the urban landscape by connection to the potable water network, regardless of whether potable standard water is actually required. Sewer flows have historically been considered as a waste stream with disposal to the environment after treatment being the usual approach. Reuse of treated sewage for irrigating agricultural land has long been an alternative option that can deliver a valuable return, but this has often been more the result of the need for a convenient disposal means rather than a deliberate resource recovery.

In a drying climate with growing demand for precious water resources for environmental, cultural, economic and social needs, the historic approach is no longer acceptable as a one-size-fits-all servicing model. Water for Victoria (DELWP, 2016b) sought to support and strengthen the adoption of Integrated Water Management (IWM) across Victoria with several actions including the formation of regional IWM Forums.

IWM is an approach to water planning that considers all elements of the whole water cycle and the nexus to urban liveability and waterway health outcomes.

Victoria's water management framework places responsibility for managing the various elements of the water cycle with a range of organisations. Water corporations manage potable water and sewerage services, catchment management authorities manage waterway health, local councils manage stormwater and public open spaces and Traditional Owners are increasingly undertaking an important role in managing water in order to better care for Country. The best overall outcomes are not going to be achieved with these groups working in isolation and the purpose of IWM Forums is to bring these organisations together in a formally structured manner. Accordingly, the Gippsland IWM Forum was formed in 2018.

Working together, a range of outcomes have already been achieved with Baw Baw Shire, Latrobe City and Wellington Shire Councils all now having developed municipal IWM plans with the support of the Forum outlining a range of initiatives to be delivered collaboratively to provide better outcomes for our region. A range of IWM initiatives are already in place or under development across our region. These include the use of recycled sewerage for irrigation of Bellbird Park ovals in Drouin, reuse of stormwater for irrigation of Western Park ovals in Warragul and at various facilities around Sale from Lake Guthridge, as well as a collaborative project at Willow Grove to establish native vegetation to filter stormwater from new developments within the Blue Rock Reservoir catchment.

These projects already demonstrate effective collaboration across our region that is reducing demand on potable water, improving the resilience of urban parklands to droughts and delivering better outcomes for the condition of our waterways.

Action 9 – Engaging with our stakeholders

Continue to work closely with our Gippsland IWM Forum partners to identify and deliver feasible IWM initiatives that benefit the security of our water resources, the liveability of our urban landscapes and the health of our waterways and the broader environment.

Case study – Willow Grove stormwater gully rehabilitation

New urban development at Willow Grove has resulted in a greater amount of stormwater runoff from areas that were once paddocks now being much more impervious to water due to house roofs and paved roads. This excess of runoff can carry urban contaminants into waterways and was resulting in erosion of downstream farmland and pollution of Blue Rock Reservoir.

Working collaboratively with Southern Rural Water, Baw Baw Shire Council, West Gippsland Catchment Management Authority and Tanjil Land Care, and with the assistance of funding from the Victorian Government, an area of the gully between the development and reservoir has been reserved, fenced and planted with native vegetation that slows and naturally filters the runoff. The benefits of this project are already being realised, having helped protect water quality in Blue Rock Reservoir during significant storm events during 2021. Planning is now underway for stage two of this project, extending re-vegetation further upstream to help manage urban runoff from another nearby development.

Before

After

Approach to future planning in this strategy

Our water resources and sewage systems are subject to the impacts of climate change, climate variability and extreme events. Changing demographics and economy also present challenges in balancing the economic, environmental, cultural and social values of water and ensuring the availability of water resources to meet future needs. To plan for the future of both our water resources and sewage systems we need an outlook that takes into account the demands on our systems as well as the available water and sewage treatment capacity.

Level of service

Planning for the future requires an understanding of the level of service that our customers desire. It is important that customers have a good understanding of the measures by which we define level of service, and what that means in terms of their real life experience and expectations, as well as what maintaining or improving levels of service might cost.

For water supply planning, level of service is measured by how reliably a system can meet customers' normal demand. If demand exceeds supply and water restrictions need to be imposed, then normal demand is not being met. Water restrictions can be imposed at four different levels of increasing severity, so the measure of reliability can be described by the expected frequency, duration and severity of water restrictions in a variable and changing climate and within the bounds of a plausible range of scenarios.

Our water supply systems have a history of high reliability by comparison to other Australian regions. With the exception of a very short duration of low level restrictions in Seaspray and Briagolong in 2010 and 2020 respectively, it has been 14 years since widespread and severe water restrictions affected our region, and this was at the height of the unprecedented Millennium Drought of 1997 to 2009, during which most of south eastern Australia was facing its worst water crisis in living memory. We managed to continue to supply the majority of our population with restrictions reaching only as far as stage 3, meaning customers could still use their water supply at certain times to keep their gardens alive. We recognise that some customers were burdened with stage 4 restrictions (basically no outdoor water use) in some of our towns like Seaspray and Boolarra, but we've invested heavily since then to increase the resilience of the water supply to those towns.

The level of service commitment or target also needs to be defined in a way that is not too complicated, or it can be difficult to measure actual performance against the target, and it can be difficult to understand what is being offered. For that reason, we've historically opted to set a level of service for supply reliability simply in terms of the proportion of years on average over the long term during which customers can expect to be able to use water without restrictions, and we've adopted a high target of 95% reliability, or restrictions of any level to be imposed in one year of every 20.

It is important to understand that this measure takes a long term average approach, just as we consider the long term record of climate variability when assessing our systems for resilience. For our larger systems the record of river flows goes back nearly 70 years. But we know we can't rely on the more regular high flows of the earlier part of that history as our climate is changing. We account for that and have robust methods that are consistent across Victoria that we use to modify those earlier river flows to reflect the current climate, but retain the natural variability from year to year. There is no specific and reliable forecast for what the weather is going to do next year or any year into the future. But climate science gives us guidance on what we should reasonably anticipate as plausible, both due to natural variability and also due to ongoing climate change.

So when assessing how reliable our water systems are now, and will be into the future, we look at a range of scenarios or adaptations of that long term record. We have simulation tools that show us how our water systems will behave over a long term period under these scenarios and we look to how reliable they are on average. So if a supply system is 95% reliable then over a 70 year period we'd expect to see between three and four years in which demand wasn't met. But in real life we have no way of knowing what order our variable weather will be experienced so it might be that two of those three to four years where full unrestricted demand wasn't met could occur within one decade, even back to back, and it is important that such an occurrence is not interpreted as a failure to meet the target reliability.

When our customers endure water restrictions for reasons of water shortage (as opposed to restrictions being imposed to help manage some other sort of extreme event such as poor river water quality and associated treatment difficulties following a bushfire or storm), it will typically mean that a severe drought has occurred, perhaps not worst on record, but given our usual high reliability it is likely to rank among the worse dry years experienced. That in itself is often a trigger for us to review our system performance such that this new drought event is included in the historic record we use to simulate system behaviour, and this may indicate a failure to provide the target reliability over the long term, potentially bringing forward an action to restore the level of service.

This is what happened at Briagolong following the 2017-19 east Gippsland drought. Water restrictions were imposed in 2020 for a short time to manage this. Restrictions were last imposed here in 2007. This didn't necessarily mean a failure to provide the level of service required, but it did initiate a full review which highlighted that the system was now falling below the required reliability with the inclusion of this drought in the long term record, and we are working towards a major supply augmentation for this town (more described in the *Briagolong* section on page 56).

In the *Customer engagement* chapter (page 9) we heard that customers are generally satisfied with a supply reliability that might mean they experience restrictions one year in 20 or even more often, especially if the restrictions don't reach stage 4. Some expressed concern for the welfare of their gardens under stage 4 restrictions where potable water use outside is banned with very few exceptions. However we also heard that while customers don't want to pay for gold plated reliable supply systems, we should be proactively planning for and preparing for drought. It is for these reasons that we've opted to continue to set a high level of service of 95% annual reliability which aims for an experience of restrictions of any level only one year in 20, although in real life a future drought could result in restrictions occurring more than once over the shorter term. As part of this level of service commitment we also plan to ensure that all of our water systems can meet as a minimum the level of demand under stage 4 restrictions, under a conservatively harsh drought scenario.

We believe this comparably high target level of service reasonably delivers on our customers' desire for the right balance between reliability and affordability and is appropriate for our region's variety of different water supply systems, none of which have multi-year storages that can enable multi-year supply guarantees and significant advance notice to allow drought mitigations to be deployed.

Where a water supply or sewerage system has been identified as being unable to provide the required level of service, either currently or at some point in the future, potential options to balance demand and water supply or sewer capacity have been identified. Options considered may either decrease demand or increase supply or capacity as appropriate and the required timing of action is determined. Due to the uncertainty of the future, a range of scenarios is considered and a corresponding range of timings for action is identified. Where it is identified that action is required in the short term to ensure adequate levels of service are provided and maintained, the best solution after rigorous assessment is programed into the next price submission period. Actions identified as being required in the medium to longer term however, are not locked into planning schedules and remain adaptable to an uncertain future. This is discussed further in *Managing risk and uncertainty*.

Level of Service we've adopted

We will continue to set a high level of service target of 95% annual reliability. This aims for water restrictions of any level to occur on average over the long term in only one year of 20.

As part of this level of service commitment we also plan to ensure that all of our water systems can meet as a minimum the level of demand under stage 4 restrictions, under a conservatively harsh drought scenario.

The following is a description of how we have developed our water and sewer system outlooks in order to assess whether changes to systems are required to maintain adequate levels of service. This is a quantitative assessment. Other drivers of actions such as system resilience risks have been assessed qualitatively.

Demand forecast

Our water and sewer demand forecast is built upon a bottom-up analysis of our current water and sewage treatment demands. Figure 15 below shows a breakdown of the component water uses across all of our systems for the past six years.

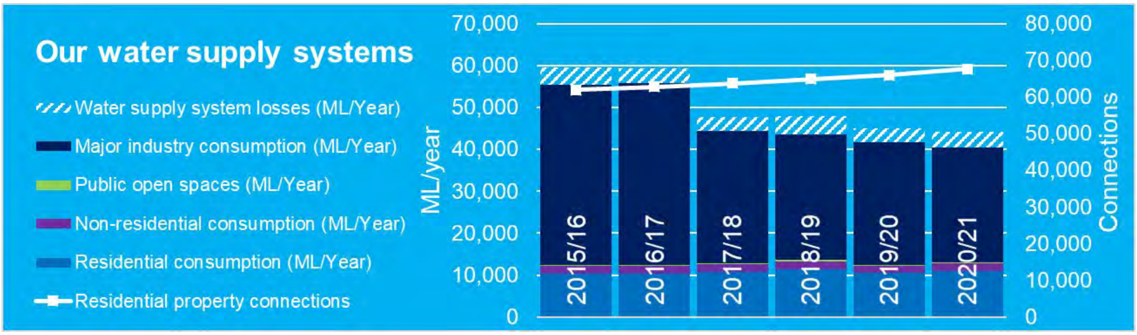


Figure 15 Previous six years overall demand for our water supply systems

We use a five-year average benchmark for our forward forecasting. Our models were created in the first half of 2021, so therefore don’t include the 2020/21 financial year data. We have presented our 2020/21 data through this report for information which is why six years are shown above.

These key components of demand have been projected separately over the 50-year planning period in proportion to individually relevant growth factors anticipated for the respective service system. They are then summed to derive total demand.

The key components of demand are described in more detail in Table 7 below:

Table 7 Description of key areas of water demand

Residential consumption	For each water supply area we looked at the current level of water usage in households, including private gardens, over the previous five-year period.
Non-residential consumption	The component of the non-residential treated water demand typically representing local business and schools.
Public open spaces	This component is presented separately from other non-residential demand for better visibility of Integrated Water Management opportunities and because it is more climate dependent. In the future, we have anticipated that as new housing developments occur, new parks and gardens will be created. We expect that water demands for parks and gardens will grow in proportion to the number of residential connections.

Major industry consumption	We service a range of major industrial customers whose water needs are significant by comparison to other regions. Some of these customers are supplied with raw water, some with treated water and some both. Forecasts of future demand for these customers are made on a case by case basis, however changes to the operations of these customers can be significant in terms of demand forecasts for the systems from which they are supplied.
Water supply system losses	Water that is treated, and as such has had funds spent on to achieve treatment, but is subsequently lost through leakage. As water supply networks expand and new connections are added there is more infrastructure and more opportunities for water losses to occur.
Treated water demand	Represents the supply from a water treatment plant. This is the sum of demands from residential, non-residential, parks and gardens, major customers (with treated water supply) and water supply system losses.
Raw water demand	Treated water demand adjusted to account for raw water losses during conveyance from the water source to the water treatment plant and due to water treatment processes.

While historic consumption in these categories is known, we don't know the specific number of people serviced by our systems, only the number of connections. We developed our population growth forecast using several data sources:

- Our customer connections data;
- The Victoria in Future official state government projection of population and households published in 2019;
- The preliminary release of the 2021 Victoria in Future population projection; and
- Population and household data collected through the Australian Bureau of Statistics 2016 Census.

For the forecast modelling we undertook to support the development of this strategy, we developed a base case population and service connections forecast. We used the same method to forecast growth in both our water and sewer systems. The base case forecast was grounded in the 2019 Victoria in the Future projection of population and dwellings, and refined with our customer connections data reflecting on connections growth in the previous five years. We tested the sensitivity of this forecast population by developing alternative population and connections growth scenarios based on the preliminary release 2021 Victoria in the Future projections and further analysis of development trends conducted as part of our Price Submission planning.

Our forecasts are proportional to these demographic outlooks except for some specific systems for which these forecasts are not appropriate, for instance, a spatially relevant sub-district may not exist in the demographic outlooks, or other drivers of, or constraints on demand are more important.

Hotter and drier conditions expected with climate change are likely to increase demand for water in settings where water is used for gardens or ovals. Sensitivity of our water demand outlook to residential water use under three climate change scenarios was tested using relationships derived between meteorological indicators and demand. We have presented the demands resulting from the high climate change factors in our outlook charts as an alternative high climate change water demand.

For some systems we also observed that data over the previous 10-year period showed a trend of generally lower consumption for newer residential connections. Based on this we produced an alternative low water use forecast for some of our systems based on lower residential water use. We considered the age of the connection and the size of the lot in this analysis. It is thought that this lower water use observed in newer houses could be attributed to smaller blocks, more efficient fixtures and appliances, drought tolerant gardens and rainwater tanks. We also found that for some systems, newer houses did not show a significant difference in water consumption compared to older connections.

For our sewer systems, we also developed an upper band forecast scenario based on the peak sewage treatment demand of the past five years.

Water resource yield

To understand whether our water systems will be able to meet future demand and provide the target level of service supply reliability, we need to also prepare an outlook of the "yield" for each system. Yield is a measure of the maximum average level of demand that we can meet while providing the target reliability. This can then be directly compared with the forecast for actual demand. If yield exceeds actual demand then the target reliability is being met, whereas if demand exceeds yield then it is likely that the system won't be reliable, water restrictions might be needed frequently, and in a worst case scenario even critical human needs for water (indoor use) might not be met. Depicting this outlook as a chart, in the *Our water resources* chapter (page 55), allows us to readily identify if and when we need to take action to maintain supply reliability.

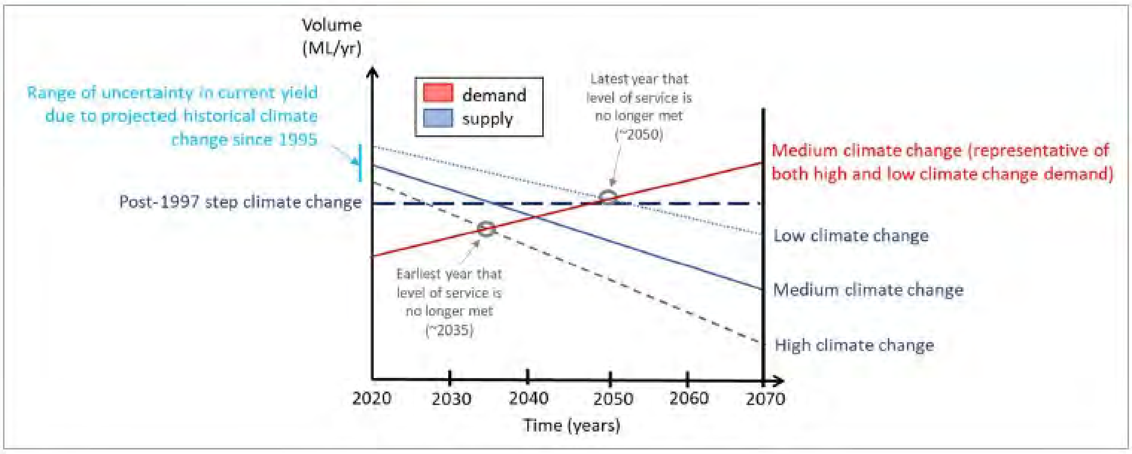


Figure 16 A typical supply and demand outlook chart Source: DELWP (2021a)

Figure 16 illustrates this concept. Blue lines of yield, representing alternative scenarios of climate change, can be compared with the red line of demand, identifying when we need to be ready to implement a suitable action, either to reduce demand (such as water efficiency and conservation improvements) or increase supply (such as purchase more water entitlement).

To estimate yield we use computer software model representations of our water supply systems. These models allow us to run a long term simulation of how our systems perform, providing us with a wide range of outputs such as reservoir levels and whether demand was met for every day of the simulation which is as long as the extent of river flow records, up to 70 years for some systems.

The model uses a long term input sequence of streamflow (for surface water systems), and for each timestep (day or month) of the simulation it directs a portion of available streamflow to meeting town and industry demand. In doing so it takes account of the typical pattern of demand from month to month which peaks in summer and is typically lowest in winter, the limitations of our infrastructure such as capacity of reservoirs and pipelines, and our legal right to take water from the environment as set out in the conditions of our entitlements and licences. We can then observe the long term reliability of our systems for a range of streamflow scenarios corresponding to the present climate as well as possible future climates.

As we've seen, climate change is already occurring and our streamflows have decreased, with notable changes occurring around 1975 and 1997. Our climate since 1975 is now considered by CSIRO and BOM to be representative of "current climate". There is also some evidence to support the possibility that the climate since 1997 is now the norm, with some climate patterns having not returned to pre 1997 conditions despite two relatively wet periods in 2010-12 and 2020-22. Furthermore, across Victoria we've also observed changes in rainfall seasonality. We will therefore consider both climate scenarios as possible baselines.

To simulate our water systems' response to a variable climate that has already changed, we need to modify our long term historic streamflow records so the higher streamflows prior to 1975 or 1997 (depending on the scenario being considered) are scaled to match the statistical distribution of recent climate. The chart below shows an example from Melbourne Water of the output of such a scaling exercise. The actual streamflows are shown by the black columns and it can be seen that the average flows prior to 1997 were significantly higher than those after 1997. By adopting a scaling method as described in the *Guidelines for Assessing the Impact of Climate Change on Water Availability in Victoria* (DELWP, 2020), the pre-1997 flows have been reduced (orange columns) to match the statistical distribution of recent flows, while retaining the useful variability information.

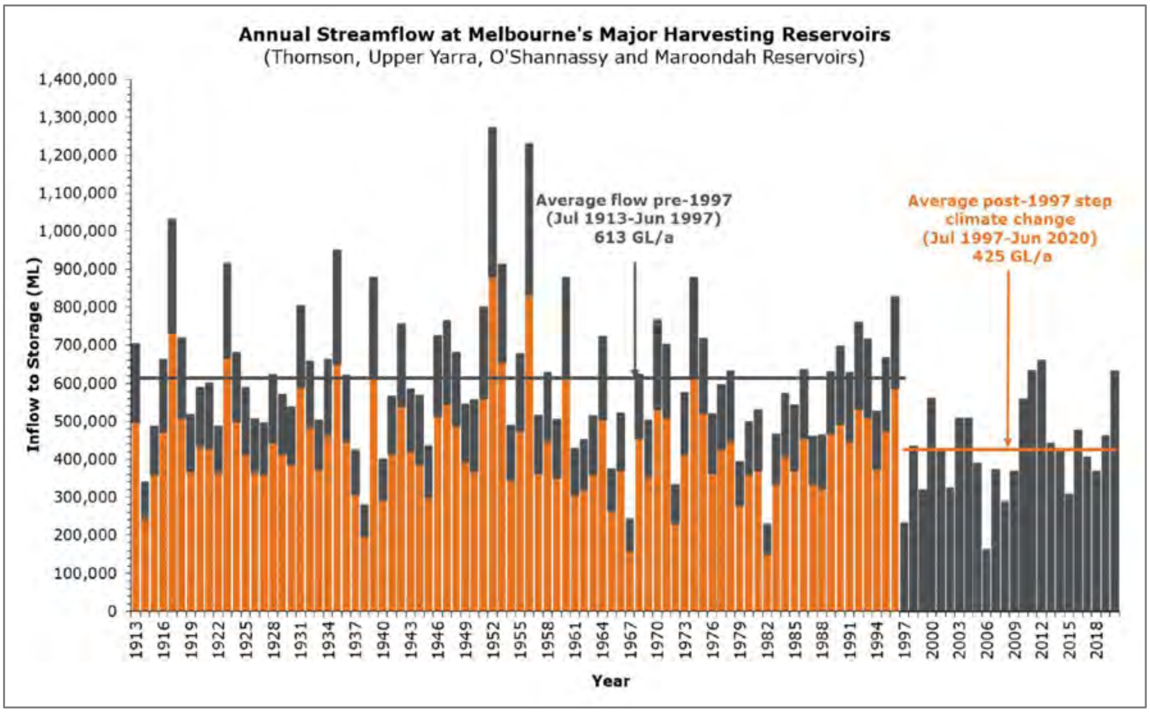


Figure 17 Annual streamflow in Melbourne's major harvesting reservoirs Source: Melbourne Water (2021)

We know that our climate is changing and forecast to continue to change, depending on how much greenhouse gas humans continue to produce, and the various environmental, atmospheric and oceanic responses to future greenhouse gas levels. As streamflow is a product of rainfall, this means that streamflows will likely change into the future but the key question is by how much. The current climate baseline of 1975 to the present is approximately centred on the year 1995 and this also happens to be the year mid way through the baseline period used by global climate models surveyed by the International Panel on Climate Change. Through a cooperative arrangement between climate scientists of DELWP, BOM, CSIRO and University of Melbourne, future projections of climate and hydrographic parameters have been prepared using a vast ensemble of global climate models using the following method. An overview of the process is presented in Figure 18.

A future greenhouse gas emissions scenario is stipulated by the *Guidelines for Assessing the Impact of Climate Change on Water Availability in Victoria* (DELWP, 2020a). This is the RCP8.5 scenario, which is the highest scenario and represents unmitigated ongoing global emissions growth which seems pessimistic but is conservative to uncertainty and also results in the broadest range of outcomes to consider in water resource planning.

This scenario of emissions is used as the climate forcer in the ensemble of global climate models. These produce estimates of how climate parameters like temperature, evaporation and rainfall will change at points in the future, compared to the baseline (1995). These estimates are at a very coarse grid resolution across the planet.
The coarse resolution estimates need to be downscaled to align with Victoria's river basins using statistical methods or local climate models. At this point there is a vast

array of outlook data from 42 global climate models for future timeslices of 2040 and 2065. The future is uncertain and climate modelling is incredibly complex and no model is necessarily “right” or “wrong” (some models of dubious suitability for Victoria were first filtered from the study), so it is important to consider the outcomes of all and consider how to plan for a future in which each could occur. For simplicity of assessment it has been considered reasonable to order the outcomes of all models and assign the 10th, 50th and 90th percentile results to low, medium and high climate change scenarios (or vice versa depending if temperature or rainfall is being considered).

Finally, this range of climate scenarios needs to be converted into streamflow and this is done using a software rainfall to runoff model. These models take rainfall amounts, intensities and patterns and consider evaporation, soil absorption and tree evapotranspiration to derive runoff, or streamflow, using a water balance method.

Figure 18 Overview of modelling process to derive climate change projections from global climate Source: Potter et al (2016)

The result of the third step of this process is shown spatially in Figure 19 as a percentage change of rainfall for the year 2065 compared with 1995. It can be seen that for west, central and south Gippsland that rainfall is predicted to decline except under the 10th percentile, or low climate change scenario. Of particular concern is the more significant proportional decline during the cooler half of the year when rivers typically have higher flows. The final step, converting this data to runoff or streamflow, will also take into account increasing temperatures and changing rainfall patterns and generally result in lower streamflows under all scenarios.

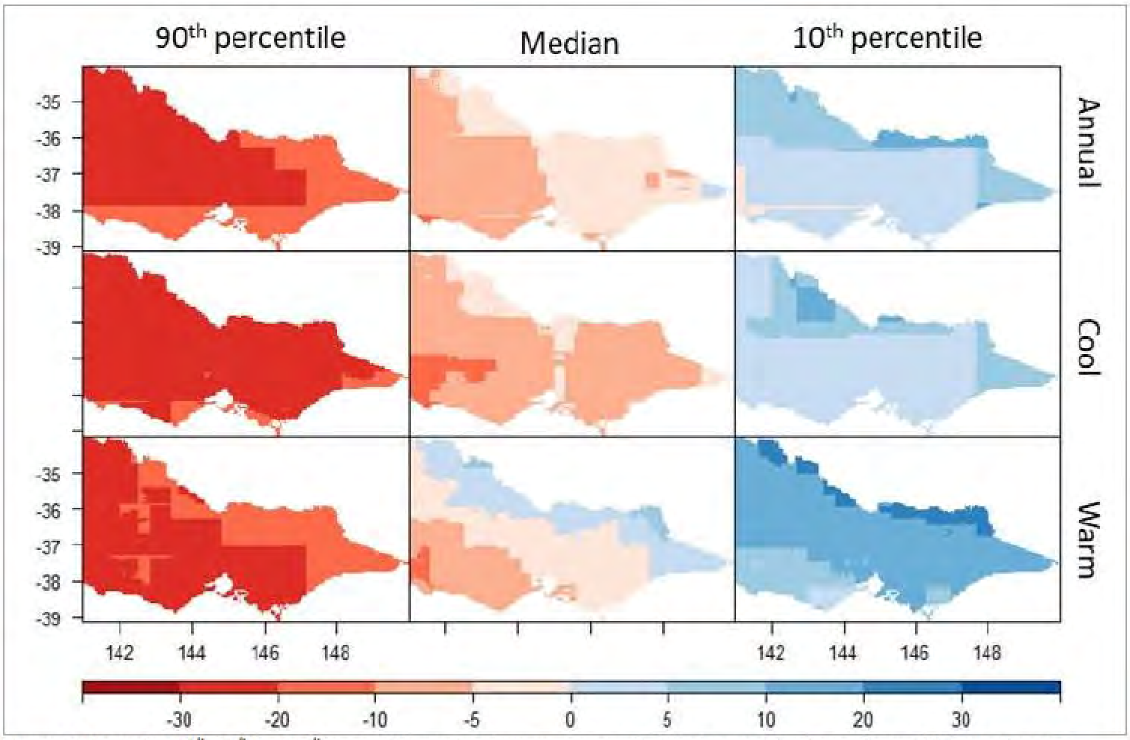


Figure 13 Projected 10th, 50th and 90th percentile cool and warm season rainfall changes (% change from 1995 value) across Victoria for RCP8.5 in the year 2065 (source: CSIRO)

Figure 19 Modelled percentage change of rainfall for the year 2065 compared with 1995 Source: DELWP (2020a)

These outlooks for streamflow are shown on Figure 20 for a particular point on an example river. The actual historic streamflow from 1975 to 2020 is shown in black. The average of the "current climate" since 1975 is shown in dark blue with the centre point at 1995. The three future trajectories for low, medium and high climate change are shown at 2020 (because climate change is already happening), 2040 and 2065 using predictions from the range of global climate models. The average of the period from 1997 to 2020 is also shown and extended, to account for the possibility of a step change in climate at the commencement of the Millennium Drought. We do not apply the global climate model future projections to this scenario as they aren't designed to be applicable to this alternative baseline, rather the post 1997 scenario serves as a useful more conservative outlook up until the point the high climate scenario takes over and becomes worse (in Figure 20 soon after 2020, but it varies from river basin to basin).

Having prepared modified streamflow sequences for the three climate scenarios for the years 2020, 2040 and 2065, as well as the "post 1997" scenario, we then come back to our water system model which we run with each of these sequences and we determine the reliability of supply by observing the incidences of supply restrictions over the long term simulation. To evaluate the yield for each of these ten streamflow sequences we iteratively re-run the simulation with a progressively higher level of average annual demand (or lower if the initial simulation showed reliability to be inadequate) until we arrive at the level of annual demand for which the frequency of water restrictions over the long term is one in 20 years. We can use these results to project yield simply by "joining the dots" from now to 2040 then 2065 and we'll compare this with our demand outlook and identify if and when we might need to take action to provide the target level of service.

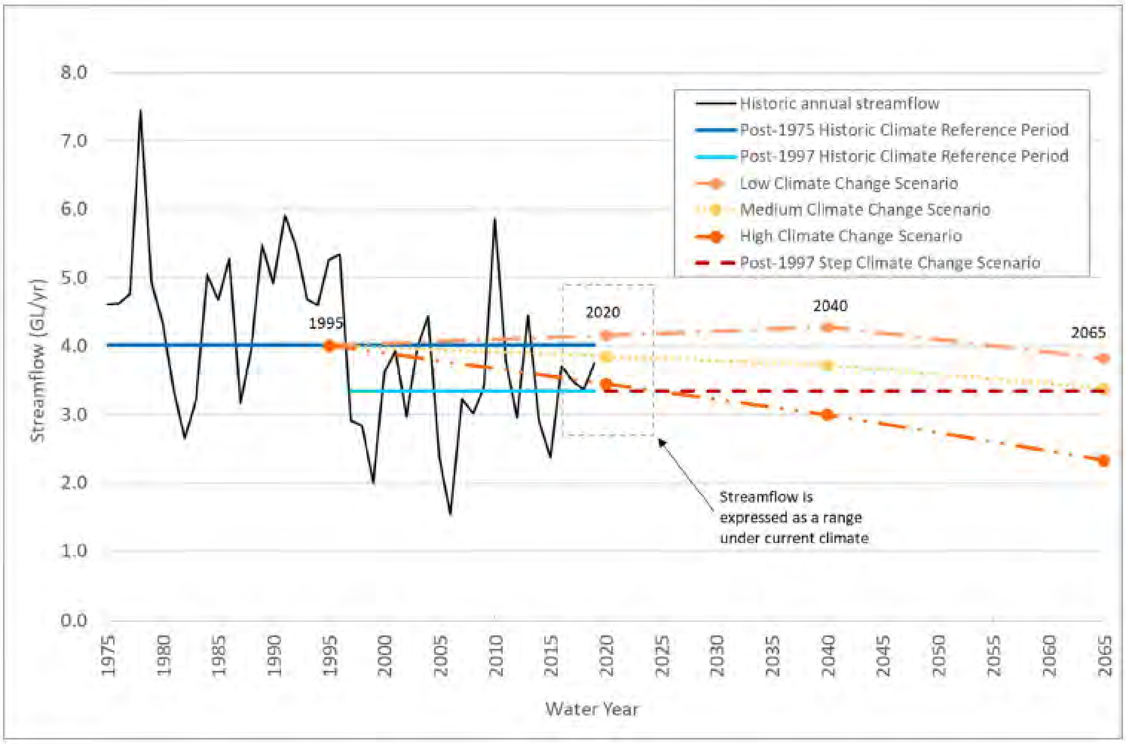


Figure 20 Example of historic annual streamflow and climate change projections applied to current climate baseline average streamflow Source: DELWP (2020a)

As a final step, we want to ensure that for the small proportion of years when supply is restricted, that there will be sufficient water to meet critical needs, and we do this by reviewing the simulation for current demand using the post 1997 scenario as a conservative approach.

Table 8 below shows the reliability of each of our water systems under a long term simulation of post-1997 scenario inflows. This created a sequence that includes droughts prior to 1997 that are more severe than actually experienced, and is therefore a conservative assessment. This assessment is done at current demand as most of our systems are only experiencing modest growth. The only exception is for our rapidly growing Tarago system (which includes Warragul and Drouin), where we've modelled demand in five years' time to ensure drought resilience through the next Price Submission.

Table 8 Reliability of each of our water systems in a long term simulation

System	Current Annual Demand (ML)	Stage 1 Annual Reliability (%)	Stage 3 Annual Reliability (%)	Shortfall (% of years)
Erica-Rawson	67	100.0%	100.0%	0%

System	Current Annual Demand (ML)	Stage 1 Annual Reliability (%)	Stage 3 Annual Reliability (%)	Shortfall (% of years)
Mirboo North	184	98.6%	100.0%	0%
Latrobe	41,268	100.0%	100.0%	0%
Seaspray	35	85.0%	90.0%	0%
Tarago(3)	5,072	1.9%	4.6%	80.6%
Thomson-Macalister	1,516	96.9%	98.5%	0%
Briagolong(2)	87	46.0%	N/A	0%

Notes: (1) Stress testing scenario is post-1997 (Step Change) climate scenario at current level of demand
(2) Stage 2 Annual Reliability
(3) Tarago demand is 2026 (High Climate) demand

It can be seen that all of our systems can provide sufficient supply reliability for critical human needs, although at times under water restrictions. The only exception is the Tarago system and action to address this is detailed in the *Warragul, Drouin and Neerim South* (page 90) section of the *Our water resources* chapter.

Sewage system capacities

Our sewerage network includes 14 sewage treatment plants where we use mechanical, chemical and biological processes to treat sewage. We convey sewage to these plants through our sewerage network predominantly via gravity, but also with pump stations to push sewage up, or over hills. Treated effluent discharges from mechanical plants are returned to the environment and contribute to environmental flows for the receiving waterway. For our lagoon-based plants, treated effluent is stored in a winter storage and recycled for summer irrigation of our agribusiness operations.

Our sewerage networks and sewage treatment plants are planned and designed in accordance with the Water and Sewer Association of Australia codes, standards and guidelines, as well as the State Environment Protection Policy (Waters) and Environmental Protection Authority (EPA) regulations and guidelines. All treated sewage that is released or recycled must comply with EPA standards and our EPA approved discharged license limits. During very wet years, such as 2020, there have been instances where some of our facilities have required emergency discharges.

In 2021 we re-evaluated the treatment, storage and disposal capacities of lagoon-based sewage treatment systems to confirm compliance with our EPA approved discharge license limits. This evaluation followed a heavy rainfall period in 2020, which resulted in limited irrigation opportunities and led to spills to the environment at some plants. The updated capacity assessments drew upon measured flow data, lagoon dimension and current configuration, population data, and rainfall and climate data from the Bureau of Meteorology. The results of the capacity assessments are presented for each of our sewer systems in *Our sewer systems* (page 106).

Unlike the yield assessments for our water systems, sewage will always be available. We do not foresee a shortage of the resource, rather a shortage of treatment capacity and networks conveyance as towns continue to grow.

Managing risk and uncertainty

The future we face is inherently uncertain and this is particularly pertinent to the water industry. Significant climate variability is a well known characteristic of our nation and region. Climate change is occurring and already impacting on our water resources and infrastructure, but the degree to which these impacts will continue to worsen, possibly stabilise or even improve in response to future greenhouse gas levels is highly uncertain. The scientific methods outlined earlier, that our industry adopts to consider the range of plausible future climate outcomes, contains uncertainty at every step. Future greenhouse gas levels are uncertain. The global climate response to these gas concentrations, regional responses and climate-land-ocean interactions then compound this uncertainty. Finally there is uncertainty in the relationship between rainfall and streamflow and even whether this relationship will remain stable into a changing future.

Future demand for water, and discharge of wastewater, is also subject to uncertainty but usually to a lesser degree than the uncertainty in supply. Population and dwellings growth into the future is influenced by a range of factors including regional migration and local economic influences. Some of these can be short term, possibly transient, such as the COVID-19 global pandemic, while others could be long term such as national population growth and local region economic and industry transitions which will be inevitable in the Latrobe Valley. Stabilisation or further improvement in water efficiency at the household level and within our networks then affects how growth trajectories will translate into demand.

The demand for water and wastewater services by large industries was fairly stable until about a decade ago when our local power industry started to contract with the 2014 closure of Energy Brix and 2017 closure of Hazelwood power station. Yallourn W power station is scheduled to close in 2028, while Opal Australian Paper is considering a range of future options for their site that may impact water needs. Finally mine rehabilitation could lead to a significant increase in demand for water from our network.

By considering a wide range of plausible future scenarios, as you will see in our water and sewage system outlook charts and summaries, we can start to understand the timing considerations for when we will need to take action to maintain our service delivery standards. A careful and adaptable approach is needed to strike the right balance between taking action too early and incurring unnecessary costs, versus delaying and running the risk of falling short on our service reliability targets. In our chapters *Our water resources* (page 55) and *Our sewer systems* (page 106) we've discussed how we've considered the range of plausible future scenarios and our individual approach to managing uncertainty for each. These decisions take into account a range of considerations specific to each system, such as the scale of the system and how that relates to lead times for augmentations, as well as the practicality of short term measures to address shortfalls.

In managing an adverse event such as drought, there is always the question of whether this event is simply transient and part of normal variability and therefore to be managed under our *Drought Preparedness and Management Plans* (page 164), or whether it represents a "new normal" such as the step we observed in our climate in 1997, many characteristics of which have since not returned to the previous normal. We have a wide range of monitoring and assessment programs to help us to make the right decisions. These include regular detailed monitoring of all of our systems through monitoring technology and assessment through a formalised Water Resource Committee, our public Annual Water Outlook process that monitors progress of UWS actions and how actual conditions are tracking against our UWS scenario forecasts, to the five yearly process of undertaking a major renewal of our UWS (this report). Further to this, in the event that an adverse event occurs, especially one that leads to water restrictions, we will undertake a brought forward review of the system concerned. This is to include the current conditions in the long term record, adopt new climate science, and run simulations to determine the new long term reliability. This helps us to adapt our plans to take the appropriate action, either continuing to manage under our drought measures, or reviewing options and implementing the most suitable augmentation to maintain reliability.

An example of this is our response to the 2017-19 east Gippsland drought and how it affected Briagolong. We first managed the situation under our Drought Response Plan, which included water restrictions and planning for water carting and temporary alternative supplies before significant rain eased the situation. In line with the approach outlined above, we concurrently re-assessed the long term system reliability and identified that this drought event had led to this system falling below our adopted reliability standard. Accordingly we are currently delivering a major supply augmentation. See the Briagolong section in *Our water resources* chapter (page 55) for more detail.

Our water resources

Briagolong

Overview of the water supply system

Briagolong is a small town located in the most north eastern extremity of our service area, approximately 14 kilometres north of Stratford.

In 2021, the Briagolong water system serviced 320 residential customers and 22 non-residential customers. The estimated population served was 720 people. We don't service any major customers from the Briagolong water system. The average raw water demand consumed by the Briagolong system is 81 ML per year. Average losses of treated water in the system are 18 ML per year.

Figure 21 Location of Briagolong water supply system

A breakdown of the previous six years of demand for this system is presented below.

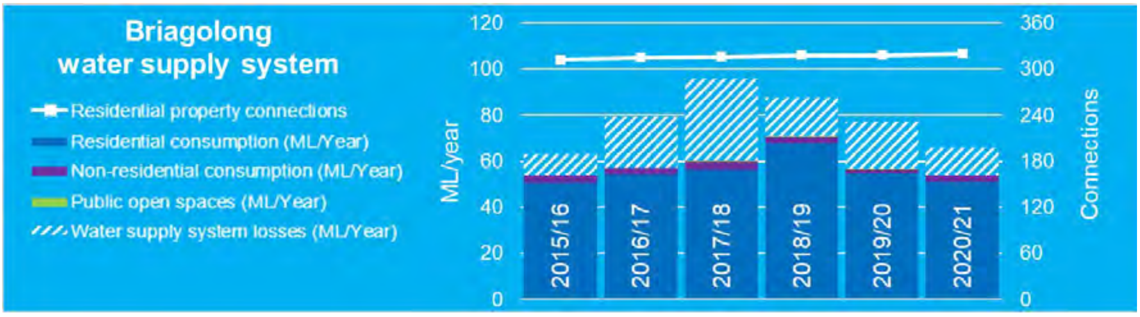


Figure 22 Previous six years demands for Briagolong water supply system

Note: Water demand for public open spaces in Briagolong is typically less than 1% of total system demand or on average 0.1 ML/Year and may not be visible in the chart above.

Briagolong sources its water from the Wa De Lock groundwater aquifer. The Wa De Lock groundwater is shallow and unconfined. Because of this, the aquifer is subject to seasonable variation in level and has a strong connection with the surface water of Freestone Creek. The aquifer responds quickly to drought and rainfall on the Freestone Creek catchment. The Freestone Creek catchment is dominated by agricultural land and the upper reaches of the catchment are forested.

The *West Gippsland Waterway Strategy 2014-2022* (West Gippsland Catchment Management Authority, 2014) identified Freestone Creek, *Wurrundyan'garla*, upstream of Briagolong as a high value waterway and management actions for reduction of threats to waterway values. West Gippsland Catchment Management Authority works with partner organisations to implement a management plan to address these threats.

The Wa De Lock aquifer is covered by a Groundwater Management Area managed by Southern Rural Water (SRW). Groundwater management plans are put in place to ensure that groundwater resources are managed in a fair, equitable and sustainable manner.

Figure 23 Briagolong Bore number 1 head works

Water is drawn out of the aquifer by two bores. These two bores are located to the north of the township, with depths of 15.3 and 16.5 metres respectively. Our groundwater extraction is subject to a Section 51 Take and Use Licence issued by SRW under the *Water Act 1989*. The maximum permissible volume that can be extracted from the two bores in total is 160 ML per year. The maximum instantaneous rate of extraction must not exceed 1.7 ML per day for each bore and no more than 1.5 ML can be taken from each bore on any given day.

The head works for Bore number 1 is pictured in Figure 23.

The water extracted from the aquifer is pumped to Briagolong water treatment plant for treatment. The treatment process comprises of two stages of filtration, after which water is disinfected and stored in a 1.2 ML steel tank before distribution to customers. The treatment plant has a capacity of 1.0 ML per day. The Briagolong treated water demand can also be met by water carting. This would be as a temporary measure and incurs a high cost.

In the years 2016 through to 2019, East Gippsland experienced significant drought and historically low levels in the Wa De Lock aquifer. During this time, water restrictions were introduced to the town for a brief period. In February 2020, the aquifer was recharged by an exceptional rainfall event in the days immediately following the introduction of restrictions. Following this record drought and the implementation of water restrictions, we have undertaken a detailed assessment of the water resources for the Briagolong system including actions to secure water into the future. You can read more about our assessment and planning in the subsequent section ‘Addressing future needs’.

For a map of the key elements of the system please refer to Appendix B and for a diagram of the water treatment process please refer to Appendix C. Alternatively you can visit our online Urban Water Strategy interactive map at www.gippswater.com.au/uws and search for any particular town.

Water system outlook and addressing future needs

Yield for this groundwater system is estimated using a similar method to surface water systems in terms of adjustments to historic records to reflect changing climate and comparing demand with reliability, except that rather than use a streamflow allocation model, we have used an aquifer water balance model to represent the section of the unconfined Wa De Lock aquifer local to our bores. A previous aquifer model used in past UWSs adopted input datasets for groundwater recharge and potential evapotranspiration (PET) from a state government regional groundwater model. This complex groundwater model provided rigorously derived inputs and boundary conditions to our simpler water balance model.

After the 2017-19 drought that affected Briagolong and resulted in the lowest rainfall and groundwater levels on record, we were keen to extend the simulation period modelled up to 2020 to ensure a comprehensive assessment of system reliability and yield. Unfortunately it was not possible to do this using the previous approach as the state regional model has not been updated since 2010 as it was developed for a specific purpose at that time and the cost of extending a model of that nature is considerable.

A fit for purpose approach was developed whereby we attempted to identify relationships between both long term rainfall data for Briagolong and streamflow data for the Freestone Creek with the aquifer recharge predictions of the state regional model for the historic period up to 2010. This was successful with good relationships able to be derived after calibration. These relationships were then used to extend the aquifer recharge and potential evapotranspiration datasets from 2010 to 2020. These extended data sets were then used in our water balance model and the aquifer level results tested against real observations with pleasing results.

Now that we had extended recharge and PET sequences we could apply the relevant scaling to these as outlined in the *Guidelines for Assessing the Impact of Climate Change on Water Availability in Victoria (DELWP, 2020a)* to simulate a range of future climate change scenarios. Water restrictions in this system are guided by aquifer level as measured in our bores. Using our model to perform a long term simulation we then tested a range of climate scenarios and levels of demand to determine the yield for each scenario, this being the estimate of the maximum average annual demand that can be provided at the target supply reliability.

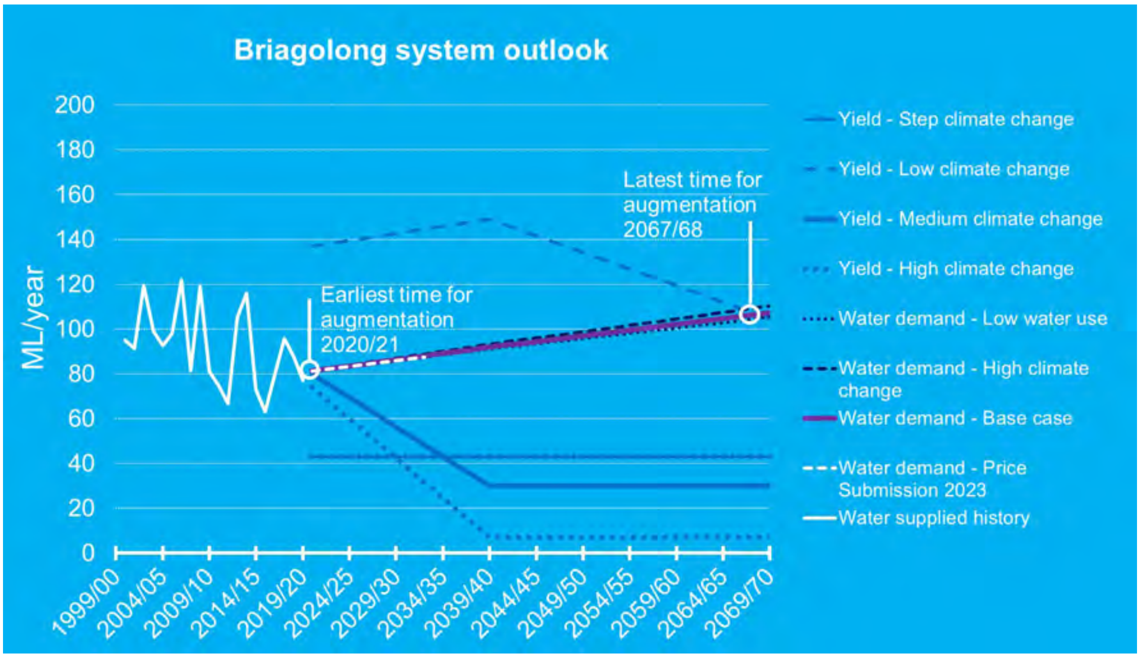


Figure 24 Briagolong water resource system outlook

Demand growth in the Briagolong system, shown in Figure 24 above, is forecast to be modest.

It is clear from the charts above that in order to maintain a supply reliability for Briagolong that meets our target commitment, all climate scenarios except for low climate change are indicating that an augmentation is needed.

As we identified this need in 2020 after undertaking an assessment of reliability following the record drought, we have already undertaken an options assessment and communicated this with our customers and the Briagolong community at that time. The full range of options considered were:

Table 9 Solutions considered for addressing future water needs for Briagolong

Option 1	Do nothing
Option 2	Provide a temporary supply from a deeper bore during low supply levels
Option 3a	Construct new bore into a deeper aquifer at water treatment plant site
Option 3b	Construct new bore into a deeper aquifer at alternative site
Option 4	Treated water supplied from Maffra's Sandy Creek Road tank
Option 5	Treated water supplied from Boisdale
Option 6	Water cartage during low supply levels

Option 7	Managed aquifer recharge
Option 8	Pipe raw water from nearby Glenmaggie main north channel to Briagolong water treatment plant
Option 9	Incentivise irrigators not to use shallow aquifer
Option 10	Develop off stream storage

The township of Briagolong has no stormwater system or sewer system, such that options that utilise stormwater or recycled water have no collection infrastructure. Furthermore, stormwater quickly passes into the gravelly soils at this location and replenishes the shallow aquifer. We have also undertaken a leak detection trial on the reticulated water system in Briagolong with great results described in the Case Study on page 38.

Of the options presented in Table 9, the preferred option balancing the best customer outcomes with life cycle cost and a range of other considerations, was to construct a new bore into the deeper aquifer at the water treatment plant site. Extensive work has already commenced on this and includes:

- In late 2020 a desktop study of sustainable groundwater extraction feasibility considering possible impacts on the environment and other existing groundwater users.
- Construction of an observation bore in February 2021 to 110 metre depth which found a productive aquifer of good water quality at about 90 metres depth.
- Pumping tests and water quality analysis of this bore in June 2021.
- Ongoing groundwater level monitoring and water quality sampling.
- Application to SRW in December 2021 for the transfer of take and use licence from a seller in the Rosedale GMA to our site and for a permit to construct a production bore. At this time of writing, this process had reached the 28 day statutory period for public notification and comment to SRW.
- In 2021-22 an engineering review of the water treatment process at Briagolong and necessary modifications to suit this alternative aquifer.

Action 10 – Briagolong water

Drill a production bore in the deeper aquifer at Briagolong, buy a water licence and upgrade the water treatment process at our Briagolong water treatment plant.

Erica and Rawson

Overview of the water supply system

Erica and Rawson are two small towns located in the foothills of Mount Baw Baw at the most northern extremity of our service area, approximately 27 kilometres northeast of Moe.

In 2021, the Erica-Rawson water system serviced 299 residential customers, 45 non-residential customers. The estimated population served was 493 people. We don't service any major customers from this system. The average raw water demand consumed by the Erica-Rawson system is 63 ML per year. Average losses of treated water in the system are 8 ML per year.

Figure 25 Location of the Erica Rawson water supply system and Trigger Creek catchment

A breakdown of the previous six years of demand for this system is presented below.

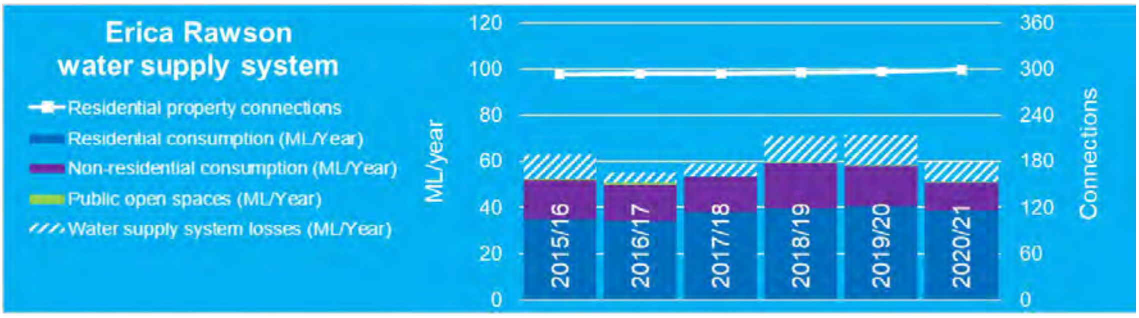


Figure 26 Previous six years demands for Erica and Rawson water supply system

Note: Water demand for public open spaces in Erica and Rawson is typically less than 1% of total system demand or on average 0.4 ML/Year and may not be visible in the chart above.

Erica and Rawson source their water from a weir on Trigger Creek, a tributary of the Tyers River (east branch). The Trigger Creek catchment is relatively small, however, as it is situated on the edge of the Baw Baw plateau it receives a reliable inflow of high quality water. The Trigger Creek catchment upstream of the weir is fully protected by the Baw Baw National Park.

The *West Gippsland Waterway Strategy 2014-2022* (West Gippsland Catchment Management Authority, 2014) identified reaches of the Tyers River upstream of Erica for reduction of threats to waterway values. Environmental values as identified in the *West Gippsland Waterway Strategy* in this reach include significant fauna and flora, naturalness and special features. West Gippsland Catchment Management Authority works with partner organisations to implement a management plan to address these threats.

The Tyers River catchment is a Declared Water Supply Catchment and is covered by a Special Area Plan. Water Supply Catchment declarations are made under the *Catchment and Land Protection Act 1994*. These declarations recognise the importance of raw water quality for human consumption and trigger referrals from councils to us for land use or development that may lead to a cumulative negative impact on water quality. A Special Area Plan complements these declarations by outlining the land uses permitted in declared catchments.

The Tyers River and Trigger Creek are located in the Latrobe basin. In the long term the impact of climate change on the Latrobe basin is forecast to result in stream flow reductions under medium and high climate change scenarios.

A weir on Trigger Creek diverts a portion of the flow via a pipeline to a 5.7 ML raw water storage basin adjacent to the Rawson water treatment plant. The larger 60 ML basin at the site is no longer in use. The raw water basin currently in service adds resilience to the system by providing a few weeks of raw water supply.

Figure 27 Trigger Creek diversion weir

Our diversions from Trigger Creek are made under our *Bulk Entitlement (Erica) Conversion Order 1997*. The maximum permissible volume that can be diverted from Trigger Creek in total is 340 ML per year. The maximum daily rate of extraction must not exceed 1.04 ML per day. We are not required to provide a minimum passing flow in the waterway downstream of Trigger Creek diversion weir. Trigger Creek diversion weir is pictured in Figure 27.

The Rawson water treatment process comprises of aeration and filtration, after which water is disinfected and stored in a 1.0 ML clear water storage before distribution to customers. The treatment plant has a capacity of 0.9 ML per day. The Erica Rawson treated water demand can also be met by water carting. This would be as a temporary measure and incurs a high cost.

For a map of the key elements of the system please refer to Appendix B and for a diagram of the water treatment process please refer to Appendix C. Alternatively you can visit our online Urban Water Strategy interactive map at www.gippswater.com.au/uws and search for any particular town.

Water system outlook

Little growth is forecast for the Erica-Rawson system, shown in Figure 28. The Erica-Rawson system is forecast to experience a significant yield surplus for the next 50 years and we are not planning any actions.

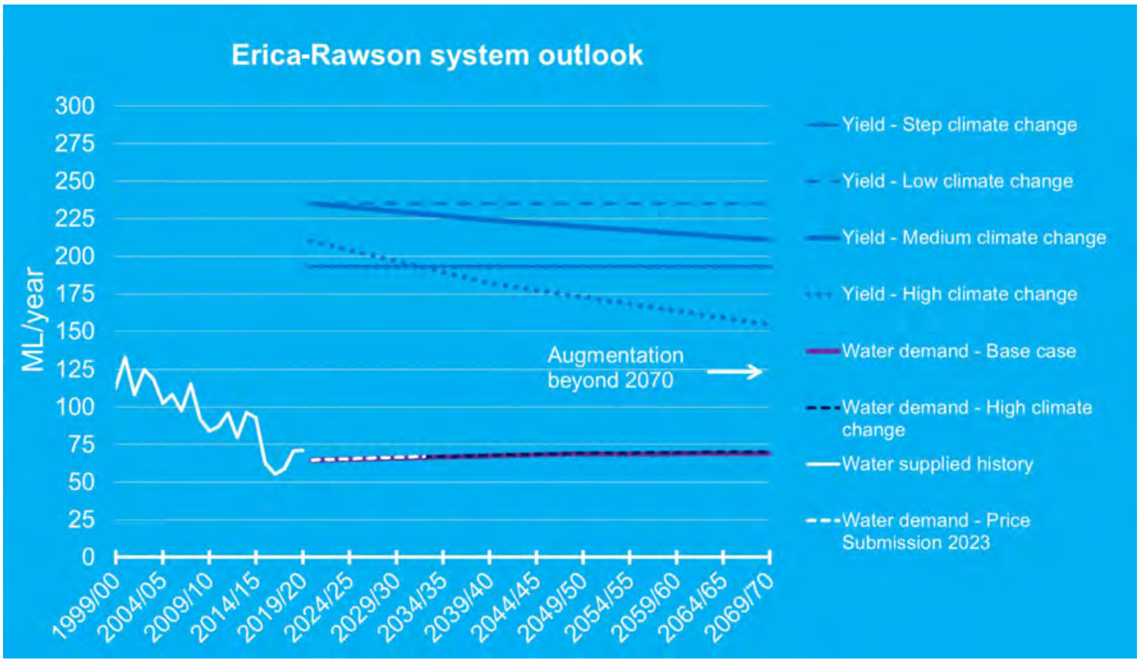


Figure 28 Erica-Rawson water resource system outlook

Latrobe Valley towns and industry

Overview of the water supply system

The water supply system for the Latrobe Valley towns and industry is by far our largest and most complex system. The Latrobe water resource system is the major source of catchment run-off for central Gippsland. Within the Latrobe system we operate five water treatment plants - Moe, Morwell, Traralgon, Tyers and Willow Grove.

The Latrobe system supplies the townships of Boolarra, Churchill, Cowwarr, Darnum (on the north side of freeway and Fonterra milk factory), Glengarry, Hazelwood North, Moe, Morwell, Rosedale, Thorpdale (via water carting), Toongabbie, Trafalgar, Traralgon, Traralgon South, Tyers, Yallourn North, Yarragon, Yinnar and Willow Grove.

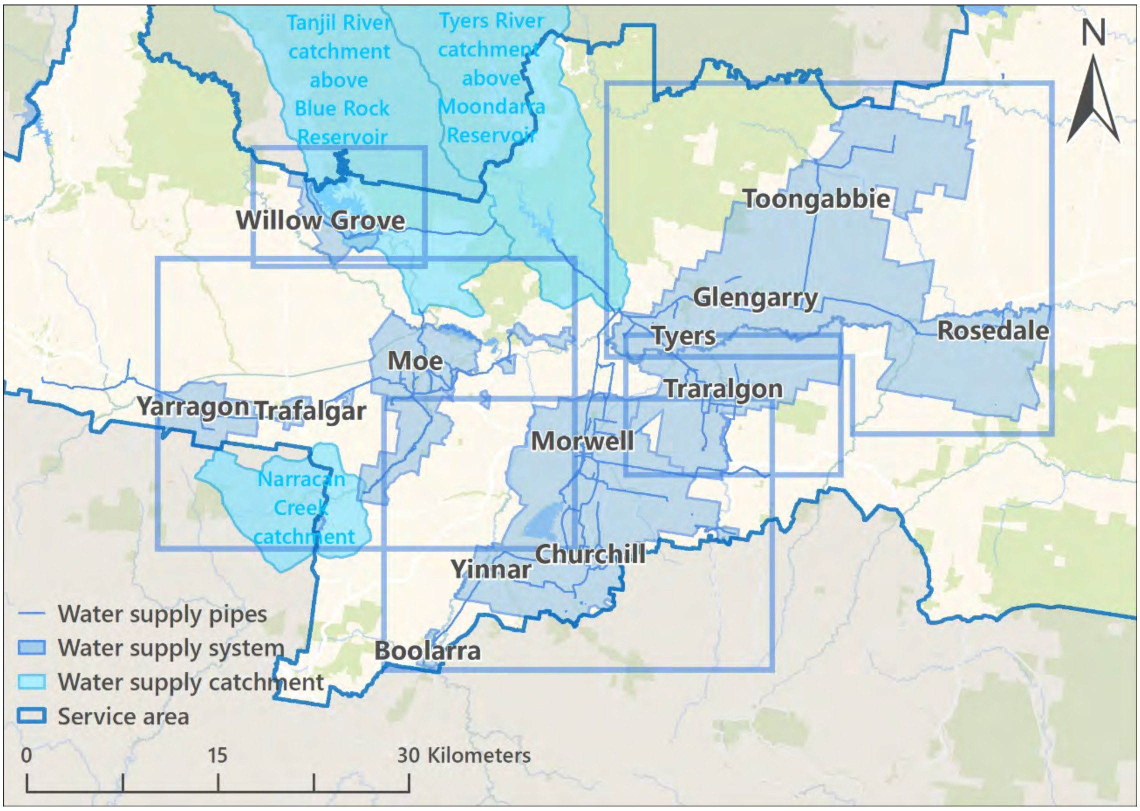


Figure 29 Location and extent of the Latrobe water supply system

In 2021, the Latrobe water system serviced 37,927 residential customers and 3,333 non-residential customers. The estimated population served was 78,829 people. The Latrobe water system supplies treated water to the following major customers: Bega (until 2021 Lion Foods), Energy Australia (Yallourn W power station), Fonterra, IXOM, Jelfor Timber, Latrobe Regional Hospital, Mechanical Engineering Corporation and Omnia.

In addition to our treated water plants, we supply high quality raw water to Opal Australian Paper for their pulp and paper-making operations and to AGL (Loy Yang A power station) and Alinta (Loy Yang B power station) for power generation.

Since the closure of Hazelwood power station, the average raw water demand consumed by the Latrobe system dropped considerably to 38,496 ML per year. Demand increased significantly in late 2021 with the commencement of supply of raw water to Engie (Hazelwood mine) for fire protection within the mine. Mine rehabilitation by creation of a pit lake, should this be approved by the government regulator, may increase demand further. Average losses of treated water in the system are 1,586 ML per year.

A breakdown of the previous six years of demand for the system is presented below.

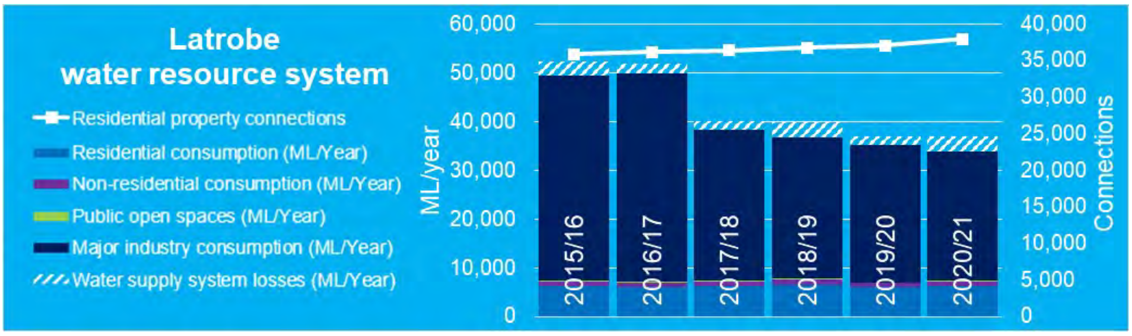


Figure 30 Previous six years demands for Latrobe water resource system

Note: As major industry consumption dominates water demand in the Latrobe water resource system, water demand for public open spaces is relatively small compared to overall demand and may not be visible in the chart above. Public open space water demand is on average 149 ML/Year for this system.

To service the demands in the Latrobe system we hold three bulk entitlements:

1. 62,000 ML per year on average from the Moondarra Reservoir located on the Tyers River;
2. 20,000 ML per year on average from a 17.08% share of Blue Rock Reservoir (total storage capacity 198,280 ML) on the Tanjil River; and
3. 3,884 ML per year from Narracan Creek.

The Latrobe system's water is normally sourced from four offtakes: Blue Rock Reservoir, Tanjil River pump station, Narracan Creek weir and Moondarra Reservoir.

The Moondarra Reservoir (Figure 31) supplies industry and towns in and around the Latrobe Valley. The Blue Rock Reservoir share is used to supplement Moondarra Reservoir in dry periods, to supply Moe during periods when water availability in Narracan Creek is insufficient or water quality is untreatable, and as the sole source of supply for Willow Grove. The Narracan Creek Weir is the main supply source for Moe.

Figure 31 View from Moondarra Reservoir towards Latrobe Valley

The usable storage capacity of Moondarra Reservoir is 29,853 ML and our capacity share of Blue Rock Reservoir is 33,866 ML. The relatively small capacity of Moondarra Reservoir, compared to other storages around the state, means that this system depends on reliable inflows. In drier years, water pumped from our share of Blue Rock Reservoir is used to supplement natural inflow to Moondarra Reservoir.

Moondarra Reservoir is located approximately 16 kilometres northwest of Traralgon and is our major reservoir for the Latrobe System. The major source of inflow into Moondarra is the Tyers River, which harnesses runoff from the southern slopes and the plateau of Mt Baw Baw. The water quality from this source is generally high. Jacobs Creek provides a minor inflow into the reservoir. As there are townships and some agriculture located within the Jacobs Creek catchment, the catchment water quality risks are higher.

Figure 32 Narracan Creek weir (W. J. White weir)

Narracan Creek, one of the main sources of raw water for the Moe water treatment plant (other is the Tanjil River), flows in a north easterly direction from the Strzelecki ranges towards the Latrobe River. A weir (Figure 32) about five kilometres downstream of Thorpdale diverts water for treatment.

The Latrobe water resource system comprises several catchments:

Upper Tyers River catchment which feeds Moondarra Reservoir

This catchment is a Declared Water Supply Catchment under the *Catchment and Land Protection Act 1994* and a Special Area Plan has been developed. Although we manage approximately 17 square kilometres of land to the north and the west of the Moondarra Reservoir which is restricted from public access, a significant portion of the catchment has land uses such as forestry, farming and town areas.

The upper Tyers River is nominated as a priority reach in *West Gippsland Waterway Strategy 2014-2022* (West Gippsland Catchment Management Authority, 2014) for threat reduction. Environmental values in this reach include significant fauna and flora, naturalness and special features.

Agricultural, recreation (four wheel driving, camping, motorbike riding, etc.) and forestry activity in the catchment can increase the risk of increased suspended solids in runoff following rainfall, as well as the risk of microbiological, pesticides and herbicides contamination.

All catchments supplying the Latrobe System are monitored for chemical, pathogenic and physical risks and appropriate treatment processes are in place to ensure compliance with public health and aesthetic standards.

While uncommon, Moondarra Reservoir has experienced algal blooms in the past and Blue Green Algae (BGA) is monitored during the warmer summer months. The last event of BGA occurred in the summer of 2007/08. BGA is always present, usually at levels that cause no effect on water treatment and palatability. The volumes and species can vary, depending on conditions. Importantly, we note that as BGA has developed a range of strategies to compete for resources this may make them even more proficient under future climate scenarios (HydroNumerics, 2020) and we may observe changes to the timing and frequency of BGA events.

We have an emergency response plan as a government requirement to respond to BGA events. Response levels range from varying the offtake level in the reservoir tower to avoid a bloom, right up to the Department of Health being the incident control agency for a public health issue.

A disused weir exists on the Tyers River between Moondarra Reservoir and the Tyers River pump station. This was part of the original Traralgon water supply and dates back to the very early 20th century. This structure, as well as the weir at the Tyers River pump station, has been deemed to be a potential barrier to the passage of native migratory fish species. The *West Gippsland Waterway Strategy* set actions to investigate the feasibility of providing fish passage arrangements at these sites and we have been working collaboratively with West Gippsland Catchment Management Authority (WGCMA) towards this endeavour.

Upper Tanjil River catchment which feeds Blue Rock Reservoir
Blue Rock Reservoir is within a Declared Water Supply Catchment under the *Catchment and Land Protection Act 1994*. The Tanjil River Catchment also has a Special Area Plan.

The upper Tanjil River and its tributaries are nominated as priority reaches in the *West Gippsland Waterway Strategy* for threat reduction. Environmental values in these reaches include significant fauna and flora, naturalness and special features.

While a significant portion of the upper Tanjil River catchment is covered by national park and state forest, the presence of dairy farming leads to a relatively high risk of microbiological contamination. In addition, public access to Blue Rock Reservoir (Figure 33) for recreational activities increases the potential for contamination. This access was extended in the last decade with the lifting of the boat and motor size restriction.

Figure 33 Blue Rock reservoir offtake tower

Similar to the upper Tyers catchment, agricultural, recreation (four wheel driving, camping, motorbike riding, etc.) and forestry activity in the catchment can increase the risk of increased suspended solids in runoff following rainfall, as well as the risk of microbiological, pesticides and herbicides contamination.

All catchments supplying the Latrobe System are monitored for chemical, pathogenic and physical risks and appropriate treatment processes are in place to ensure compliance with public health and aesthetic standards.

Lower Tanjil River catchment which feeds Tanjil River pump station

The Tanjil River downstream of Blue Rock Reservoir is nominated as a priority reach in the *West Gippsland Waterway Strategy* for threat reduction. Environmental values in this reach include significant fauna and flora, naturalness and special features. Flow regulation in the Tanjil and Latrobe Rivers is considered one of the significant threats to these reaches. The Victorian Environmental Water Holder holds an environmental entitlement in Blue Rock Reservoir that is managed by the WGCMA to reinstate ecologically important flow events in these rivers. The environmental entitlement is 9.45% of the available inflows and storage capacity of Blue Rock Reservoir.

Figure 34 Tanjil River raw water pump station

The Tanjil River pump station (Figure 34) offtake is subject to water quality risks stemming from the presence of significantly more rural land which lies either side of the reach of the Tanjil River downstream of Blue Rock Reservoir. A catchment audit has identified significantly more risk of microbiological contamination when compared with the upper catchment, as well as risks of nutrient and agricultural chemical contamination.

All catchments supplying the Latrobe System are monitored for chemical, pathogenic and physical risks and appropriate treatment processes are in place to ensure compliance with public health and aesthetic standards.

Narracan Creek catchment which feeds Moe water treatment plant
The Narracan Creek is not nominated as a priority reach in the *West Gippsland Waterway Strategy*. Environmental values in this reach include significant flora, naturalness and special features.

Narracan Creek is within a Declared Water Supply Catchment under the *Catchment and Land Protection Act 1994* but does not have a Special Area Plan. Compared with the Tanjil catchment, a catchment audit has identified higher risks from agricultural chemicals, largely due to extensive potato growing, but lower risks of microbiological contamination. Given that Thorpdale is not sewered however, and is located within the Narracan Creek catchment, there is some potential for contamination of this water source. Nutrient contamination is also a risk in this catchment.

All catchments supplying the Latrobe System are monitored for chemical, pathogenic and physical risks and appropriate treatment processes are in place to ensure compliance with public health and aesthetic standards.

Tyers River, Tanjil River and the Narracan Creek are tributaries of the Latrobe basin. In the long term the impact of climate change on the Latrobe basin is forecast to result in stream flow reductions under medium and high climate change scenarios.

The Latrobe water resource system water is normally sourced from four offtakes. These are Blue Rock Reservoir, Tanjil River pump station, Narracan Creek weir and Moondarra Reservoir.

Blue Rock Reservoir and Tanjil River
Blue Rock Reservoir is managed and operated by Southern Rural Water. We have two normal extraction points for water from our Blue Rock Reservoir share. One is located at the dam wall and the other is at a pump station on the Tanjil River downstream of the reservoir. The extraction point at the dam wall is used to supply the Willow Grove water treatment plant and to transfer water to Moondarra Reservoir.

The extraction point on the Tanjil River is used to supply the Moe water treatment plant. The Tanjil River raw water pump station is located approximately three kilometres north of Moe on the Tanjil River and allows water released from Blue Rock Reservoir to be pumped to the water treatment plant. A nearby platform and manifold arrangement allows the installation of portable diesel pumps at short notice as a backup to the fixed electric pumps.

The Bulk Entitlement for Blue Rock Reservoir provides us with the following entitlements and responsibilities:

- 60,000 ML over any three year period;

- Maximum daily extraction of:
    - 71.3 ML per day at Blue Rock Reservoir head works for supply to Moondarra Reservoir or Willow Grove;
    - 24 ML per day at Tanjil River pump station for supply to Moe;
    - 70 ML per day at Latrobe River pump station for emergency supply to industry;
- 17.08 % share of total storage capacity of Blue Rock Reservoir; and 17.08 % of inflows into Blue Rock Reservoir, once passing flow requirements have been satisfied.

Narracan Creek weir

As previously described, a weir about five kilometres downstream of Thorpdale diverts water to the Moe water treatment plant for treatment.

The Bulk Entitlement for Narracan Creek provides us with the following entitlements and responsibilities:

- Maximum annual extraction volume 3,884 ML per year;
- Maximum daily extraction of 16 ML per day, subject to passing the minimum environmental flow; and
- Minimum passing flow of 11 ML per day.

Moondarra Reservoir

Raw water from the Moondarra Reservoir is transferred by the Tyers River Conduit. The Tyers River Conduit is a large diameter raw main, which transfers water from the valve house at Moondarra Reservoir to the Morwell, Traralgon and Tyers water treatment plants as well as to our major industry high quality raw water customers via the Pine Gully and Buckleys Hill service reservoirs.

Figure 35 Tyers River raw water pump station

The Latrobe System also has two emergency offtakes, Tyers River pump station (Figure 35) and Latrobe River pump station. The Tyers River pump station, downstream of Moondarra Reservoir, can be used to meet part of the demand on the reservoir in the event of a problem with the Tyers River Conduit from the reservoir. Latrobe River pump station is a third extraction point for water from Blue Rock Reservoir and is located on the Latrobe River downstream of Yallourn weir. This pump station can also be used to meet part of the demand on the Moondarra Reservoir in the event of a problem with the Tyers River Conduit, or with the Blue Rock to Moondarra pump, but extraction at this location carries much more significant water quality risks, in particular for major industry that relies on high quality raw water and has no treatment facilities.

The Bulk Entitlement for Moondarra Reservoir provides us with the following entitlements and responsibilities:

- Up to 124,000 ML over any two year period;
- A maximum extraction rate of 270 ML per day;
- Use of the full storage capacity of Moondarra Reservoir (30,458 ML);
- The requirement to pass a minimum environmental flow of 30 ML per day when the accumulated reservoir inflow over the preceding six months exceeds 45,000 ML; and
- The requirement to pass a minimum environmental flow of 8 ML per day when the accumulated inflow over the preceding six months drops below 25,000 ML.

Latrobe system treatment plants

At the Moe water treatment plant, raw water is diverted from Narracan Creek weir or pumped via Tanjil River pump station for treatment. The plant process comprises of solids separation and filtration, after which water is disinfected and stored in a 22 ML clear water storage before distribution to customers in Moe, Newborough, Yallourn North, Trafalgar, Yarragon and Darnum, as well as the Yallourn W power station. The treatment plant has a capacity of 22.5 ML per day.

The Moe treated water reticulation system has an interconnection with the Warragul treated water reticulation system. This means that the Moe system can supply the Warragul system with treated water and the Warragul system can supply the Moe system with treated water. For the Moe system, this adds further supply resilience in addition to the treatment plant being able to be fed from two raw water sources.

Raw water from Moondarra Reservoir is supplied by gravity to Morwell water treatment plant via the Tyers River Conduit. Raw water is also available via a backup supply from the Tyers River Pump Station or raw water can be delivered to the Buckleys Hill raw water basin for storage prior to transfer to the plant for treatment. The plant process comprises of solids separation and filtration, after which water is disinfected and stored in a 3.4 ML clear water storage tank at the treatment plan and 20.9 ML clear water storage basin at Buckleys Hill before distribution to customers in Morwell, Churchill, Yinnar, Boolarra, Hazelwood North and Traralgon South. The treatment plant has a capacity of 18.5 ML per day.

The Traralgon water treatment plant is also supplied raw water from Moondarra Reservoir under gravity via the Tyers River Conduit. A backup supply from the Tyers River Pump Station is also available for raw water. The plant process comprises of solids separation and filtration, after which water is disinfected and stored in a 1 ML clear water storage before distribution to customers in Traralgon or transfer to the Clarkes Road treated water storage basin to the south of Traralgon. The treatment plant has a capacity of 22 ML per day.

The Tyers water treatment plant is the third plant supplied raw water from Moondarra Reservoir under gravity via the Tyers River Conduit. As for Traralgon, a backup supply from the Tyers River Pump Station is also available for raw water. The Tyers water treatment process comprises of two plants. Both plants include solids separation and filtration, however the methods employed are different for each plant, with Plant 1 utilising traditional media filtration and Plant 2 dissolved air flotation and membrane filtration. Treated water is stored in a 13.6 ML covered basin before distribution to customers in Tyers, Glengarry, Toongabbie, Cowwarr and Rosedale. The treatment plant has a capacity of 6.4 ML per day. If required, the Tyers treated water system demand can be supplemented by water carting however this would be as a temporary measure and incurs a high cost.

To supply the Willow Grove water treatment plant raw water is extracted from Blue Rock reservoir at a point at the dam wall. The plant process comprises of solids separation and filtration, after which water is disinfected and stored in a small clear water storage tank before distribution to customers in Willow Grove. The treatment plant has a capacity of 1 ML per day. As a backup, water can be carted to a system with demand of this size.

For a map of the key elements of the system please refer to Appendix B and for a diagram of the water treatment process please refer to Appendix C. Alternatively you can visit our online Urban Water Strategy interactive map at www.gippswater.com.au/uws and search for any particular town.

Water system outlook and addressing future needs

The Latrobe system currently has a yield surplus under all climate scenarios, with only the high climate change scenario anticipated to give rise to supply reliability challenges into the future. Yield in this system for some climate scenarios is not presented as a maximum level of demand that can be met without water restrictions in 19 years of 20 on average. Instead the yield represents the maximum demand that can be met without drawing our reservoirs too low. For all scenarios, at the yield level of demand the reliability of supply in terms of frequency of restrictions meets or exceeds our 95% target.

Demand in this system decreased significantly in 2017 after the closure of the Hazelwood power station. Demand has remained at this lower level in the following years but has increased more recently with commencement of supply of fire protection water to the Hazelwood mine in November 2021. Should the Hazelwood mine owner be successful in their application to the mine regulator to rehabilitate the mine as a "pit lake", supply of water to the mine is likely to increase further. At the time of writing, the mine operators' application to the regulator for the next stage of rehabilitation is the subject of an Environment Effects Statement process.

The demand associated with supply to the Hazelwood mine for both the current fire protection operations and possible future mine rehabilitation has not been shown on the charts as under our supply agreement this water is provided only when it is available.

This means that during times of drought, supply to the Hazelwood mine could be reduced or even ceased, in order to preserve water resources for our existing residential and commercial customers, as well as to ensure water is available to service new industries in our region. Supply to the mine would take advantage of the surplus of water that is available in most years over and above normal demand and within our water entitlement and delivery infrastructure capacity constraints. For this reason it is not appropriate to directly compare this flexible demand with our yield outlook.

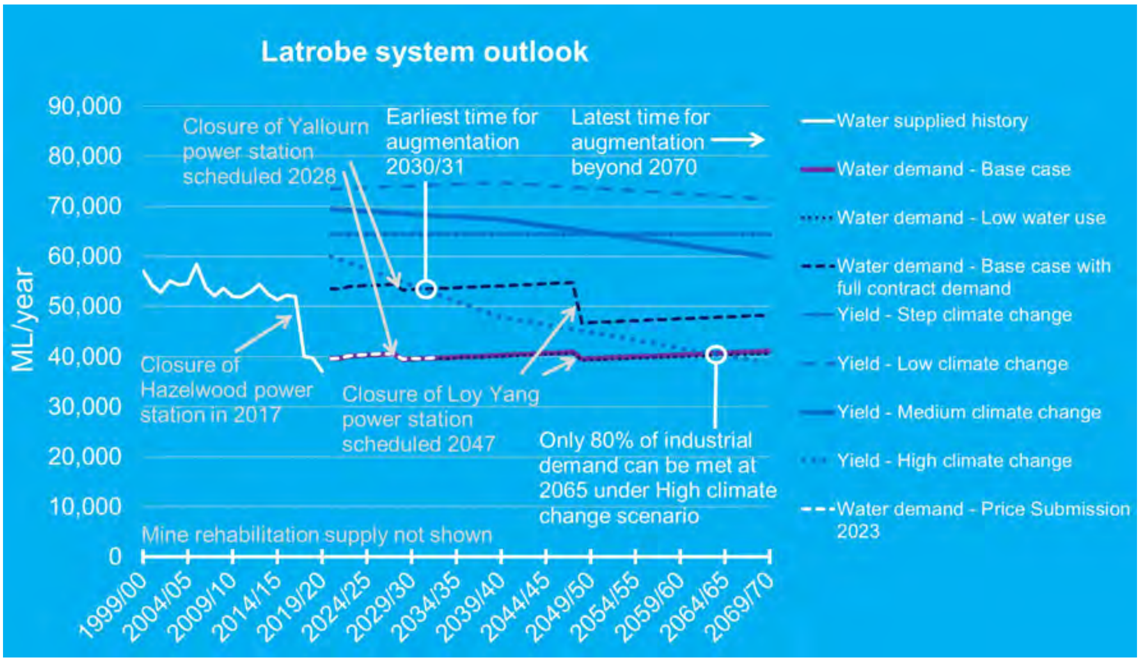


Figure 36 Latrobe water resource system outlook

Note: Loy Yang A (AGL) has revised its closure window to 2040-2045 since this yield and demand modelling was undertaken.

Our demand outlook presents a range of scenarios. The base case and low water use scenarios consider alternative outlooks for the residential sector but for this system these two scenarios are effectively superimposed as the difference between the residential base case and low water use demand is negligible compared to industrial demand. A further scenario adopts the base case for residential demand but includes the full contractual obligation of our industrial supply contracts, a supply volume that has never been drawn. All scenarios account for the currently scheduled closures of power stations that we supply with water for “process use” (we do not supply Yallourn W power station or Loy Yang power station with cooling water).

The one scenario that could be cause for concern is the high climate change scenario. Shortfalls begin to occur under this scenario in about a decade if full industrial contract demand is drawn, but under the base case demand outlook the shortfall is forecast to occur much later. Through our ongoing engagement with our major customers, we consider that full contract demand is unlikely to occur in the short term. This will continue to be the subject of ongoing regular review.

In the longer term, under the high climate change scenario and even under the base case demand outlook, to achieve an outcome where residential and commercial customers don't bear actual water supply shortfalls in the future, it is likely to be necessary to reduce the annual volume supplied to major customers like Opal Australian Paper and Loy Yang power station by about 20%. However this might not be required in all years and the prospect of a restriction policy that could apply to major industrial demand in critical years has been considered below.

These results all assume that the current flow sharing rules as set out in our bulk entitlements remain. It should be noted that work undertaken prior to and during the CGRSWS development by DELWP and WGCMA has identified that the Latrobe basin has suffered a sustained decline in stream flows, at least in part due to climate change, when compared to historic stream flows that formed the basis of the flow sharing rules set by government in our entitlements in the late 1990s. Through the government's Long Term Water Resource Assessment (DELWP, 2020b), this decline has been shown to have a disproportionately adverse impact on environmental flows in the basin if consumptive bulk entitlements are fully utilised. At present they are underutilised but future demands including for mine rehabilitation may see demands increase closer towards full uptake. Environmental flow studies undertaken to support the SWS have also identified the Tyers River downstream of Moondarra Reservoir as being flow stressed at times, and recovery of environmental water in the Tyers River has been identified as necessary to preserve the current good condition of this reach into a future of further climate change and possible increased water demand.

GLaWAC has also identified this reach as being of high importance to Traditional Owners, important to maintain current condition, and is a priority for an Aboriginal Waterway Assessment.

We recognise the need to preserve this important river reach and maintain its high environmental values. However this is not at all straight-forward. We undertook simulations to understand the effects on our ability to meet the needs of customers while also providing guaranteed minimum additional flows to the downstream river environment and found the impact to be significant. This was as expected and is a consequence of the configuration of the Latrobe Valley's water network. Moondarra Reservoir is a relatively small reservoir, holding only about half of the annual system yield. This means its ability to buffer dry periods while also providing increased environmental flows is minimal.

It also acts as the "hub" of the network. While we have significant water resources in Blue Rock Reservoir, this water must first be transferred to Moondarra Reservoir before being supplied to customers. This is both to avoid delivery via Lake Narracan so we maintain the high water quality needed for our customers' industrial processes as well as to minimise treatment costs for drinking water and best protect human health. The transfer infrastructure from Blue Rock to Moondarra Reservoir is of limited capacity, further increasing our reliance on Moondarra Reservoir's inflows and storage to maintain supply reliability.

Regional water infrastructure project to realise multi-beneficiary outcomes

There is currently significant water resources available in Blue Rock Reservoir that could be made available for multiple beneficial uses in the broader Latrobe basin, however there are significant constraints in delivering it to where it's needed. This is an issue in particular for environmental, cultural, irrigation and mine rehabilitation purposes.

Through the development of the CGRSWS and engagement with our regional partners including WGCMA, GLaWAC and SRW, we took the opportunity to collaboratively "think big" about what could be done that would provide outcomes that deliver multiple benefits for the region, it's communities and economy.

One concept that attracted mutual interest and that has been presented in the discussion draft CGRSWS is a major gravity pipeline from Blue Rock Reservoir to the Latrobe Valley. This would provide the ability for good quality water in Blue Rock to be supplied directly to demands without high costs of pumping, without the constraints of transferring it via Moondarra Reservoir, and without the deterioration of water quality that comes from using the Tanjil and Latrobe Rivers as the delivery path. The demands could include existing water treatment plants and industry, possible new industries or intensive agriculture and, mine rehabilitation.

Furthermore, this concept has the potential to open up a range of flexibility options for the various parts of the greater water delivery system including rivers. Blue Rock Reservoir holds extensive water resources under a range of entitlements. A direct pipeline could allow more of these water resources to be used from time to time to meet consumptive demands that are presently supplied from Moondarra Reservoir. This could make available an equivalent volume of water in Moondarra Reservoir for flow releases to the Tyers River that support environmental and Traditional Owner values.

The concept could provide broad regional benefits that support a wide range of water related values beyond servicing urban and industrial needs. This is consistent with directions contained in the discussion draft CGRSWS – particularly in terms of recovery of environmental water for the Tyers River and in supporting the region's water supply reliability and economic prosperity.

We will work collaboratively with the department and regional stakeholders to further investigate this option as part of the final CGRSWS, applying a quadruple bottom line approach that considers the benefits and risks across four pillars: cultural, economic, environmental and social.

As mentioned above and shown in the charts, the high climate change scenario could result in supply shortfalls into the longer term. While this is forecast to be well out into the future, we reviewed the effectiveness of four currently available options to mitigate this outcome. These included:

- Reinstatement of an electric backup pump for Blue Rock to Moondarra transfers that has been decommissioned due to end of life and that is not currently needed;
- Use of recycled water for industry from the existing Gippsland Water Factory recycling plant;
- Purchase of temporary water from the Blue Rock drought reserve; and
- Implementation of a drought water restriction policy for Australian Paper.

Of these options, only the recycled water and industrial water restrictions options provided a tangible yield benefit of 2-4 GL per year. However the restrictions option could only deliver such an outcome at considerable impact to industrial supply, with many incidences of restrictions during drought periods of the 2065 high climate change simulation. This indicates that if this climate scenario develops into the long term future, the Latrobe system will need a significant augmentation to meet current demands and anticipated future growth.

Action 11 – Latrobe water

Continue working with the Department of Environment, Land, Water and Planning (DELWP) and other agencies to plan and deliver on directions for the Latrobe basin set by the *Central Gippsland Region Sustainable Water Strategy* (CGRSWS) and the Latrobe Valley Regional Rehabilitation Strategy.

Mirboo North

Overview of the water supply system

Mirboo North is a medium sized rural town located on top of the Strzelecki Ranges, approximately 25 kilometres southwest of Moe.

In 2021, the Mirboo North water system serviced 750 residential customers and 83 non-residential customers. The estimated population served was 1,710 people. We don't service any major customers from this system. The average raw water demand consumed by the Mirboo North system is 190 ML per year. Average losses of treated water in the system are 47 ML per year.

Figure 37 Location of the Mirboo North water supply system and Little Morwell River catchment

A breakdown of the previous six years of demand for this system is presented below.

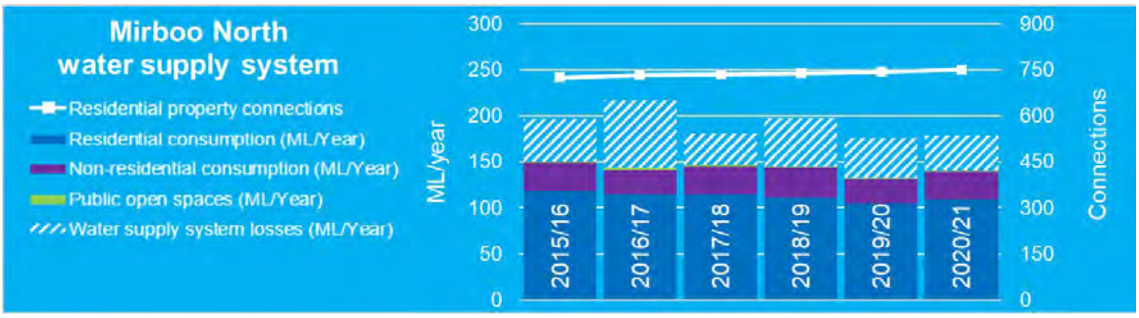


Figure 38 Previous six years demands for Mirboo North water supply system

Note: Water demand for public open spaces in Briagolong is typically less than 1% of total system demand or on average 1.3 ML/Year and may not be visible in the chart above.

Mirboo North sources its water from a weir on the Little Morwell River (north branch). The Little Morwell River is a spring fed waterway in the Strzelecki Ranges. The catchment is steeply undulating hills, with a mix of agricultural land and forestry, intersected by the Strzelecki Highway. These land uses give rise to an increased level of suspended solids runoff following rainfall and also a larger risk of microbiological, pesticide and herbicide contamination. The Little Morwell River catchment is monitored for chemical, pathogenic and physical risks and appropriate treatment processes are in place to ensure compliance with public health and aesthetic standards.

The Little Morwell River was not identified as a priority reach in the *West Gippsland Waterway Strategy 2014-2022* (West Gippsland Catchment Management Authority, 2014). Environmental values for the Morwell River downstream of the Little Morwell River confluence include significant fauna and flora, naturalness and special features.

The Little Morwell River (north branch) catchment is a Declared Water Supply Catchment. Water Supply Catchment declarations are made under the *Catchment and Land Protection Act 1994*. These declarations recognise the importance of raw water quality for human consumption and trigger referrals from councils to us for land use or development than may lead to a cumulative negative impact on water quality. This catchment is not covered by a Special Area Plan.

The Little Morwell River is located in the Latrobe basin. In the long term the impact of climate change on the Latrobe basin is forecast to result in stream flow reductions under medium and high climate change scenarios.

Figure 39 Little Morwell River diversion weir

A weir on the Little Morwell River diverts a portion of the flow via a pipeline to Mirboo North water treatment plant for treatment. Our diversions from the Little Morwell River are made under our *Bulk Entitlement (Mirboo North) Conversion Order 1997*. The maximum permissible volume that can be diverted from Little Morwell River in total is 270 ML per year. The maximum daily rate of extraction must not exceed 2.4 ML per day. We are not required to provide a minimum passing flow in the waterway downstream of Little Morwell River diversion weir. Little Morwell River diversion weir is pictured in Figure 39.

The Mirboo North water treatment process comprises of solids separation and filtration, after which water is disinfected and stored in a 1.9 ML clear water storage before distribution to customers. The treatment plant has a capacity of 2.0 ML per day.

This is a run-of-river system with no significant drought buffering capacity. Despite this, being spring fed, this system has a history of having no issues during periods of drought. Water can be carted to a system with demand of this size, if the need arose.

For a map of the key elements of the system please refer to Appendix B and for a diagram of the water treatment process please refer to Appendix C. Alternatively you can visit our online Urban Water Strategy interactive map at www.gippswater.com.au/uws and search for any particular town.

Water system outlook

Demand growth in the Mirboo North system, shown in Figure 40 is forecast to be modest.

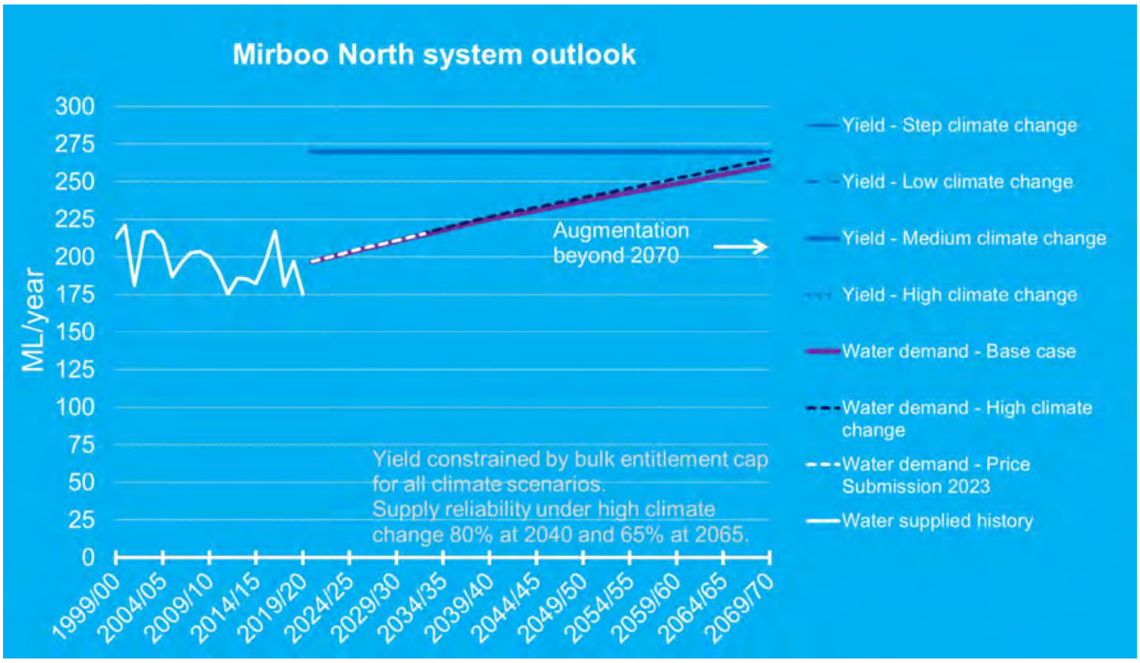


Figure 40 Mirboo North water resource system outlook under

The Mirboo North system draws its water from a spring fed stream with historically reliable base flows even in drought years. It therefore has little storage other than a treated water basin to buffer short high demand periods and water treatment plant outages. This means that the review point for imposing water restrictions can’t be based on a volume in storage and is therefore based on stream flows in the Little Morwell River. The normal procedure for estimating yield by iteratively increasing annual demand for each successive simulation therefore has no effect on the frequency of water restrictions. In a system with large storage, increasing demand draws storages lower during dry periods, at times below the restriction level, thus varying demand impacts on restriction frequency and a level of demand can be found for which the frequency matches the target level of service. For Mirboo North, where restrictions occur based on streamflows entering the weir, we can’t derive a yield that is based on a level of service defined by how often water restrictions are likely to occur.

Yield is therefore constrained by the limit on our extractions which is set by the bulk entitlement annual cap of 270 ML per year. For a system of this nature however, it is important that we then consider the reliability of supply at the current and future anticipated levels of demand. Our simulation model allow us to estimate how often restrictions may be needed to reduce discretionary demand (typically outside water uses) to match supply under each of the climate change scenarios.

It was found that for all climate change scenarios except for high climate change, at a demand level of 270 ML per year restrictions were not needed more often than the target reliability of 95%. Under the high climate change scenario, as noted on Figure 40, the frequency of water restrictions is forecast to drop below target to once per five years by 2040 and once per three years by 2065. While this is below target, considering our customers told us that low level restrictions are little cause for concern and could be tolerated more often than our current target, we also looked at the reliability outlook for stage 3 or 4 restrictions and found that these more severe restrictions are forecast to occur less than once in 20 years at 2040 but that by 2065 under high climate change severe restrictions are likely to be needed on average once every ten years.

This long-term outlook is clearly below the acceptable level of service but given it is some decades away and only under the worst climate scenario, we are not proposing any actions for this system at this time, other than to continue to monitor and adapt to emerging trends, as per our general plans for managing uncertainty.

Sale

Overview of the water supply system

Sale is a large town in the eastern region of our service area, approximately 200 kilometres southeast of Melbourne. The nearby town of Wurruk is also serviced by the Sale water supply system.

Figure 41 Location of Sale water supply system

In 2021, the Sale water system serviced 7,324 residential customers and 866 non-residential customers. The estimated population served was 14,941 people. The Sale system supplies water to four major industries: Central Gippsland Health Service (Sale Hospital), RAAF Base, Sale Livestock Exchange and The GEO Group Aust P/L (Fulham Correctional Centre).
The average raw water demand consumed by the Sale system is 1,907 ML per year. Average losses of treated water in the system are 202 ML per year.

A breakdown of the previous six years of demand for this system is presented below.

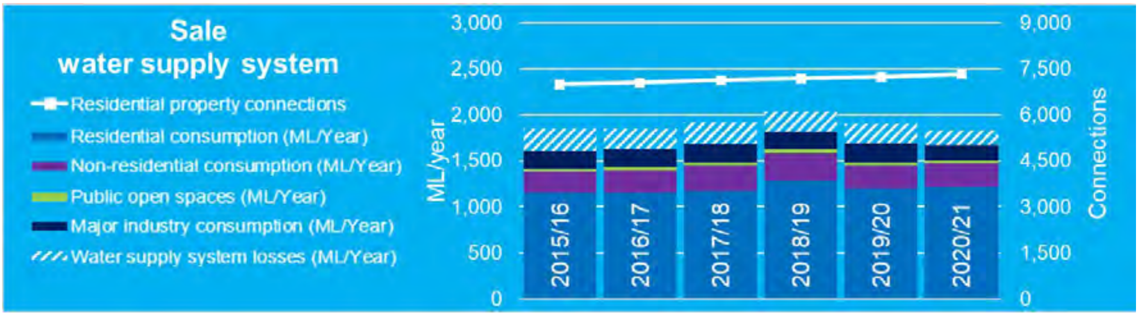


Figure 42 Previous six years demands for Sale water supply system

Sale and Wurruk source their water from the Boisdale groundwater aquifer. Our Sale system is supplied by bores which screen the Boisdale aquifer sand formation between 125 to 176 metres depth. The groundwater from this aquifer is generally of a high standard for a large majority of the time. On rare occasions the raw water received from the bores has increased levels of iron and manganese however, this is removed in the treatment process. There have also been instances of taste and odour in the past attributed to the groundwater source. The Boisdale aquifer has also been subject to a gradual rate of decline for some time.

The Boisdale aquifer is covered by the Sale Water Supply Protection Area (WSPA).

The WSPA has a maximum extraction limit of 21,238 ML per year and is generally understood to be over-allocated. Although extractions for the four years to the end of the 2019/20 financial year fall well short of the full licensed extraction (DELWP, 2021c):

- 14,092 ML in the 2019/20 financial year
- 17,867 ML in the 2018/19 financial year
- 14,447 ML in the 2017/18 financial year
- 11,982 ML in the 2016/17 financial year

The WSPA does not have an approved statutory management plan and the Local Management Plan does not address the over allocation nor aquifer decline. The Permissible Consumptive Volume of 21,212 ML per year was declared in 2011 (Victorian Government Gazette Reference: General - G28 14 July 2011 pp. 1639-1645) for all aquifer formations between 25 metres and 200 metres depth however, previous studies suggest that the true sustainable yield is likely much lower.

During 2016, DELWP undertook a review for us of groundwater trends in the Boisdale and neighbouring aquifers. The conclusion was that the current long term declining trend in the Boisdale Aquifer is most likely a result of excessive irrigation extraction. The discussion draft for the *Central and Gippsland Region Sustainable Water Strategy* supports the need to study the Boisdale Aquifer and its sustainability in more detail.

Water is drawn out of the aquifer by four bores. Our groundwater extraction is subject to a Section 51 Take and Use Licence issued by Southern Rural Water (SRW) under the *Water Act 1989*. The details of these bores are presented in Table 10 below. The combined maximum extraction volume that can be taken from the four bores is 3,480 ML in one year. Note this limit also includes usage at some bores at our Gippsland Regional Agribusiness at Maffra and Dutson Downs.

Table 10 Details of Sale bore licence for Boisdale aquifer

Bore Reference Number	**Bore 1**	**Bore 2**	**Bore 3**	**Bore 6**
Bore Licence Number	90144 WRK039408	90142 WRK047347	90418 WRK039413	90145 WRK062901
Maximum daily permissible extraction volume	8.2 ML	8.2 ML	9.0 ML	8.2 ML
Maximum rate of extraction	8.2 ML/day	8.2 ML/day	9.0 ML/day	8.2 ML/day

Figure 43 Sale water treatment plant

The water extracted from the aquifer is pumped to Sale water treatment plant (Figure 43) for treatment. The Sale water treatment process comprises of two stages of filtration, after which water is disinfected and stored in two treated water storage basins. The storage basins have capacity of 10.1 ML and 12.5 ML. From the storage basins, treated water is pumped to the Sale high level water tower to provide sufficient pressure to supply the reticulation network. The treatment plant has a capacity of 17 ML per day.

For a map of the key elements of the system please refer to Appendix B and for a diagram of the water treatment process please refer to Appendix C. Alternatively you can visit our online Urban Water Strategy interactive map at www.gippswater.com.au/uws and search for any particular town.

Water system outlook and addressing future needs

Our outlook for Sale shows that our current groundwater licence conditions provides ample water to meet forecast demand over the coming 50 years. However the aquifer from which we draw water for Sale has been in decline for over two decades and this is some cause for concern when required to provide a 50 year outlook. As the licence holder, and with the current extent of information available from the regulators of the groundwater resource, DELWP and SRW, we are not in a position to provide any other robust alternative forecast.

When we were preparing our 2017 UWS, DELWP provided advice from a simple groundwater study undertaken for us that we could be confident that the aquifer supplying the Sale system would continue to meet our needs for at least the next decade, but sustainability risks further into the future were acknowledged for further investigation. We set an action in our 2017 UWS to work with DELWP and SRW over the following five years to better understand longer term risks to the resource.

This action has not been done but remains a priority for us and we have been advised that an assessment of sustainable extraction and future projections for this resource will be undertaken by the resource regulators during the next few years. Following the findings of this assessment, if changes are made by SRW to the aquifer management plans or our licence conditions, we will need to reassess this outlook for this system.

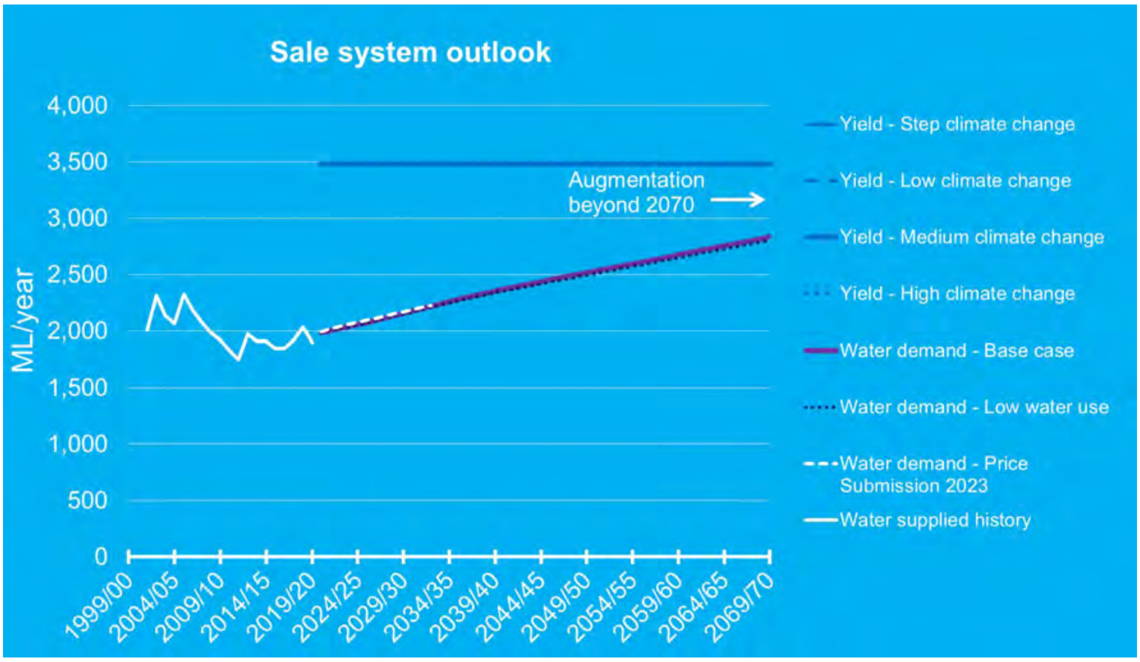


Figure 44 Sale water resource outlook

Action 12 – Sale water

Continue to work with Southern Rural Water (SRW) and DELWP to better understand the Boisdale aquifer and its future sustainable use.

Seaspray

Overview of the water supply system

Seaspray is a small coastal town located on 90 Mile beach, approximately 30 kilometres southeast of Sale.

In 2021, the Seaspray water system serviced 342 residential customers and 10 non-residential customers. The estimated population served was 339 people, however the population served can increase significantly during holiday periods. We don't service any major customers from this system. The average raw water demand consumed by the Seaspray system is 38 ML per year. Average losses of treated water in the system are 5 ML per year.

Figure 45 Location of Seaspray water supply system and Merriman Creek catchment

A breakdown of the previous six years of demand for this system is presented below.

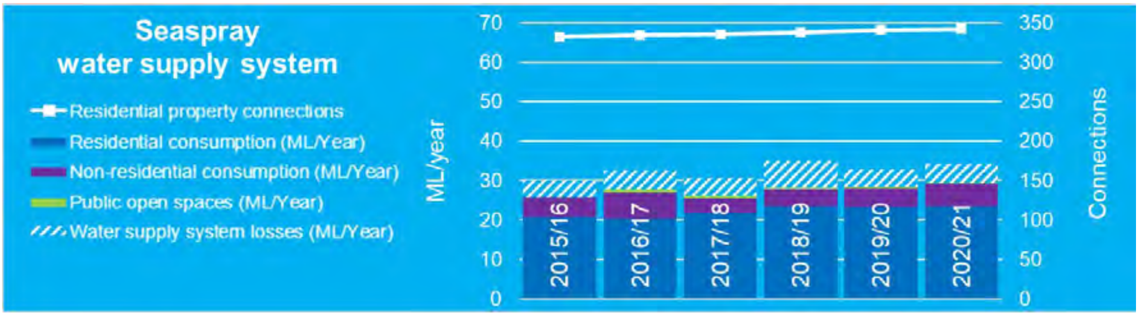


Figure 46 Previous six years demands for Seaspray water supply system

Note: Water demand for public open spaces in Seaspray is typically around 1% of total system demand or on average 0.4 ML/Year and may not be visible in the chart above.

Seaspray sources its water from a weir on Merriman Creek, *Drelin*. Merriman Creek catchment is located on the eastern side of the Strzelecki Ranges. The catchment can be affected by rain shadow due to this position, leading to low inflows. The upper catchment is forested, while the mid-catchment is mostly agricultural land. These characteristics give rise to an increased microbial risk and high organic loadings. The Merriman Creek catchment is monitored for chemical, pathogenic and physical risks and appropriate treatment processes are in place to ensure compliance with public health and aesthetic standards.

Merriman Creek, and its tributary Monkey Creek, were identified as priority reaches in the *West Gippsland Waterway Strategy 2014-2022* (West Gippsland Catchment Management Authority, 2014) for reduction of threats to waterway values.

Environmental values in Merriman Creek between Callignee South and Seaspray include significant fauna and flora, naturalness and special features. Upstream of Callignee South the only identified environmental value is significant flora. The work program for the Waterway Strategy addresses the following threats for this management unit: fish barrier, floodplain connectivity, invasive flora and reduced riparian large trees. West Gippsland Catchment Management Authority works with partner organisations to implement a management plan to address these threats.

In the *West Gippsland Waterway Strategy*, the foundations of a former weir which form the pool which our pump station extracts water from, was identified as potentially posing a barrier to the passing of native migratory fish species. Although some planning has been done, this project has not yet been delivered due to competing priorities for river funding. The project remains a medium term action and has been included in the *Central and Gippsland Region Sustainable Water Strategy* as a complementary measure.

Merriman Creek catchment is a Declared Water Supply Catchment. Water Supply Catchment declarations are made under the *Catchment and Land Protection Act 1994*. These declarations recognise the importance of raw water quality for human consumption and trigger referrals from councils to us for land use or development that may lead to a cumulative negative impact on water quality. This catchment is not covered by a Special Area Plan.

Merriman Creek is located in the South Gippsland basin. In the long term the impact of climate change on the South Gippsland basin is forecast to result in stream flow reductions under medium and high climate change scenarios.

Figure 47 Merriman Creek raw water pump station

A portion of the Merriman Creek flow is diverted and transferred by a raw water pump station and pipeline to a 30 ML raw water basin. Our diversions from Merriman Creek are made under our *Bulk Entitlement (Seaspray) Conversion Order 1997*. The maximum extractable volume under our entitlement is 133 ML per year. Our extraction rates are subject to different flow sharing rules depending on the time of the year. From July to October, our entitlement allows us to extract flows up to 2.4 ML per day from the creek when flow past our offtake point is 39.6 ML per day or greater. From November to June, extraction up to 0.78 ML per day is permitted at any time.

Raw water is stored in the raw water basin until it is transferred to the water treatment plant for treatment. The Seaspray water treatment process comprises of solids separation and two stages of filtration. Following treatment, water is stored in a 3.7 ML treated water storage basin, from where it is disinfected before distribution to customers. The treatment plant has a capacity of 1.5 ML per day.

Particularly important to the supply resilience for the Seaspray system, and supply to the water treatment plant, is the need to undertake desilting at the raw water pump station offtake structure. Sediment builds up over time at the offtake point and if left untreated has the potential to limit or prevent diversions from the creek. Desilting is required around once every five years and sometimes more often depending on storm events. In addition to the large raw water basin, which has storage capacity to supply close to 12 months' demand, the Seaspray treated water demand can also be met by water carting.

For a map of the key elements of the system please refer to Appendix B and for a diagram of the water treatment process please refer to Appendix C. Alternatively you can visit our online Urban Water Strategy interactive map at www.gippswater.com.au/uws and search for any particular town.

Water system outlook and addressing future needs

The Seaspray system has shown a general trend of decreasing demand over the last two decades.

We applied to have our bulk entitlement annual diversion limit increased in 2008, to provide water resources for an expected direction to service the nearby Honeysuckles hamlet, as well as anticipated increased demand in Seaspray associated with the provision of the sewer system for the town.

Our application led to the remaining unallocated water resources in the Merriman Creek being acquired by us as an additional entitlement, however the expected growth in demand at Seaspray never eventuated. These arrangements have remained in place ever since and up until the east Gippsland drought, the system coped quite well.

In 2018-19, we were unable to divert the necessary water to fully meet town demand. This was partly a consequence of the current flow-sharing rules that were prescribed as part of the 2008 bulk entitlement amendment. This resulted in the raw water basin being drawn below the restriction review point at times in that year and the following year, during the unprecedented drought conditions. Restrictions were not imposed during that period as we opted to absorb the risk by drawing the basin lower than desired and carting treated water to the town if required. The basin was able to be recovered from time to time, in some cases during summer when the diversion rules offer greater flexibility, and water carting was not needed.

However, when preparing the current and future yield outlook for the system, we have assumed that restrictions would apply in our simulations as per the review points set out in our Drought Response Plan, and these review points adopt a precautionary approach to manage the constraints of the flow sharing rules of the bulk entitlement. This is to ensure the raw water basin is kept at a level that can endure periods when the creek naturally stops flowing, as well as periods during July to October when streamflows can be relatively plentiful but not able to be diverted under our bulk entitlement. Applying this approach to our outlook ensures that any shortfall in our ability to maintain the target supply reliability will be identified.

It is for this reason, and the occurrence of the record dry conditions of 2017-19, that our outlook has changed from that presented in our 2017 UWS, which showed a future yield surplus for all climate scenarios. The streamflow record upon which the simulations are based is relatively short compared to other rivers in our region, and the inclusion of three record dry years to a relatively short measurement period has completely changed the reliability and yield outlook for this system.
We are now showing a significant shortfall for all climate scenarios (Figure 48). As this result is in part due to the flow sharing rules set out in our bulk entitlement, we are proposing first to engage with our partners GLaWAC, WGCMA and SRW to explore alternative flow sharing rules. Through this process we will investigate options that could provide Seaspray with adequate supply reliability while not adversely impacting upon environmental and Traditional Owner values or the rights of other diverters such as stock and domestic users. Should this be successful, we would approach DELWP to seek the Minister's approval for an amendment to our bulk entitlement.

Although forecast demand already exceeds long term yield, we can meet customer requirements without restrictions during wet or average conditions such as those experienced recently.

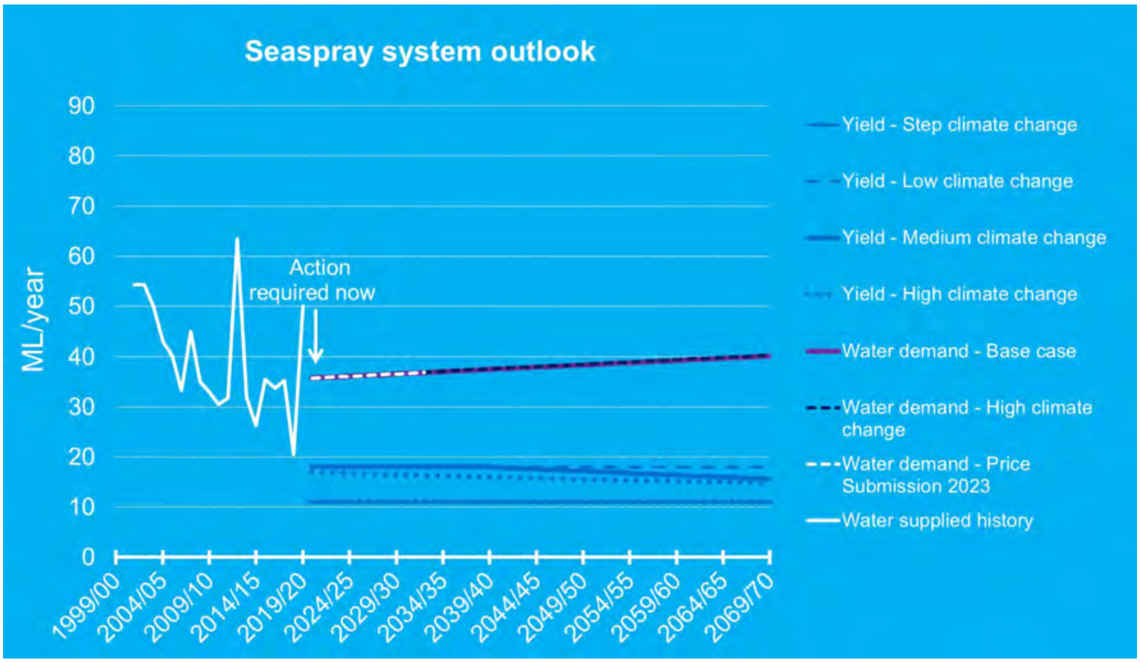


Figure 48 Seaspray water resource outlook

Action 13 – Seaspray water

Explore alternative flow sharing arrangements for the Merriman Creek Bulk Entitlement.

Warragul, Drouin and Neerim South

Overview of the water supply system

The townships of Warragul, Drouin, Buln Buln, Rokeby, Darnum, Nilma, Neerim South and Noojee are located in the west of our region. These townships are supplied by two water supply systems: Warragul and Neerim South. Together, these systems are described as the Tarago water resource system. The Tarago water resource system also has an interconnection between the Warragul water supply system and the Moe water supply system.

Figure 49 Location of the Tarago water supply system and Tarago catchment

In 2021, the Tarago water system serviced 15,963 residential customers and 1,297 non-residential customers. The estimated population served was 38,254 people. The Tarago water system supplies water to four major customers: Park Avenue Laundry, Pureharvest, Warragul Linen Service and West Gippsland Hospital.

The average raw water demand consumed by the Tarago system is 3,944 ML per year. Average losses of treated water in the system are 831 ML per year.

A breakdown of the previous six years of demand for the system is presented below.

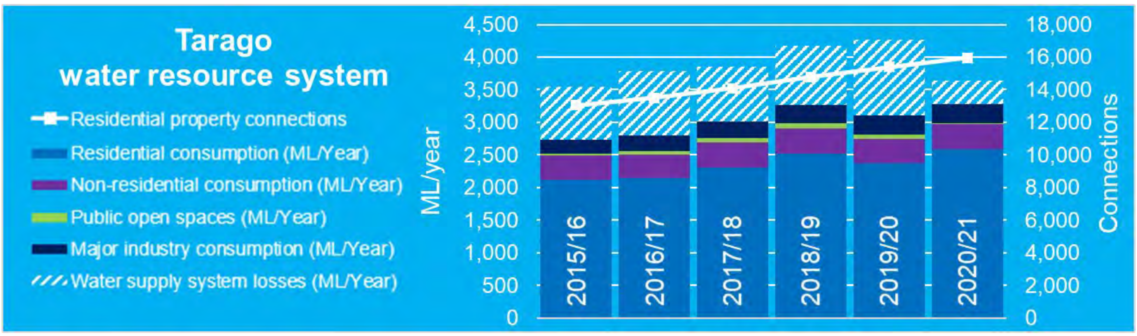


Figure 50 Previous six years demands for Tarago water resource system

The Tarago system draws its water from three main points. Pederson Weir on the Tarago River west branch (upstream of Tarago Reservoir) and Rokeby pump station on the Westernport Pipeline (downstream of Tarago Reservoir) supply water to Warragul water treatment plant. Neerim South water treatment plant is supplied directly from Tarago Reservoir.

The Tarago River is part of the Bunyip Basin and located within the Port Phillip and Westernport catchment. Pederson Weir is located upstream of the Tarago Reservoir, on the west branch of the Tarago River. The catchment above Pederson Weir is heavily forested and for this reason the water quality is usually quite good. The forested catchment also ensures that the health of the Tarago River west branch upstream of Tarago Reservoir remains relatively good.

The Tarago River and its tributary Labertouche Creek have been identified as important habitats for platypus, supporting the highest density of platypus recorded anywhere around Melbourne since 2000 (Melbourne Water Healthy Waterways Strategy, 2018). The work program for the Healthy Waterways Strategy includes an action to investigate and mitigate threats to physical form and other high values for this management area. The requirement for a passing flow at Pederson Weir contributes to the generally good condition of this reach of river.

Pederson Weir and the Tarago Reservoir are within the Tarago River Declared Water Supply Catchment and are covered by a Special Area Plan. Water Supply Catchment declarations are made under the *Catchment and Land Protection Act 1994*. These declarations recognise the importance of raw water quality for human consumption and trigger referrals from councils to us and Melbourne Water for development that may lead to a cumulative negative impact on water quality. A Special Area Plan complements these declarations by outlining the land uses permitted in declared catchments.

The Tarago River is located in the Bunyip basin. In the long term the impact of climate change on the Bunyip basin is forecast to result in stream flow reductions under medium and high climate change scenarios.

Tarago Reservoir, pictured in Figure 51, is owned and operated by Melbourne Water. The reservoir has a maximum capacity of 37,580 ML, from which we are entitled to a small portion for supply to Neerim South. A number of other primary entitlement holders of the Melbourne Yarra-Thomson Pool also draw either directly or indirectly from the Tarago system.

Figure 51 Tarago Reservoir offtake tower

Pederson Weir on the Tarago River (Figure 52) and the Rokeby pump station both divert water to into the Pederson main for supply to the Warragul water treatment plant. The Rokeby pump station extracts water from Melbourne Water's Westernport Pipeline. A pump station at the Tarago Reservoir head works diverts water to Neerim South water treatment plant. A branch pipe on the Pederson Main also provides an alternative means for the Neerim South water treatment plant to be supplied by Pederson Weir.

During times of low flow in the Tarago River upstream of Pederson Weir, minimum passing flow requirements introduced in 2009 mean the weir may not be able to meet the demand on the Warragul water treatment plant. In this case, we are able to retrieve the flows afforded to us under our entitlement at Pederson Weir from the Tarago Reservoir. This is the means by which the Rokeby pump station transfers water to the Warragul treatment plant.


Figure 52 Pederson Weir on the Tarago River

We are permitted to divert or extract water from the Pederson Weir or Tarago Reservoir subject to the following entitlements:

1. A maximum extraction of 275 ML/year from the Tarago Reservoir extraction point for Neerim South water treatment plant.
2. A five-year rolling average extraction of 4,070 ML/year from Pederson Weir or the Tarago Westernport Pipeline interface point (Rokeby pump station).

We are restricted to the following maximum daily extraction rates as detailed in Table 11 below.

Table 11 Maximum daily extraction rates from the Tarago system

Waterway	Location	Transfer Conduit	Extraction Rate (ML/day)
Tarago River	Pederson Weir	Pederson Supply Main	12.6
Tarago River (from Tarago Reservoir)	Rokeby	Pederson Supply Main	12.6
Tarago River (from Tarago Reservoir)	Tarago Reservoir	Neerim South Supply Main	2.2

Table 12 details the minimum flow that we are required to pass on to Tarago Reservoir from Pederson Weir.

We also currently have an agreement with Melbourne's retail water corporations that provides a 400 ML per year share of Tarago Reservoir for supplementary supply to the Warragul water treatment plant. This agreement is crucial to ensuring a reliable supply to Warragul and Drouin during summer. The agreement also allows a greater diversion rate than the Bulk Entitlement at the Rokeby Pump Station.

Table 12 Passing flow Requirements of Pederson Weir

Waterway and Offtake Point	**Passing Flow** (all flows are minimum values)
Tarago River at Pederson Weir	The lesser of – 1. 15 ML/d or natural, if inflow to Pederson Weir is greater than 700 ML over the previous 30 days; or 2. 7 ML/d or natural, if inflow to Pederson Weir is less than 700 ML over the previous 30 days.

We also have further contingency in this system with the ability to supply our Warragul water reticulation network with treated water from our Moe water treatment plant. Our Warragul system can also supply the Moe system with treated water. The ability to transfer water from our Moe treatment plant during warm periods in recent summers has also been critical for ensuring a reliable supply to our Warragul and Drouin customers.

The Warragul water treatment process comprises of combined primary and secondary treatment. Chemicals are added to assist solid particles in the raw water to stick together then diffusers apply dissolved air to the water to cause the solids to float and separate from the water. Water is disinfected and stored in a 37.5 ML clear water storage basin before distribution to reticulation network storages and on to customers in Warragul and Drouin. The treatment plant has a capacity of 18 ML per day.

The Neerim South water treatment process also comprises of combined primary and secondary treatment. As for the Warragul treatment process, chemicals are added to assist solid particles in the raw water to stick together then diffusers apply dissolved air to the water to cause the solids to float and separate from the water. Water is disinfected and stored in a 2.2 ML clear water storage basin, or a further 1.3 ML storage tank, before distribution to customers in Neerim South and Noojee. The treatment plant has a capacity of 1.4 ML per day.

For a map of the key elements of the system please refer to Appendix B and for a diagram of the water treatment process please refer to Appendix C. Alternatively you can visit our online Urban Water Strategy interactive map at www.gippswater.com.au/uws and search for any particular town.

Water system outlook and addressing future needs

The Tarago system is in immediate need of a supply augmentation (Figure 53). Demand side measures will be important too but not enough to address the increasing shortfall magnitude alone.

While the Warragul and Drouin community have a long history of supply from the Tarago Reservoir, there is no formal entitlement. Instead, water has been sourced under a range of agreements, most recently with Melbourne's retail water companies.

Over time, we have continued to investigate a wide range of alternative options to secure reliable water supply for our customers, while at the same time purchasing water as required from the Melbourne retailers. This has assisted with supply, but it is not a permanent arrangement.

Options we've been pursuing include groundwater investigations in the deep confined aquifers near Yarragon and interconnection of our Moe and Warragul water systems. The latter project has now been completed with Moe water treatment plant and its Blue Rock Reservoir and Narracan Creek water resources now able to supplement the Warragul system.

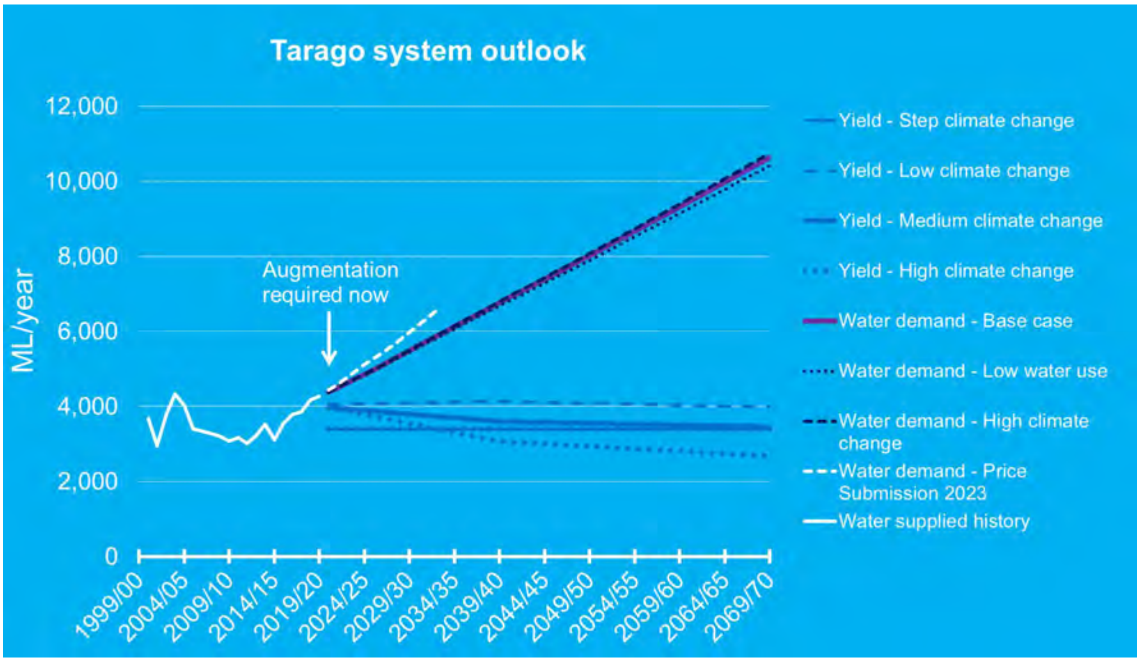


Figure 53 Tarago water resource system outlook

In 2020, as the water supply shortfall date loomed ever closer, and in anticipation of this UWS and the *Central and Gippsland Region Sustainable Water Strategy* (CGRSWS), we undertook further detailed analysis of the following options:

Table 13 Solutions considered for addressing future water needs for Warragul and Drouin

Option 1a	Purchase a small Bulk Entitlement in the Melbourne pool (which includes Tarago Reservoir), to allow us to make temporary trades as they become available and if affordable.
Option 1b	Share in the purchase of outstanding water entitlement in the Melbourne pool made available to others in 2014 but not yet taken up.
Option 1c	Apply to government for an inflow and capacity share of Tarago Reservoir.
Option 2a	Construction of a pipeline from Blue Rock Reservoir to the Warragul water treatment plant.
Option 2b	Construction of a pipeline from Blue Rock Reservoir to the Tarago Reservoir.
Option 2c	Construction of water treatment plant at Blue Rock Reservoir and pipeline to Moe-Warragul Interconnect.
Option 3a	Access groundwater in Moe Aquifer and treat at Warragul water treatment plant.
Option 3b	Access groundwater in Moe Aquifer and construct a new water treatment plant.
Option 4	Integrated Water Management (IWM) opportunities.
Option 5	System efficiency opportunities.
Option 6	Moe-Warragul interconnect trade opportunities.
Option 7a	Transfer of allocation from Thomson Reservoir to Tarago Reservoir from our Thomson-Macalister Bulk Entitlement.
Option 7b	Restore the upper Tanjil River to upper Thomson River aqueduct as a pipeline to use a portion of our Blue Rock inflow share to supplement the Yarra-Thomson pool inflows with associated transfer of allocation to Tarago Reservoir.
Option 8a	Labertouche Creek to Tarago Reservoir pipeline.
Option 8b	Labertouche Creek supply to South East Water Tarago Main Race customers, with offset arrangement for access to Tarago Reservoir water.
Option 8c	Construction of a pipe from Bunyip Weir to upper Tarago River and water trade with Melbourne Water.
Option 9a	Indirect potable re-use of treated effluent from Warragul sewage treatment plant to Tarago Reservoir.
Option 9b	Direct potable re-use of treated effluent.

These options were assessed in detail, organised by practical delivery timeframe, and ranked according to lifecycle costs, water yields, and social and environmental considerations. It became apparent that only projects of very high capital cost would address the forecast shortfall with an acceptable likelihood of success and with current pressure to maintain stable tariffs most either were too expensive or had low likelihood of success.

As outlined in the discussion draft CGRSWS, and in response to this work and the current predicament, the Victorian Government is proposing to secure Warragul and Drouin's urban water supply by increasing our access to water from Tarago Reservoir. The draft CGRSWS recognises the need for up to 2,000 ML per year of additional reliable yield. This new entitlement would be provided at a suitable price that reflects the value of this water resource, but also takes into consideration current affordability concerns. We will work collaboratively with DELWP and regional stakeholders to implement this action as part of the final CGRSWS.

We have concurrently been working with Melbourne Water to secure an adequate share of the capacity of the Westernport Pipeline downstream from Tarago Reservoir to the Rokeby pump station that diverts water to Warragul. Our Rokeby pump station is already sized to provide sufficient delivery of water to Warragul for the next decade.

This is a great outcome for Warragul and Drouin as these communities continue to experience high rates of regional immigration and growth. It will also allow us to withdraw our longstanding application for groundwater from the Moe groundwater management area, potentially freeing up this resource for other purposes subject to Government approval under the Water Act.

Finally, our work identified that while a significant supply side augmentation is necessary to address the current and future shortfall, there are also other augmentations that have a favourable demand reduction or supply increase to cost ratio. These include some water conservation and efficiency measures such as ongoing network leak detection. We will also continue to work with government and our Gippsland Integrated Water Management Forum partners to identify and secure funding for alternative water projects such as the already operational Bellbird Park recycled wastewater irrigation system in Drouin and the under construction Western Park stormwater reuse irrigation system in Warragul, as well as potentially the inclusion of water tanks for new housing developments.

Action 14 – Tarago water

Acquire a 2 GL yield Bulk Entitlement to the Yarra-Thomson Pool to secure Warragul and Drouin's future water.

The following actions presented in earlier chapters of this report complement Action 14 through demand-side strategies in the Tarago system:

Action 6 – Engaging with our stakeholders

Continue to work with local councils and government to embed better water conservation planning for greenfield development.

Action 7 – Water efficiency and conservation

Continue to deliver our Non-revenue Water Action Plan.

Action 8 – Water efficiency and conservation

We will expand our activities that support the government's Target Your Water Use program including continuing with the Schools Water Efficiency program, facilitating any applicable grant schemes and expanding our community education programs.

Maffra, Stratford and Heyfield

Overview of the water supply system

The townships of Maffra, Stratford, Boisdale, Heyfield, Coongulla and Glenmaggie are located in the north-east of our service area, north of Sale. These townships are supplied by three water supply systems: Maffra, Heyfield and Coongulla-Glenmaggie. Together, these systems are described as the Thomson-Macalister water resource system. Work is currently underway to interconnect the Heyfield and Coongulla-Glenmaggie supply systems.

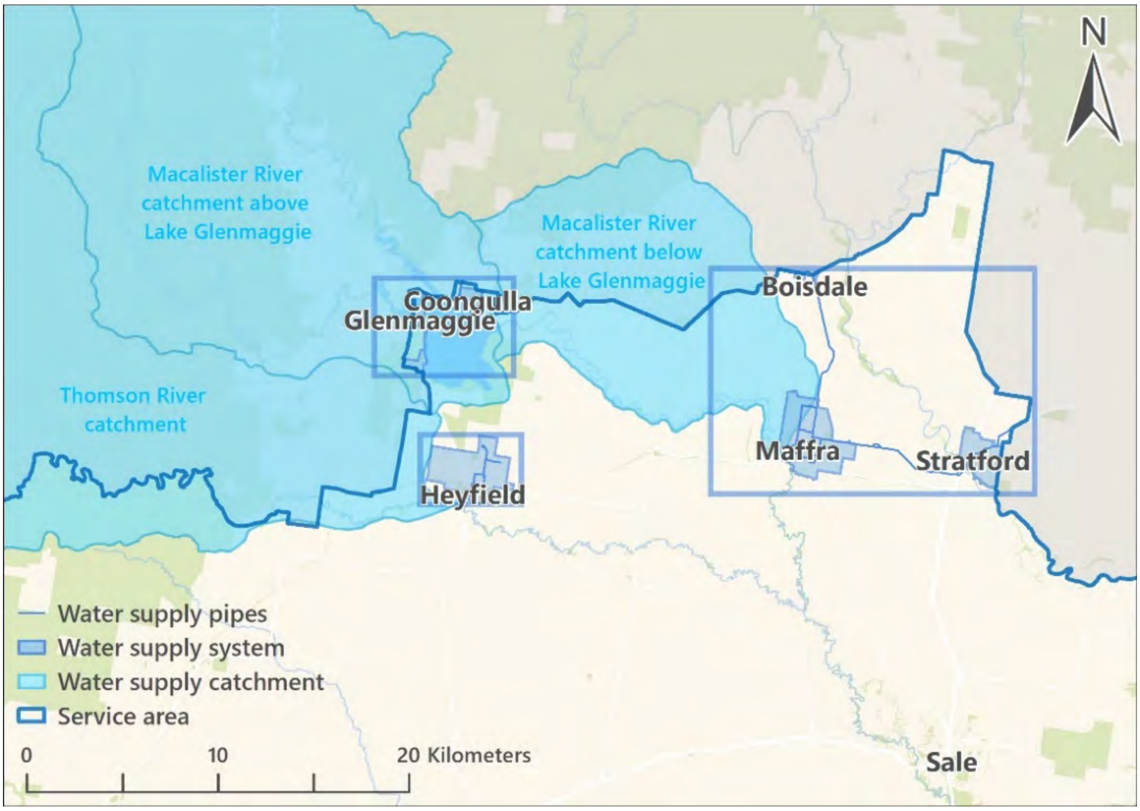


Figure 54 Location of the Thomson-Macalister water resource system and the Macalister and Thomson River catchments

In 2021, the Thomson-Macalister water system serviced 4,645 residential customers and 415 non-residential customers. The estimated population served was 10,008 people. The Thomson-Macalister system has one major customer, the Saputo milk factory based in Maffra.

The average raw water demand consumed by the Thomson-Macalister system is 1,466 ML per year. Average losses of treated water in the system are 164 ML per year.

A breakdown of the previous six years of demand for the system is presented below.

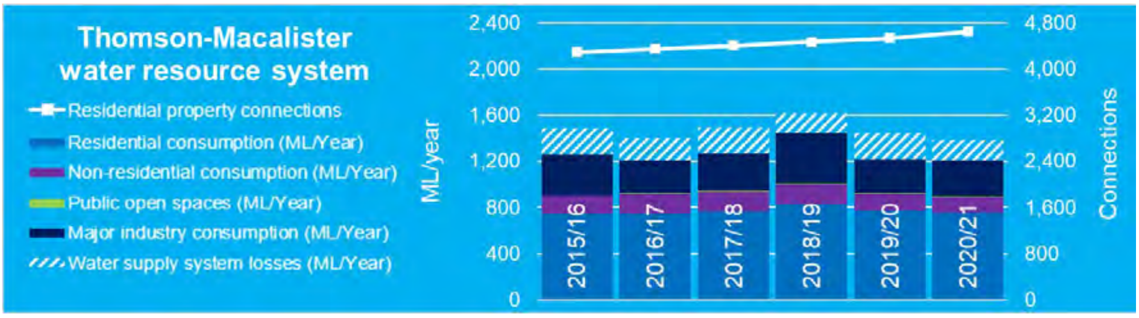


Figure 55 Previous six years demands for Thomson-Macalister water resource system

Note: Water demand for public open spaces in the Thomson-Macalister water resource system is typically less than 1% of total system demand or on average 6.0 ML/Year and may not be visible in the chart above.

Water for the Thomson-Macalister system is sourced from two of Gippsland's major rivers: the Macalister River, *Wirnwirndook'yeerung* and the Thomson River, *Carran-carran*.

The Thomson River originates in the eastern slopes of the Baw Baw plateau. North of Erica the river is dammed by the Thomson Reservoir, which is Melbourne's major water supply and there are passing flow requirements downstream of the reservoir. Downstream of the dam the Aberfeldy River joins the Thomson and at times contributes a significant portion of the total flow. At Cowwarr Weir, the Thomson River splits into the original Thomson River course and Rainbow Creek. The Thomson River then flows eastwards via Heyfield and Sale before reaching a confluence with the Latrobe River which flows on to the Gippsland Lakes. The Thomson River between Thomson Reservoir and Cowwarr Weir is a heritage river under the *Heritage Rivers Act 1992*.

The Macalister catchment is much larger than the Thomson catchment. The Macalister River flows from Mount Howitt and joins the Thomson River south of Maffra. Lake Glenmaggie is on the Macalister River and is located just north of Heyfield. Lake Glenmaggie is managed by Southern Rural Water and is mostly used for irrigation purposes. Over the past 20 years the Macalister River water quality has been severely impacted at times by bushfires and floods.

The presence of agriculture and forestry in both the Macalister and Thomson River catchments leads to increased suspended solids runoff following rainfall as well as an increased risk of pesticides and herbicides contamination. All catchments supplying the Thomson-Macalister water resource system are monitored for chemical, pathogenic and physical risks and appropriate treatment processes are in place to ensure compliance with public health and aesthetic standards.

The *West Gippsland Waterway Strategy 2014-2022* (West Gippsland Catchment Management Authority, 2014) identified upper reaches of the Thomson River and the Macalister River for reduction of threats to waterway values. These values include significant fauna and flora, naturalness and special features for both waterways. Sections of both the Thomson River and the Macalister River are nominated as priority reaches for reduction of threats to waterway values. The work program for the Waterway Strategy addresses the following threats for this management unit specific to the upper reaches of the Thomson and Macalister Rivers: bank erosion, fish barrier, flow stress, invasive flora and invasive fauna.

Historically, septic tank overflow and leakage from the Coongulla township was a microbiological contamination risk, although we have now completed the small town sewer scheme project for Coongulla/Glenmaggie so this risk has been reduced.

The Glenmaggie caravan park poses a number of risks to water quality. These include:

- Year round sediment loading to Lake Glenmaggie resulting from dry wind erosion as well as stormwater / wastewater run-off from the significant amount of un-vegetated land around the park;
- Well-developed cabin-style caravans with enclosed annexes and reticulated water supply that have water fixtures, but are not connected to adequate wastewater services. A previous audit requested by Southern Rural Water, undertaken by the current park management, showed many sites had inadequate wastewater management systems in place; and
- Reports of wastewater running freely from under vans/cabins straight across the ground into the lake.

The risks are greater during times of high occupancy, which coincides with summer and the usual low lake conditions and algae conducive weather conditions. We have two projects underway which will assist in addressing these risks. The interconnection of the Coongulla water supply system with the Heyfield water supply system will allow the townships of Coongulla and Glenmaggie to be supplied from the Heyfield water treatment plant rather than the Lake Glenmaggie supply. Further, the introduction of ultra-violet (UV) disinfection system at the Maffra water treatment plant provides an additional treatment barrier for pathogens.

In addition to the measures we are putting in place, the *Wellington and East Gippsland Shires Domestic Wastewater Management Plan* (2016) assesses environmental and public health risks in unsewered areas and areas with on-site domestic wastewater systems. The plan identifies strategies and actions to minimise resultant impacts.

Algae, including blue-green algae (BGA), occurs naturally in waterways, wetlands and water storages and is a common seasonal occurrence in Victoria. Blooms can be triggered by nutrient levels, low inflows, lower storage volumes and warmer weather conditions. Southern Rural Water (SRW) monitors its storages, including Lake Glenmaggie, to determine the suitability of the water for recreation and drinking purposes and advises water stakeholders and the public of any outbreaks.

BGA and significant dirty water in Lake Glenmaggie was identified as an issue during and after the 2007 summer fires and floods and this has proven to be an ongoing risk. More recently, in early 2020, sustained blooms were observed in the more widespread Macalister Irrigation District, including species previously not observed in the region (HydroNumerics, 2020).

From time to time both BGA and dirty water events have impacted on treatment processes in terms of taste and odour and the ability to treat the water at normal flow rates. We use water quality monitoring to inform our water treatment plant response, occasionally resulting in short-term water carting or water restrictions. Once interconnection of the Coongulla and Heyfield systems is completed, this will assist in addressing the water quality risk for the customers of Coongulla and Glenmaggie. Our Maffra treatment plant is a more advanced plant that has processes in place to improve taste and odour with the presence of BGA in Lake Glenmaggie.

The Maffra pump station offtake point is subject to significantly higher microbiological, nutrient and agricultural chemical risks as the reach of the Macalister River downstream of Lake Glenmaggie to the Maffra pump station is flanked by irrigated agricultural land. All catchments supplying the Thomson-Macalister water resource system are monitored for chemical, pathogenic and physical risks and appropriate treatment processes are in place to ensure compliance with public health and aesthetic standards.

Lake Glenmaggie is covered by a Declared Water Supply Catchment under the *Catchment and Land Protection Act 1994* but does not have a Special Area Plan. This declared supply catchment does not extend to our Maffra offtake point. The Thomson River upstream from the Thomson Reservoir is covered by a Declared Water Supply Catchment, however the area upstream from the Heyfield offtake and downstream of Thomson Reservoir is outside of this declaration. The Thomson River declared catchment also has a Special Area Plan.

The Victorian Environmental Water Holder (VEWH) holds environmental entitlements in both the Thomson Reservoir and Lake Glenmaggie. The VEWH holds 12.5 GL of high reliability entitlement and 6.2 GL of low reliability entitlement in the Macalister system, and holds 18 GL of high reliability entitlement in the Thomson system. The VEWH prepare a seasonal watering plan each financial year which describes where, when, how and why environmental water including these entitlements can be used across Victoria's rivers, wetlands and floodplains.

The Thomson River and Macalister River are both tributaries of the Thomson basin. In the long term the impact of climate change on the Thomson basin is forecast to result in stream flow reductions under medium and high climate change scenarios.

We are entitled to draw 2,335 ML per year from the Thomson-Macalister water resource system, subject to the restrictions presented in Table 14, which are based on the announced irrigation high reliability allocation for the Macalister Irrigation District. Our minimum annual entitlement is 1,401 ML per year (60%) in the case that the irrigation allocations are less than or equal to 40%.

Table 14 Water allocation rules for our Thomson-Macalister Bulk Entitlement

Seasonal Allocation of High Reliability Water Shares	Restriction to Bulk Entitlement
More than 100%	None
100%	None
90%	None
80%	None
70%	90%
60%	80%
50%	70%
40%	60%
Less than 40%	60%

SRW manages the annual irrigation allocation. As irrigation allocations increase, our allocation increases from 60% at the same rate as shown in Table 14. Since the year 2000, our allocation has been restricted for a full year in just one financial year, 2006/07. The irrigation season closed that year at 60% allocation, with the restriction on our entitlement being 80%.

Several other stakeholders hold and administer environmental and bulk entitlements in both the Thomson and Macalister systems. These include the primary entitlement holders of the Melbourne Yarra-Thomson Pool, the VEWH and SRW. SRW is responsible for ensuring minimum environmental flows at all of our offtakes.

There are three water treatment plants in the Thomson-Macalister water resource system. The Maffra water treatment plant is supplied by a pump station on the Macalister River, downstream of Lake Glenmaggie. The Heyfield water treatment plant is supplied by a pump station on the Thomson River. Water for the Coongulla water treatment plant is pumped directly from Lake Glenmaggie. Table 15 details the daily diversion limits that apply to the Thomson Macalister system.

Table 15 Diversion Limits for the Thomson Macalister system

Diversion Location	Maximum Diversion Rate (ML/d)
Lake Glenmaggie	3.0
Maffra Weir	12.0

Diversion Location	Maximum Diversion Rate (ML/d)
Cowwarr Weir (not used)	2.3
Thomson River at Heyfield	6.5
Main Southern Channel (not used)	6.5

Each of the water treatment plants has a treatment process corresponding to the source water.

The Maffra water treatment process comprises of two stages of solids separation followed by ultra-violet radiation disinfection. Following disinfection, water is stored in tanks before distribution to customers in Maffra, Stratford and Boisdale. The treatment plant has a capacity of 8 ML per day.

The Heyfield water supply has a large 23 ML raw water basin before the treatment plant. The treatment process comprises of two stages of filtration, after which water is disinfected and stored in a 4.9 ML covered basin. From the covered basin, water is transferred to a 1.1 ML steel high level storage tank before distribution to customers. The treatment plant has a capacity of 3 ML per day.

The Coongulla water treatment process comprises of two stages of filtration, after which water is subject to granular activated carbon. In this step the taste and odour is improved by culprit compounds sticking to the surface of carbon particles. Water is then disinfected and stored in a 2.4 ML covered basin before distribution to customers. The treatment plant has a capacity of 1.2 ML per day.

At present, the Coongulla treated water reticulation system is being interconnected with the Heyfield treated water reticulation system. This means that the Heyfield treatment plant will supply the Coongulla and Glenmaggie reticulation networks treated water. The Coongulla treated water demand can also be met by water carting as a temporary measure and incurring a high cost.

For a map of the key elements of the system please refer to Appendix B and for a diagram of the water treatment process please refer to Appendix C. Alternatively you can visit our online Urban Water Strategy interactive map at www.gippswater.com.au/uws and search for any particular town.

Water system outlook

The Thomson Macalister system draws water from several locations in this declared irrigation system. The conditions of our bulk entitlement determine our annual access to water as a function of the high reliability irrigation allocation as announced by SRW in response to storage levels and inflows primarily to Lake Glenmaggie but also Thomson

Reservoir. Our water restriction review points are designed to recommend restrictions in response to various levels of allocation at different times of year to ensure we don't fall short.

As our customers' demand has no bearing on the allocation and therefore on the frequency of restrictions in a reliability simulation for this system, the standard method of estimating the yield by iteratively increasing demand until the reliability drops below target is not suitable. We therefore look for actual shortfalls in meeting supply in our simulations and for all scenarios except high climate change, the limit on demand is governed by the bulk entitlement annual cap for years in which we receive our full allocation, 2,335 ML.

When adopting this method it is important that we consider the actual reliability at the yield level of demand and as noted in the chart, our simulations found that for all climate scenarios except high climate change, the reliability at 2,335 ML per year exceeded the 95% target. Under high climate change, it is estimated that by 2040 the reliability at the shortfall yield of 1,750 ML per year will drop below 95%. As demand is forecast to increase to this level at that time, under high climate change action will be needed in this system by 2040.

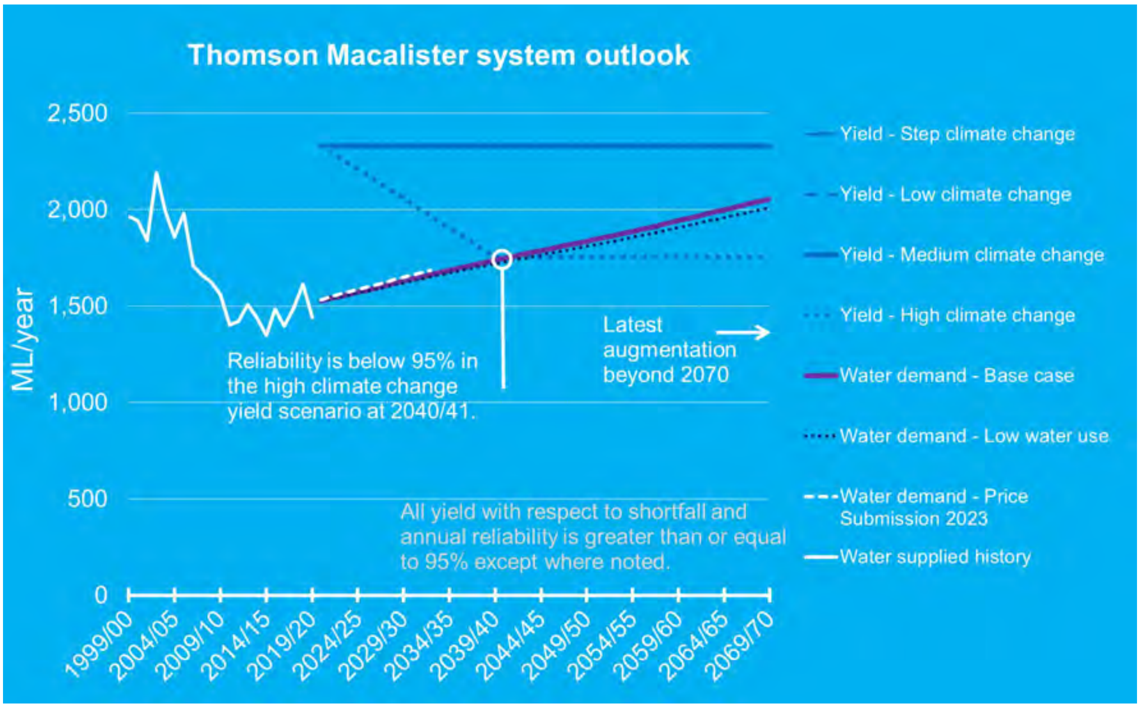


Figure 56 Thomson Macalister water resource system outlook

While it is not possible to determine at what point between now and 2040 this could occur, as climate change can manifest in steps as well as gradually, this outcome is at the 90th percentile extreme of the range of outcomes, and presently the system operates at very high reliability and modelling has shown it to be resilient to short falling under the post 1997 climate scenario. We are therefore not currently planning any capital investments in actions for this system in our 2023-28 Price Submission period, rather we will continue to monitor emerging trends and performance through our adaptive approach to managing uncertainty.

In the interim, shortfalls in this system should they occur, can be managed by trading allocation on the well established temporary market.

Our sewer systems

Drouin

Overview of the sewer system

Drouin is the town furthest to the west of our service area, located approximately 100 kilometres southeast of Melbourne. The town of Drouin is serviced by the Drouin sewage treatment lagoons, with the new mechanical-biological plant nearing completion at the site.

Figure 57 Location of Drouin sewer system

In 2021, the Drouin sewer system serviced 5,383 residential customers and 276 non-residential customers. The estimated population served was 12,428 people. The catchment is mostly domestic with some light commercial, industrial and public use zones. The average sewage inflow to the Drouin treatment plant is 916 ML per year. The maximum annual treated sewage volume in the past five years is 1,075 ML per year.

A breakdown of the previous six years of volumes in the sewage system is presented below.

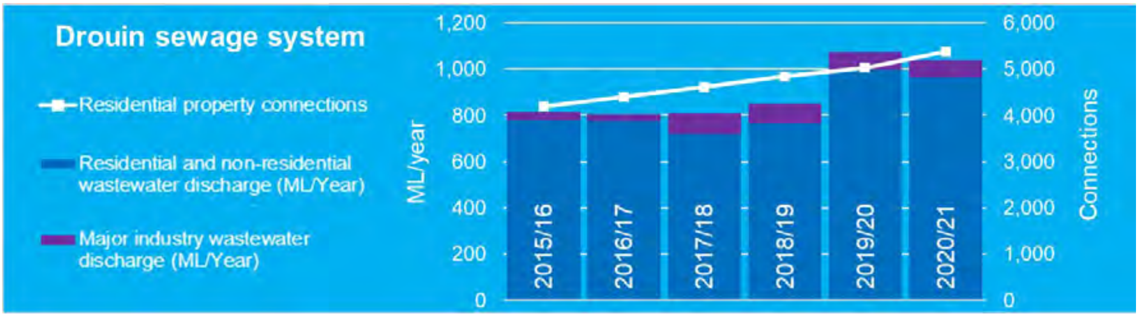


Figure 58 Previous six years sewage volumes for Drouin sewage system

The Drouin sewerage network is predominantly a gravity system, with some pump stations. Sewer mains transport the sewage to treatment facilities. The existing lagoon based sewage treatment is reaching capacity for the population serviced. Identified in the 2017 Urban Water Strategy and 2018 Price Submission, we embarked on significant upgrades to the Drouin wastewater (sewage) treatment plant to cater for future growth of the town. The upgrades, which include the construction of a new mechanical biological plant, similar to of the upgrades at Warragul, are expected to be completed by 2022/23.

The new treatment process will include screens and grit systems to remove large solids, grits and oils from the sewage before it enters the treatment plant. In the biological reactor, bacteria (biological processes) help break down organic material and nutrients into other forms which can then be easily separated into solids or clear liquid. Sewage which has passed through the biological reactor is driven by pressure through a membrane with openings sized to filter out small particles and bacteria before release to the environment. Thickened solids are dewatered and discharged to bins and sent to Gippsland Regional Organics (GRO). GRO is our EPA-licensed waste treatment and composting facility located at our Dutson Downs property. The new treatment plant at Drouin will have a treatment capacity of 1,570 ML per year once Stage 1 upgrades are complete and 2,336 ML per year following Stage 2 upgrades.

Figure 59 Drouin sewage treatment lagoons with new treatment plant under construction

The new mechanical - biological treatment plant and existing lagoon based treatment will continue to operate in parallel, to maximise re-usage of treated effluent by our Gippsland Regional Agribusiness.

The Drouin sewage treatment plant currently provides Class C treatment and the future treatment process will treat to Class B. From both the existing and new facility, treated sewage is either used for irrigation of our Gippsland Regional Agribusiness farmland, sent to Bellbird Park for recreation irrigation after further treatment by Baw Baw Shire Council or released to the environment via Shillinglaw Creek, which is a tributary of King Parrot Creek.

The Westernport catchment these waterways are located in is managed by Melbourne Water. The Melbourne Water Healthy Waterways Strategy (2018) does not provide any actions for the King Parrot Creek and Musk Creek catchment, however performance objectives for condition for this catchment include: establish continuous riparian vegetated buffer and maintain existing vegetation along priority reaches; prevent decline in stormwater condition by treating any new development; and increase community participation rates.

There have been three emergency discharges of partially treated effluent to King Parrot Creek since our 2017 Urban Water Strategy (UWS).

- September to December 2019

- May to November 2020
- September to December 2021

These discharges were required to provide capacity in the winter storage. This need was the result of an exceptional sequence of peak rainfall events that reduced irrigation capacity due to saturation of pasture. These discharges were a breach of our EPA Amalgamated Licence and occurred while upgrade works at the site were underway. The completed upgrade works at the site will cater for current and future growth and ensure compliance. Throughout each of the discharge periods, a comprehensive monitoring program was completed in the receiving waters to monitor for potential impacts. Careful management of discharge flows achieved the desired lagoon levels whilst also ensuring discharge has caused no significant or long term impacts on the water quality of the Shillinglaw Creek and King Parrot Creek.

For a map of the key elements of the system please refer to Appendix D and for a diagram of the sewage treatment process please refer to Appendix E. Alternatively you can visit our online Urban Water Strategy interactive map at www.gippswater.com.au/uws and search for any particular town.

Sewer system outlook and addressing future needs

Growth in sewage volumes in the Drouin system is forecast to be significant and is shown in Figure 60. This was identified in the 2017 Urban Water Strategy and 2018 Price Submission. Following this we embarked on significant upgrades to the Drouin sewage treatment plant to cater for this future growth of the town and a strategy for addressing future need is in place.

The new mechanical-biological treatment plant at Drouin will have a treatment capacity of 1,570 ML per year once Stage 1 upgrades are complete, which is expected to be by 2022/23.

Figure 60 forecasts that the earliest (worst case) time for augmentation of this system following Stage 1 upgrades is 2035/36 while the latest time for augmentation is 2047/48. The Stage 2 augmentation is currently planned for 2035, however timing as part of our strategy for this site will be determined based on the trajectory of demand over the next five to 10 years and will be included in our capital expenditure long term model accordingly. The Stage 2 upgrades are expected to afford at least an additional 25 years of growth servicing beyond the Stage 1 upgrades.

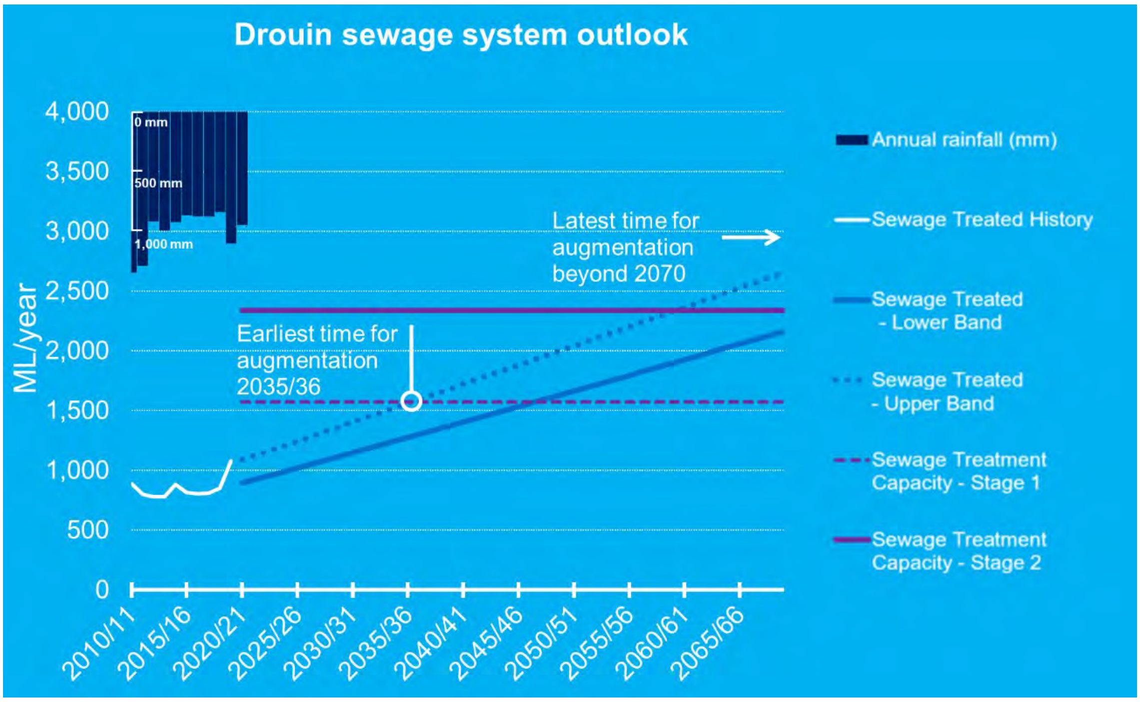


Figure 60 Drouin sewage system outlook

Case study – Investing in Drouin's future needs

Our new $55 million Drouin wastewater (sewage) treatment plant addresses the need to expand the capacity of the existing sewage treatment plant to meet Drouin's rapidly growing population. After weighing up environmental, technical, social and economic factors, we assessed that the best course of action is to build a new mechanical treatment plant on the existing site on Settlement Road.

The upgrade will ensure a more flexible and robust wastewater treatment facility that delivers sustainable and affordable wastewater treatment to the residents of Drouin. Improving the reliability of the plant has several community and environmental benefits:

- Cleaner wastewater means less odour for nearby residents and better protection of public health.
- The treated water released from the new treatment plant will be of higher quality, therefore protecting the ecology of local waterways and Westernport Bay.
- Producing high quality treated wastewater could allow us to recycle more wastewater for irrigation.

The site will also include solar panels, to equip the plant with renewable energy. These will be installed to float on our existing lagoon – an innovative use of the site and lagoon.

Heyfield

Overview of the sewer system

The townships of Heyfield, Coongulla and Glenmaggie are located in the east of our service area. The Heyfield sewage treatment lagoons services both towns.

In 2021, the Heyfield sewer system serviced 1,024 residential customers and 83 non-residential customers. The estimated population served was 1,615 people. The catchment is mostly domestic with some light commercial, industrial and public use zones. The average sewage inflow to the Heyfield treatment plant is 114 ML per year. The maximum annual treated sewage volume in the past five years is 134 ML per year.

Figure 61 Location of Heyfield sewer system

A breakdown of the previous six years of volumes in the sewage system is presented below.

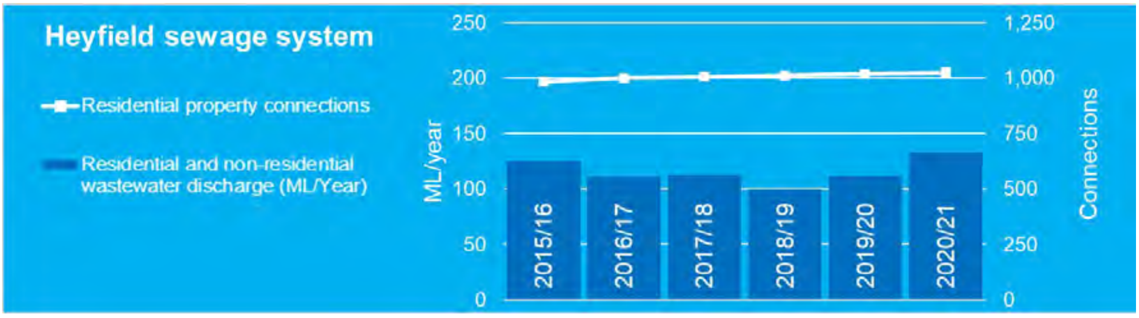


Figure 62 Previous six years sewage volumes for Heyfield sewage system

The Heyfield sewerage network is predominantly a gravity system while the Coongulla-Glenmaggie network is a pressure sewer system. The Heyfield sewage treatment plant comprises of four lagoons. The first two lagoons are facultative lagoons, where natural biological treatment takes place to stabilise sewage. In the third lagoon, natural disinfection reduces the pathogenic bacteria. The treated sewage is then moved to the winter storage and recycled for summer irrigation. The Heyfield sewage treatment plant has a treatment capacity of 133 ML per year.

Figure 63 Aerial view of Heyfield sewage treatment lagoons

The resulting treated effluent from the Heyfield sewage treatment plant is Class C and is re-used by our Gippsland Regional Agribusiness for irrigation of farmland. Over the past five years the average annual reuse volume has been 62 ML per year. All treated sewage that is recycled must comply with Environment Protection Authority standards.

There has been a single emergency discharge of partially treated effluent from this site since our 2017 Urban Water Strategy (UWS) which occurred between October and November in 2021. Treated effluent from the winter storage was pumped via flood irrigation overland to Back Creek. Back Creek is an ephemeral creek that flows for approximately nine kilometres where is enters the Thomson River.

The discharge was required to provide capacity in the winter storage. This need was the result of an exceptional sequence of peak rainfall events that reduced summer irrigation capacity due to saturation of pasture. This discharge was managed in accordance with Condition 2.8 of our EPA Amalgamated Licence. Throughout the discharge period, a comprehensive monitoring program was completed in the receiving waters to monitor for potential impacts. Careful management of discharge flows achieved the desired lagoon levels whilst also ensuring discharge has caused no significant or long term impacts on the water quality in the receiving environment.

The Thomson catchment these waterways are located in is managed by the West Gippsland Catchment Management Authority. The *West Gippsland Waterway Strategy 2014-2022* (West Gippsland Catchment Management Authority, 2014) identifies the catchment as highly modified through agricultural practices, and that stability, erosion, channel change and impacts of flood flow on private land are major issues for the waterways and their associated floodplains.

For a map of the key elements of the system please refer to Appendix D and for a diagram of the sewage treatment process please refer to Appendix E. Alternatively you can visit our online Urban Water Strategy interactive map at www.gippswater.com.au/uws and search for any particular town.

Sewer system outlook and addressing future needs

Low growth in sewage volumes is forecast for the Heyfield system. The outlook shown in Figure 64 forecasts the earliest (worst case) time for augmentation for this system is by 2028/29 and the latest time for augmentation based on 2047/48.

This system has been identified for development of an augmentation strategy in the next five years for servicing future growth. The strategy will inform potential augmentation actions to be planned for the following five years.

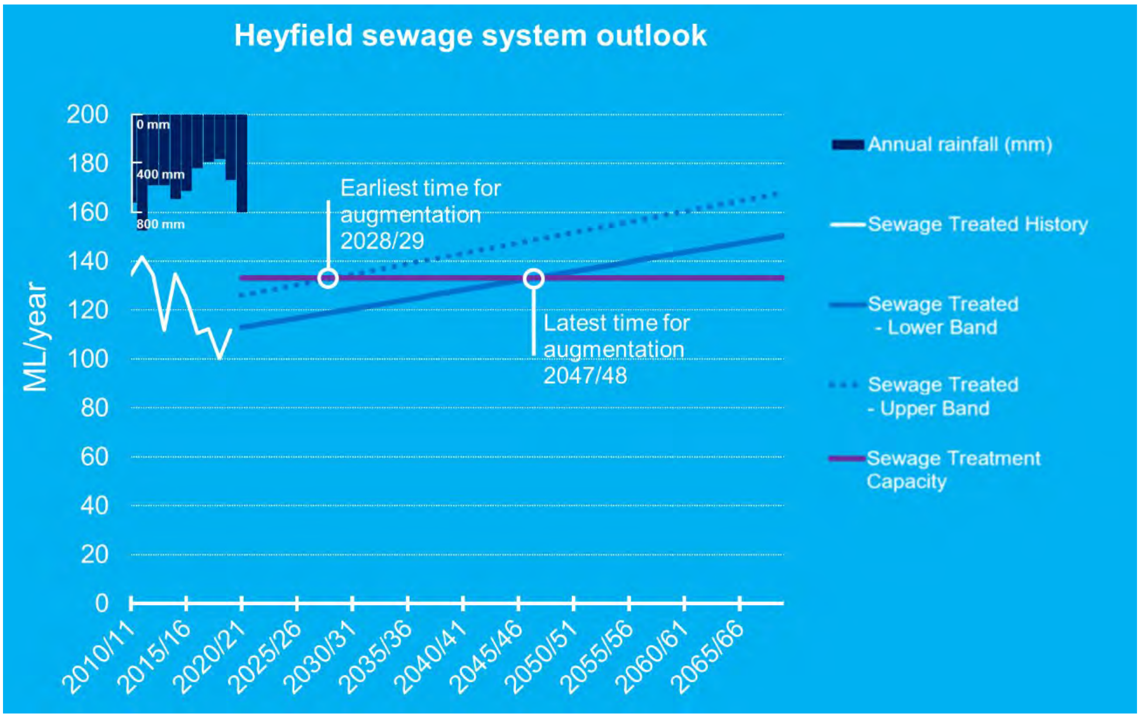


Figure 64 Heyfield sewage system outlook

Action 15 – Heyfield sewage

Develop an augmentation strategy for servicing future growth at the Heyfield sewage treatment plant.

Latrobe Valley towns

Overview of the sewer system

The sewer service system for the Latrobe Valley towns is by far the largest and most complex system within our jurisdiction. The towns of the Latrobe Valley are serviced by the domestic plant at our Gippsland Water Factory. Within the Gippsland Water Factory domestic system are the towns of Boolarra, Churchill, Glengarry, Morwell, Rosedale, Toongabbie, Traralgon, Yallourn North and Yinnar. The west side of Morwell is serviced by the Morwell (west) sewer system. The Gippsland Water Factory also includes an industrial wastewater treatment plant that is detailed on page 146 of this report.

Figure 65 Location of the Gippsland Water factory domestic sewer system

Gippsland Water Factory

In 2021, the Gippsland Water Factory domestic sewer system serviced 20,530 residential customers and 7,835 non-residential customers. The estimated population served was 42,628 people. The catchment is mostly domestic with some light commercial, industrial and public use zones.

The Gippsland Water Factory domestic sewer system also services the following major customers: AGL (Loy Yang A power station), Alinta (Loy Yang B power station), Australian Char, Bambach Wires and Cables (previously Rosedale Leather site), Bega (until 2021 Lion Foods), Energy Australia (Yallourn W power station), Energy Brix (for decommissioning purposes), IXOM, Jelfor Timber, Latrobe Regional Hospital, Omnia and Snowy Hydro (Valley Power station).

The average sewage inflow to the Gippsland Water Factory domestic treatment plant is 4,732 ML per year. The maximum annual treated sewage volume in the past five years was 4,964 ML per year.

A breakdown of the previous six years of volumes in the Gippsland Water Factory domestic sewer system is presented below.

Figure 66 Previous six years sewage volumes for Gippsland Water Factory domestic sewage system

The Gippsland Water Factory receives sewage from a mixture of pumped and gravity catchments. The facility comprises two treatment plants sharing common infrastructure: a domestic sewage treatment process (for residential, non-residential and all industrial other than Opal Australian Paper) and an industrial wastewater treatment process (to service wastewater treatment for Opal Australian Paper). Before sewage enters the domestic treatment plant, screens and grit systems remove large solids, grits and oils.

Once in the domestic side of the plant, sewage enters the activated primary sedimentation tank where materials that can be settled or floated are removed. Following this, sewage is prefiltered for residual solids before entering the membrane bioreactor. In the membrane bioreactor nutrients, bacteria, protozoa and viruses are removed. The facility typically operates with four membrane cells online for domestic treatment. Subsequent filtrate is sent to the domestic filtrate tank prior to release to the environment via the regional outfall to ocean discharge. All releases must comply with Environment Protect Authority Standards. The Gippsland Water Factory domestic system has a treatment capacity of 6,022 ML per year.

Figure 67 Aerial photo of the Gippsland Water Factory site

The Gippsland Water Factory domestic system provides Class B treatment with ability to treat to Class A for re-use by Opal Australian Paper. When Class A treatment is in place, following the membrane bioreactor step, filtrate is sent to the domestic filtrate tank to buffer flows moving into the reverse osmosis unit. The reverse osmosis unit provides very high quality water treatment with removal of dissolved material, including salts, viruses, bacteria and protozoa. After passing through the reverse osmosis unit, product water is stored in a tank for chlorination and from which up to 8 ML per day of product water can be pumped to the Pine Gully reservoir. From Pine Gully reservoir water is available to Opal Australia Paper to be used in the pulp and paper-making process.

Morwell (west) sewer system

The Morwell (west) sewer system serviced 3,144 residential customers and 396 non-residential customers in 2021. The estimated population served was 5,950 people. The average residential sewage inflow to the Morwell (west) treatment plant is 638 ML per year. The maximum annual treated sewage volume in the past five years was 728 ML per year.

A breakdown of the previous six years of volumes in the Morwell (west) sewage system is presented below.

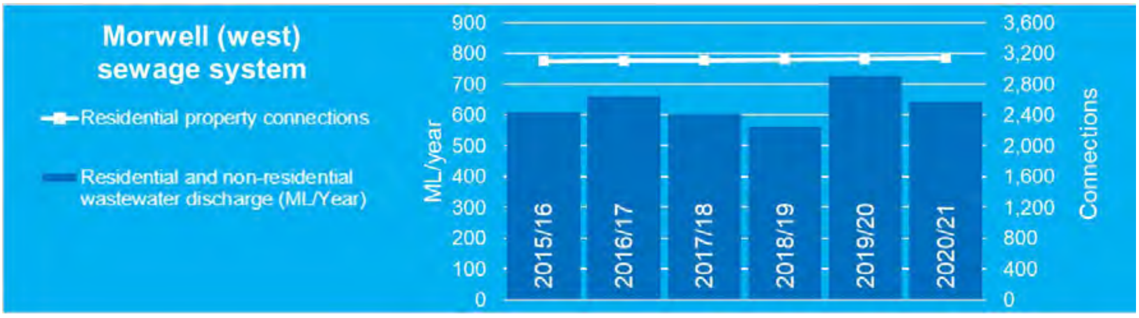


Figure 68 Previous six years sewage volumes for Morwell (west) sewage system

The Morwell (west) sewerage system is predominantly a gravity system. Morwell sewage treatment plant (Figure 69) is a mechanical treatment facility. Before sewage enters the plant, screens and grit systems remove large solids, grits and oils. Once in the plant, bacteria (biological processes) help break down organic material and nutrients into other forms which can then be easily separated into solids or clear liquid. Ultra-violet radiation is then used to reduce the bacteria in the treated effluent before it is released to the environment. The Morwell sewage treatment plant has a treatment capacity of 1,189 ML per year.

Figure 69 Morwell (west) sewage treatment plant

The resulting treated effluent from the Morwell (west) sewage treatment plant is Class B and is released to the environment via the Morwell River wetlands. The wetlands and river are only connected during times of high river levels, the wetlands otherwise being a closed system. Releases from the treatment plant provide base flow in the wetlands during dry periods. All treated sewage that is recycled must comply with Environment Protection Authority standards.

The *West Gippsland Waterway Strategy 2014-2022* (West Gippsland Catchment Management Authority, 2014) identifies Morwell River as a priority reach for reduction of threat to waterway values.

For a map of the key elements of the system please refer to Appendix D and for a diagram of the sewage treatment process please refer to Appendix E. Alternatively you can visit our online Urban Water Strategy interactive map at www.gippswater.com.au/uws and search for any particular town.

Sewer system outlook and addressing future needs

Growth in sewage volumes in the Gippsland Water Factory domestic system is forecast to be modest and is shown in Figure 70. Although the earliest time for augmentation is shown as some years out on the chart, at 2046/47, due to the proportion of sewage in this system from major customers we have a need to regularly monitor this system for changes in demand.

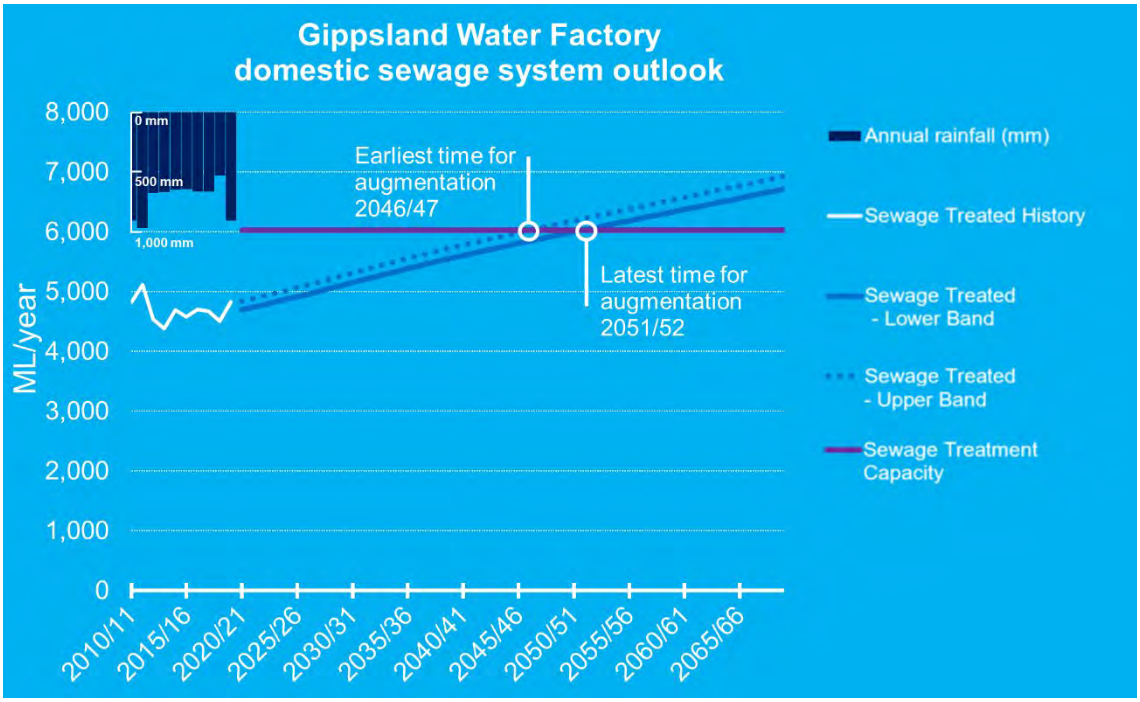


Figure 70 Gippsland Water Factory domestic sewage system outlook

Aside from residential and non-residential growth, changes to major customer sewage volumes or attracting new major customers in this system will mean that we will need to reassess the timing of augmentation for this system.

Growth in sewage volumes in the Morwell (west) sewage system is forecast to be modest and is shown in Figure 71. The growth in this system is constrained by the number of lots within the west side of Morwell that this system services. The earliest time for augmentation is beyond the 50-year outlook period. We plan to continue to assess the outlook for this system on a 5-yearly basis.

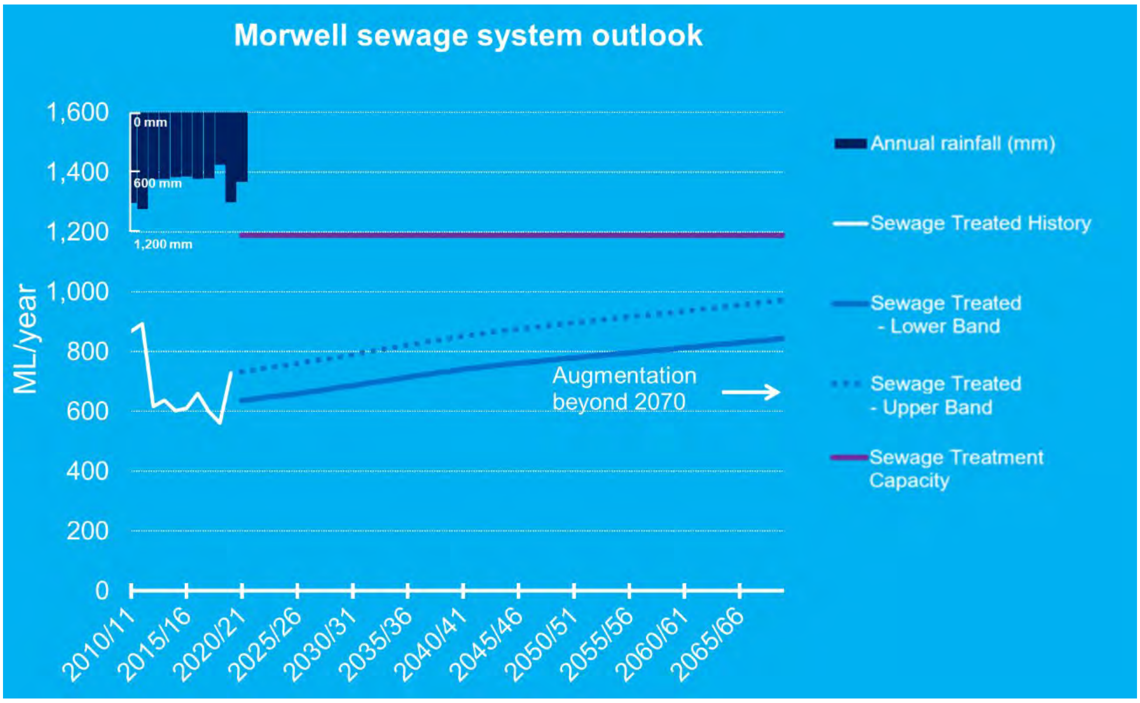


Figure 71 Morwell sewage system outlook

Maffra

Overview of the sewer system

Maffra is located in the north-east of our service area, approximately 15 kilometres north of Sale. The town is serviced by the Maffra sewage treatment lagoons.

In 2021, the Maffra sewer system serviced 2,093 residential customers and 200 non-residential customers. The estimated population served was 4,550 people. The catchment is mostly domestic with some light commercial, industrial and public use zones. The average sewage inflow to the Maffra treatment plant is 353 ML per year. The maximum annual treated sewage volume in the past five years was 381 ML per year.

Figure 72 Location of the Maffra sewer system

A breakdown of the previous six years of volumes in the sewage system is presented below.

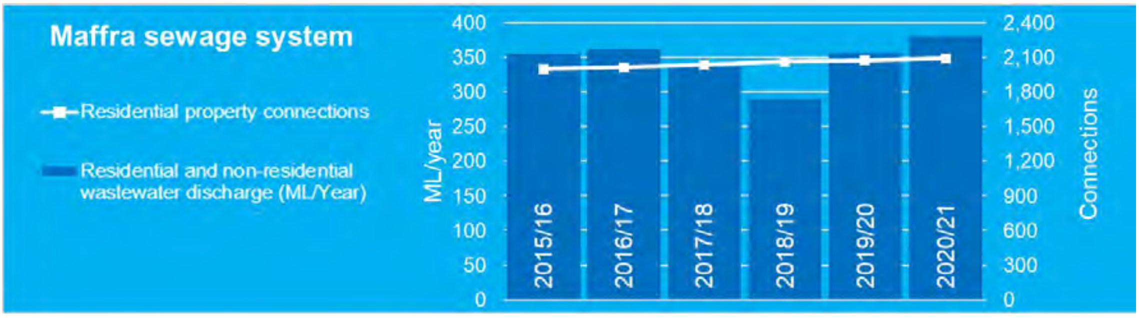


Figure 73 Previous six years sewage volumes for Maffra sewage system

The Maffra sewerage network is predominantly a gravity system. The Maffra sewage treatment plant comprises of three lagoons (Figure 74). The first is a facultative lagoon, where natural biological treatment takes place to stabilise sewage. In the second lagoon, natural disinfection reduces the pathogenic bacteria. The treated sewage is then moved to the winter storage and recycled for summer irrigation. The Maffra sewage treatment plant has a treatment capacity of 537 ML per year.

The resulting treated effluent from the Maffra sewage treatment plant is Class C and is re-used by our Gippsland Regional Agribusiness for irrigation of farmland. Over the past five years the average annual reuse volume has been 229 ML per year. All treated sewage that is recycled must comply with Environment Protection Authority standards.

Figure 74 Maffra sewage treatment lagoons

There have been two emergency discharges of partially treated effluent from this site since our 2017 Urban Water Strategy (UWS) which occurred between August and September 2020 and October and November in 2021. Treated effluent from the winter storage was released overland from the southern end of our property into the Bundulaguah Creek and then into the Thomson River at Myrtlebank.

The discharges were required to provide capacity in the winter storage. This need was the result of an exceptional sequence of peak rainfall events that reduced summer irrigation capacity due to saturation of pasture. These discharges were in breach of our EPA licence for the site. Throughout the discharge periods, a comprehensive monitoring program was completed in the receiving waters to monitor for potential impacts. Careful management of discharge flows achieved the desired lagoon levels whilst also ensuring discharge has caused no significant or long term impacts on the water quality in the receiving environment.

The Thomson catchment these waterways are located in is managed by the West Gippsland Catchment Management Authority. The *West Gippsland Waterway Strategy 2014-2022* (West Gippsland Catchment Management Authority, 2014) identifies the catchment as highly modified through agricultural practices, and that stability, erosion, channel change and impacts of flood flow on private land are major issues for the waterways and their associated floodplains.

For a map of the key elements of the system please refer to Appendix D and for a diagram of the sewage treatment process please refer to Appendix E. Alternatively you can visit our online Urban Water Strategy interactive map at www.gippswater.com.au/uws and search for any particular town.

Sewer system outlook and addressing future needs

Growth in sewage volumes in the Maffra sewage system is forecast to be modest and is shown in Figure 75. The earliest time forecast for augmentation is 2063/64 and latest time is beyond the 50-year outlook period. We plan to continue to assess the outlook for this system on a 5-yearly basis.

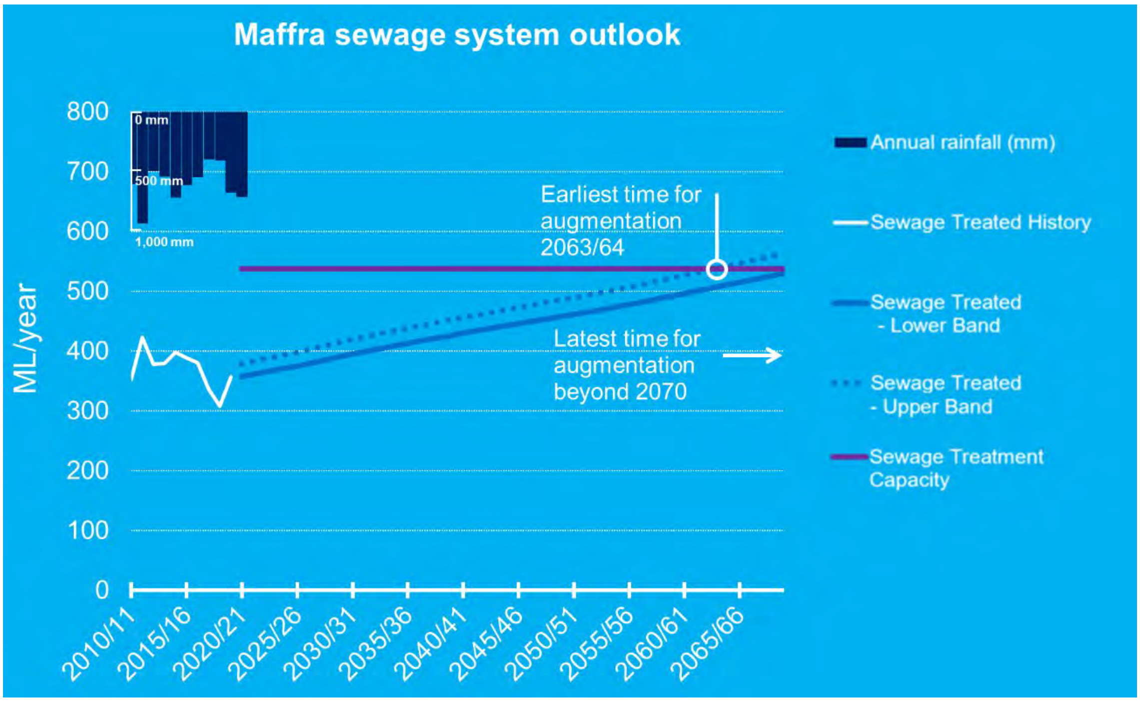


Figure 75 Maffra sewage system outlook

Mirboo North

Overview of the sewer system

Mirboo North is a medium sized rural town located on top of the Strzelecki Ranges, approximately 25 kilometres southwest of Moe. The town of Mirboo North, and neighbouring locality of Baromi, are serviced by the Mirboo North sewage treatment lagoons.

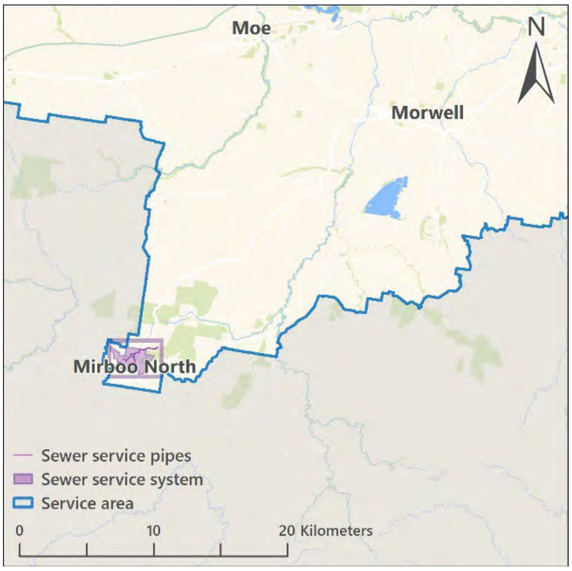


Figure 76 Location of Mirboo North sewer system

In 2021, the Mirboo North sewer system serviced 570 residential customers and 72 non-residential customers. The estimated population served was 1,301 people. The catchment is mostly domestic with some light commercial, industrial and public use zones. The average sewage inflow to the Mirboo North treatment plant is 104 ML per year.
The maximum annual treated sewage volume in the past five years was 111 ML per year.

A breakdown of the previous six years of volumes in the sewage system is presented below.

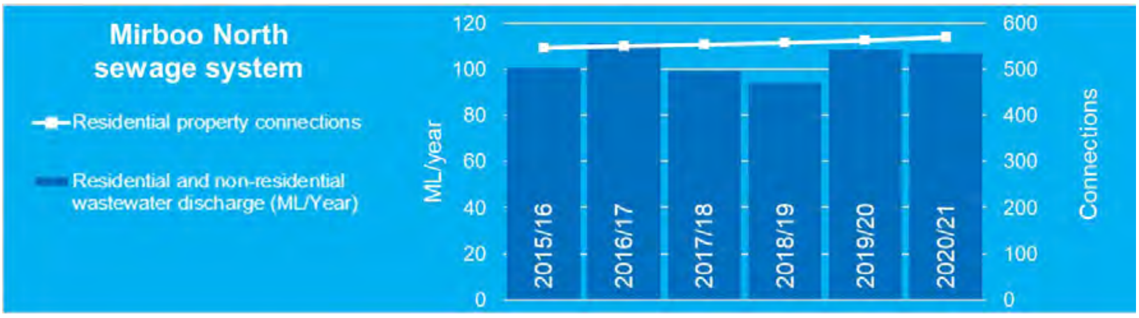


Figure 77 Previous six years sewage volumes for Mirboo North sewage system

The Mirboo North sewerage network is predominantly a gravity system. The Mirboo North sewage treatment plant comprises of five lagoons. The first two lagoons are facultative lagoons, where natural biological treatment takes place to stabilise sewage. In the second two lagoons, natural disinfection reduces the pathogenic bacteria. The treated sewage is then moved to the winter storage and recycled for summer irrigation. The Mirboo North sewage treatment plant has a treatment capacity of 131 ML per year.

The resulting treated effluent from the Mirboo North sewage treatment plant is Class C and is re-used by the Mirboo North golf course and recreation reserve for watering, as well as by our Gippsland Regional Agribusiness for irrigation of farmland. Over the past five years the average annual reuse volume has been 70 ML per year. All treated sewage that is recycled must comply with Environment Protection Authority standards.

For a map of the key elements of the system please refer to Appendix D and for a diagram of the sewage treatment process please refer to Appendix E. Alternatively you can visit our online Urban Water Strategy interactive map at www.gippswater.com.au/uws and search for any particular town.

Sewer system outlook and addressing future needs

Low growth in sewage volumes is forecast for the Mirboo North system. The outlook shown in Figure 78 forecasts the earliest time for augmentation is 2045/46 and latest time is 2062/63.

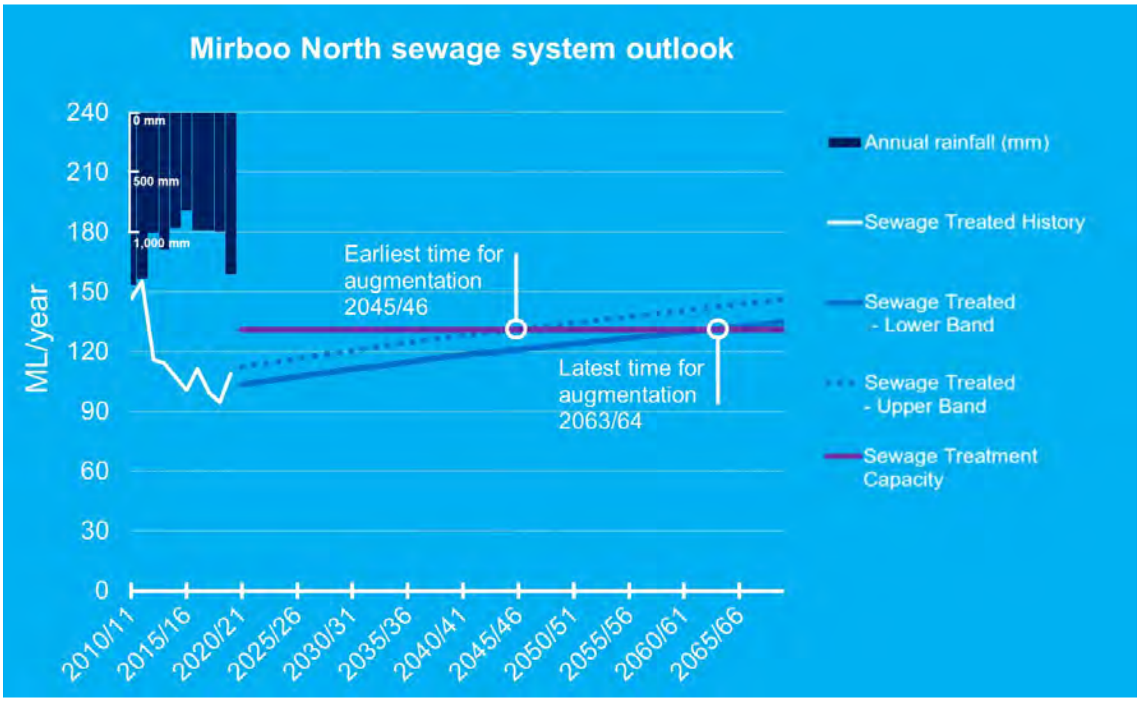


Figure 78 Mirboo North sewage system outlook

The 2017 Urban Water Strategy identified a project for additional irrigation capacity at the treatment plant site to allow greater discharge to our agribusiness operation. This project is planned for 2022/23. We plan to continue to assess the outlook for this system on a 5-yearly basis.

Action 16 – Mirboo North sewage

Deliver project for additional irrigation capacity at the Mirboo North sewage treatment plant site to allow greater re-use by our agribusiness operation.

Moe, Trafalgar and Yarragon

Overview of the sewer system

Moe, Trafalgar and Yarragon are located in the centre of our service area, approximately 120 kilometres east of Melbourne. These towns are serviced by the Moe mechanical sewage treatment plant.

Figure 79 Location of Moe sewer system

In 2021, the Moe sewer system serviced 10,210 residential customers and 740 non-residential customers. The estimated population served was 20,473 people. The catchment is mostly domestic with some light commercial, industrial and public use zones. The average sewage inflow to the Moe treatment plant is 2,140 ML per year. The maximum annual treated sewage volume in the past five years was 2,351 ML per year.

A breakdown of the previous six years of volumes in the sewage system is presented below.

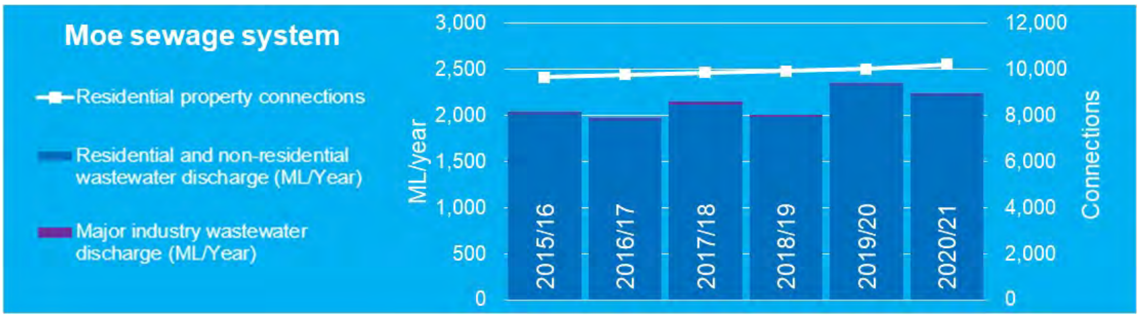


Figure 80 Previous six years sewage volumes for Moe sewage system

The Moe sewerage network is predominantly a gravity system, receiving pumped sewage from Yarragon and Trafalgar. Moe sewage treatment plant is a mechanical treatment facility. Before sewage enters the plant, screens and grit systems remove large solids, grits and oils. Once in the plant, bacteria (biological processes) help break down organic material and nutrients into other forms which can then be easily separated into solids or clear liquid. Ultra-violet radiation is then used to reduce the bacteria in the treated effluent before it is released to the environment. The Moe sewage treatment plant has a treatment capacity of 2,943 ML per year.

The resulting treated effluent from the Moe sewage treatment plant is Class B and is released to the environment via Moe River. All treated sewage that is recycled must comply with Environment Protection Authority standards.

The Moe River was not identified as a priority reach in the *West Gippsland Waterway Strategy 2014-2022* (West Gippsland Catchment Management Authority, 2014). The waterways of the Mid Latrobe management unit, which the Moe River belongs to, have been significantly impacted by past management practices and changes to natural water regimes.

For a map of the key elements of the system please refer to Appendix D and for a diagram of the sewage treatment process please refer to Appendix E. Alternatively you can visit our online Urban Water Strategy interactive map at www.gippswater.com.au/uws and search for any particular town.

Sewer system outlook and addressing future needs

Growth in sewage volumes in the Moe sewage system is forecast to be modest and is shown in Figure 81. The earliest time forecast for augmentation is 2058/59 and latest time is beyond the 50-year outlook period. We plan to continue to assess the outlook for this system on a 5-yearly basis.

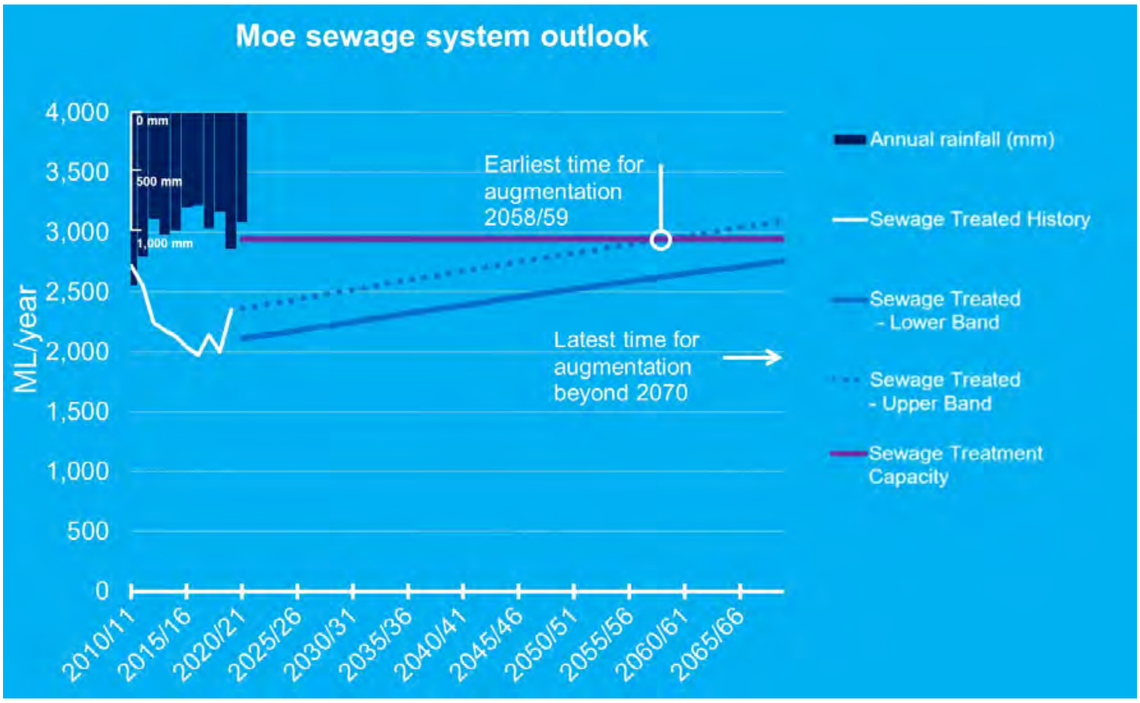


Figure 81 Moe sewage system outlook

Neerim South

Overview of the sewer system

Neerim South is located in the west of our serviced area, approximately 15 kilometres north of Warragul. Neerim South is serviced by the Neerim South mechanical sewage treatment plant.

In 2021, the Neerim South sewer system serviced 408 residential customers and 41 non-residential customers. The estimated population served was 968 people. The catchment is mostly domestic with some light commercial, industrial and public use zones. The average sewage inflow to the Neerim South treatment plant is 53 ML per year. The maximum annual treated sewage volume in the past five years was 59 ML per year.

Figure 82 Location of Neerim South sewer system

A breakdown of the previous six years of volumes in the sewage system is presented below.

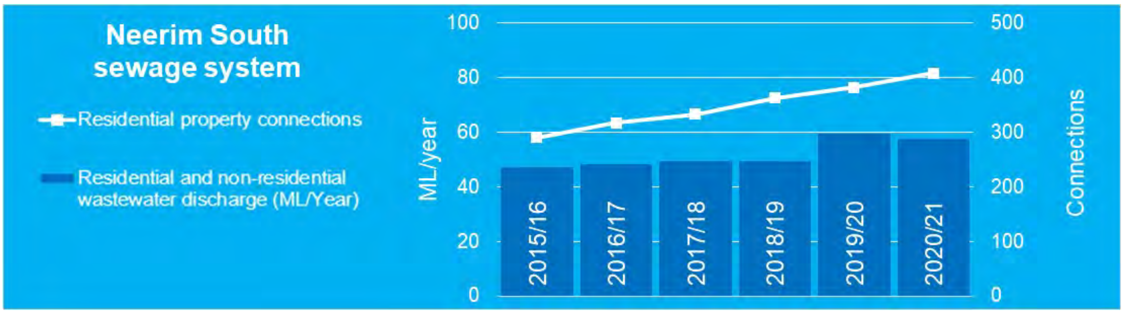


Figure 83 Previous six years sewage volumes for Neerim South sewage system

The Neerim South sewerage network is predominantly a gravity system. Neerim South sewage treatment plant is a mechanical treatment facility. Before sewage enters the plant, screens and grit systems remove large solids, grits and oils. Once in the plant, bacteria (biological processes) help break down organic material and nutrients into other forms which can then be easily separated into solids or clear liquid.

The Neerim South sewage treatment plant has a treatment capacity of 54 ML per year.


Figure 84 Neerim South sewage treatment plant

The resulting treated effluent from the Neerim South sewage treatment plant is Class B and is released to the environment via Red Hill Creek, which is a tributary of the Shady Creek. All treated sewage that is recycled must comply with Environment Protection Authority standards.

The *West Gippsland Waterway Strategy 2014-2022* (West Gippsland Catchment Management Authority, 2014) identifies Shady Creek as a priority reach for reduction of threat to waterway values. The work program for the Waterway Strategy addresses the following threats for this management unit specific to this reach: bank erosion, incision, invasive flora, poor water quality, reduced riparian large trees and reduced riparian width.

For a map of the key elements of the system please refer to Appendix D and for a diagram of the sewage treatment process please refer to Appendix E. Alternatively you can visit our online Urban Water Strategy interactive map at www.gippswater.com.au/uws and search for any particular town.

Sewer system outlook and addressing future needs

Low growth in sewage volumes is forecast for the Neerim South system however the outlook for this system (Figure 85) indicates that augmentation is required now for managing wet years. This forecast is slightly earlier than that of the 2017 Urban Water Strategy and likely due to recent residential growth in this system.

There is currently a project planned for storage at the front of the plant which will allow buffering of sewage inflows to the plant during peak times. This project will be supported by works planned within the sewer service area to reduce rainfall inflows and infiltration to the system with a view to reduce flows to the treatment plant. Both of these projects are planned for this Price Submission 2018-23.

This system has been identified for development of an augmentation strategy in the next five years for servicing future growth. The strategy will inform potential augmentation actions to be planned for the following five years.

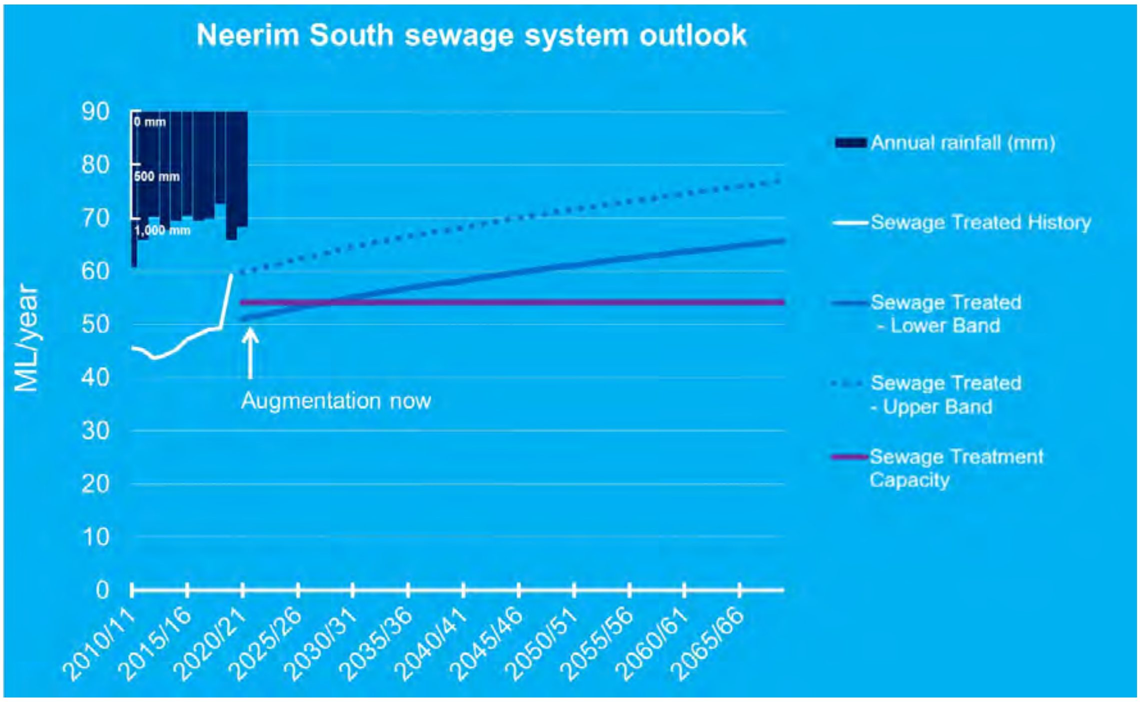


Figure 85 Neerim South sewage system outlook

Action 17 – Neerim South sewage

Develop an augmentation strategy for servicing future growth at the Neerim South sewage treatment plant.

Rawson

Overview of the sewer system

Rawson is a small town located in the foothills of Mount Baw Baw at the most northern extremity of our service area, approximately 27 kilometres northeast of Moe. The town of Rawson is serviced by the Rawson mechanical sewage treatment plant.

Figure 86 Location of Rawson sewer system

In 2021, the Rawson sewer system serviced 152 residential customers and 22 non-residential customers. The estimated population served was 213 people. The catchment is mostly domestic with some light commercial, industrial and public use zones. The average sewage inflow to the Rawson treatment plant is 32 ML per year.

The maximum annual treated sewage volume in the past five years was 34 ML per year.

A breakdown of the previous six years of volumes in the sewage system is presented below.

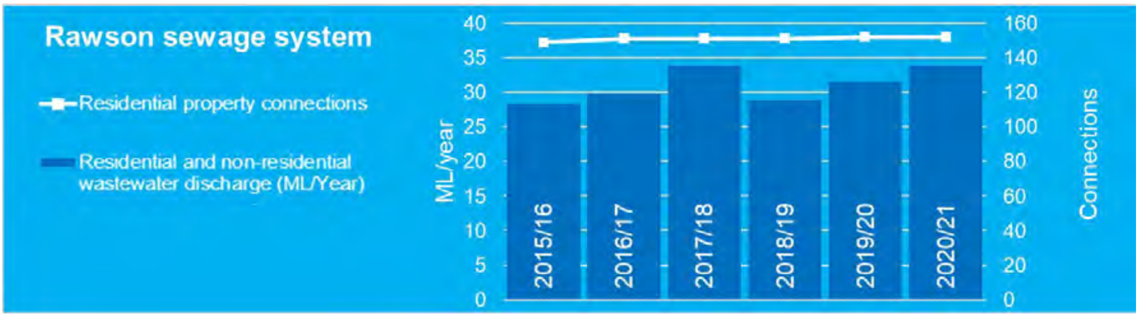


Figure 87 Previous six years sewage volumes for Rawson sewage system

The Rawson sewerage network is predominantly a gravity system. Rawson sewage treatment plant is a mechanical treatment facility. Before sewage enters the plant, screens and grit systems remove large solids, grits and oils. In the first stage of treatment, bacteria (biological processes) help break down organic material and nutrients into other forms which can then be easily separated into solids or clear liquid.

In the second stage, mechanical settling basins, called clarifiers, aid in particles sinking and separating from liquid sewage so that solids can be removed. In the final stage, ultra-violet radiation is used to reduce the bacteria in the treated effluent before it is released to the environment. The Rawson sewage treatment plant has a treatment capacity of 160 ML per year.

The resulting treated effluent from the Rawson sewage treatment plant is Class B and is released to the environment via Coopers Creek, a tributary of the Thomson River. All treated sewage that is recycled must comply with Environment Protection Authority standards.

A severe weather event over two days in June 2021 resulted in impacts across our service region. In addition to the recorded rainfall within the operational area, very high rainfall over the wider region resulted in major flooding events within our operating region.

During this event, the Rawson sewage treatment plant lost power for 12 hours and access was not possible to the site for several days due to trees across access roads during this period. When operator access to the site was once again possible, it was confirmed that partially treated effluent was spilling to the environment into Coopers Creek, a tributary of the Thomson River. Once power was returned to the site, the plant was safely brought back on line and the spill ceased. This exceptional event does not indicate a need for augmentation to address future servicing needs at this site. However, we are investing in generators at strategic locations across our network which will assist portable generators to be deployed during emergency response events.

The *West Gippsland Waterway Strategy 2014-2022* (West Gippsland Catchment Management Authority, 2014) identifies the waterways of the upper Thomson catchment as being an important tourism destination and having important cultural values. The waterways are also important water sources for irrigation and urban uses. Thomson River flows are regulated by the Thomson Reservoir. The upper catchment is in much better condition than in other parts of the region. The impacts of bushfire, floods and climate change are major issues for the waterways and their associated floodplains.

For a map of the key elements of the system please refer to Appendix D and for a diagram of the sewage treatment process please refer to Appendix E. Alternatively you can visit our online Urban Water Strategy interactive map at www.gippswater.com.au/uws and search for any particular town.

Sewer system outlook and addressing future needs

Low growth in sewage volumes is forecast for the Rawson system with growth in this system constrained by the number of lots able to be developed within our sewer service area. The outlook shown in Figure 88 forecasts the earliest time for augmentation is beyond the 50-year outlook period. We plan to continue to assess the outlook for this system on a five-yearly basis.

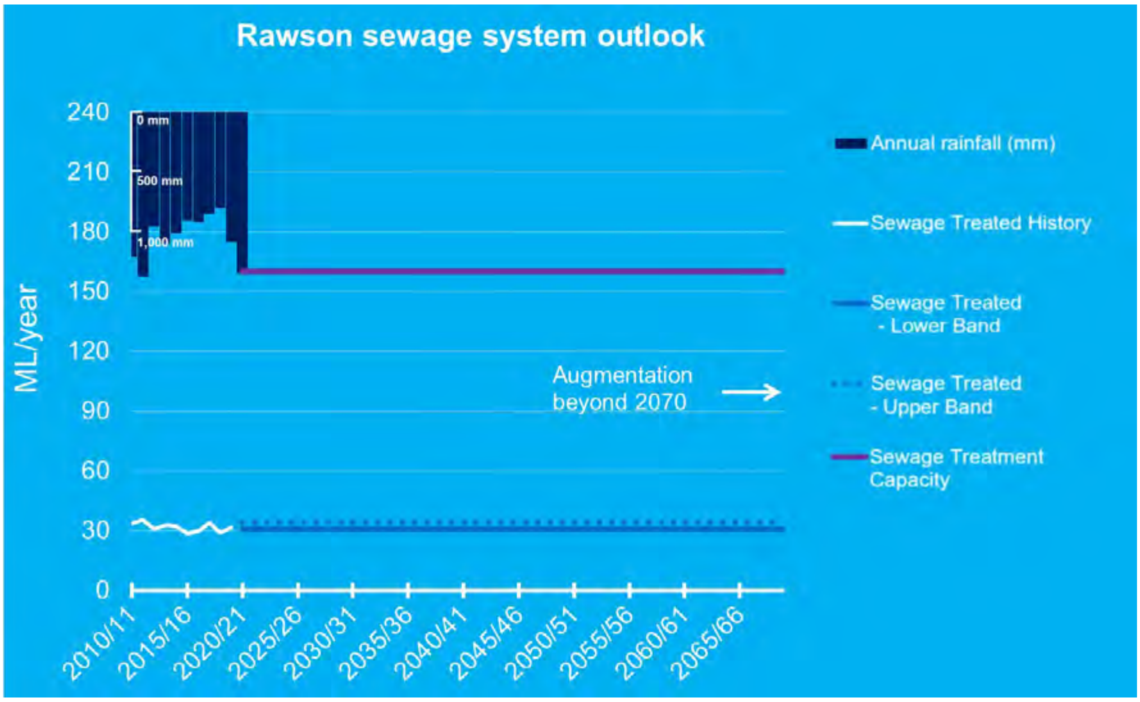


Figure 88 Rawson sewage system outlook

Sale and Loch Sport

Overview of the sewer system

Sale is a large town in the eastern region of our service area, approximately 200 kilometres southeast of Melbourne. Sale, and the nearby towns of Wurruk and Loch Sport, are serviced by the Sale domestic sewage treatment lagoons located at our Dutson Downs facility.

Figure 89 Location of Sale sewer system

In 2021, the Sale and Loch Sport sewer system serviced 8,506 residential customers and 783 non-residential customers. The estimated population served was 15,018 people. The catchment is mostly domestic with some light commercial, industrial and public use zones. The average sewage inflow to the Sale domestic treatment plant is 1,306 ML per year. The maximum annual treated sewage volume in the past five years was 1,377 ML per year.

A breakdown of the previous six years of volumes in the sewage system is presented below.

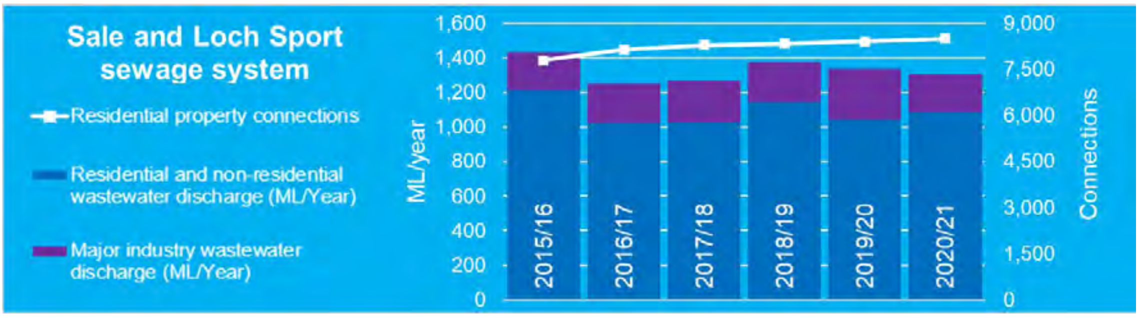


Figure 90 Previous six years sewage volumes for Sale sewage system

The Sale and Loch Sport sewerage system catchments collect sewage from their respective systems, and transfer this sewage to Sale domestic sewage treatment lagoons at our Dutson Downs property for treatment. The Sale sewerage system is a combination of gravity pipelines and lift stations, constrained by the low elevation above sea level and the resultant high water table. It also receives sewage from Wurruk, Fulham Prison and RAAF Sale.

The Loch Sport pressure sewerage scheme (representing a contemporary approach to overcoming high water tables and low elevation above sea level) was completed in

2015. The system comprises of many individual “on lot” pump stations that discharge to a common network of pressurised mains.

Figure 91 Sale domestic sewage treatment lagoons at Dutson Downs

The Sale domestic sewage treatment process comprises of a series of interconnected lagoons, which is also interconnected with a series of industrial treatment lagoons associated with our Gippsland Water Factory and Regional Outfall System. The first stage is the facultative lagoon, where natural biological treatment takes place to stabilise sewage. The second stage is the maturation lagoon, where natural disinfection reduces the pathogenic bacteria. The Sale domestic sewage treatment lagoons have a treatment capacity of 1,800 ML per year.

The resulting treated effluent from the Sale domestic sewage treatment lagoons is Class C and is stored in a winter storage lagoon to be recycled or released to the environment. The treated effluent is re-used by our Gippsland Regional Agribusiness for irrigation of farmland. Over the past five years the average annual reuse volume has been 858 ML per year. Alternatively, treated effluent is released to the environment via ocean outfall at Delray Beach. All treated sewage that is recycled must comply with Environment Protection Authority standards.

For a map of the key elements of the system please refer to Appendix D and for a diagram of the sewage treatment process please refer to Appendix E. Alternatively you can visit our online Urban Water Strategy interactive map at www.gippswater.com.au/uws and search for any particular town.

Sewer system outlook and addressing future needs

Growth in sewage volumes in the Sale sewage system is forecast to be modest and is shown in Figure 92. The earliest time forecast for augmentation is 2045/46 and latest time is 2061/62. We plan to continue to assess the outlook for this system on a five-yearly basis.

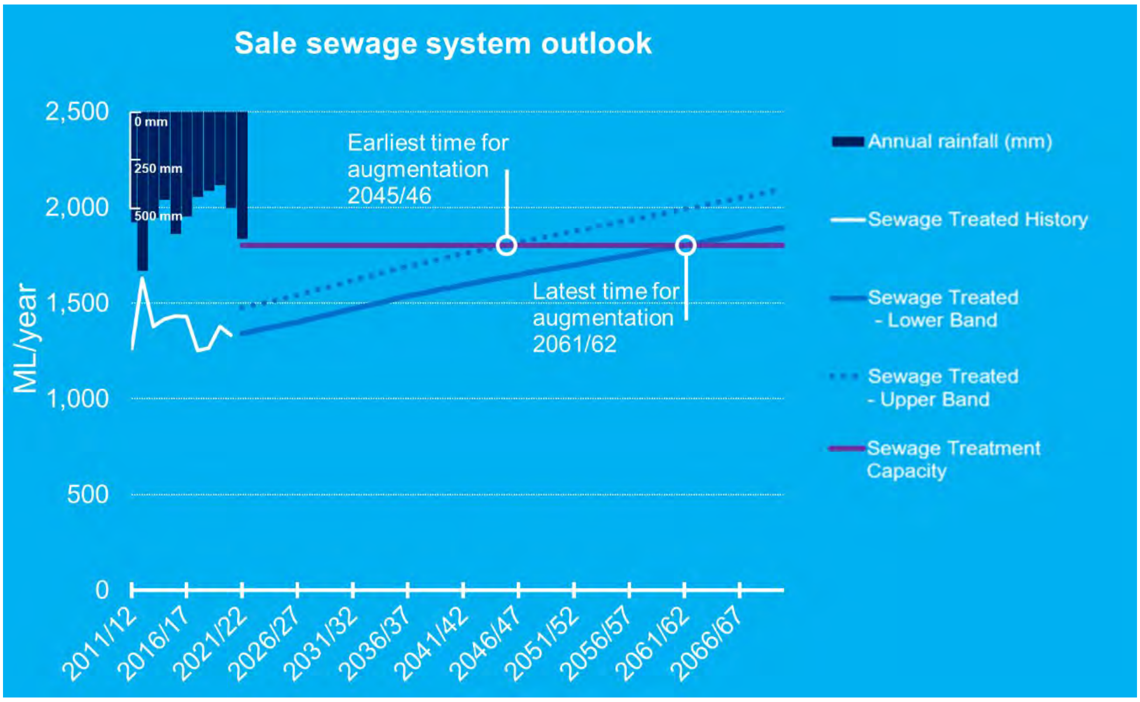


Figure 92 Sale sewage system outlook

Seaspray

Overview of the sewer system

Seaspray is a small coastal town located on 90 Mile beach, approximately 30 kilometres southeast of Sale. The town is serviced by the Seaspray sewage treatment lagoons.

In 2021, the Seaspray sewer system serviced 310 residential customers and 8 non-residential customers. The estimated population served was 294 people. The catchment is mostly domestic with some light commercial and public use zones. The average sewage inflow to the Seaspray treatment plant is 17 ML per year. The maximum annual treated sewage volume in the past five years was 21 ML per year.

Figure 93 Location of Seaspray sewer system

A breakdown of the previous six years of volumes in the sewage system is presented below.

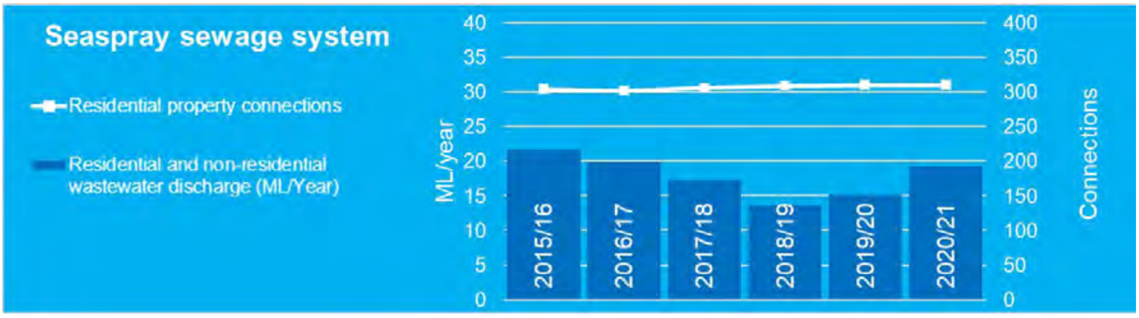


Figure 94 Previous six years sewage volumes for Seaspray sewage system

The Seaspray sewerage network is a pressure sewer system, where sewage is conveyed to the treatment facility by pressure sewer pipelines due to the flat, low-lying topography in the service area. The Seaspray sewage treatment plant (Figure 95) comprises of three lagoons. The first is a facultative lagoon, where natural biological treatment takes place to stabilise sewage. In the second lagoon, natural disinfection reduces the pathogenic bacteria. The treated sewage is then moved to the winter storage and recycled for summer irrigation.

The Seaspray sewage treatment plant has a treatment capacity of 30 ML per year.

The resulting treated effluent from the Seaspray sewage treatment plant is Class C and is re-used by our Gippsland Regional Agribusiness for irrigation of farmland. Over the past five years the average annual reuse volume has been 8 ML per year. All treated sewage that is recycled must comply with Environment Protection Authority standards.

Figure 95 Seaspray sewage treatment lagoons

For a map of the key elements of the system please refer to Appendix D and for a diagram of the sewage treatment process please refer to Appendix E. Alternatively you can visit our online Urban Water Strategy interactive map at www.gippswater.com.au/uws and search for any particular town.

Sewer system outlook and addressing future needs

Low growth in sewage volumes is forecast for the Seaspray system with growth in this system constrained by the number of lots able to be developed within our sewer service area. The outlook shown in Figure 96 forecasts the earliest time for augmentation is beyond the 50-year outlook period. We plan to continue to assess the outlook for this system on a five-yearly basis.

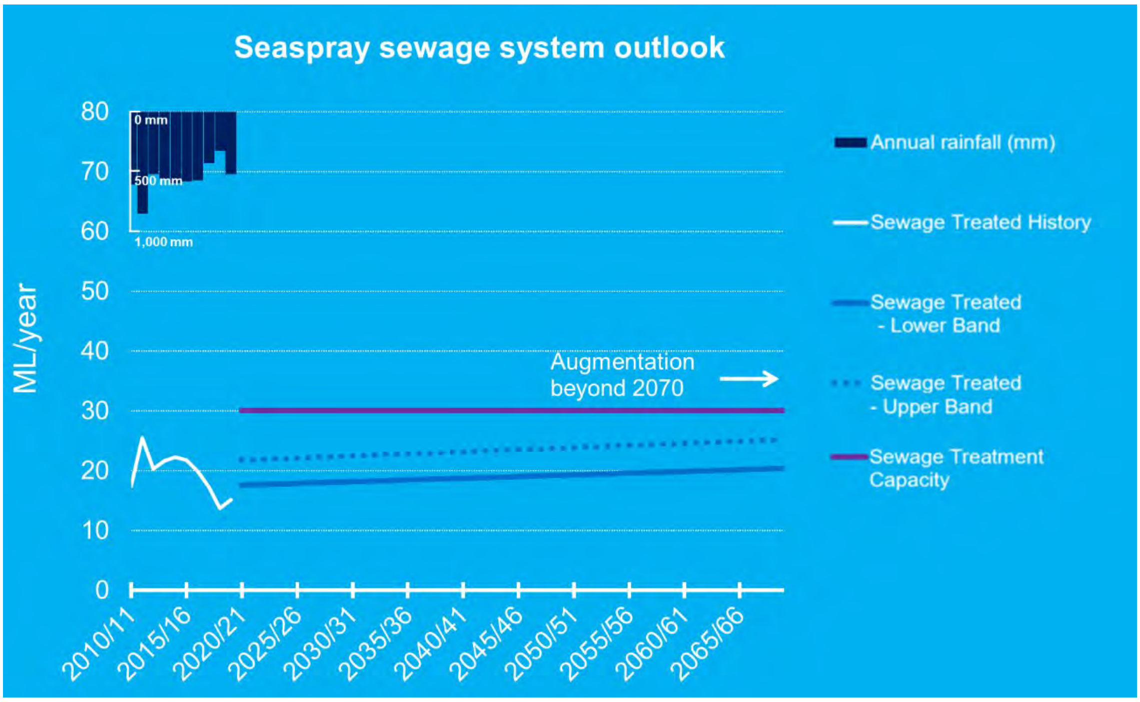


Figure 96 Seaspray sewage system outlook

Stratford

Overview of the sewer system

Stratford is located in the north-east of our service area, approximately 15 kilometres north of Sale. The town is serviced by the Stratford sewage treatment lagoons.

In 2021, the Stratford sewer system serviced 933 residential customers and 66 non-residential customers. The estimated population served was 1,982 people. The catchment is mostly domestic with some light commercial, industrial and public use zones. The average sewage inflow to the Stratford treatment plant is 111 ML per year. The maximum annual treated sewage volume in the past five years was 122 ML per year.

Figure 97 Location of Stratford sewer system

A breakdown of the previous six years of volumes in the sewage system is presented below.

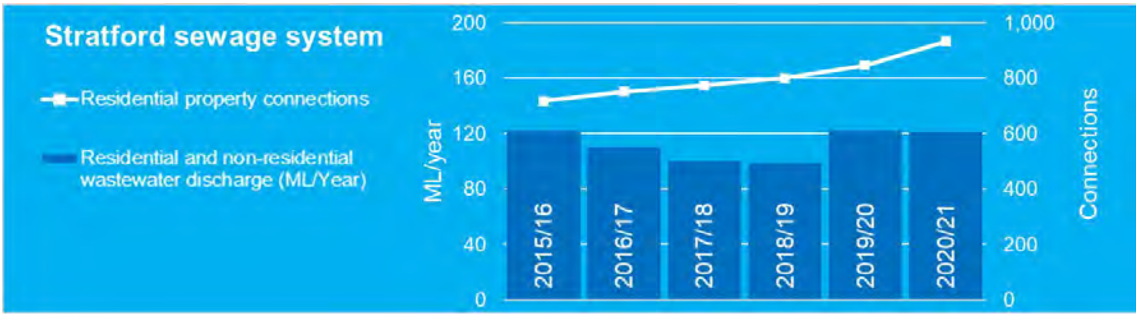


Figure 98 Previous six years sewage volumes for Stratford sewage system

The Stratford sewerage network is predominantly a gravity system. The Stratford sewage treatment plant comprises of two lagoons. The first is a facultative lagoon, where natural biological treatment takes place to stabilise sewage. In the second lagoon, treated sewage is stored over winter and recycled for summer irrigation. The Stratford sewage treatment plant has a treatment capacity of 172 ML per year.

The resulting treated effluent from the Stratford sewage treatment plant is Class C and is re-used by our Gippsland Regional Agribusiness for irrigation of farmland.

Figure 99 Stratford sewage treatment lagoons

Over the past five years the average annual reuse volume has been 123 ML per year. All treated sewage that is recycled must comply with Environment Protection Authority standards.

There has been a single emergency discharge of partially treated effluent from this site since our 2017 Urban Water Strategy which occurred during October and November in 2021. Treated effluent from the winter storage was released overland from the southern end of our property into the Deep Creek which is an ephemeral creek and then into the Avon River.

The discharge was required to provide capacity in the winter storage. This need was the result of an exceptional sequence of peak rainfall events that reduced summer irrigation capacity due to saturation of pasture. These discharges were in breach of our EPA licence for the site. Throughout the discharge periods, a comprehensive monitoring program was completed in the receiving waters to monitor for potential impacts. Careful management of discharge flows achieved the desired lagoon levels whilst also ensuring discharge has caused no significant or long term impacts on the water quality in the receiving environment.

The *West Gippsland Waterway Strategy 2014-2022* (West Gippsland Catchment Management Authority, 2014) identifies the Avon River at Stratford as a priority reach for reduction of threat to waterway values. The work program for the Waterway Strategy addresses the following threats for this management unit specific to this reach: flow stress, incision, loss of large wood, reduced riparian large trees, reduced riparian width and sedimentation.

For a map of the key elements of the system please refer to Appendix D and for a diagram of the sewage treatment process please refer to Appendix E. Alternatively you can visit our online Urban Water Strategy interactive map at www.gippswater.com.au/uws and search for any particular town.

Sewer system outlook and addressing future needs

Modest growth in sewage volumes is forecast for the Stratford system with growth in this system constrained by the number of lots able to be developed within our sewer service area. The outlook shown in Figure 100 forecasts the earliest time for augmentation is 2060/61 and the latest time for augmentation beyond the 50-year outlook period. We plan to continue to assess the outlook for this system on a five-yearly basis.

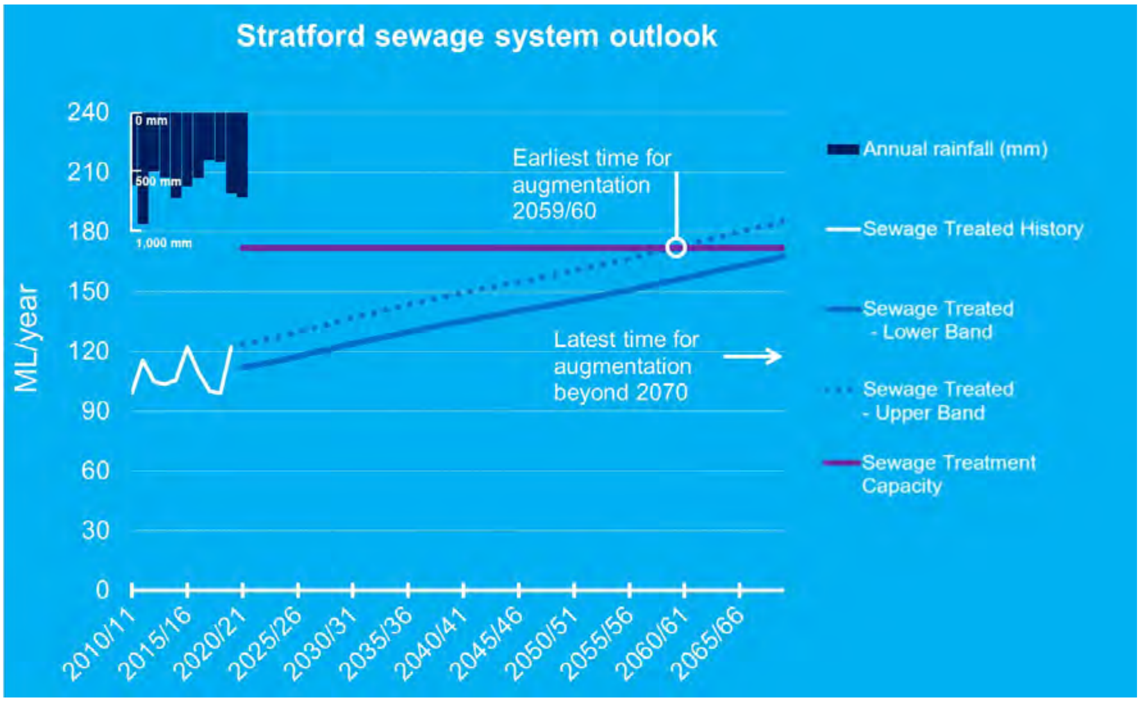


Figure 100 Stratford sewage system outlook

Warragul

Overview of the sewer system

Warragul is located in the west of our service area, approximately 100 kilometres southeast of Melbourne. The town of Warragul is serviced by the Warragul mechanical sewage treatment plant.

Figure 101 Location of Warragul sewer system

In 2021, the Warragul sewer system serviced 7,465 residential customers and 810 non-residential customers. The estimated population served was 16,493 people. The catchment is mostly domestic with some light commercial, industrial and public use zones. The average sewage inflow to the Warragul treatment plant is 1,775 ML per year.
The maximum annual treated sewage volume in the past five years was 2,198 ML per year.

A breakdown of the previous six years of volumes in the sewage system is presented below.

Figure 102 Previous six years sewage volumes for Warragul sewage system

The Warragul sewerage network is predominantly a gravity system. Warragul sewage treatment plant is a mechanical treatment facility. Before sewage enters the plant, screens and grit systems remove large solids, grits and oils. In the first stage of treatment, bacteria (biological processes) help break down organic material and nutrients into other forms which can then be easily separated into solids or clear liquid.

In the second stage, mechanical settling basins, called clarifiers, aid in particles sinking and separating from liquid sewage so that solids can be removed. Thickened solids are dewatered and discharged to bins and transported for composting. Gippsland Regional Organics is our EPA-licensed waste treatment and composting facility located at our

Dutson Downs property. In the final stage, ultra-violet radiation is used to reduce the bacteria in the treated effluent before it is released to the environment. The Warragul sewage treatment plant has a treatment capacity of 2,478 ML per year.

Figure 103 Warragul sewage treatment plant

The resulting treated effluent from the Warragul sewage treatment plant is Class B and is released to the environment via Hazel Creek, which is a tributary of the Moe River. All treated sewage that is recycled must comply with Environment Protection Authority standards.

The *West Gippsland Waterway Strategy 2014-2022* (West Gippsland Catchment Management Authority, 2014) identifies Hazel Creek as a priority reach for reduction of threat to waterway values. The work program for the Waterway Strategy addresses the following threats for this management unit specific to this reach: poor water quality, reduced riparian large trees and reduced riparian width.

For a map of the key elements of the system please refer to Appendix D and for a diagram of the sewage treatment process please refer to Appendix E. Alternatively you can visit our online Urban Water Strategy interactive map at www.gippswater.com.au/uws and search for any particular town.

Sewer system outlook and addressing future needs

Growth in sewage volumes in the Warragul system is forecast to be significant and is shown in Figure 104. The 2017 Urban Water Strategy (UWS) forecast that plant capacity would be exceeded by 2029, however increased rates of residential growth in this system have brought forward the earliest time for augmentation to 2024/25.

Since the 2017 UWS we have developed a staged, 40-year strategy to service growth in the Warragul system to 2060. In Price Submission 2023-28 we'll be upgrading aeration and dewatering systems at the site to increase plant treatment capacity. In Price Submission 2028-33 we'll pursue further significant aeration augmentation to further increase the capacity of the plant in order to service growth to 2045. Beyond 2045 significant works will be required with a new treatment process.

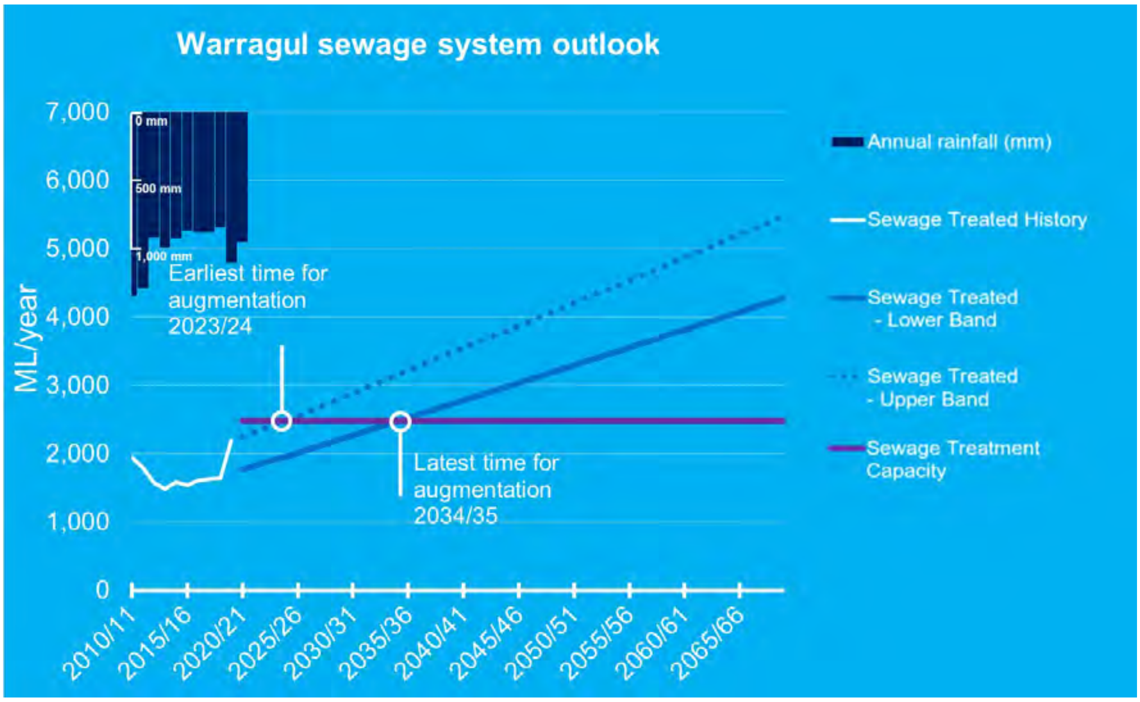


Figure 104 Warragul sewage system outlook

Action 18 – Warragul sewage

Plan and deliver augmentations to increase Warragul sewage treatment plant capacity.

Willow Grove

Overview of the sewer system

Willow Grove is a small town located in the northwest of our service area, located approximately 15 kilometres northwest of Moe. The town is serviced by the Willow Grove sewage treatment lagoons.

In 2021, the Willow Grove sewer system serviced 130 residential customers and eight non-residential customers. The estimated population served was 328 people. The catchment is mostly domestic with some light commercial and public use zones. The average sewage inflow to the Willow Grove treatment plant is 20 ML per year. The maximum annual treated sewage volume in the past five years was 21 ML per year.

Figure 105 Location of Willow Grove sewer system

A breakdown of the previous six years of volumes in the sewage system is presented below.

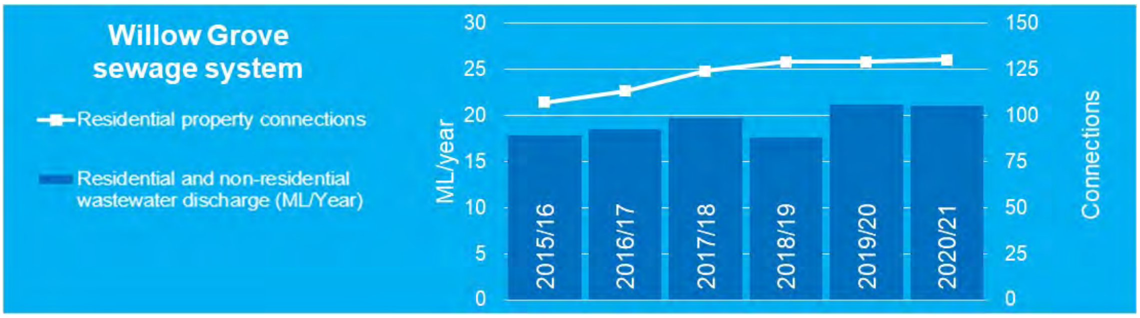


Figure 106 Previous six years sewage volumes for Willow Grove sewage system

The Willow Grove sewerage network is predominantly a gravity system. The Willow Grove sewage treatment plant comprises of three lagoons. The first is a facultative lagoon, where natural biological treatment takes place to stabilise sewage. In the second lagoon, natural disinfection reduces the pathogenic bacteria. The treated sewage is then moved to the winter storage and recycled for summer irrigation. The Willow Grove sewage treatment plant has a treatment capacity of 32 ML per year.

Figure 107 Willow Grove sewage treatment lagoons

The resulting treated effluent from the Willow Grove sewage treatment plant is Class C and is re-used under a private third-party arrangement for irrigation of farmland. Over the past five years the average annual reuse volume has been 14 ML per year. All treated sewage that is recycled must comply with Environment Protection Authority standards.

For a map of the key elements of the system please refer to Appendix D and for a diagram of the sewage treatment process please refer to Appendix E. Alternatively you can visit our online Urban Water Strategy interactive map at www.gippswater.com.au/uws and search for any particular town.

Sewer system outlook and addressing future needs

Low growth in sewage volumes is forecast for the Willow Grove system with growth in this system constrained by the number of lots able to be developed within our sewer service area. The outlook shown in Figure 108 indicates that sewage volumes will be maintained below the 32 ML upper limit treatment capacity for the Willow Grove Plant. We plan to continue to assess the outlook for this system on a five-yearly basis, including monitoring our capacity to discharge to land, as this is a significant factor for treatment capacity at this site.

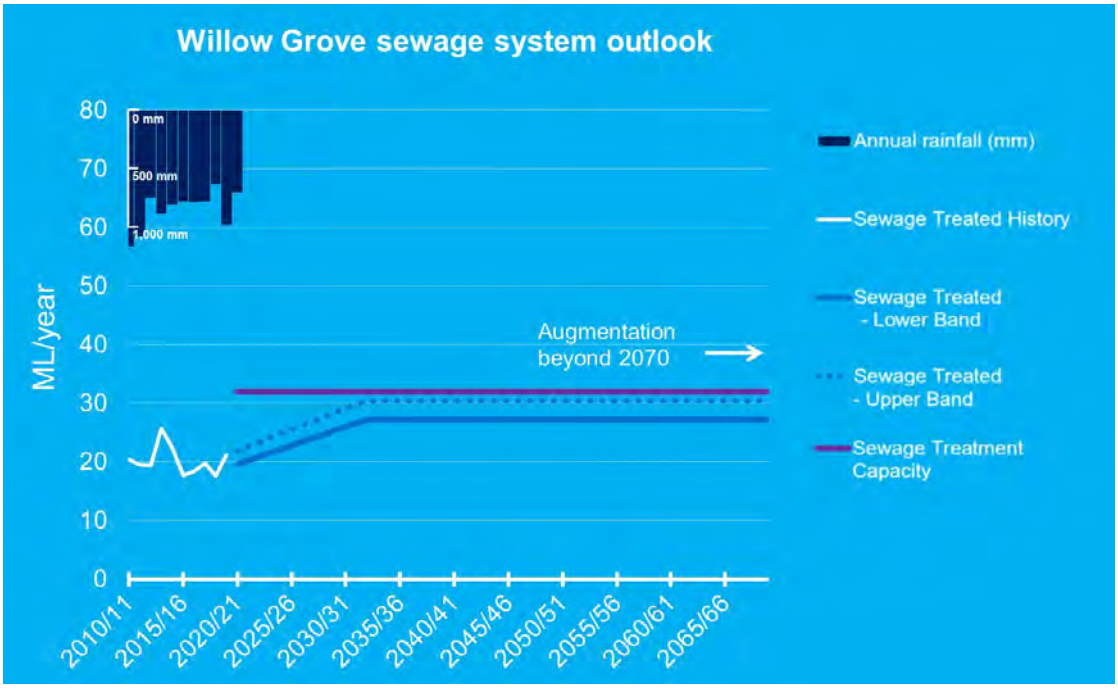


Figure 108 Willow Grove sewage system outlook

Our industrial sewer systems

Overview of the sewer system

We operate two dedicated industrial wastewater systems: the Gippsland Water Factory industrial wastewater treatment plant and the Saline Water Outfall Pipeline.

Gippsland Water Factory industrial wastewater treatment plant
Opal Australian Paper is the sole customer of our industrial wastewater treatment plant. The facility comprises two treatment plants sharing common infrastructure: a domestic sewage treatment process (for residential, non-residential and all industrial other than Opal Australian Paper) and an industrial wastewater treatment process (to service wastewater treatment for Opal Australian Paper).

The average inflow for Opal Australian Paper to the Water Factory is 5,355 ML per year. The maximum annual treated wastewater volume in the past five years was 5,726 ML per year.

A breakdown of the previous six years of volumes in this system is presented below.

Figure 109 Previous six years sewage volumes for Gippsland Water Factory industrial system

Before entering the treatment plant, wastewater is stored in pre-treatment storages where metering and sampling is conducted. Some pre-treatment occurs at this step including grit removal. There are also two larger storage lagoons reserved for pre-treatment storage during emergency events.

Once in the industrial side of the plant, flows are balanced using a tank and set of booster pumps to maintain consistent flow to the first stage of treatment in the anaerobic reactors. The anaerobic reactors conduct primary treatment of the industrial wastewater. There are two anaerobic reactors at the site which operate in parallel. Yoghurt, septic sludge and domestic waste sludge are all added to aid in the biological treatment. From the anaerobic reactor, the wastewater is pumped to the membrane bioreactor prefilters for removal of residual solids before entering the membrane bioreactor (Figure 110). In the membrane bioreactor nutrients, bacteria, protozoa and viruses are removed.

The facility typically operates with eight membrane cells online for industrial treatment. Subsequent filtrate is sent to the Regional Outfall System and on to our Dutson Downs industrial wastewater lagoons for further biological treatment and then released to the environment via ocean discharge. All releases must comply with Environment Protection Authority standards.

Figure 110 View across the top of the Gippsland Water Factory membrane bioreactor

The Gippsland Water Factory industrial system treatment capacity is highly dependent on the composition of the incoming wastewater. Typically the treatment system operates at a capacity of 16 ML per day or 5,840 ML per year. The industrial treatment system provides Class B treatment.

Saline Water Outfall Pipeline

The Saline Water Outfall Pipeline system simply conveys highly saline wastewater from power stations Yallourn W and Loy Yang A and B in the Latrobe Valley to the ocean. There is no treatment process. The pipeline has a capacity of 35 ML per day or 12,775 ML per year. Saline water is released to the environment via ocean outfall located 550 metres seaward from the shoreline. The water is released by a diffuser which is 85 metres in length and in a water depth of approximately 7.5 metres at low tide to assist dilution with the surrounding seawater. Releases are in accordance with a discharge licence issued by the Environment Protection Authority.

Figure 111 Previous six years discharge volumes for the Saline Water Outfall Pipeline

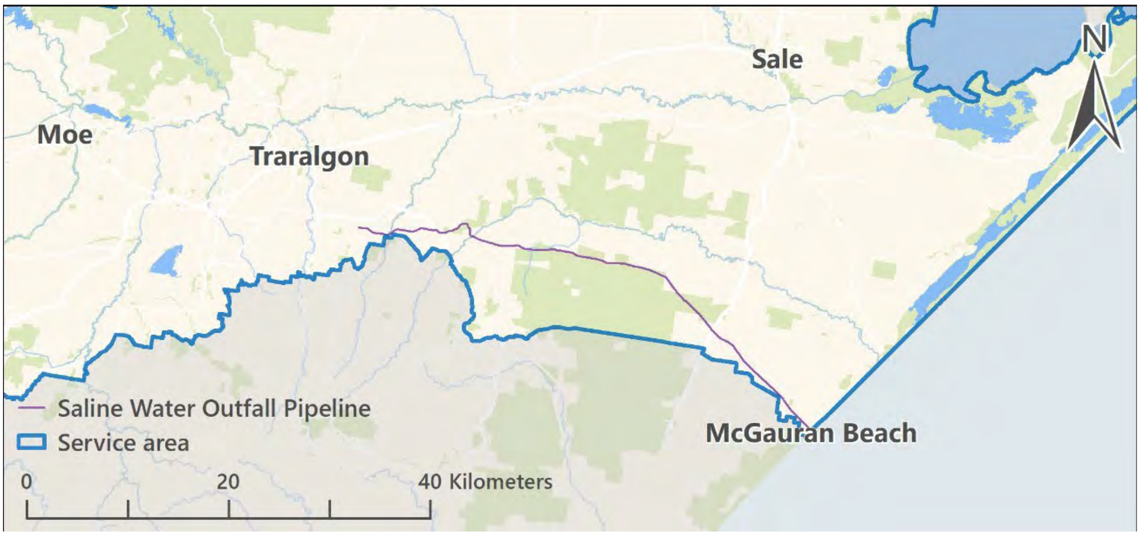


Figure 112 Alignment of the Saline Water Outfall Pipeline from Latrobe Valley to McGauran Beach

Sewer system outlook and addressing future needs

Gippsland Water Factory industrial wastewater treatment plant

Capacity for the industrial component of the Gippsland Water Factory is sufficient to meet incoming wastewater volumes from Opal Australian Paper. The outlook for the Gippsland Water Factory industrial system is governed by the service contract we have in place with Opal Australian Paper. Any changes to the outlook for the treatment plant will be in consultation with Opal Australian Paper.

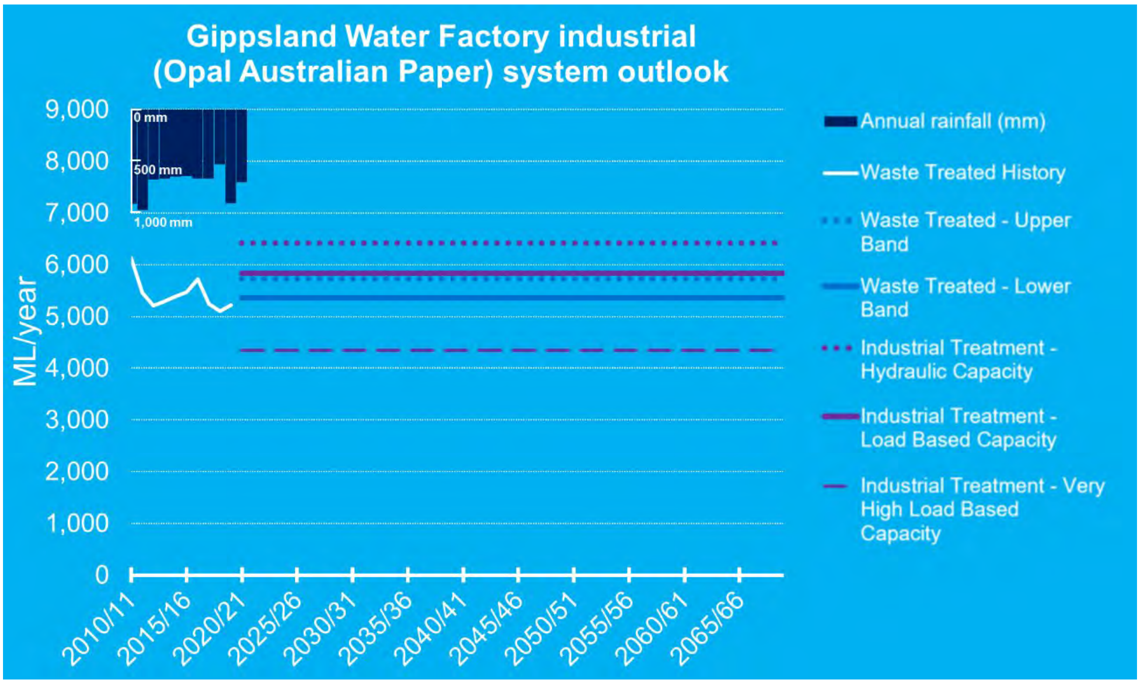


Figure 113 Gippsland Water Factory industrial (Opal Australian Paper) wastewater system outlook

Figure 113 above shows three capacity scenarios for the Gippsland Water Factory industrial system.

Load based capacity reflects typical operation of the industrial treatment system, where wastewater received by the plant is in accordance with the service contract we have in place with Opal Australian Paper.

Very high load capacity is reflective of event-based treatment capacity typically in the order of weeks, rather than an annual treatment capacity. These events are typically the result of very high contaminant load flows being delivered by Opal Australian Paper and these events are managed with local storages.

The hydraulic capacity is the treatment capacity of the plant when operated with low contaminant-load wastewater, different to the wastewater currently released by Opal Australian Paper.

Saline Water Outfall Pipeline

The capacity of the Saline Water Outfall Pipeline is fixed at the pipe capacity of 35 ML per day or 12,775 ML per year. The forecast demand for the pipeline is expected to decrease over time with the planned closure of the Latrobe Valley power stations and an indicative forecast of volumes discharged to the pipeline has been shown in Figure 114. An upper band forecast has been included to represent the scenario of no power station closures.

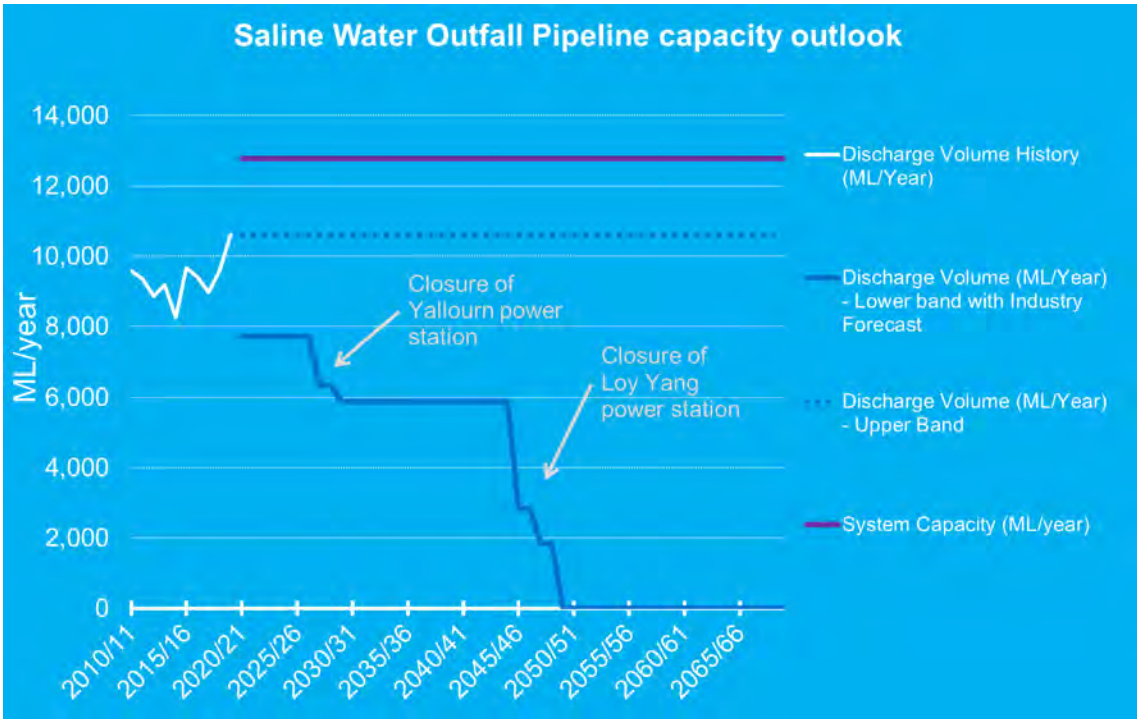


Figure 114 Saline water outfall pipeline capacity outlook

Action plan

Throughout our strategy we have identified the actions for the next five years for how we will work together with our Traditional Owners, engage with our stakeholders, continue our water efficiency and conservation programs and address the future needs of our water and sewer systems.

Our actions are presented in Table 16 below.

Table 16 Our Action plan

	Theme or System	Action	Timeframe	Page Number
Action 1	Partnering with our Traditional Owners	Develop and implement a Moondarra On-Country Plan, which focuses on Traditional Owner access to land and water, increasing opportunities to realise objectives for cultural values and uses and building the cultural awareness of our staff and the community.	To be progressed during the 2022-27 Urban Water Strategy period	Page 3
Action 2	Partnering with our Traditional Owners	Provision of reticulated water to Knob Reserve, a significant meeting place for the Gunaikurnai Community. Reticulated water will support cultural events at the site and support sustainable use of water and health outcomes for Community.	To be progressed during the 2022-27 Urban Water Strategy period	Page 3
Action 3	Partnering with our Traditional Owners	Pilot the application of the *'Multiple Benefits Of Ownership And Management Of Water By Traditional Owners Framework'** on key projects.	To be progressed during the 2022-27 Urban Water Strategy period	Page 3

	Theme or System	Action	Timeframe	Page Number
Action 4	Partnering with our Traditional Owners	Integrate the *'Multiple Benefits Of Ownership And Management Of Water By Traditional Owners Framework'** into our planning frameworks to ensure quadruple bottom line assessments are integrated into business decisions.	To be progressed during the 2022-27 Urban Water Strategy period	Page 3
Action 5	Engaging with our stakeholders	Build on our existing close relationship with West Gippsland Catchment Management Authority (WGCMA) to better identify opportunities to collaboratively achieve outcomes that benefit each other's objectives and values, and to foster an enhanced mutual understanding of our respective challenges.	Ongoing	Page 21
Action 6	Engaging with our stakeholders	Continue to work with local councils and government to embed better water conservation planning for greenfield development.	Ongoing	Page 21
Action 7	Water efficiency and conservation	Continue to deliver our Non-revenue Water Action Plan.	Ongoing	Page 36
Action 8	Water efficiency and conservation	Expand our activities that support the government's Target Your Water Use program including continuing with the Schools Water Efficiency program, facilitating any applicable grant schemes for water efficiency improvements in homes and businesses, and expanding our community education programs.	Ongoing	Page 36

	Theme or System	Action	Timeframe	Page Number
Action 9	Stakeholder engagement	Continue to work closely with our Gippsland Integrated Water Management (IWM) Forum partners to identify and deliver feasible IWM initiatives that benefit the security of our water resources, the liveability of our urban landscapes and the health of our waterways and the broader environment.	Ongoing	Page 36
Action 10	Briagolong water	Drill a production bore in the deeper aquifer at Briagolong, buy a water licence and upgrade the water treatment process at our Briagolong water treatment plant.	2023/24	Page 56
Action 11	Latrobe water	Continue working with the Department of Environment, Land, Water and Planning (DELWP) and other agencies to plan and deliver on directions for the Latrobe basin set by the *Central Gippsland Region Sustainable Water Strategy* (CGRSWS) and the Latrobe Valley Regional Rehabilitation Strategy.	Ongoing – subject to regulator timeframes	Page 64
Action 12	Sale water	Continue to work with Southern Rural Water (SRW) and DELWP to better understand the Boisdale aquifer and its future sustainable use.	Ongoing – subject to regulator timeframes	Page 81
Action 13	Seaspray water	Explore alternative flow sharing arrangements for the Merriman Creek Bulk Entitlement.	2022/23	Page 85

	Theme or System	Action	Timeframe	Page Number
Action 14	Tarago water	Acquire a 2 GL yield Bulk Entitlement to the Yarra-Thomson Pool to secure Warragul and Drouin's future water.	2023/24	Page 90
Action 15	Heyfield sewage	Develop an augmentation strategy for servicing future growth at the Heyfield sewage treatment plant.	2026/27	Page 112
Action 16	Mirboo North sewage	Deliver project for additional irrigation capacity at the Mirboo North sewage treatment plant site to allow greater re-use by our agribusiness operation.	2023/24	Page 123
Action 17	Neerim South sewage	Develop an augmentation strategy for servicing future growth at the Neerim South sewage treatment plant.	2026/27	Page 127
Action 18	Warragul sewage	Plan and deliver augmentations to increase Warragul sewage treatment plant capacity.	First stage by 2026/27	Page 141

* The *'Multiple Benefits Of Ownership And Management Of Water By Traditional Owners Framework'* was prepared for the Gunaikurnai Land and Waters Aboriginal Corporation on behalf of the *Central and Gippsland Region Sustainable Water Strategy* (CGRSWS) Traditional Owner Partnership (GLaWAC, Bunurong Land Council Aboriginal Corporation, Wadawarrung Traditional Owners Aboriginal Corporation and the Wurundjeri Woi-wurring Cultural Heritage Aboriginal Corporation).

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Acronyms

AHD	Australian Height Datum
BE	Bulk Entitlement
BGA	Blue Green Algae
BOM	Bureau of Meteorology
CFA	Country Fire Authority
CGRSWS	Central and Gippsland Region Sustainable Water Strategy
CMA	Catchment Management Authority
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DAF(F)	Dissolved Air Floatation (and Filtration)
DELWP	Department of Environment, Land, Water and Planning
DPP	Drought Preparedness Plan
DRP	Drought Response Plan
ENSO	El Nino Southern Oscillation
EPA	Environment Protection Authority
ESC	Essential Services Commission
GCM	Global Climate Model
GL	Gigalitre, or 1,000,000,000 (billion) litres
GMA	Groundwater Management Area
GRO	Gippsland Regional Organics
GW	Gippsland Water
GWF	Gippsland Water Factory
Ha	Hectares
HVP	Hancock Victorian Plantations
IAP2	International Association for Public Participation
IDEA	Intermittent Decanting Extended Aeration
IOD	Indian Ocean Dipole
IPCC	Intergovernmental Panel on Climate Change
IPO	Inter-decadal Pacific Oscillation
ISC	Index of Stream Condition
IWM	Integrated Water Management
km	Kilometres
LOS	Level of Service
LTWRA	Long Term Water Resource Assessment
MBR	Membrane Bioreactor
MID	Macalister Irrigation District
ML	Megalitre, or 1,000,000 (million) litres
MW	Melbourne Water
NRW	Non-revenue water
PCV	Permissible Consumptive Volume
PET	Potential Evapotranspiration

PFS	Poly Ferric Sulphate
PVC	Poly Vinyl Chloride
PWSR	Permanent Water Saving Rules
RCP	Representative Concentration Pathway
RO	Reverse Osmosis
ROS	Regional Outfall Sewer
SAM	Southern Annular Mode
SCADA	Supervisory Control and Data Acquisition
SEACI	South Eastern Australian Climate Initiative
SOI	Southern Oscillation Index
SRW	Southern Rural Water
STP	Sewage Treatment Plant
STR	Sub-Tropical Ridge
SWEP	Schools Water Efficiency Program
SWOP	Saline Water Outfall Pipeline
UV	Ultra Violet
UWS	Urban Water Strategy
VAGO	Victorian Auditor General's Office
VEWH	Victorian Environmental Water Holder
VicWACI	Victorian Water and Climate Initiative
WGCMA	West Gippsland Catchment Management Authority
WSDS	Water Supply Demand Strategy
WSPA	Water Supply Protection Area
WTP	Water Treatment Plant
WWTP	Waste Water Treatment Plant (same as STP)

Glossary

allocation	Water that is actually available to use or trade in any given year, including new allocations and carryover. The water that is actually in the dam in any given year is allocated against water shares. The seasonal allocation is the percentage of water share volume available under current resource conditions, as determined by the resource manager.
alternative water	Water not supplied from a traditional drinking water catchment and includes sources such as rainwater, stormwater or recycled water.
assets	Resources that provide benefit. This includes, for example, infrastructure such as treatment plants, pipes and pumps, water assets such as dams, bores and wetlands, and community assets such as sporting facilities, public gardens and street trees. Natural assets are assets of the natural environment, for example waterways and vegetation, also known as natural capital.
aquifer	A layer of underground sediments which holds groundwater or allows water to flow through it.
augmentation	Increase in size and/or number, for example of assets in a water supply system.
basin (river basin)	Area of land which a river and its tributaries drain.
bulk entitlement	The right to water held by water corporations and other authorities defined in the *Water Act 1989*. The bulk entitlement defines the amount of water in a river or storage to which an authority is entitled and the conditions under which it may be taken.
cap	An upper limit for the diversion of water from a waterway, catchment, basin or aquifer.
catchment	An area where water falling as rain is collected by the landscape, eventually flowing to a body of water such as a creek, river, dam, lake, ocean, or into a groundwater system.
Catchment management authorities (CMAs)	Statutory bodies established under the *Catchment and Land Protection Act 1994*. CMAs have responsibilities under the *Catchment and Land Protection Act 1994* and the *Water Act 1989* which include river health, regional and catchment planning and coordination, and waterway, floodplain, salinity and water quality management.
climate	The average weather over time which occurs in a given location. Weather is day-to-day individual events which make up climate. These are partially determined by the climatic systems and local conditions. Climate is what you expect; weather is what you get.
climate change	The change in climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods.
climate variability	The mean state and other statistics (such as standard deviations, the occurrence of extremes, etc.) of the climate on all spatial and temporal scales beyond that of individual weather events. Variability may be due to natural internal processes within the climate system (internal variability), or to variations in natural or anthropogenic external forcing (external variability).
consequence	The impact arising from a climate change incident, e.g. water operators become severely dehydrated in a heatwave.
consumptive bulk entitlement	A water entitlement that permits the holder to use the water taken under the entitlement for the purposes of consumption.
Country	Aboriginal culture revolves around relationships to the land and water. For Traditional Owners, Country is a part of who they are, just as they are a part of it.

critical human needs	The amount of water required to supply Stage 4 restricted demand in urban areas, supply domestic and stock needs and operate the distribution system to deliver that water.
community	Includes individuals, public and private landholders, community groups and business owners.
dead storage	Water in a storage that is below the lowest constructed outlet.
desalination	Removing salt from water sources, normally for drinking purposes.
diversions	The removal of water from a waterway.
drinking (potable) water	Drinking water is water that is intended for human consumption or for purposes connected with human consumption, such as the preparation of food or the making of ice for consumption or for the preservation of unpackaged food, whether or not the water is used for other purposes.
Drought response plan (DRP)	Used by urban water corporations to manage water shortages, including implementation of water restrictions.
emission	The production and discharge of something, especially gas or radiation. Greenhouse gas emissions in particular are gases released from human activities that strengthen the greenhouse effect by trapping heat in the atmosphere, including carbon dioxide, methane, nitrous oxide and fluorinated gases.
environmental entitlement	A (bulk) water entitlement that permits the use of water in a river or storage for a purpose that benefits the environment.
environmental flow	The streamflow required to maintain appropriate environmental conditions in a waterway.
environmental water	Water to support environmental values and ecological processes.
floodplain	Low-lying land adjacent to a river or stream with unique ecosystems dependent on inundation from flood events.
groundwater	All subsurface water, generally occupying the pores and crevices of rock and soil.
Groundwater management area (GMA)	An area where groundwater resources of a suitable quality for irrigation, commercial or domestic and stock use have been developed (or have the potential to be developed) and warrant careful management.
Groundwater management plan	A management plan prepared for a water supply protection area to manage the groundwater resources of the area.
Groundwater management unit (GMU)	A discrete area – such as a groundwater management area (GMA), a water supply protection area (WSPA) or an unincorporated area – identifying an aquifer or group of aquifers.
hazard	A potential or contained threat.
incidents	Occurs when an event leads to a consequence, e.g. a flood event becomes an incident when it destroys valuable crops that were ready for harvest.
indirect potable re-use	Intentional introduction of treated alternative water into an environmental buffer e.g. a storage reservoir, a water feeding into a storage reservoir or a groundwater aquifer.
inflows	Water flowing into a storage.
Integrated water management (IWM)	A collaborative approach to planning that brings together all elements of the water cycle including sewage management, water supply, stormwater management and water treatment, considering environmental, economic and social benefits.

in stream	The component of a river within the river channel, including pools, riffles, woody debris, the river bank and benches.
irrigation district	An area declared under the *Water Act 1989* supplied with water by channels and pipelines used mainly for irrigation purposes.
likelihood	The probability that an event or incident might happen, e.g. heatwaves will be more common (likely) because of climate change.
Millennium Drought	The drought period that occurred in Victoria (and other parts of south-eastern Australia) from 1997 to 2009.
non-residential consumption	Typically represents water usage by local business and schools.
non-revenue water (NRW)	Water that has been prepared for consumption and is "lost" before it reaches the customer. Losses can be real, occurring within the treatment plan or the reticulation network, or apparent losses due to metering inaccuracies or water theft.
order (ordering of water)	The advance notification given to the storage operator by individual entitlement holders to enable the storage operator to regulate water flows so that all entitlement holders' water needs can be delivered at the agreed time.
passing flow	Flows that must be allowed to pass a dam or weir before water can be harvested for later use.
Permissible consumptive volume (PCV)	The total amount of water that can be taken in a water management area under a Ministerial declaration. PCVs can apply to surface water, groundwater or both.
potable	Water of suitable quality for drinking.
recharge (to groundwater)	The process where water moves downward from surface water to groundwater due to rainfall infiltration or seepage/ leakage.
recycled water	Water derived from sewerage systems or industry processes that is treated to a standard appropriate for its intended use. Also known as reclaimed water or wastewater reuse.
reliability of supply	The frequency with which water that has been allocated under a water entitlement is expected to be supplied in full.
reservoir	Natural or artificial dam or lake used for the storage and regulation of water.
residential consumption	Water usage in households, including private gardens.
resilience	The capacity of a community, business, or natural environment to prevent, withstand, respond to, and recover from disruption.
restrictable (unrestrictable) demand	Demand for water occurs as a result of customers wishing to use water for a range of purposes. In a residential setting this includes inside uses like drinking, cooking, showering, clothes washing and toilet flushing, as well as outside uses like garden watering, car washing and pool filling. Water restrictions that can be applied under our by-law set out rules that apply to some uses, such as setting times for such uses or banning them entirely. The portion of total demand to which the rules apply is called "restrictable demand" while the remaining portion is called "unrestrictable demand". Generally speaking, restrictable demands are outside uses while unrestrictable demands are inside uses.
restricted (unrestricted) demand	Demand is the volume of water desired by customers to meet their needs at the time they need it and at the required flow. Unrestricted demand in the context of this Urban Water Strategy means the full demand sought, subject only to the constraints of Permanent Water Saving Rules. If it is anticipated that water supply may fall short of meeting unrestricted demand, such as during drought, as a water corporation we are able to apply and enforce water restrictions under our by-law. The by-law sets out 4 stages of increasingly severe restrictions.

	Restricted demand is the resulting demand for water when a stage of water restrictions is in force.
reticulation	The network of pipelines or channels used to deliver water to end users.
risk	The chance of something happening that will have an impact on an objective, system, sector, asset, activity or community. A risk is often discussed in terms of the event (for example, a weather event or climatic change), the consequence of the event (positive or negative), and the likelihood it will happen. Residual risk is the remaining chance of something happening after action has been taken to reduce the risk.
river	Large stream of water flowing to sea or lake or marsh or another river.
run-off	Precipitation or rainfall that flows from a catchment into streams, lakes, rivers or reservoirs.
Seasonal allocation	The volume of water available to an entitlement holder for a water year, as determined by the relevant water corporation and often expressed as a percentage of the entitlement volume. Sometimes shortened to 'allocation'.
sewage	Wastewater produced from households, businesses and industry.
sewerage	The network of pipes, pumps and equipment that transfers all our wastewater from our homes and businesses to a treatment plant.
Statement of Obligations	Statements made under section 41 of the *Water Industry Act 1994* that specify the obligations of Victoria's water corporations in relation to the performance of their functions and the exercise of their powers.
stormwater	Water that runs off impervious surfaces like roads and footpaths when it rains, that would have seeped into the ground and been taken up by vegetation before urban development occurred. Unless rainwater is captured, it also contributes to stormwater.
surface water	Freshwater found above ground in rivers, wetlands and storages.
sustainable water strategies	Regional long-term planning documents legislated under the Water Act 1989, to address threats to, and identify opportunities to improve water security and river health outcomes.
threat	A hazard in a state that it is harmful to people, infrastructure or the environment.
Traditional Owners	People who, through membership of a descent group or clan, are responsible for caring for Country. Aboriginal people with knowledge about traditions, observances, customs or beliefs associated with a particular area. A Traditional Owner is authorised to speak for Country and its heritage.
wastewater	Water that has had its quality affected by human influence, deriving from industrial, domestic, agricultural or commercial activities.
Water corporations	Government owned organisations who provide a range of water services to customers within their service areas including water supply, sewage and trade waste disposal and treatment, water delivery for irrigation and domestic and stock purposes, drainage, and salinity mitigation services. Some water corporations have a regulatory function for the diversion of water from waterways and the extraction of groundwater. Formerly known as water authorities.
water cycle	The cycle of processes by which water circulates between the earth's oceans, atmosphere, and land, involving precipitation as rain and snow, drainage in streams and rivers, and return to the atmosphere by evaporation and transpiration.
water entitlement	The volume of water authorised to be taken and used (or stored) by an individual, water corporation or other authority. Water entitlements include bulk entitlements, environmental entitlements, water shares, surface water and groundwater licences.

water infrastructure	Facilities, services and installations needed for the functioning of a water system.
water market	Market in which the trade of entitlements and allocations is allowed under certain conditions.
water quality	Refers to the chemical, physical, biological, and radiological characteristics of water. It is a measure of the condition of water relative to the requirements of one or more biotic species and or to any human need or purpose.
water security	The capacity of a population to access adequate quantities of acceptable quality water to sustain life, socio-economic development and human wellbeing.
water sector	The broad range of entities with a stake or role in water management. For example, water corporations, catchment management authorities, local government and environmental water holders.
Water supply protection area (WSPA)	An area declared under the Water Act 1989 to protect the groundwater and/or surface water resources in the area. Once an area has been declared, a water management plan is prepared.
water systems	All sources of water supply including centralised and decentralised sources and structural or non-structural options, including planning, regulatory or pricing measures.
waterway	*The Water Act 1989* defines a waterway as a river, creek, stream, watercourse and a natural channel where water regularly flows, whether or not the flow is continuous.
wetlands	Inland, standing, shallow bodies of water, which may be permanent or temporary, fresh or saline.

Appendix A

Drought Preparedness Plan

Following the release of Water for Victoria in 2016, government has emphasised its expectations that water corporations plan into the future to not simply respond to drought, but to actively prepare for it. The Millennium Drought not only impacted upon the health of the environment and the economies of regions, but it has become accepted that it also impacted upon the wellbeing of the community. Across Victoria, sporting clubs were unable to play on local grounds as they dried up, street trees died and local places of recreation and relaxation lost their amenity as they became parched.

2017-19 saw east Gippsland affected by a drought that was for that region worse than the Millennium Drought and which culminated in the Black Summer fires. Our town of Briagolong and its groundwater resource were affected by that drought.

We undertake a range of activities to improve drought resilience and preparedness for our customers. These include:

1. Drought stress testing
2. Planning and delivery of Integrated Water Management (IWM) in partnership with other local agencies
3. Contingency planning such as outlined later in this document

Planning for drought also means opening the dialogue between water corporations, local councils and their communities to understand community values and expectations, identify the most valuable water reliant community assets, and find ways to ensure their protection during drought. This could mean planning potable water system security to provide sufficient water to these assets during plausible drought scenarios, or it could mean identifying alternative sources of fit for purpose water.

Parks and Gardens Water Restrictions Exemptions

Water for Victoria Action 5.1 states that water corporations will work with councils and communities to identify whether the community would support exemptions to water restrictions for a select number of high value community assets such as playing fields and parks. Providing for such an exemption may result in a higher level of restriction for residences to ensure water is available for community spaces, or alternatively it could result in the need to invest in supply systems with an associated community cost.

We specifically engaged on this topic with some customers stating that use of water for public facilities should not be prioritised over private use. It is interpreted that this primarily relates to sporting fields and that those who directly benefit should not be subsidised. We note though that we engaged a subset of the community and that this position needs further validation. In particular this feedback is at odds with feedback received in 2017 which showed strong support for us to work with councils and communities to select parks and ovals for drought proofing.

During engagement with councils on the 2017 UWS we sought advice on local councils' views of the priority areas in each town for water restriction exemptions. Some local councils provided advice as listed in Table 17. During development of this UWS we engaged with our local councils through the Gippsland IWM Forum at both executive and practitioner level. Following this Latrobe City Council opened discussion on opportunities to develop alternative water resources for irrigation of the valued sporting fields along the Waterhole Creek corridor in Morwell and we have committed to a feasibility study for reuse of filter backwash water from the nearby water treatment plant subject to government grant funding.

Table 17 Priority community assets for water restriction exemptions during drought

Local Government Area	Priority Community Assets for restriction exemptions
Baw Baw Shire	Bellbird Park Recreation Reserve, Drouin
	Trafalgar Recreation Reserve
	Drouin Recreation Reserve
	Dowton Park Recreation Reserve, Yarragon
	Western Park Reserve, Warragul
Latrobe City	Gaskin Park, Churchill
	Mathison Park, Churchill
	Apex Park, Moe
	Latrobe City Sports and Entertainment Complex, Morwell
	Town Common, Morwell
	Morwell Recreation Reserve
	Supply for filling of Kernot Lake, Morwell (historic supply from Energy Brix which is now shut)
	Traralgon Recreation Reserve
	Newman Park, Traralgon
	Waterhole Creek sporting reserves, Morwell

Some of these facilities are already irrigated from the potable water system. Both Baw Baw Shire and Latrobe City Councils have advised that the cost of potable water is a hindrance to adequate irrigation of some reserves. We already contribute to addressing this at the Bellbird Park Recreation Reserve in Drouin which is equipped with a sewerage reuse scheme that sources water from Drouin sewage treatment plant.

Wellington Shire Council has advised that for Sale in particular, Lake Guthridge has allowed them to set up extensive stormwater reuse systems. Parks and gardens irrigated with stormwater in Sale include:

1. Sale Botanic Gardens;
2. Stephenson's Park Recreation Reserve including the tennis and croquet clubs;
3. Lake Guyatt Environmental Playspace Picnic Area;
4. Little McMillan Park;
5. Victoria Park;
6. Sale 545 Primary School grounds;
7. Sale Oval; and
8. Gippsland Regional Sports Complex (not from Lake Guthridge but from an onsite pond).

Baw Baw Shire Council is currently constructing the Western Park stormwater reuse irrigation system in Warragul with DELWP co-funding and a smaller financial contribution from us. While there will continue to be case-by-case opportunities to retrofit reuse schemes within our towns, and we will continue to explore these with our IWM partners, we have also been taking a lead role at executive level with two other water corporations and DELWP through the *Central and Gippsland Region Sustainable Water Strategy* (CGRSWS) to better embed IWM at the planning level for new developments. This is a much more cost effective delivery means and will help ensure developers are more proactive in delivering new neighbourhoods with community open space and recreation facilities that are provided with long term reliable non-potable watering.

Cost of restrictions

Action 5.1 of Water for Victoria also states that the water industry will build a shared understanding of the costs of water restrictions. The aim of this exercise is to quantify the community cost of episodes of restrictions, with a view to weighing those costs against the more readily identifiable costs of augmenting water systems to increase supply. Imposing restrictions has been seen as a cheap way of balancing supply and demand during times of shortage when compared with building infrastructure to buffer droughts.

Ultimately the community pays either through drought proofing infrastructure delivery or through bearing water restrictions from time to time and the key is striking the right balance. DELWP undertook a study in 2017-18 in response to a Water for Victoria action to assess the community costs of water restrictions, but the results were based on work done in Canberra which has a different climate and demographic to our region and the outcomes need to be understood in that context.

It may be that with more comprehensive data on the true community costs of restrictions, the cost of infrastructure could be less than the cost of restrictions. We heard from our community that restrictions to stage 2 are acceptable, even more frequently than in the past and as set out in our level of service target, but that stage 4 restrictions should be avoided and reserved only for the worst of droughts.

We are already taking action to improve reliability and avoid restrictions in Warragul, Drouin, Briagolong and Seaspray with our other systems deemed currently resilient.

How do restrictions affect demand?

When designing restriction review points (the level in storage or other measure that guides us when considering imposing restrictions), and when undertaking yield modelling, assumptions need to be made as to the savings in demand expected under the 4 stages of water restrictions. This is a complex task that is made harder by the absence of data given that our region has a very limited history of restrictions. The expected efficacy of restrictions also depends on a range of matters including but not limited to the following:

1. Type of demand mix within the system, i.e. industrial, residential, rural residential, commercial and their associated proportions as the restriction rules affect each sector differently;
2. Local climate and soil types;
3. Existence of alternative supplies whether at a town or lot scale;
4. Ratio of base demand to restrictable demand; and
5. Demand hardening, or the degree to which demand recovers to pre-restriction levels after the lifting of restrictions. We have seen ongoing reductions in water use per household in the last 15 years averaged across our region. This is likely due to the penetration of water efficient fixtures and appliances (as evidenced by online surveys) as well as a cultural shift in water use habits. Accordingly it is quite possible that the restrictable component of demand (outside uses like garden and lawn watering) has already been voluntarily restricted and therefore future episodes of restrictions may have less effect than expected.

The efficacy of restrictions varies significantly around Victoria and as such there is no one set of demand reduction factors provided by government. We need to choose a set of factors for the savings expected under restrictions for the purpose of modelling and choosing review points. In the absence of better data, resulting from few recent incidences of water restrictions, we have chosen to continue to rely on factors used in the past UWS. The origin of these factors was the government's model Water Restriction By-Law of 2007. With the assumption that base demand for a system is 85% of average winter demand, restrictable demand is the balance of total demand for each month of the year. The adopted demand reduction factors apply to restrictable demand. Under each level of restriction, the expected reduction in restrictable demand is shown in Table 18.

Table 18 Expected reduction in total and restrictable demand under the four water restrictions stages

Level of water restrictions	Expected reduction in total demand (averaged over year)	Expected reduction in restrictable demand
1	2.5 %	14 %
2	8.0 %	44 %
3	12.0 %	67 %
4	17.5 %	98 %

Drought modelling

When preparing a system yield outlook for comparison against demand, the estimate of yield provides an indication of the level of average annual demand a water system can service while maintaining the target level of service. If that level of service target is anything other than 100% reliability, there will be times when supply is restricted. The level of service provides an indication of how often that is likely to occur, but does not explicitly indicate what happens during those times. We have adopted a minimum level of service that towns do not run dry during droughts and that critical human needs can be met. We have undertaken drought resilience modelling to determine our water systems' ability to meet this level of service. Taking a conservative approach in accordance with the *Guidelines for Assessing the Impact of Climate Change on Water Availability in Victoria (DELWP, 2020a)*, we've adopted a drought streamflow scenario that includes historic variability as well as droughts more severe than actually experienced.

We operate several “run-of-river” systems which means they divert water from a stream, treat it to potable standard, then supply to customers with relatively little storage for either raw or treated water. Understanding the impact of short term droughts is important for these systems. Systems like Latrobe with large storage are better equipped to buffer such droughts. Therefore, our models for run-of-river systems as well as some large storage systems, now run at a daily timestep. This then allows a daily streamflow record to be analysed at a fine temporal resolution for shortfalls, rather than averaging flows out over a month long timestep.

The choice of streamflow record is important, and we opted to use the long term records, adjusted seasonally in accordance with the guidelines to reflect the statistical characteristics of the post 1997 period. This method retains the variability of the long term record, but scales all flows pre 1997 to reflect the step change in climate, including the change in seasonality of flows. This means that historic droughts like 1967/68 and 1982/83 are scaled to become worse droughts and may then become the governing design drought, worse for some catchments than the 2006/07 record low streamflow year. This provides each system with a drought “stress test”.

None of our systems shortfall at current levels of demand with restrictions under the post 1997 scenario. Note the Latrobe system drought resilience assessment, similar to the yield outlook, does not take into account mine rehabilitation supply to Hazelwood as this supply can be turned off during times of drought.

Other events that may give rise to shortages

Events that require the use of water restrictions as a management tool are not confined to a lack of water. During a water quality event, it is quite possible that the flow rate of water treatment processes will be constrained by the poor quality of the incoming water. For example, very dirty water will clog filters more often, leading to more frequent backwashing and therefore less online filtering availability. An example of this was the 2006/07 fires in the Macalister River catchment which when followed by the mid 2007 flood event, resulted in extremely turbid water. This meant that while rivers were flooding, the inability to treat that water to potable standard meant that supply to customers needed to continue to be restricted. While most of our systems had restrictions lifted in August 2007, Maffra had restrictions continue for this reason until October 2007, and Coongulla's restrictions continued until January 2008.

More recently, the storm event in June 2021, followed by other storm events in that year, resulted in elevated turbidity in Moondarra Reservoir. This caused problems with the water treatment process at the Tyers water treatment plant. Infrastructure and process measures were put in place to manage this until water quality returned to normal, and media communication to our customers encouraged water conservation as the summer commenced. As a further measure, our Board authorised the use of water restrictions as a demand management measure over summer in the event of further deterioration of water quality or high demand during heatwaves.

Review of Blue Rock to Moondarra Transfers and mine rehabilitation cease to supply point

We are able to transfer water from our share of Blue Rock Reservoir to Moondarra Reservoir. The infrastructure that allows this consists of a pump at Blue Rock Reservoir that is driven by a turbine that is powered by the releases from Blue Rock Reservoir to the Tanjil River to meet environmental flows and orders for cooling water by power stations. Water can only be transferred in one direction and the rate depends on the Blue Rock release orders. Decisions need to be made with respect to the starting and stopping of this transfer and they need to strike a balance between keeping up with demand from Moondarra Reservoir during periods of low inflows and not transferring too much water that may then spill from Moondarra Reservoir in the following winter and spring.

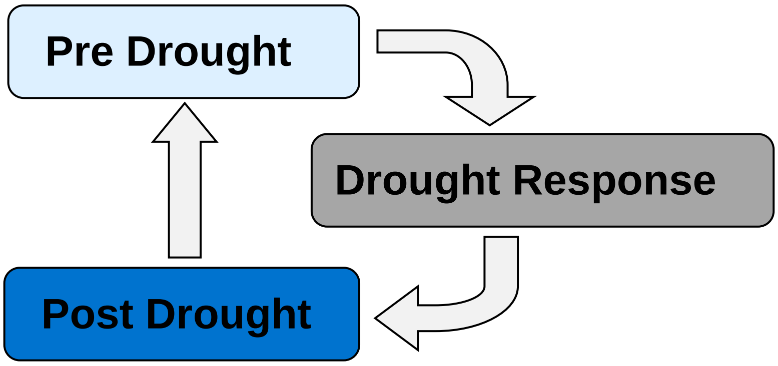
A review point of 23,000 ML of water in Moondarra Reservoir has been used historically to guide these decisions. Since the closure of Hazelwood power station, we've not needed to transfer water to meet demand. Only occasional transfers have occurred during late winter or early spring to maximise overall harvest of water across our two storages. Modelling in 2016 suggested that the system would be reliable at the post Hazelwood closure demand with no transfers.

While the 23,000 ML review point, or even a higher 27,500 ML review point, would maximise yield, demand following the Hazelwood power station closure has been well below the yield. With increased demand for fire prevention in the Hazelwood mine, we will revert back to the 23,000 ML review point, and may increase this to 27,500 ML should mine rehabilitation commence.

A review point in Moondarra Reservoir will also be needed to guide the ceasing of transfers of water to the Hazelwood mine to protect the supply reliability of existing customers. This further work will be undertaken as we know more about the government regulator's and mine owner's intentions.

Drought Response Plan

All Victorian water corporations have plans in place that guide actions that are to be taken to respond to drought. These plans outline actions prior to, during and after drought events and are referred to as Drought Response Plans (DRP). The following is an update of our DRP, which now forms part of the Drought Preparedness Plan. The DRP is referenced in the current Water Restriction By-Law, as renewed in 2022, and sets out the system by system review points we use to guide decisions on whether to impose or lift water restrictions.



Pre Drought Activities

<u>Review Climate Forecasts</u>
Monitor for early warning signs of drought conditions by assessing information from the Bureau of Meteorology (www.bom.gov.au). Indicators of drought include rainfall deficiency over recent months. An example of Victorian rainfall deciles, which indicate how much below average rainfall was in the last three months of 2018 leading into the town of Briagolong being placed on water restrictions is shown below in Figure 115.

The Bureau of Meteorology (BOM) website also provides seasonal outlooks, which forecast the probabilities of above or below average rainfall. An example seasonal outlook for autumn 2022 is shown below in Figure 116. The website also contains information on drought indicators such as the Southern Oscillation Index and El Niño events.

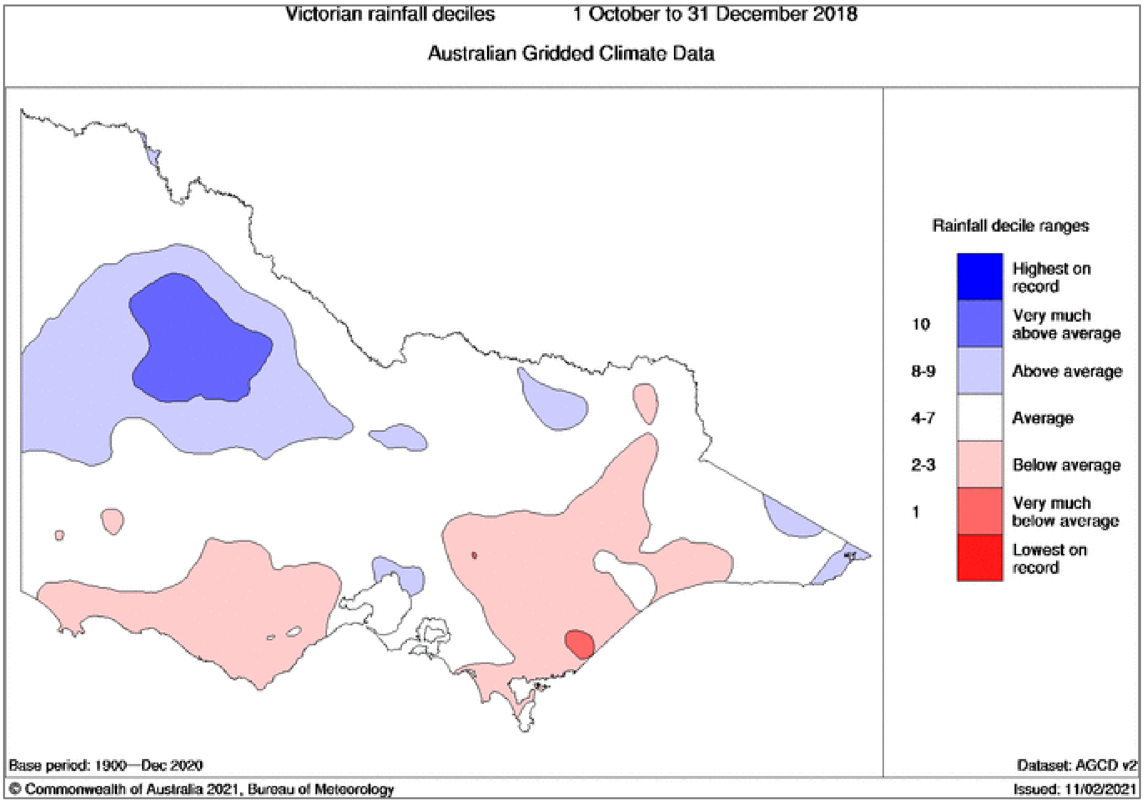


Figure 115 Example of BOM website rainfall decile map showing last 3 months of 2018

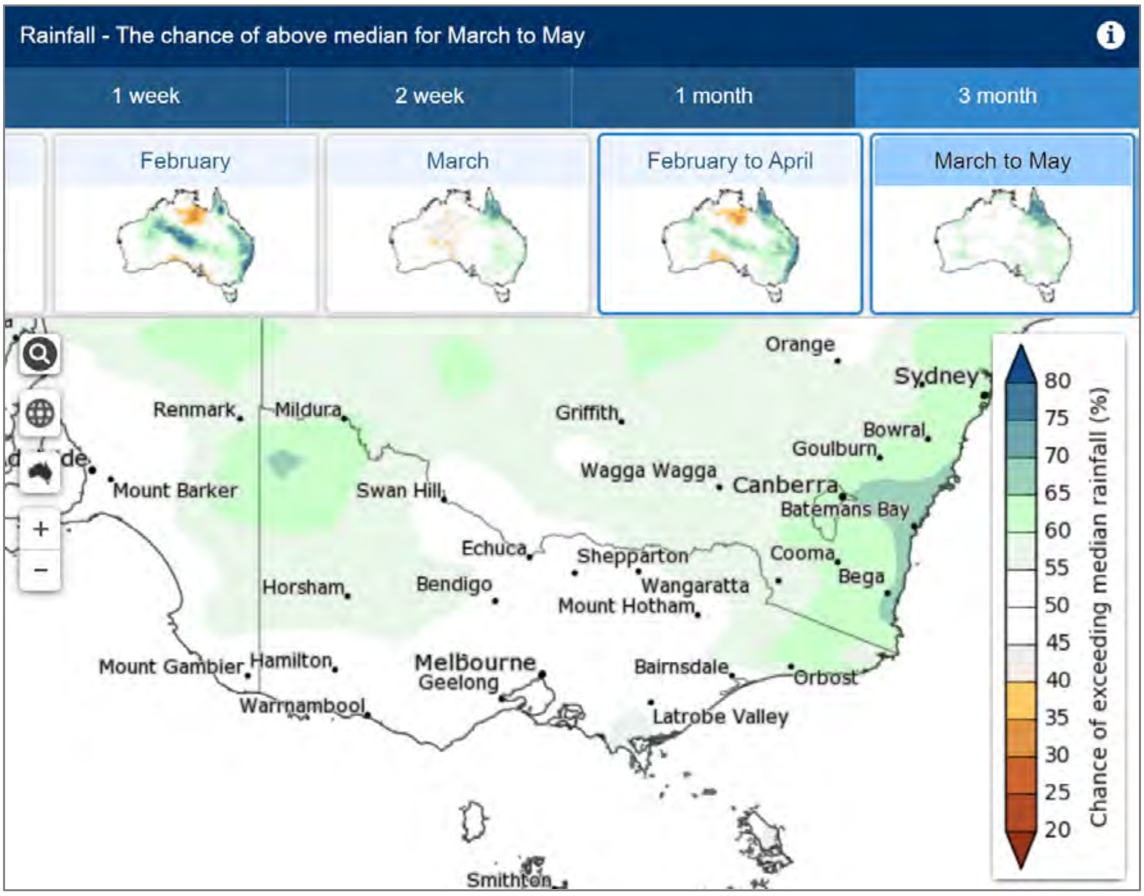


Figure 116 Examples of BOM website seasonal outlook data for autumn 2022

Monitor Streamflow and Storage Level Trends
Reservoir levels and streamflows will be tracked and compared with historic drought reservoir storage and streamflow conditions and water restriction review points. If the rate of storage drawdown exceeds typical historical rates or streamflows decline to unusually low levels, short term scenario modelling may be used to predict future levels based on expected inflows.

Status reports are prepared at a frequency commensurate with the level of deviation from normal storage levels and streamflows. These reports are presented to our Executive Leadership Team or Board as appropriate.

Communications
Ensure that communication links have been established with all groups that need to be contacted when drought management measures are to be implemented. Internal personnel include:

1. Executive Leadership Team
2. Gippsland Water Board
3. Communications Group
4. Field Services Group
5. Major Systems Group
6. Water Treatment Group
7. Customer Service Group
8. Customer Relations Group
9. Water Compliance Officers
10. Business Support Group

External agencies and organisations include:

1. Department of Environment, Land, Water and Planning
2. Southern Rural Water
3. Melbourne Water
4. West Gippsland Catchment Management Authority
5. Environment Protection Authority
6. Baw Baw Shire
7. Latrobe City
8. South Gippsland Shire
9. Wellington Shire
10. Major customers
11. Water cartage contractors

Urban customers should be given timely advice to adopt voluntary reductions in water use via electronic and print media. Promotion of “waterwise” information would be a part of this process. Direct contact should be made with major industrial and commercial customers.

A communications strategy has been prepared to capture water conservation education activities. If not covered by routine contact, liaison with our Customer Reference Group may be initiated when there is a high probability that drought management policies will need to be applied.

Permanent Water Saving Rules (PWSR) apply at all times unless overridden by a water restriction level. These rules assist in creating community awareness of the precious nature of our water resources and reduce excessive and unnecessary demand.

Drought Response

Monitoring of Drought Conditions

Confirm the onset of drought and continue to monitor climate information from the Bureau of Meteorology, reservoir storage levels and stream flows. Water usage should be compared with expected levels of demand and available water.

Reaching a Review Point Level

During normal times, all of our customers are subject to PWSR. In 2011, PWSR were reviewed across the Victorian water industry with a view to achieving state wide consistency. We updated our PWSR accordingly. A further review in 2021 proposed no changes.

When a resource becomes curtailed, such as during drought, review points will be used as a basis to consider the need to impose, or increase water restrictions. There are 4 levels of water restrictions set out in our By-Law. Similar to PWSR, the By-Law was also updated in 2011 to achieve state wide consistency, with minor changes following the 2021 review.

In the event that conditions approach or exceed review point levels, the issue will be raised with our Executive Leadership Team for consideration. The Executive Leadership Team will consider a range of issues, including seasonal outlook, time of year and current levels of demand before recommending water restrictions to our Board. The Board will approve water restrictions, as the Board deems necessary, after receiving technical advice. The Board will have regard to the practicality of introducing restrictions on a staged approach or on an accelerated basis. In some cases the Board may introduce a high level of restriction immediately.

The Board can use its discretion to apply water restrictions during periods where the review points outlined in this Drought Response Plan have not been reached.

Implement Communication Plan

A communication plan should be implemented once water restrictions become necessary. The plan will identify key stakeholders and outline communication processes for the introduction and removal of restrictions. Details of restrictions are to be advised to consumers by promulgation in the media and direct contact if applicable.

Demand Reduction and Supply Enhancement

Water restrictions are used to prolong the availability of water resources through a period of drought by introducing increasingly severe restrictions as water supplies reduce. The restriction review points are developed for each system using water resource models.

Following consultation with other relevant authorities and the Board, implement staged restrictions according to established policy and the restriction By-Law. The implementation of restrictions for each of the systems will be guided by the restriction review points detailed below.

A range of restriction review points have been adopted for different systems, including review points based on reservoir storage level, streamflow, groundwater level, and other measures of water availability. If the predicted reductions in demand are not achieved it may be necessary to move to a more severe level of restrictions without applying each stage in turn e.g. move from Stage 1 restrictions to Stage 3 without applying Stage 2.

In the past in extreme situations, a Ministerial qualification of rights was an available option that could be used to make additional water available from allocations to other water users. While still available under the Water Act, government has made it clear that it expects that water corporations will not place any reliance on this remedy in the future.

The impact of contingency measures on water quality should be considered, so that users can be advised if necessary of any requirements to accommodate water of a quality that is not normally supplied.

As water restrictions are introduced, build on existing recording and reporting systems to produce a log of actions and results for internal and external groups requiring information. As time progresses, a history of compliance or otherwise will be built up by recording the demand reduction achieved and reports of violations of the restriction conditions. Staff members who are required to monitor and enforce adherence to the By-Law should be provided with adequate support.

During periods when water restrictions apply, we also review the amount of water consumed in maintenance activities such as mains cleaning. In addition to considering the impact of such activities on water resources, consideration must also be given to other issues such as water quality.

Monitor Effectiveness

The effectiveness of water restrictions will be monitored to check projected savings are achieved and ensure long term security of supplies.

Update of Restriction Review Points

The points at which restrictions are imposed have a direct bearing on the system yield. If restriction review points are set such that they are reached too soon, then the system may encounter frequent episodes of restrictions, decreasing reliability and decreasing the amount of average demand that system can satisfy at a particular level of service, otherwise known as the yield. If review points are set such that they are not reached soon enough during a drought, the water resource supplying the system may become depleted, leading to a system failure. The purpose of the update of review points is to find the right balance to ensure systems do not fail in a reasonably conceivable drought, while also striving to minimise episodes of restrictions.

It is important to note that an unprecedented event could still lead to a system failure. For this reason, we have undertaken stress testing of our water systems using the post 1997 streamflow scenario and daily water models for run-of-river systems.

We undertook a major review and update of the restriction review points for all of our systems in the development of the 2012 UWS. The suitability of review points was reviewed for each system during the development of the 2017 UWS and the review points for two systems were updated, Erica-Rawson and Mirboo North. In the case of Erica-Rawson, the revised review points reflect the large basin being offline, while for Mirboo North the update was needed due to an earlier overestimate of the available water resource. During the development of this UWS we've updated Latrobe system review points for post Hazelwood closure demand.

It must be noted that while the Drought Response Plan sets review points for restrictions, we are not obliged to impose a particular level of restrictions when a system reaches a review point. Rather, all relevant information will be considered such as current demand level, expected water savings under restrictions, forecast weather and other inputs, in order to decide whether restrictions are appropriate. In addition, restrictions may be imposed at times when water may seem abundant and a review point has not been met. An example may be after fire, flood or storms, when water quality has deteriorated to the point where a treatment plant cannot run at full capacity and hence supply is curtailed.

<u>System Review Points</u>

Briagolong System
Restrictions in this system are not highly effective in reducing drawdown at the production bores. This is partly because restrictions (particularly stage 2) do not have a very large impact on total demand. Furthermore our extraction is only one component of extraction from a resource that is also used by irrigators. Natural aquifer throughflow and evapotranspiration are also significant sources of water loss in dry periods. Therefore review points are more reactive to the operational risk of pumping at low groundwater levels as opposed to preventive measures taken to prevent aquifer drawdown. Restriction review points are presented in Table 19.

The stage 2 review point is set at the minimum preferred operating level of the higher bore. The stage 4 review point is 2 m above the lower bore pump. Implementing stage 4 restrictions is appropriate to minimise pumping rates, and reduce demand in the event of the need to cart water.

The use of only two levels of restriction has been selected to minimise rapid changes in restriction level. Past experience and modelling suggest that restrictions may only need to be applied for one to three months in summer or autumn. Hence quick application of restrictions may be necessary.

Table 19 Briagolong system restriction review points

Stage 1	Stage 2	Stage 3	Stage 4
Aquifer water level (mAHD)			
-	50.8	-	49.6

Erica-Rawson System

The Erica-Rawson system has two large raw water storages, although the much larger of the two is now offline indefinitely. Restriction review points are now based on the volume in storage in the smaller 5.7 ML basin as shown in Table 20.

Table 20 Erica-Rawson system restriction review points

Stage 1	Stage 2	Stage 3	Stage 4
No. 1 Basin Storage (ML)			
2.7	2.1	1.6	1.0

Latrobe System

Restriction review points for the Latrobe System were reviewed and revised as part of this current UWS (Table 21). The review points ensure 12 months of remaining supply when stage 1 commences. These review points are less conservative than in the previous Drought Response Plan, as the minimum storage level adopted for Moondarra Reservoir in the last review was significantly larger than the actual dead storage. The review points have been updated to account for Hazelwood power station and Energy Brix closures.

Table 21 Latrobe system restriction review points

Month	Combined Blue Rock Reservoir (Gippsland Water share) and Moondarra Reservoir Storage Volume (ML)			
	Stage 1 review point	Stage 2 review point	Stage 3 review point	Stage 4 review point
July	11,120	7,086	6,711	6,336
August	14,979	12,663	7,088	6,329
September	17,205	16,365	11,029	6,263
October	19,796	18,899	14,524	8,587

Month	Combined Blue Rock Reservoir (Gippsland Water share) and Moondarra Reservoir Storage Volume (ML)			
	Stage 1 review point	Stage 2 review point	Stage 3 review point	Stage 4 review point
November	19,274	18,373	15,963	10,317
December	19,414	18,539	17,721	12,403
January	18,416	16,916	16,216	11,993
February	16,458	14,958	13,458	11,414
March	15,437	13,937	12,437	10,937
April	14,190	12,690	11,190	9,690
May	13,310	11,810	9,810	7,810
June	12,076	10,922	8,922	6,922

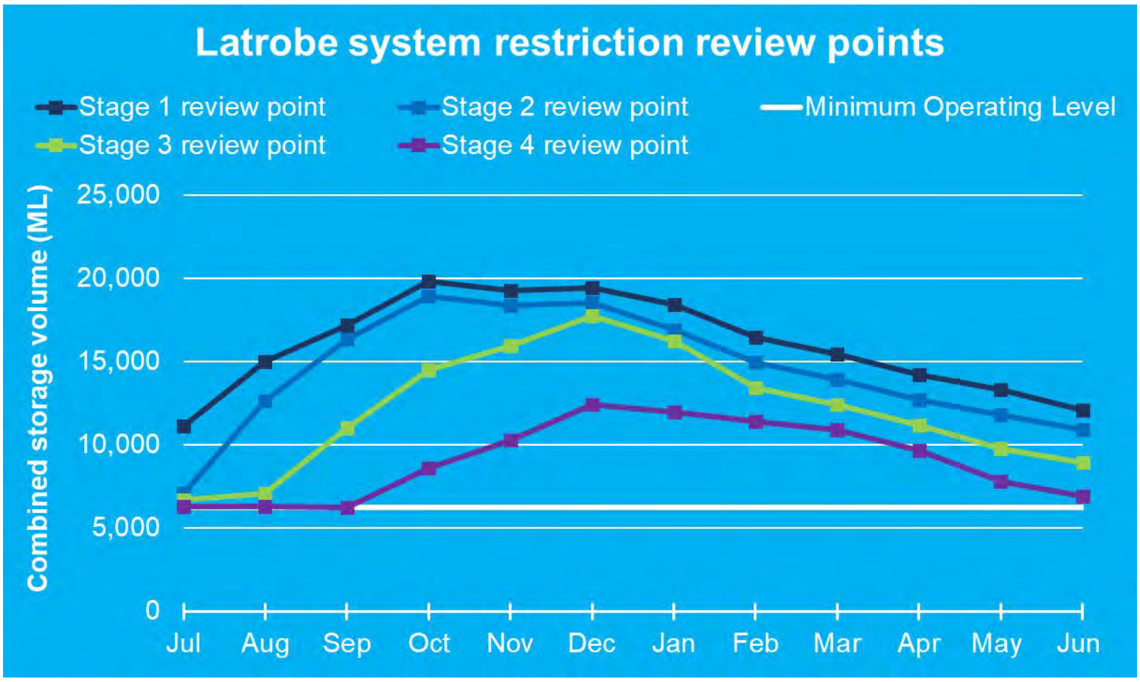


Figure 117 Latrobe system restriction review points

Mirboo North System

The Mirboo North System is a run of river system with restriction review points based on the available streamflow over the previous 14 days, with a 20% margin. The restriction review points were updated in 2017 to address an overestimate of the available water resource. The revised review points are shown in Table 22.

Table 22 Mirboo North restriction review points

	Stage 1	Stage 2	Stage 3	Stage 4
14 day available water	< 15 ML	< 12 ML	< 10 ML	< 8 ML

Sale System

While we acknowledge some level of connection between surrounding surface water catchments and the Sale groundwater resource, it is not possible to simply align the Sale System water restrictions with water restrictions on the Thomson-Macalister or Latrobe Systems. This is due in part to the time lag between drought and reduced bore levels and the difficulty in predicting its effect. The matter is also made more complex by the fact that SRW is the authority responsible for the Boisdale Aquifer. SRW's other customers, mainly irrigators, also source water from this aquifer, their aggregate extraction far exceeding Sale's demand. Therefore any restriction on use of the resource would have to be undertaken collaboratively with SRW in order for it to be fair and equitable.

Our approach will be to closely monitor aquifer levels and liaise with SRW if necessary. Additionally, restriction review points have been devised that aim to reduce demand in the event that aquifer levels approach bore pump levels, potentially causing operational pumping problems, as well as reducing demand in the event that SRW imposes a reduced allocation on all Boisdale Aquifer licence holders.

Table 23 below shows the restriction review points for the Sale system.

Table 23 Sale system restriction review points

Stage 1	Stage 2	Stage 3	Stage 4
SCADA Bore Level RL (mAHD)*			
N/A	-20.0	-25.0	-27.0
Stage 1	**Stage 2**	**Stage 3**	**Stage 4**
Groundwater allocation (%)^			
< 60	< 55	< 50	< 45

*Note: Minimum drawdown level in Sale production bores.

^Note: seasonal groundwater licence allocation set by SRW

Seaspray System

The Seaspray System includes a 30 ML raw water basin. This volume of water is almost sufficient for one year of supply. The bulk entitlement for Seaspray requires us to pass a minimum environmental flow from July to October constraining our ability to divert water from Merriman Creek during dry winters. Imposing restrictions during a winter period is considered to be ineffective for two main reasons: firstly the difficulty in convincing customers of the need to save water during winter months, and secondly the small volume of savings that water restrictions would likely achieve.

Restriction review points have been developed based on a summer and a winter drawdown period (Table 24). Restrictions are based on maintaining sufficient water in the raw water storage to enable a consecutive summer then winter drawdown period without falling below a nominated minimum operating level for the storage.

Table 24 Seaspray system restriction review points

	Storage Volume (ML)											
Month	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**
Stage 1	21	21	19	18	16	26	25	22	22	22	22	22
Stage 2	20	19	18	16	14	24	23	20	20	20	20	20
Stage 3	18	18	16	14	12	22	21	19	19	18	18	18
Stage 4	16	16	14	13	11	20	20	17	17	17	17	17
Minimum Operating Level	9	9	9	9	9	9	9	9	9	9	9	9

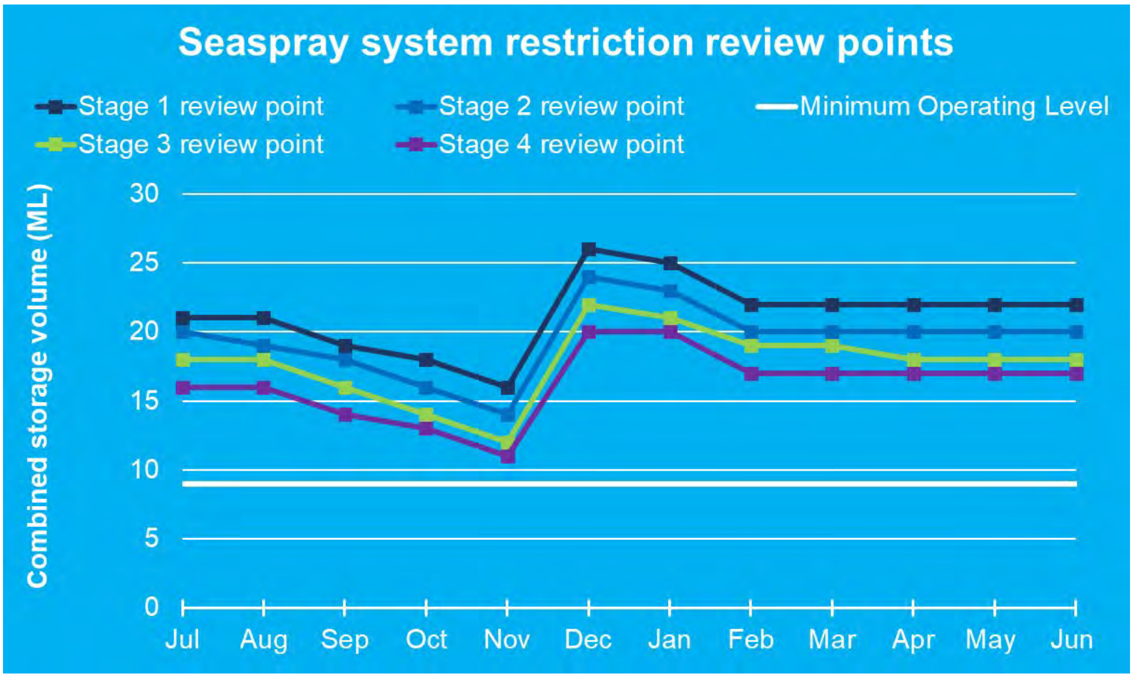


Figure 118 Seaspray restriction review points

The benefit of the review points selected is that they provide for restrictions to be applied during summer when the savings that can be achieved are greater. The aim of bringing on restrictions in the summer months is to maintain a sufficiently high storage volume to supply demand over the winter period in the event low streamflows prevent diversions being allowed under the bulk entitlement.

Note we are planning to collaboratively review the Seaspray bulk entitlement with our partner agencies and GLaWAC to see if alternative flow sharing arrangements can be identified for net mutual benefit and the review points may change depending on the outcome.

Tarago System

The availability of water in the Tarago System can be measured by the extent to which the 400 ML/y bulk water supply agreement (BWSA) in Tarago Reservoir is used. Water restriction review points for the Tarago System are presented in Figure 119.

Restrictions are based on the volume of water remaining in the Tarago Reservoir under our BWSA.

The CGRSWS is proposing that a share of the Yarra-Thomson entitlement pool (which includes Tarago Reservoir) be made available for us to purchase and this would replace the BWSA and provide much greater security for the future. The restriction review points will need to be reassessed when that occurs.

Table 25 Tarago system restriction review points

	Supplementary volume remaining (ML)			
Month	**Stage 1**	**Stage 2**	**Stage 3**	**Stage 4**
July	200	200	200	200
August	200	200	200	200
September	200	200	200	200
October	200	200	200	200
November	200	198	196	194
December	186	178	170	162
January	166	160	153	147
February	127	117	107	97
March	91	66	40	15
April	89	63	35	9
May	89	63	35	9
June	89	63	35	9

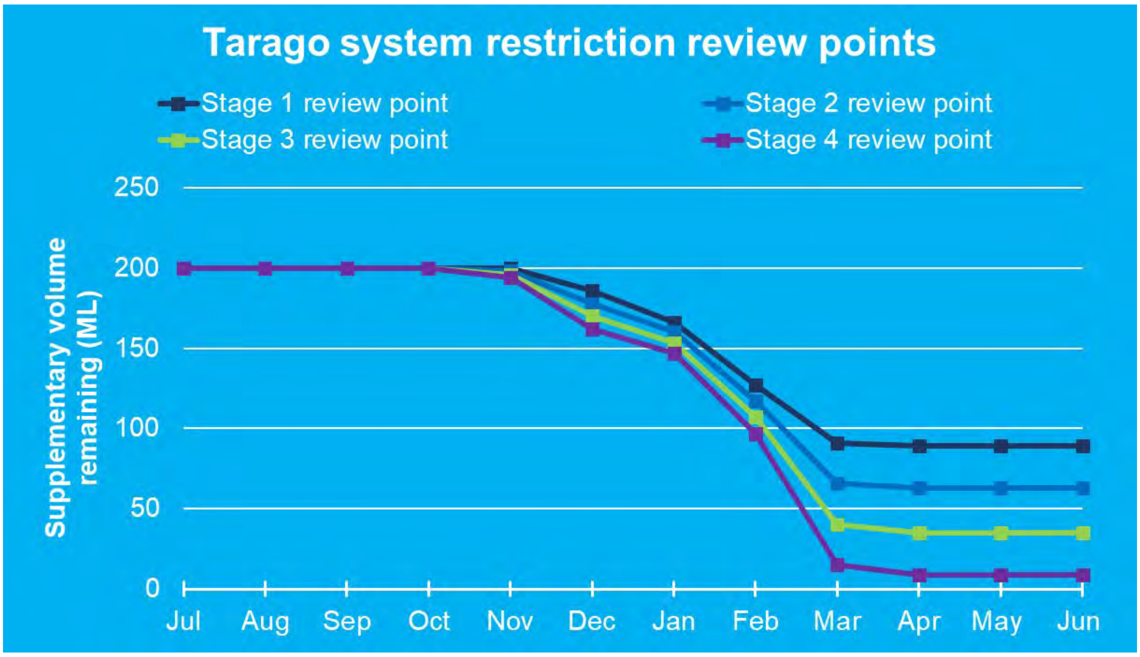


Figure 119 Tarago system restriction review points with 400 ML per year storage

Thomson Macalister System

Restriction review points for the urban demands of Maffra, Heyfield and Coongulla are based on our allocations from the Thomson-Macalister System, which in turn are linked to SRW's irrigation allocation. Allocations often commence conservatively low, until winter and early spring inflows are known, after which, except in the case of drought years, they are typically lifted. Allocations can only be lifted and not reduced during a financial year. The adopted restriction review points vary by month to allow for the usual low allocation levels in the first few months of the year by not unnecessarily applying restrictions, while ensuring reserves will be sufficient in the case allocations remain low. The adopted restriction review points are shown in Figure 120.

Table 26 Thomson-Macalister restriction review points

	Gippsland Water Allocation (%)			
Month	**Stage 1**	**Stage 2**	**Stage 3**	**Stage 4**
July	PWSR	PWSR	PWSR	PWSR
August	PWSR	PWSR	PWSR	PWSR
September	PWSR	PWSR	PWSR	PWSR
October	60	PWSR	PWSR	PWSR
November	65	60	PWSR	PWSR
December	70	65	60	PWSR
January	75	70	65	60
February	80	75	70	65
March	85	80	75	70
April	85	80	75	70
May	85	80	75	70
June	85	80	75	70

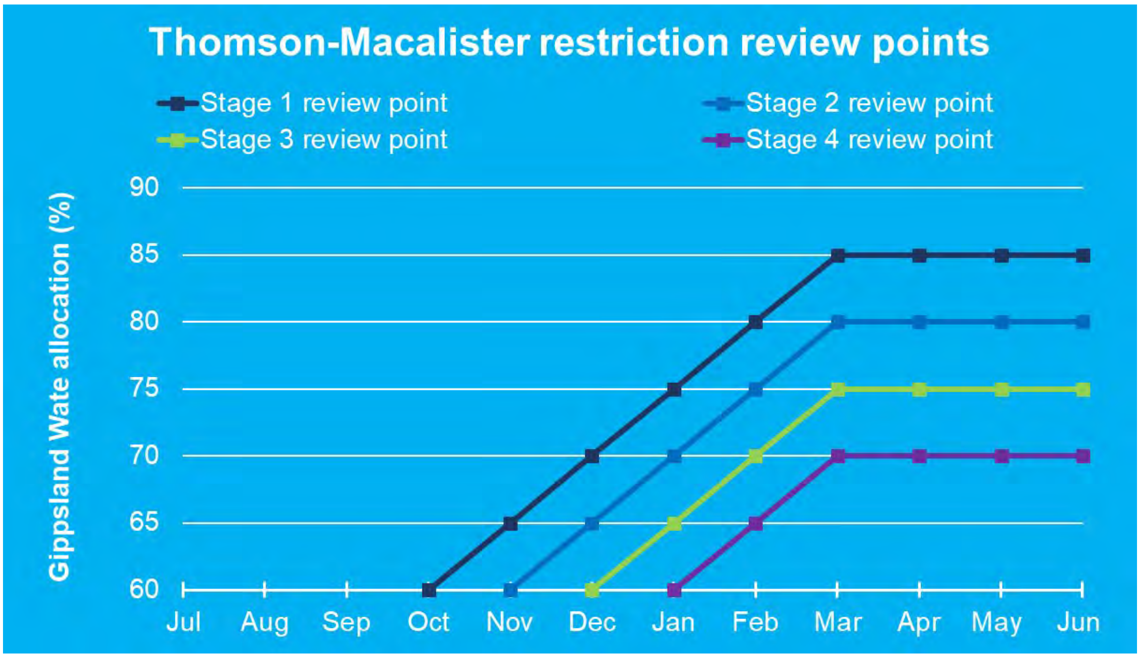


Figure 120 Thomson-Macalister restriction review points

<u>System Contingency Actions</u>

The following actions have been identified as options that may be implemented in times of drought either in conjunction with water restrictions or as an alternative.

Briagolong System

Demand in this system can be met by water carting, most likely from the Maffra System. While carting is taking place the town may be subject to high level restrictions. In addition, we will work closely with SRW to ensure that irrigation allocations in the Wa De Lock Aquifer system are appropriate for the level of resource depletion.

Erica-Rawson System

No contingency options have been identified for this system as it is very reliable. Water can be carted to a system with demand of this size but as a temporary measure and at high cost.

Latrobe System

Actions identified for this large system are:

1. Liaise with major industry to identify any water consumption savings that may be achievable;
2. Purchase temporary allocation from the Blue Rock Reservoir drought reserve;
3. Utilise the Gippsland Water Factory recycled water facility; and
4. Operate the Latrobe River pumping station to enable better capability of meeting industrial demand.

Mirboo North System

This system is typically very reliable. While the Little Morwell River does reduce to low flows in drought, it typically has a reliable base flow that is spring fed and can usually meet restricted demand. However, water can be carted to a system with demand of this size but as a temporary measure and at high cost. In an unprecedented year, we may seek to purchase water from upstream licence holders.

Sale System

This system is relatively immune to the short term effects of drought as it sources its supply from a deep confined aquifer. While droughts do affect recharge to a groundwater aquifer, there tends to be a lag effect. At present the bore pumps are at a depth of approximately 30 metres. They can be lowered to 60 metres in the event of reduced bore levels and this would form a contingency action.

Seaspray System

The Seaspray System has in the past been very susceptible to droughts with Merriman Creek ceasing to flow several times during the Millennium Drought and more recent east Gippsland drought. The usual contingency was to cart water from Sale. However the system now has the 30 ML raw water basin to buffer drought events and this basin has made the system much more reliable. Water carting remains as a contingency in the event that the basin is depleted or suffers from a Blue Green Algae outbreak. We have equipped this basin with floating pods to reduce sunlight reaching the storage, reducing the risk of Blue Green Algae. The results of the pods to date have been promising.

Tarago System

The Tarago System is split into two sub-systems, Warragul and Neerim South. The Neerim South System draws its water from Tarago Reservoir under a primary entitlement and is therefore quite secure. The Warragul System, however, draws from the Tarago River upstream of the reservoir and is susceptible to drought. Water carting is not an option for this system due to its size. We have redundancy available in this system through the recently commissioned interconnection to the Moe water supply system. This interconnection also provides flexibility and contingency to supply the Moe system with water from the Warragul water treatment plant. Additionally, we have negotiated a temporary purchase of a 400 ML per year share of Tarago Reservoir from the Melbourne Yarra-Thomson Pool delivery entitlements held by Melbourne's three retail water companies. This share is critical to both short and long term security of supply. Since the disaggregation of entitlements in the Melbourne System in 2014, there are now six primary entitlement holders to the Melbourne Yarra-Thomson pool. We can negotiate to purchase water from any one of these entitlement holders and access the water at Tarago Reservoir via the Rokeby Pump Station for supply to Warragul and Drouin. These arrangements will complement the action being taken to address future needs for this system described in the *Warragul, Drouin and Neerim South* section of the *Our water resources* chapter of this report.

Thomson Macalister System

This system is fairly resilient to drought as our Bulk Entitlement provides a guaranteed minimum supply of 1401 ML per year under the worst irrigation allocation level. While average demand is slightly higher than this, under restrictions, demand could be managed to meet this amount. However, if demand could not be managed using restrictions, we would seek to purchase water from other licence holders in the Macalister Irrigation District on the temporary water market.

Post Drought Activities

Lifting a Stage of Restriction

The lifting of the current stage of restrictions generally follows an eight week proving period. An assessment is made of whether the water source has recovered to a level that could satisfy demand under a lower restriction level. If this increased supply can be maintained for a period of eight weeks, the restriction is lifted to the appropriate level. A flow chart of this assessment process is shown in Figure 121.

We may decide not to lift the current stage of restriction if the change could be so temporary that the inconvenience to customers caused by lifting and re-imposing a stage of restriction would outweigh the benefits to customers of temporarily lifting the restriction. As such, temporary weather events may not affect restrictions due to the requirement for an eight week proving period.

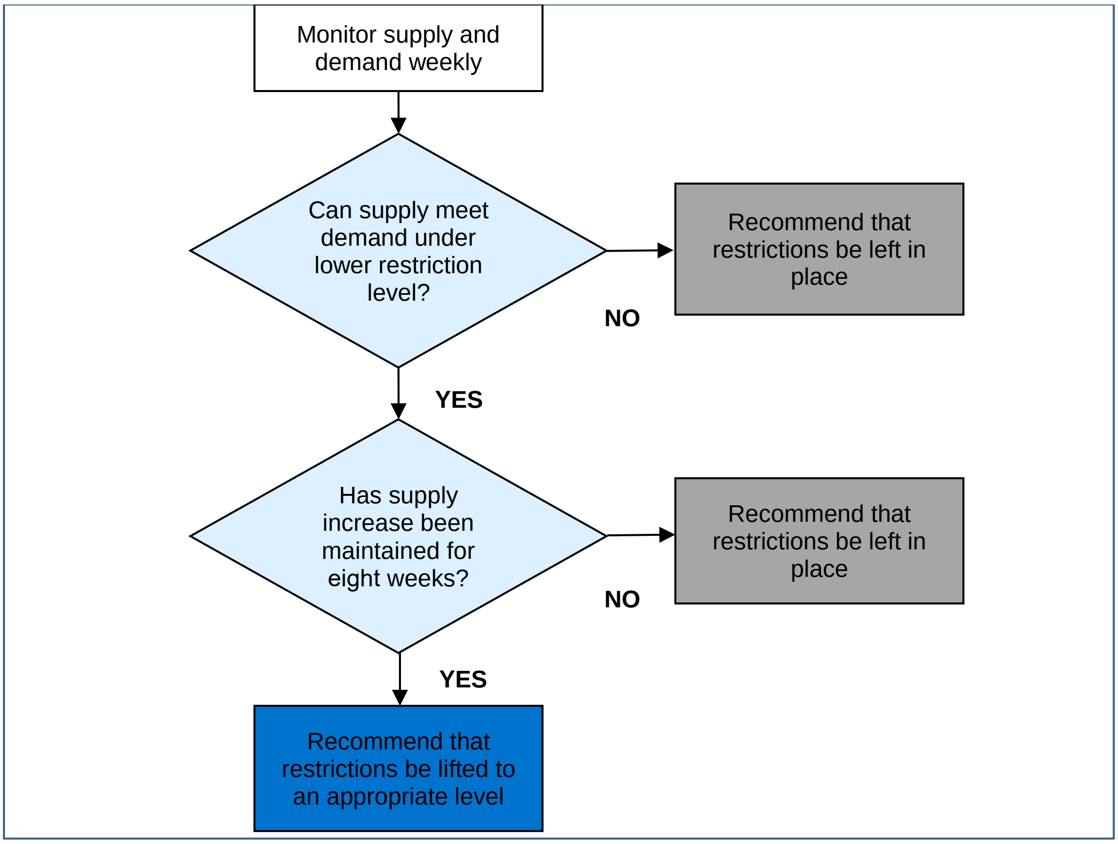


Figure 121 Flow chart for lifting of restrictions

Review of Drought Response Plan

A review will be conducted of planned actions and results compared with actual experiences and results achieved during the drought period. Lessons from this review will be incorporated back into this Drought Response Plan.

Our Statement of Obligations requires that the review be carried out as soon as practicable after the end of a drought, but not later than 12 months after the lifting of water restrictions and return to Permanent Water Saving Rules.

During non drought years, the Drought Response Plan should be reviewed at an interval of no greater than five years.

The following items will be assessed to gauge the effectiveness of the plan:

1. Comparison of actual savings in demand with expected savings for each stage of restrictions;
2. The use of restriction review points and whether review points remain appropriate;
3. A review of inflows during the drought and whether current models are still appropriate;
4. The effectiveness of the Water Restriction By-Law and issues associated with enforcement and exemptions; and
5. The communication strategies used to inform the community and key stakeholders along with customer feedback and media response.

Once the effectiveness of the plan has been evaluated, lessons from the review will be incorporated into the next revision/version of the Drought Response Plan.

Appendix B

Water system maps

Figure 122 Briagolong water system

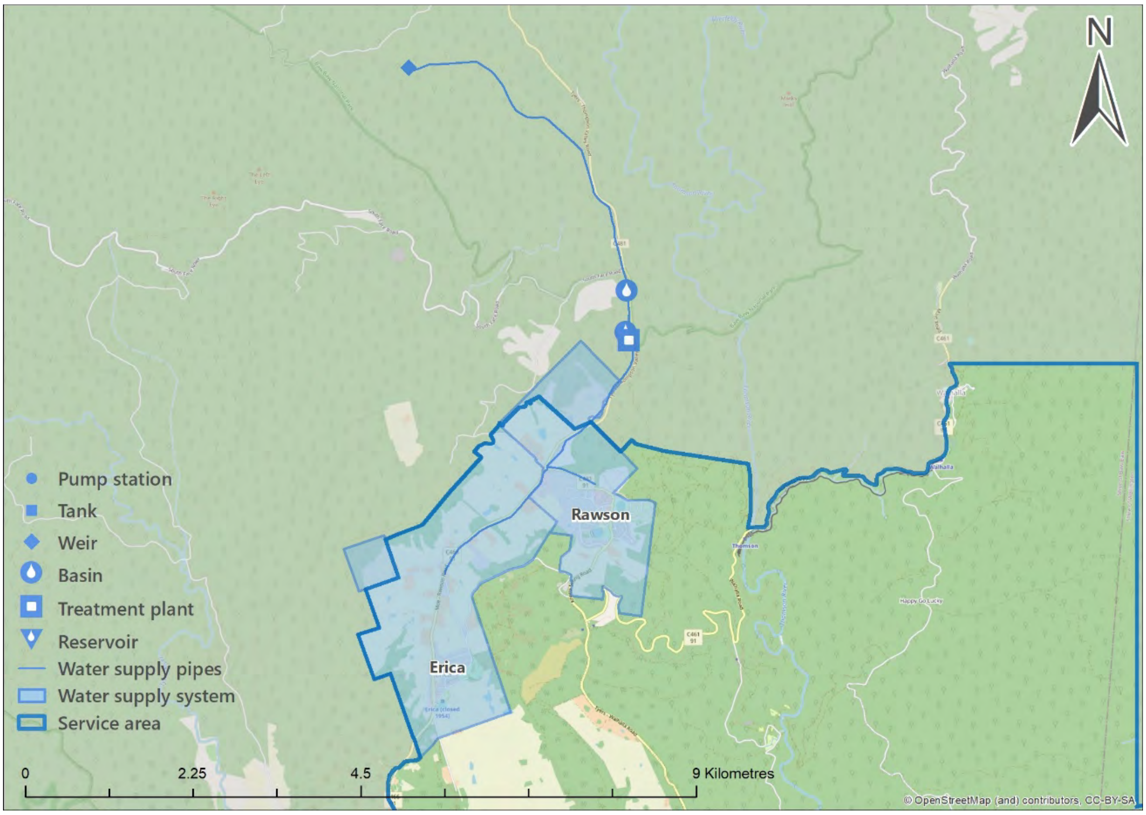


Figure 123 Erica and Rawson water system

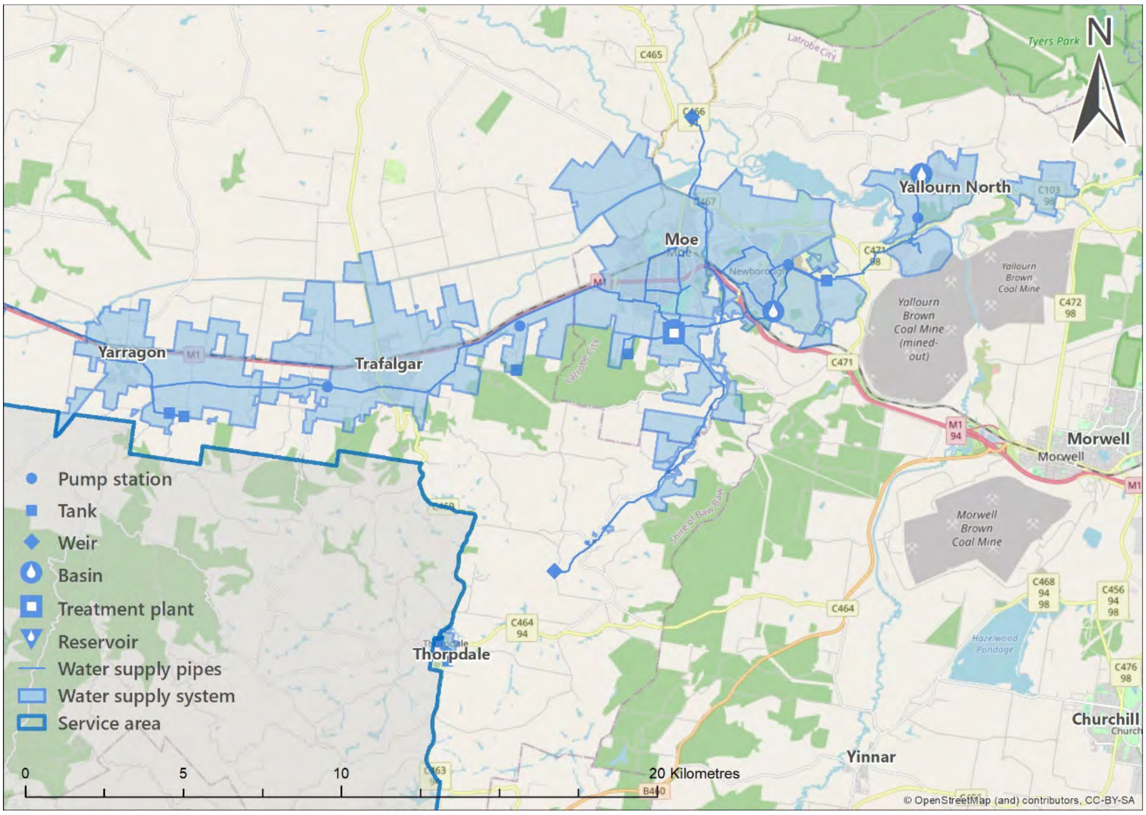


Figure 124 Moe water system

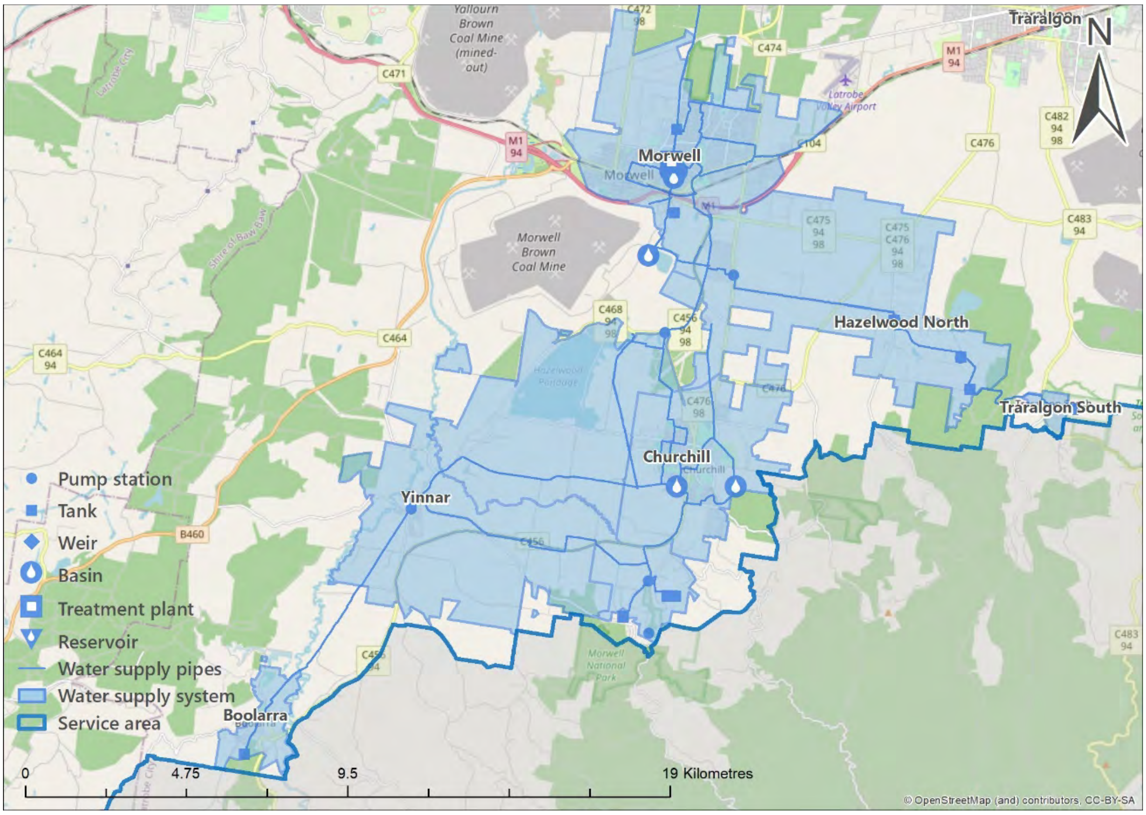


Figure 125 Morwell water system

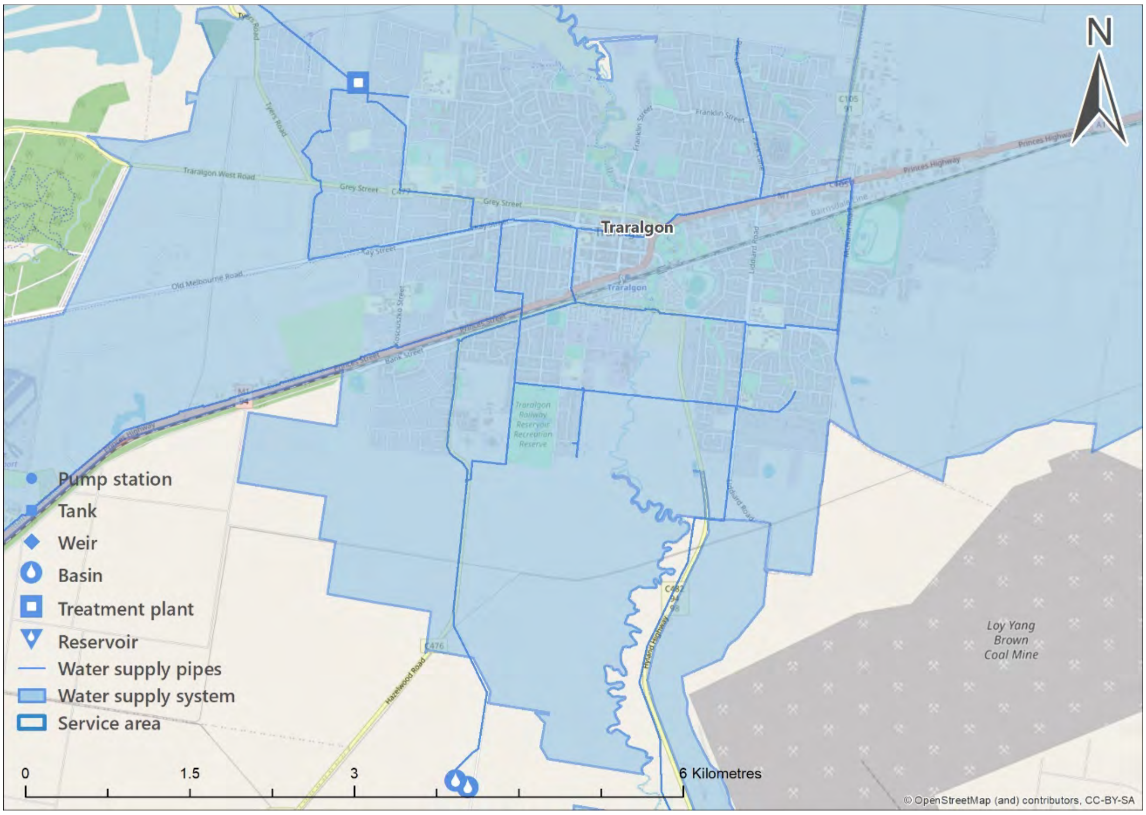


Figure 126 Traralgon water system

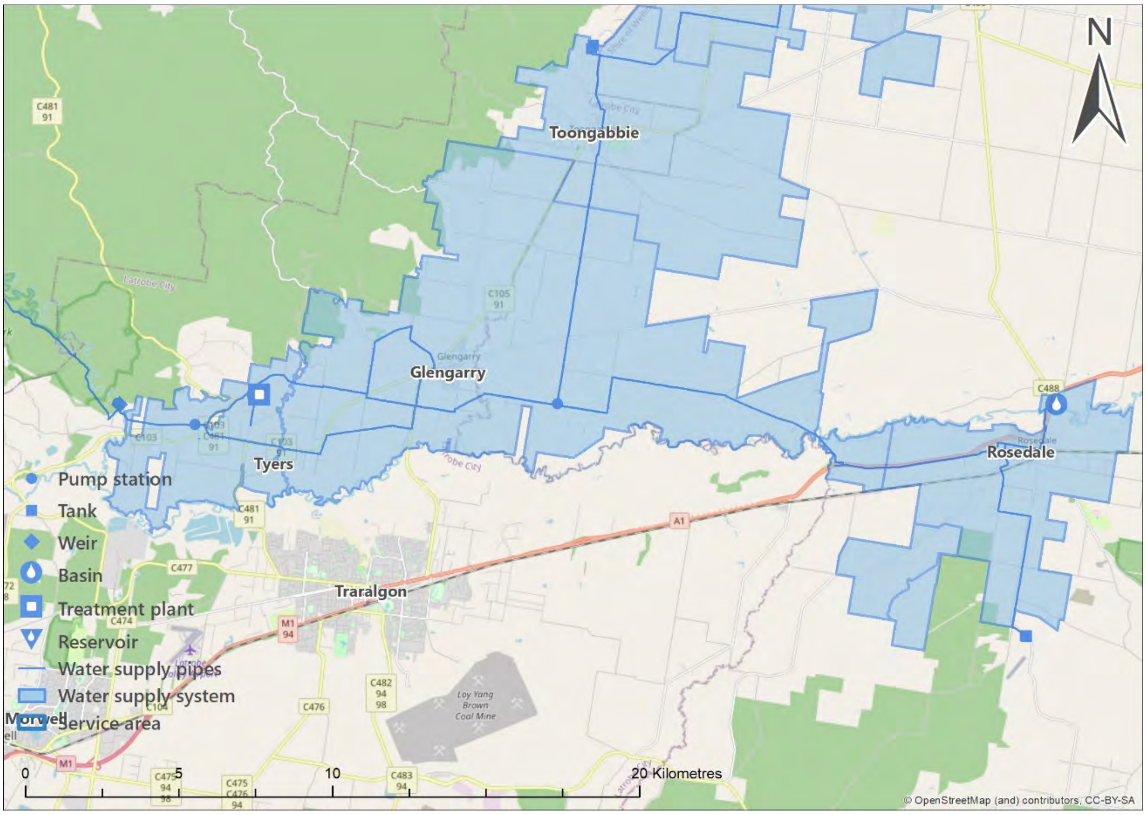


Figure 127 Tyers water system

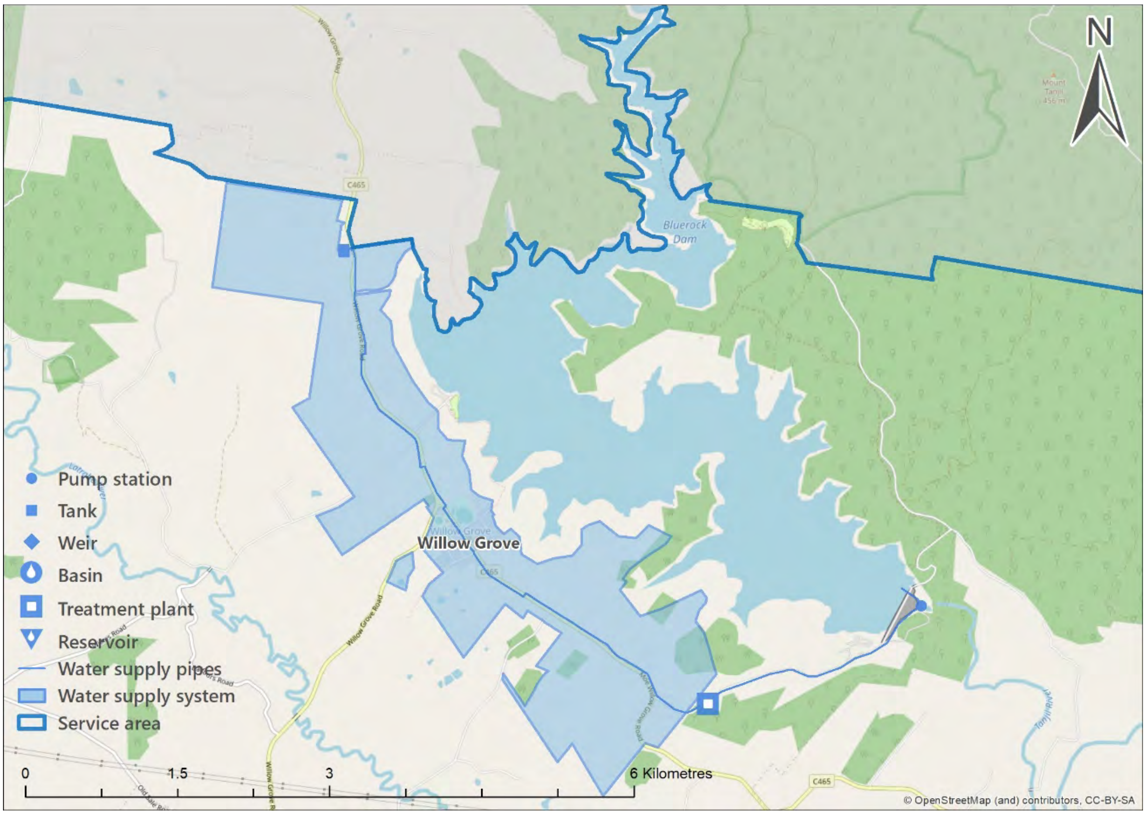


Figure 128 Willow Grove water system

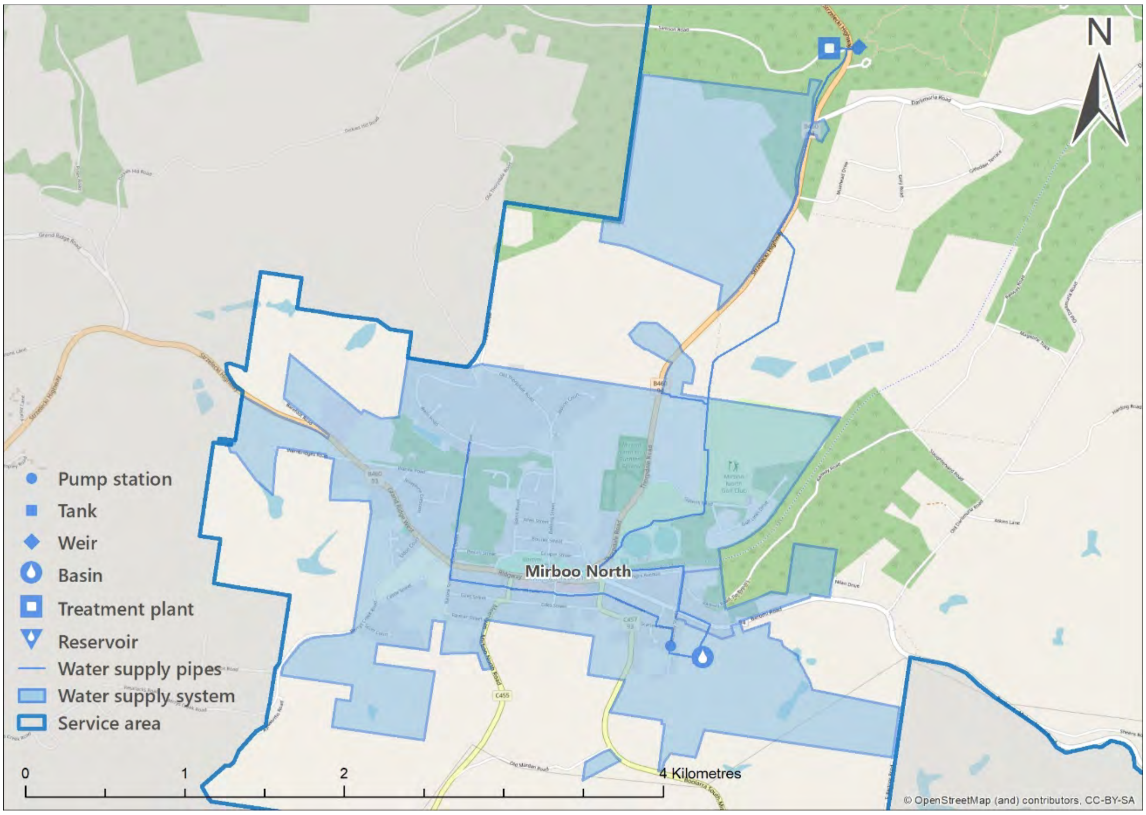


Figure 129 Mirboo North water system

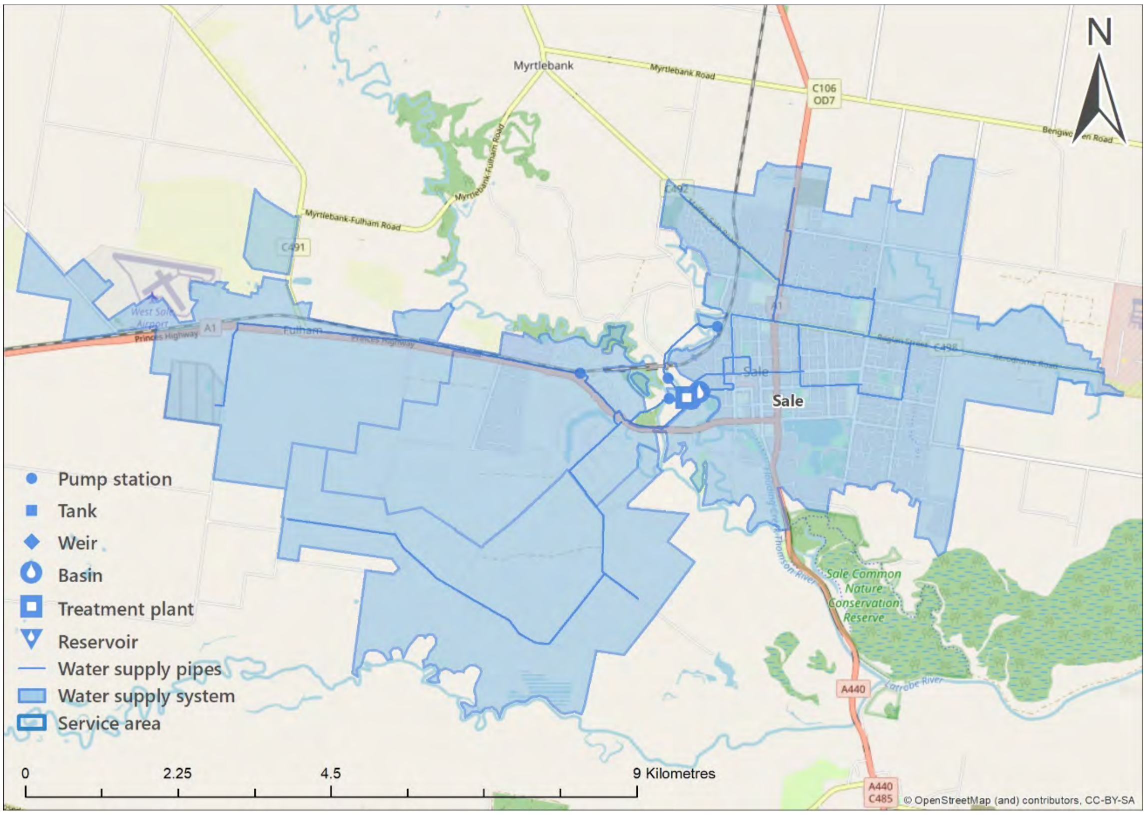


Figure 130 Sale water system

Figure 131 Seaspray water system

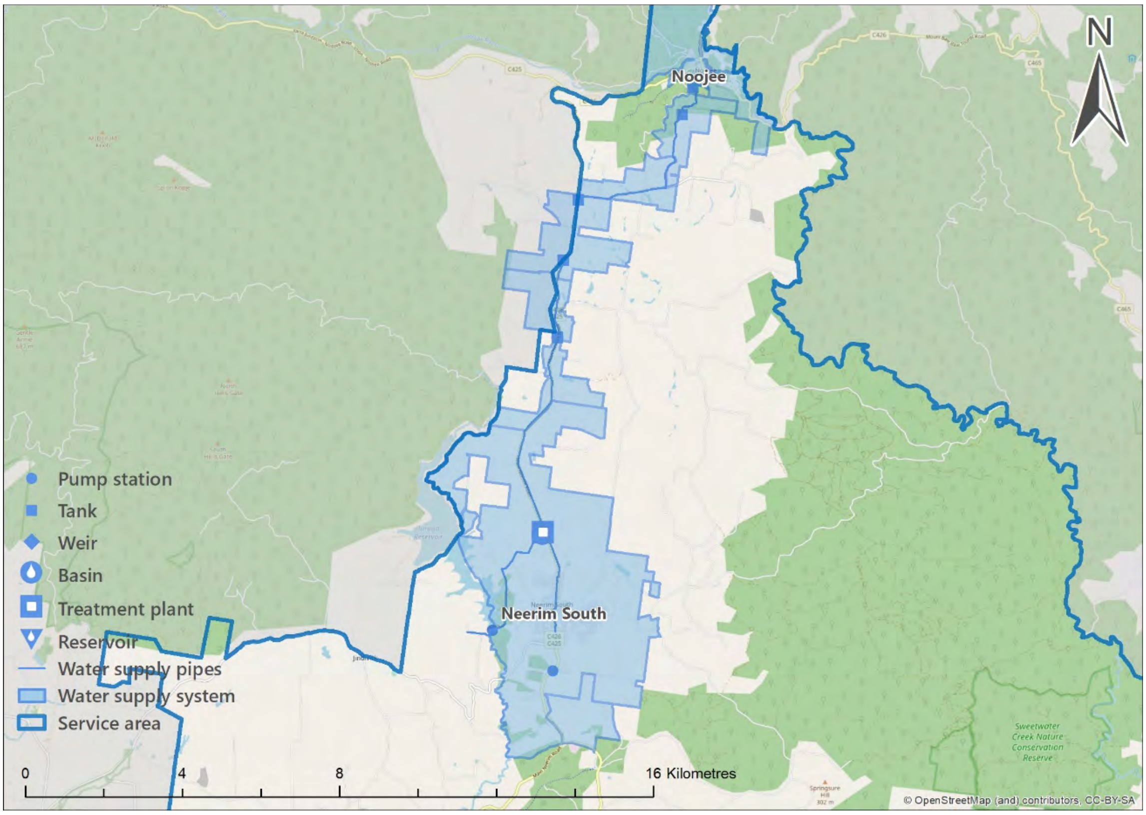


Figure 132 Neerim South water system

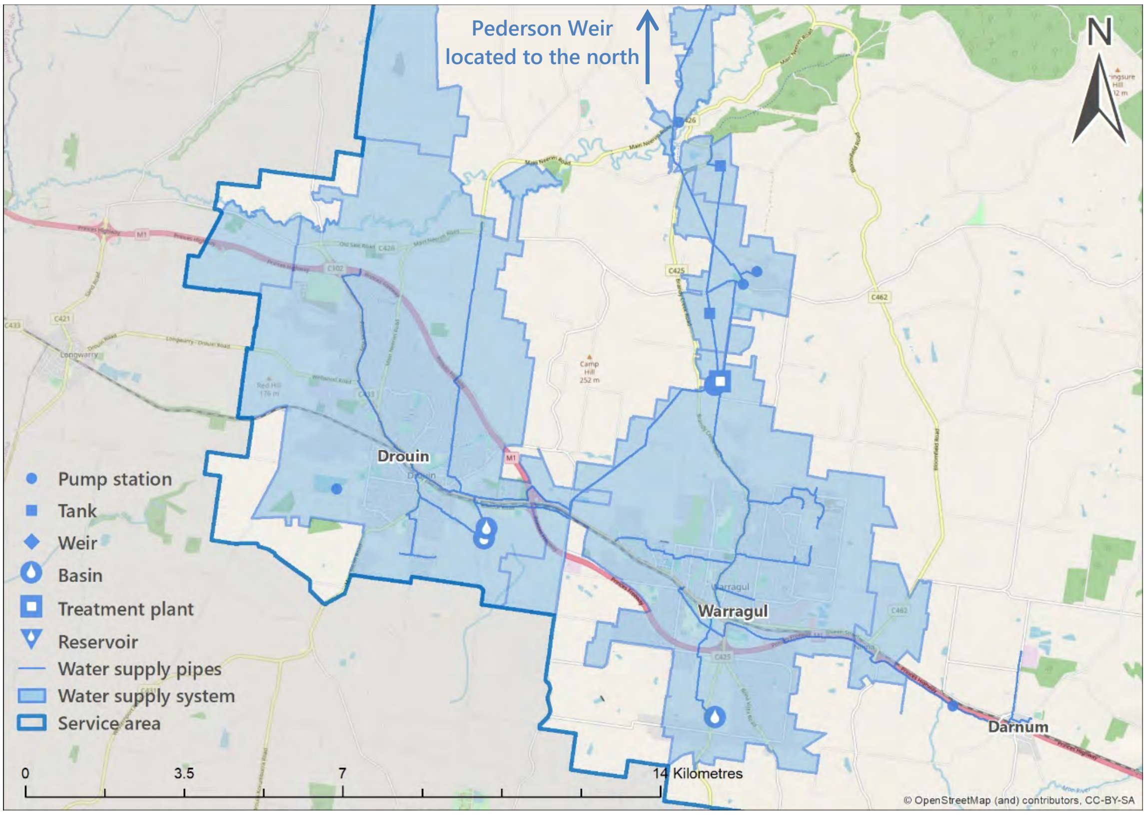


Figure 133 Warragul and Drouin water system

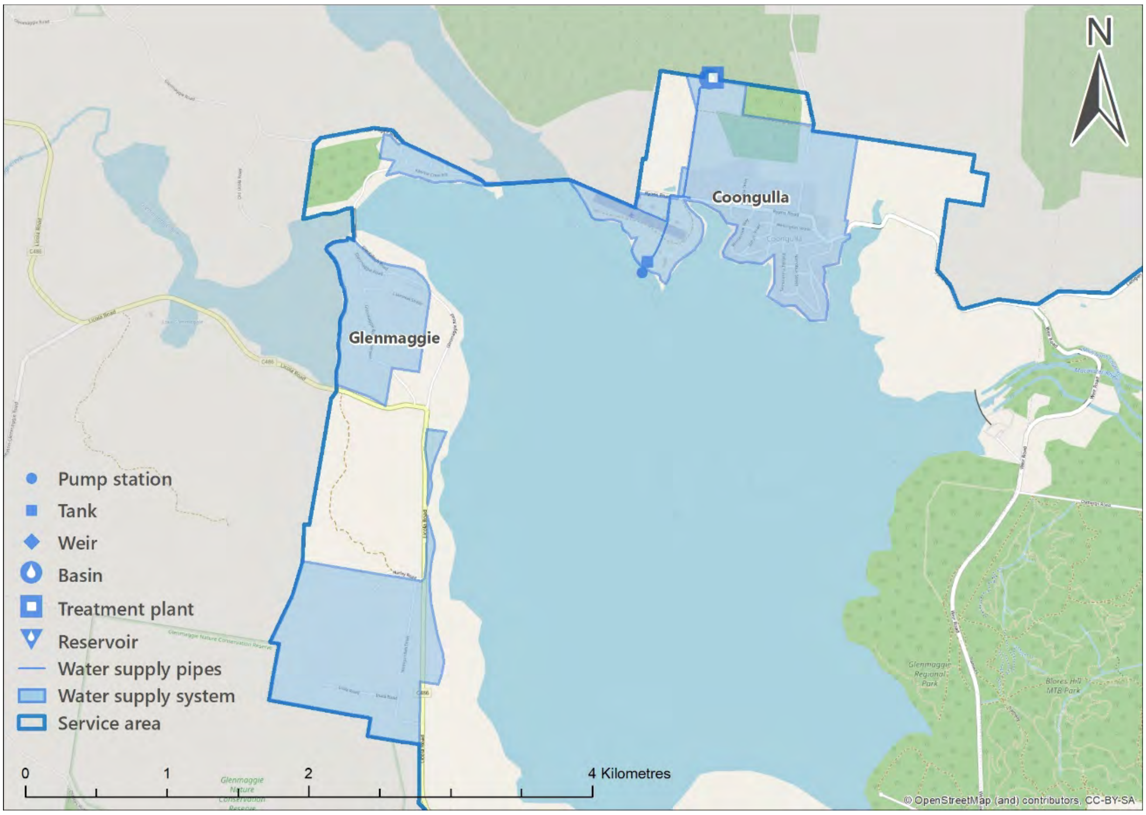


Figure 134 Coongulla and Glenmaggie water system

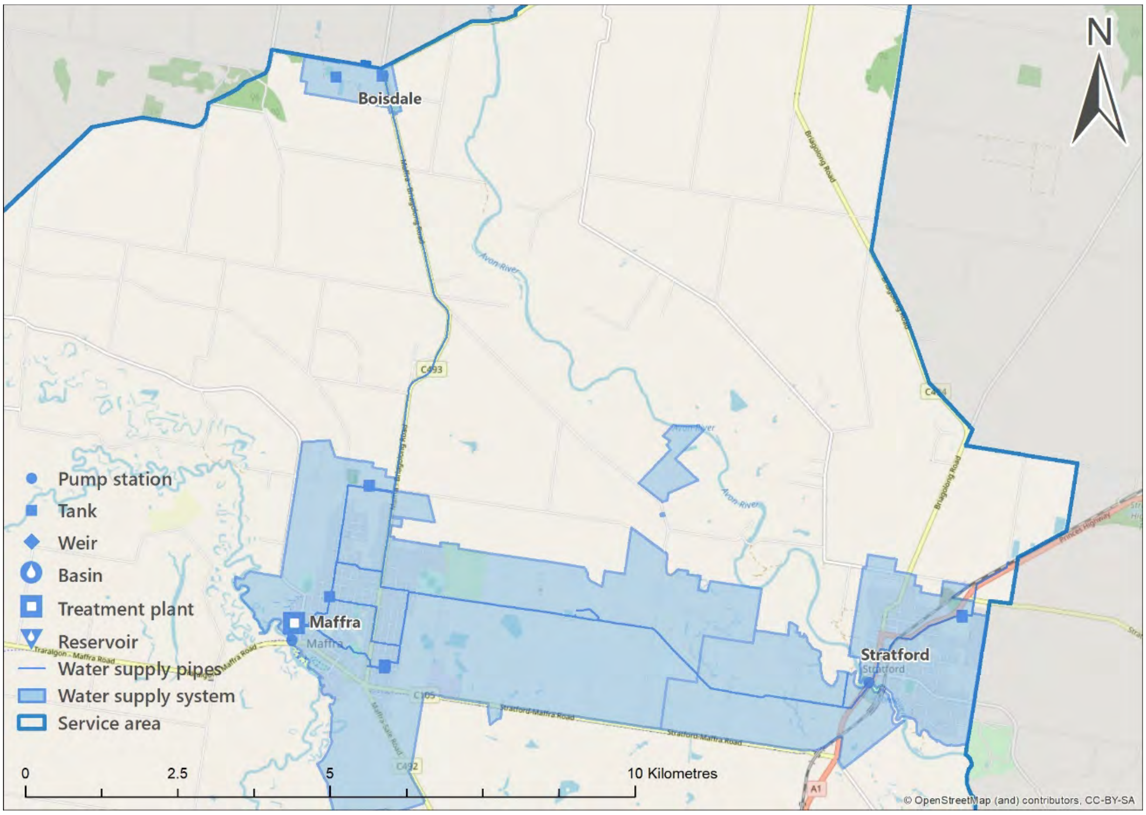


Figure 135 Maffra water system

Appendix C

Water treatment process diagrams

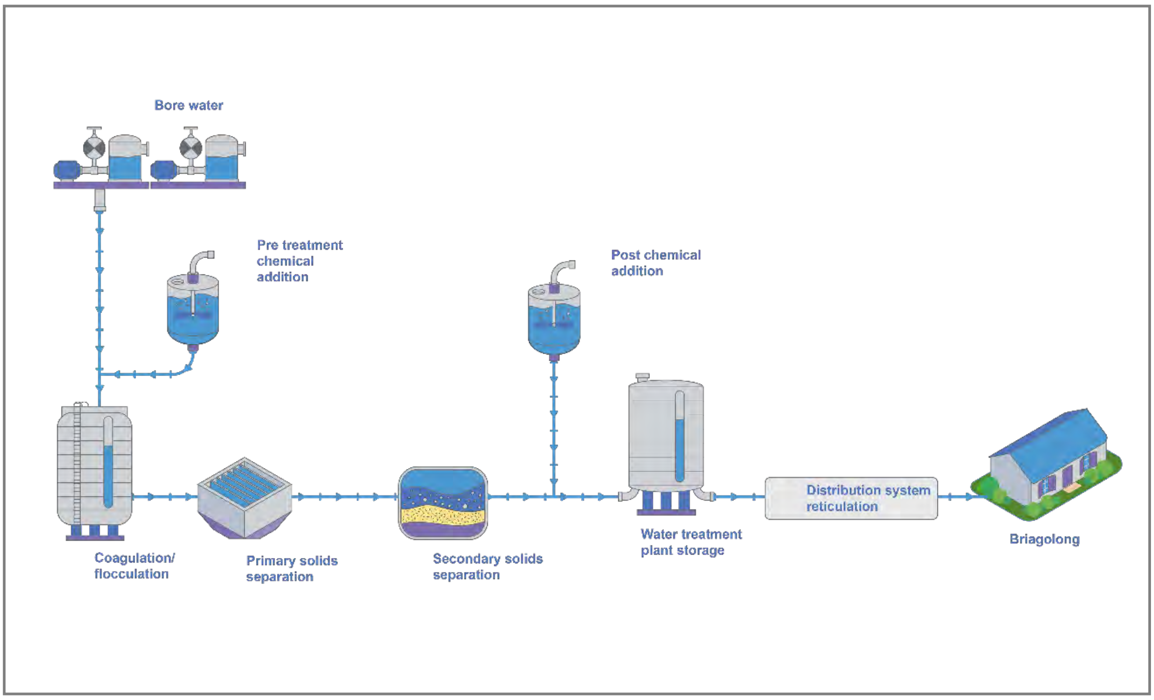


Figure 136 Briagolong water treatment process

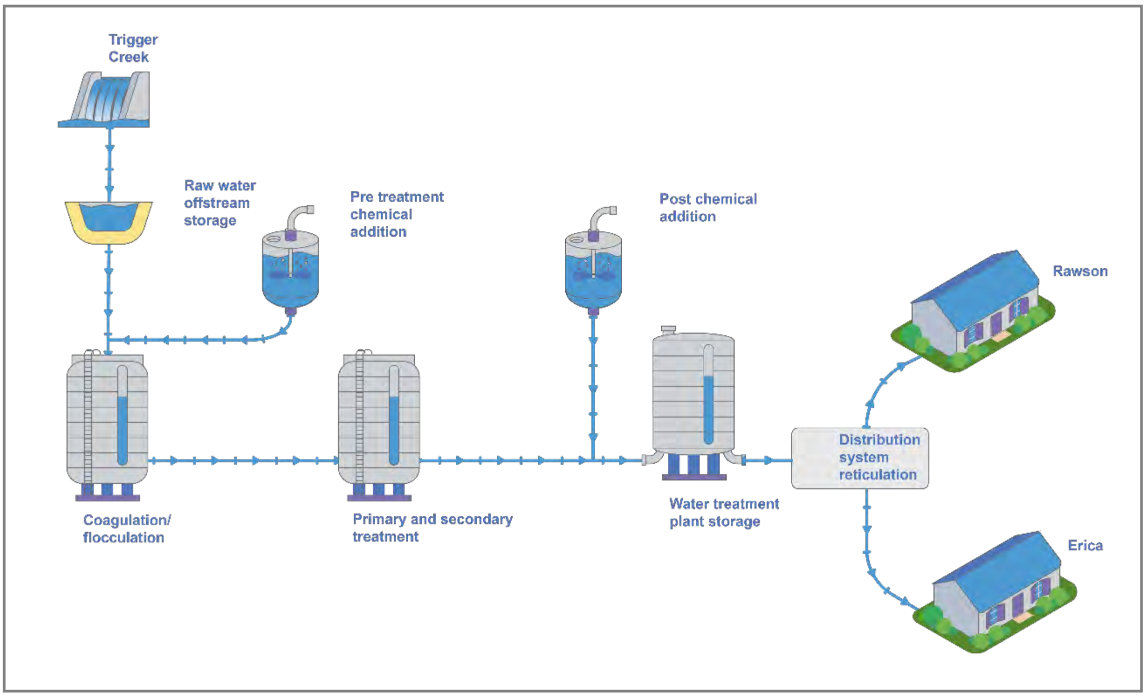


Figure 137 Rawson water treatment process

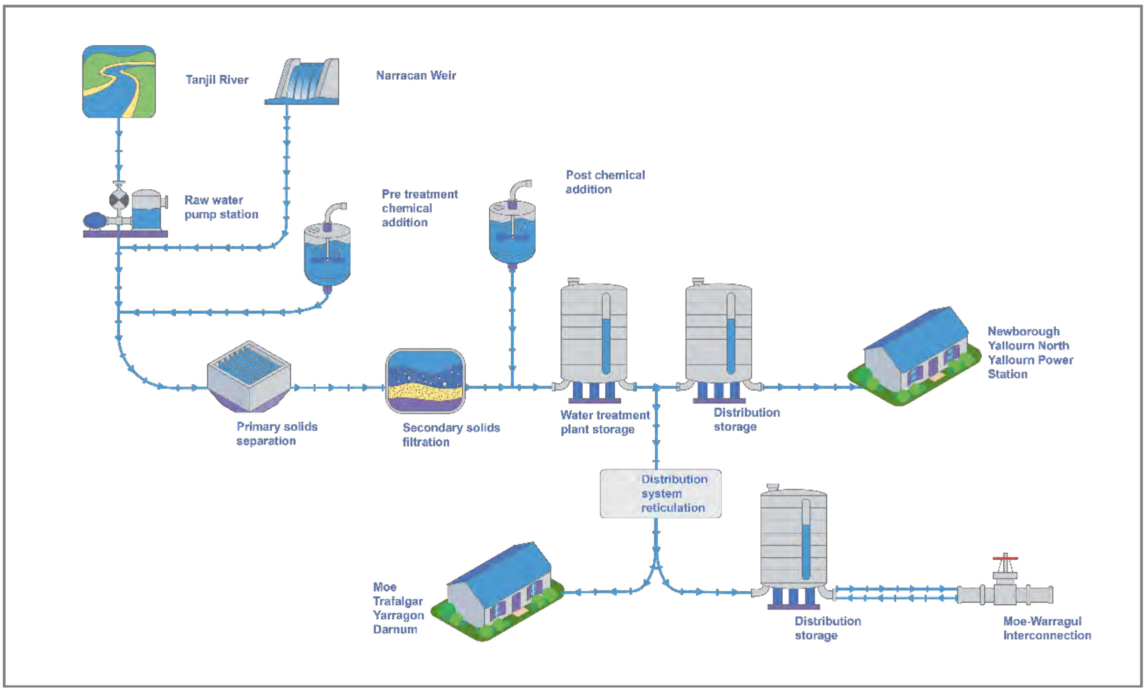


Figure 138 Moe water treatment process

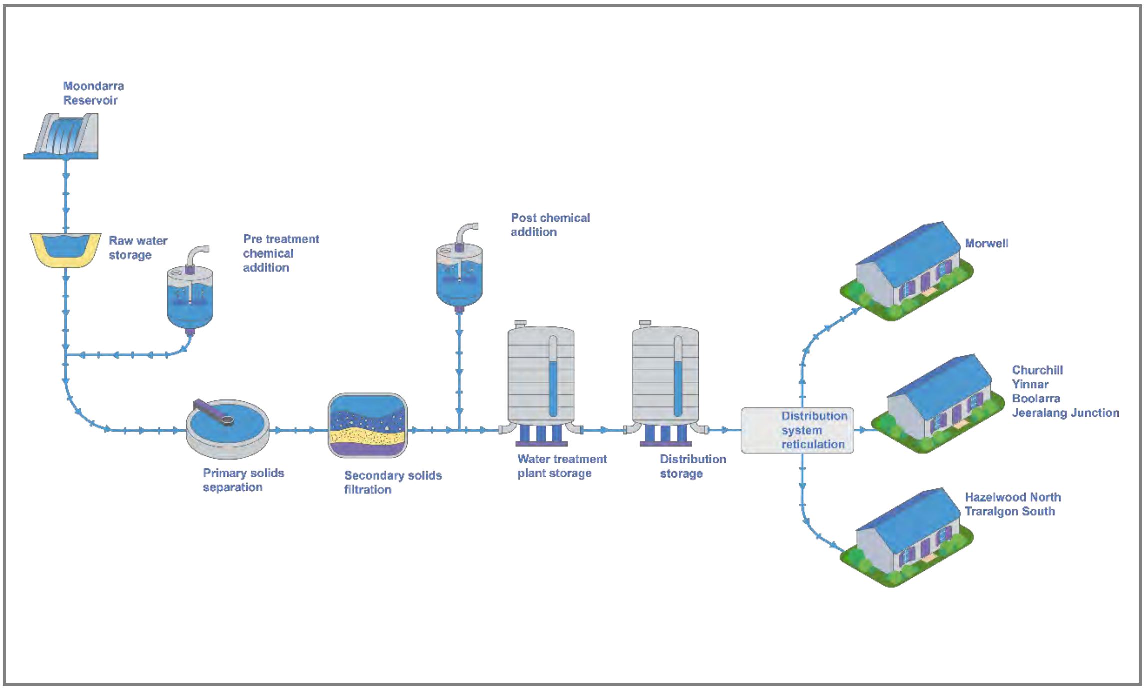


Figure 139 Morwell water treatment process

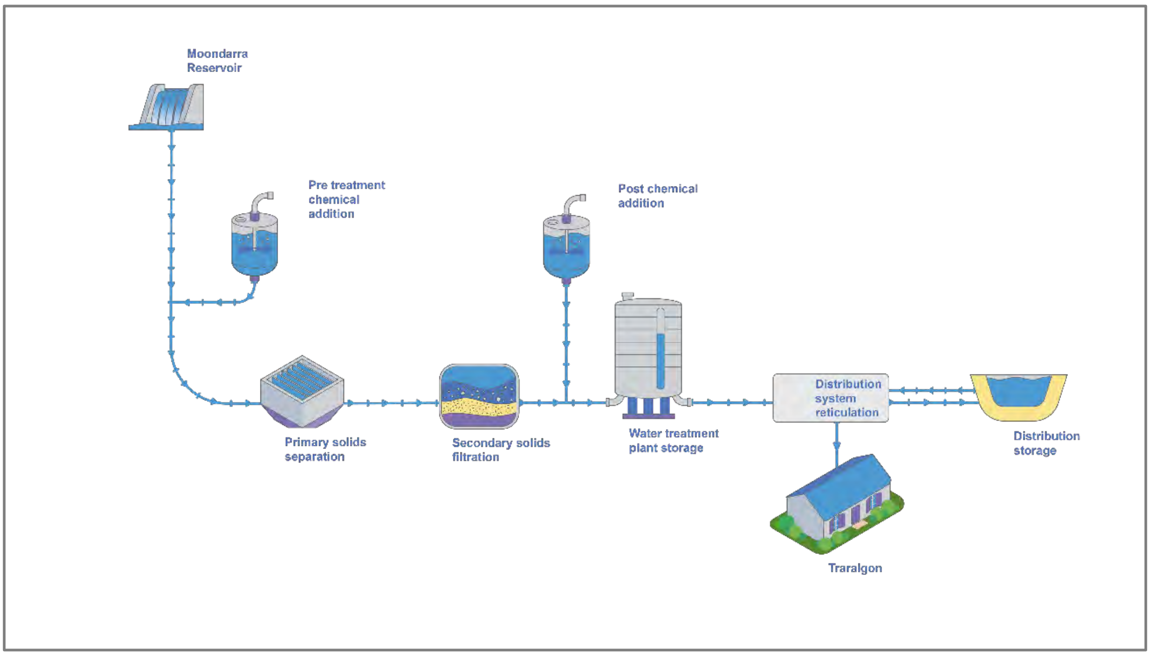


Figure 140 Traralgon water treatment process

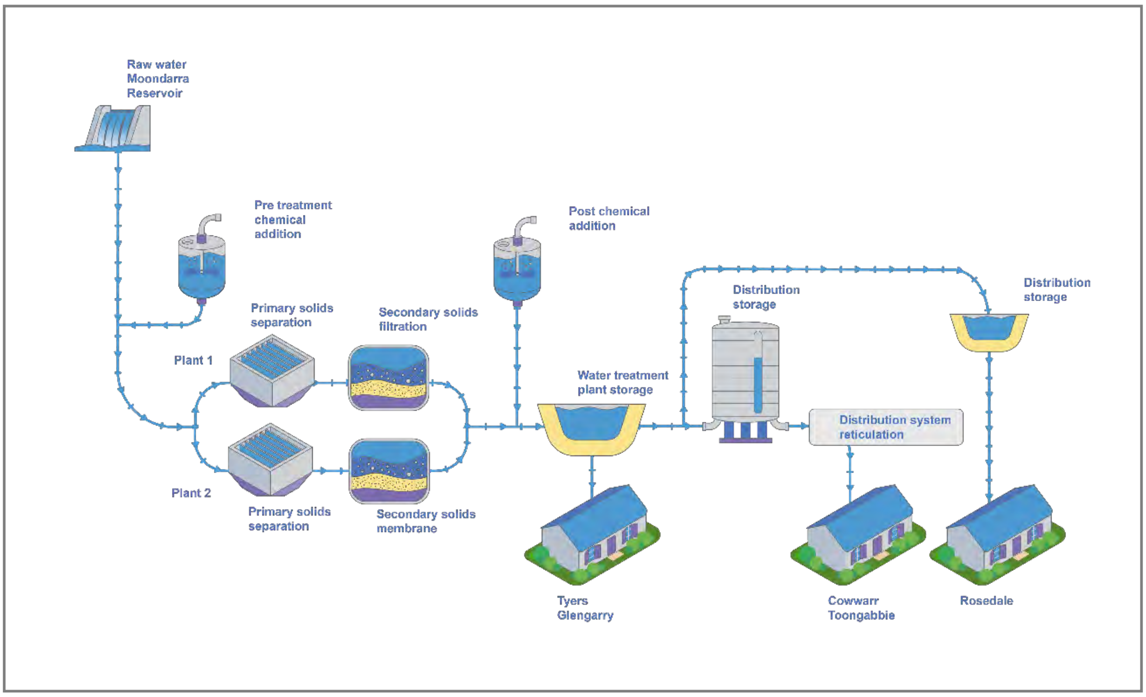


Figure 141 Tyers water treatment process

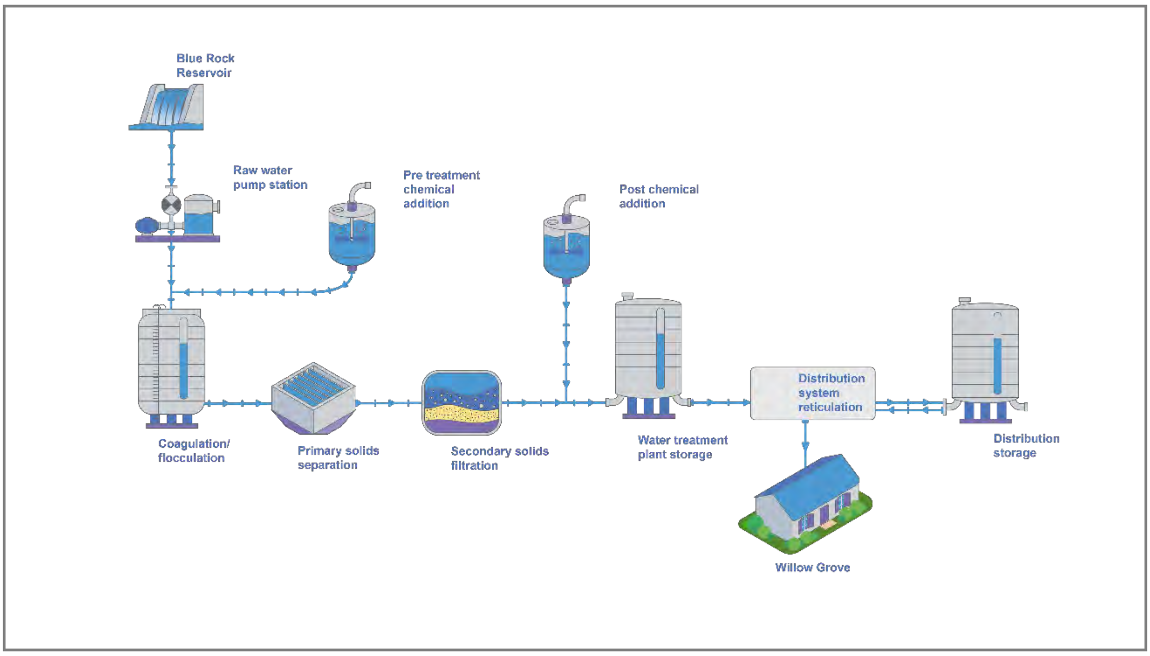


Figure 142 Willow Grove water treatment process

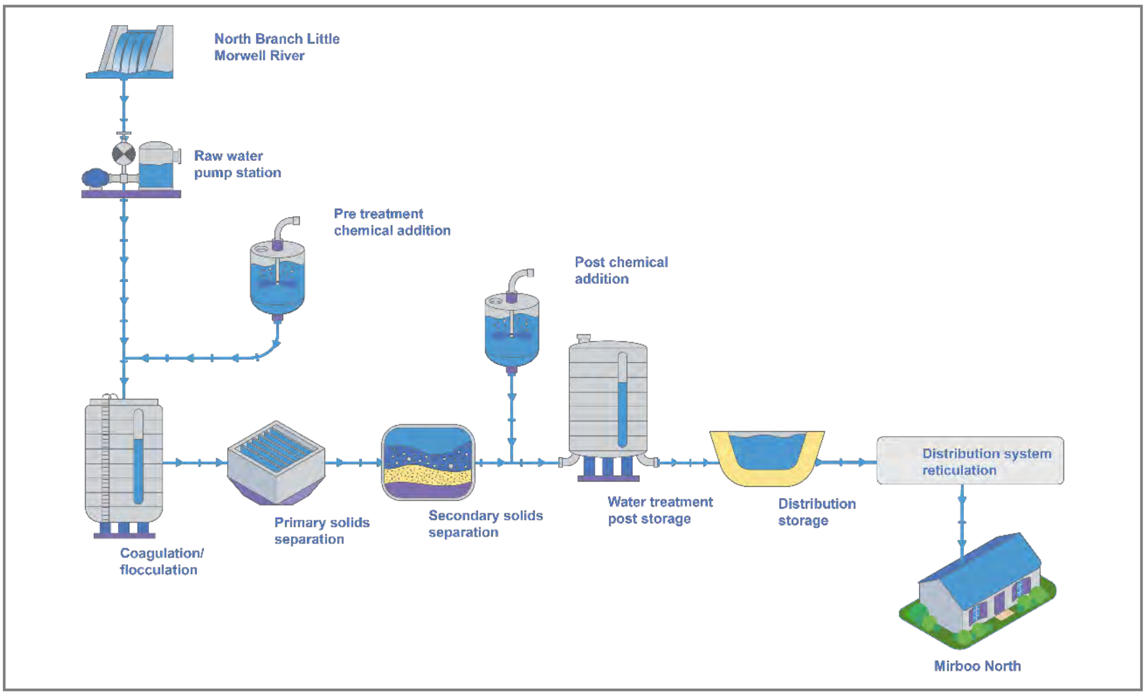


Figure 143 Mirboo North water treatment process

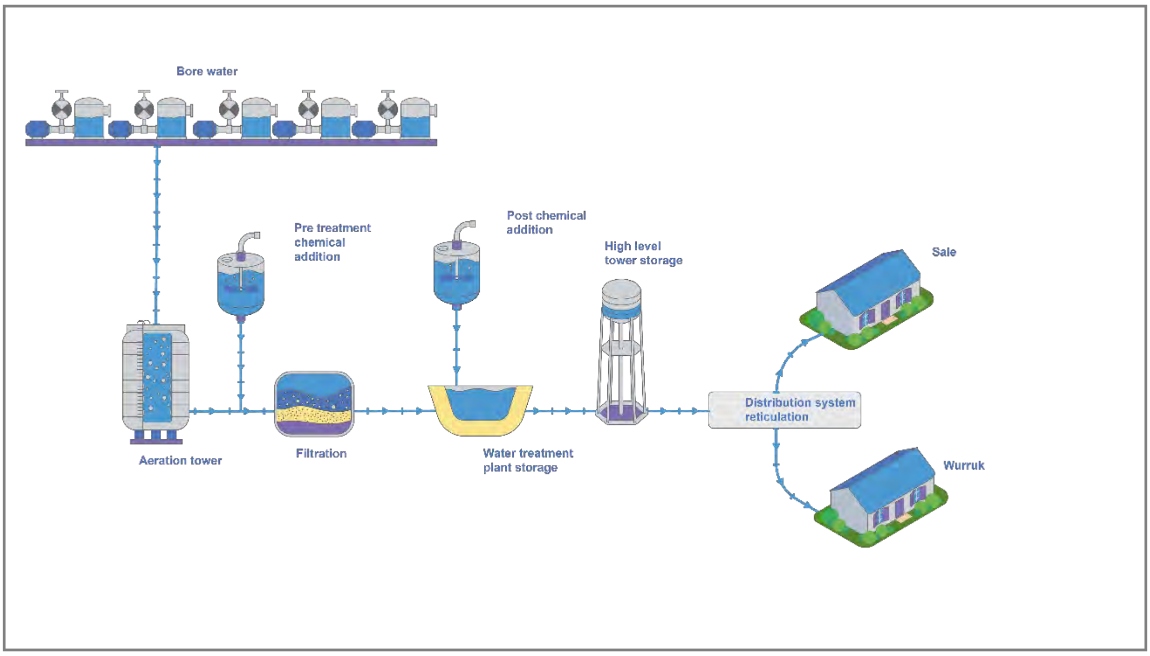


Figure 144 Sale water treatment process

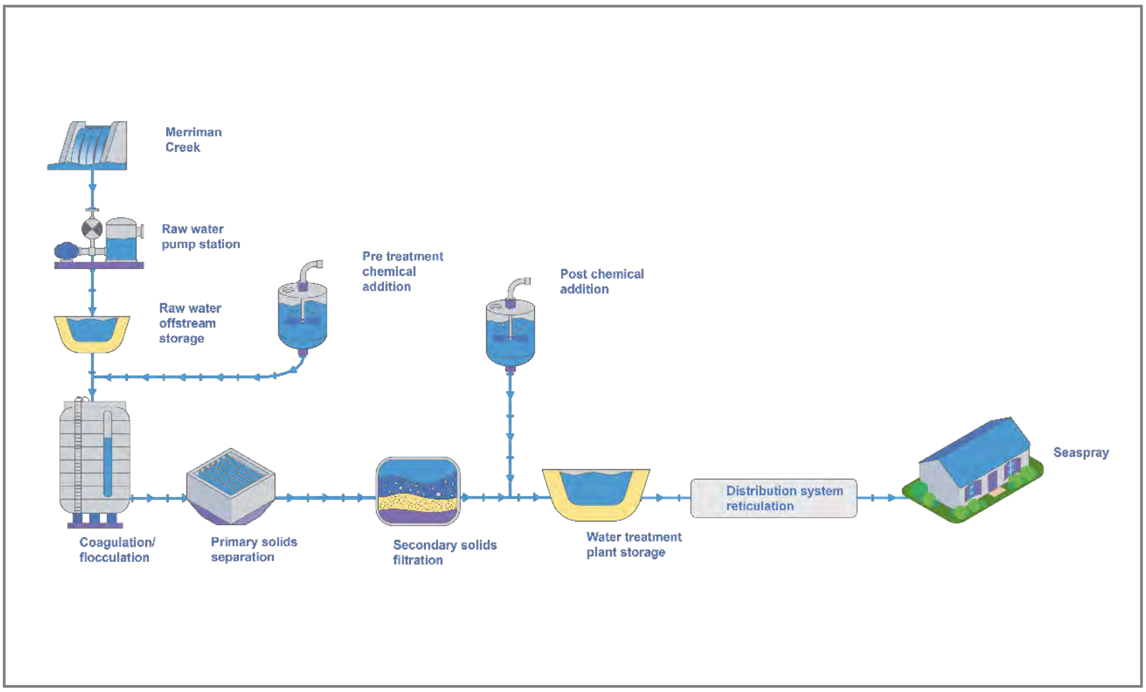


Figure 145 Seaspray water treatment process

Appendix D

Sewerage system maps

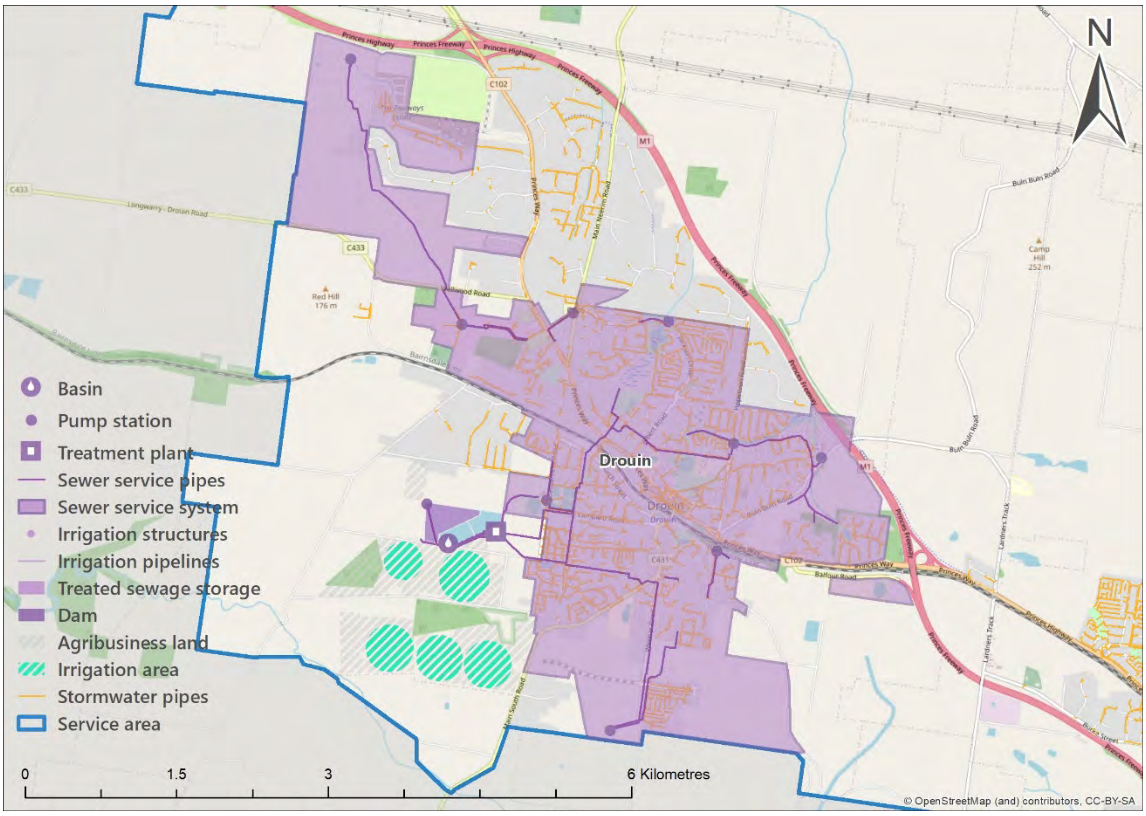


Figure 146 Drouin sewage system

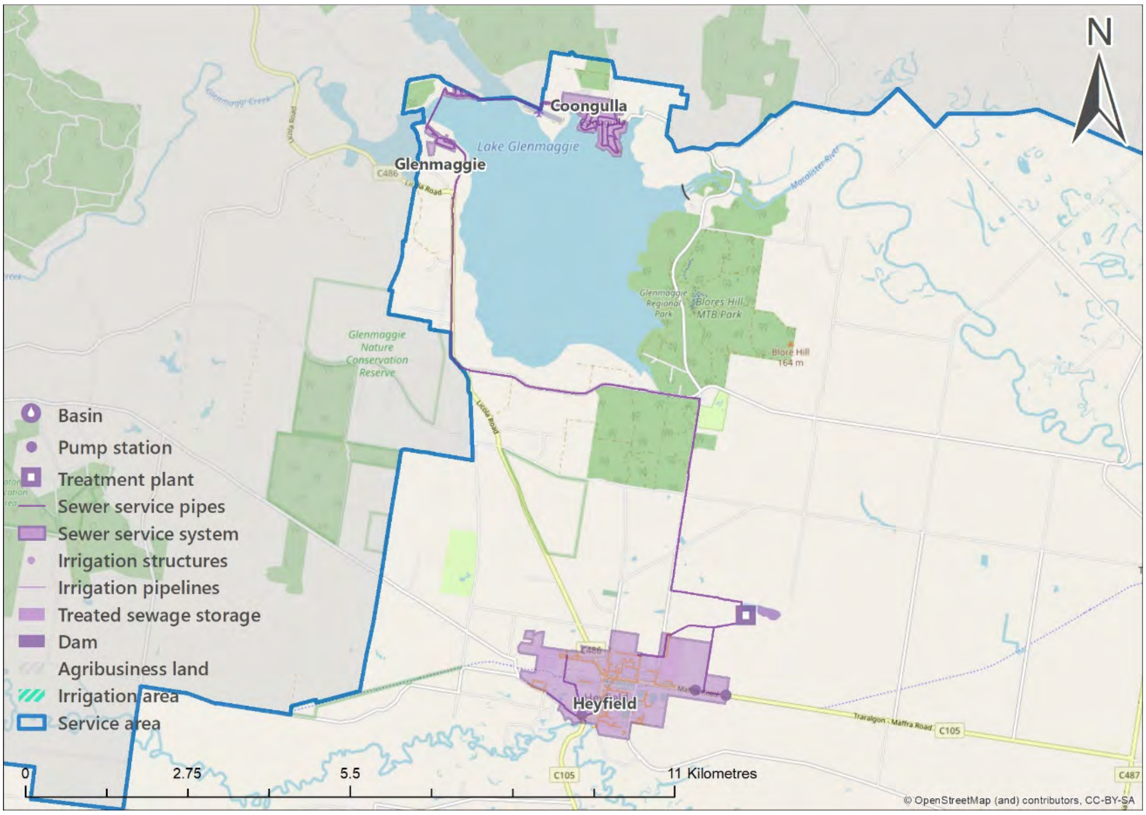


Figure 147 Heyfield sewage system

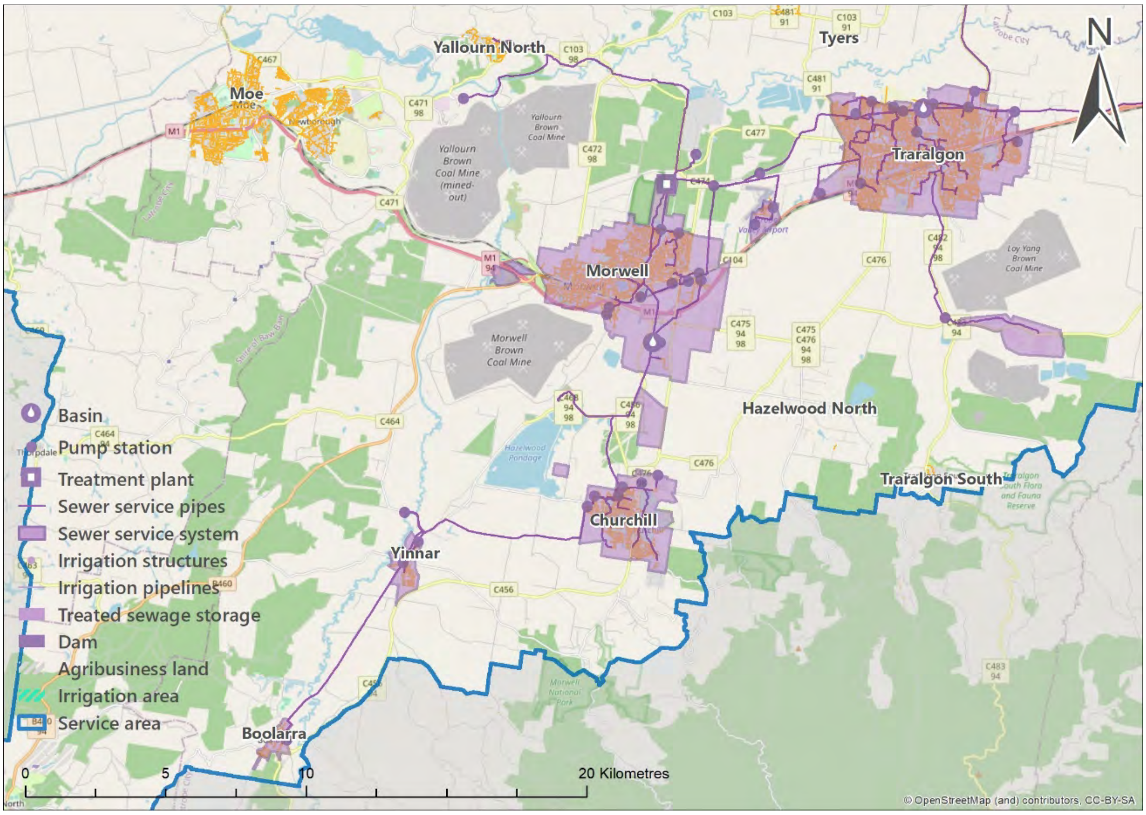


Figure 148 Western extent of the Gippsland Water Factory domestic sewage system

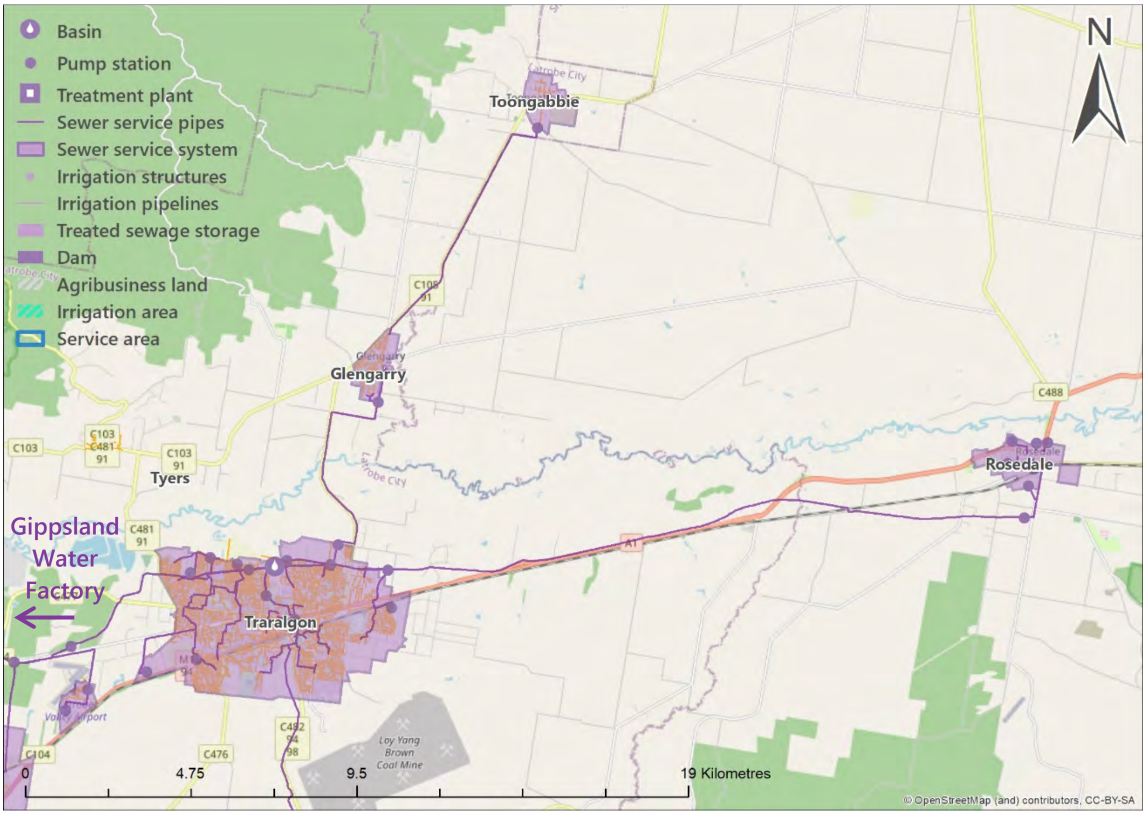


Figure 149 Eastern extent of the Gippsland Water Factory domestic sewage system

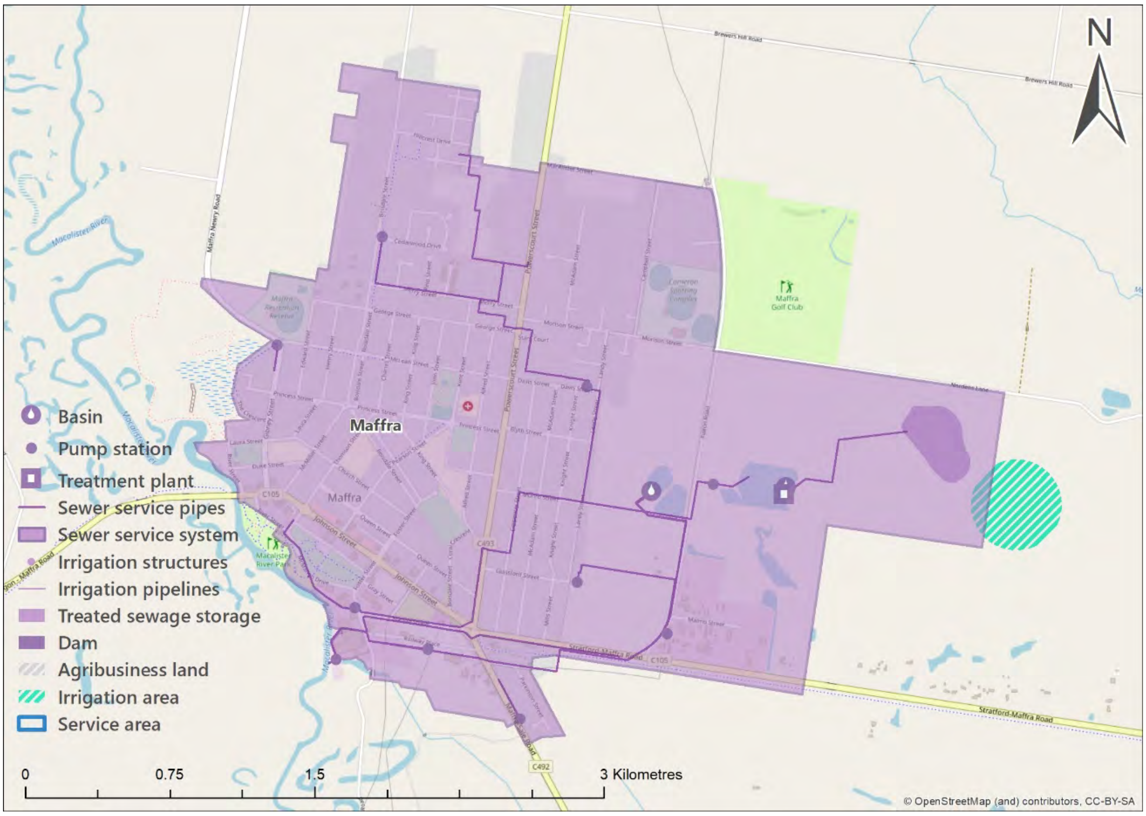


Figure 150 Maffra sewage system

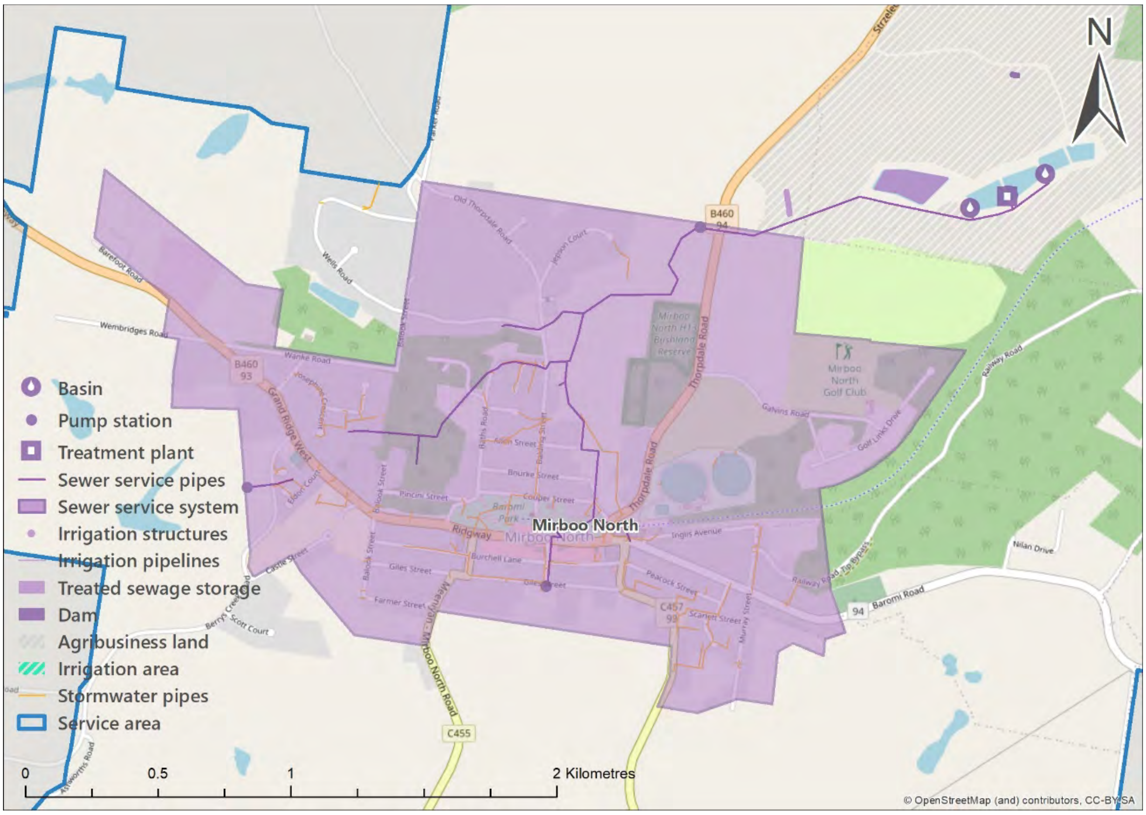


Figure 151 Mirboo North sewage system

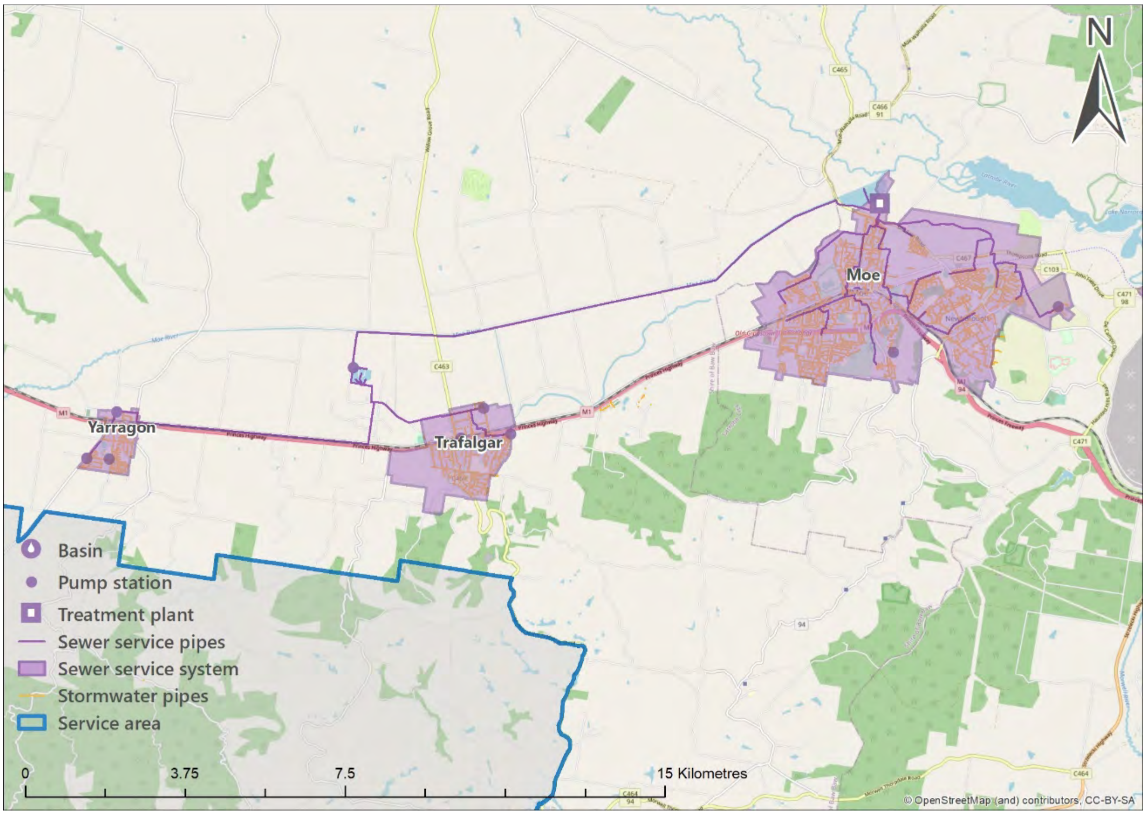


Figure 152 Moe sewage system

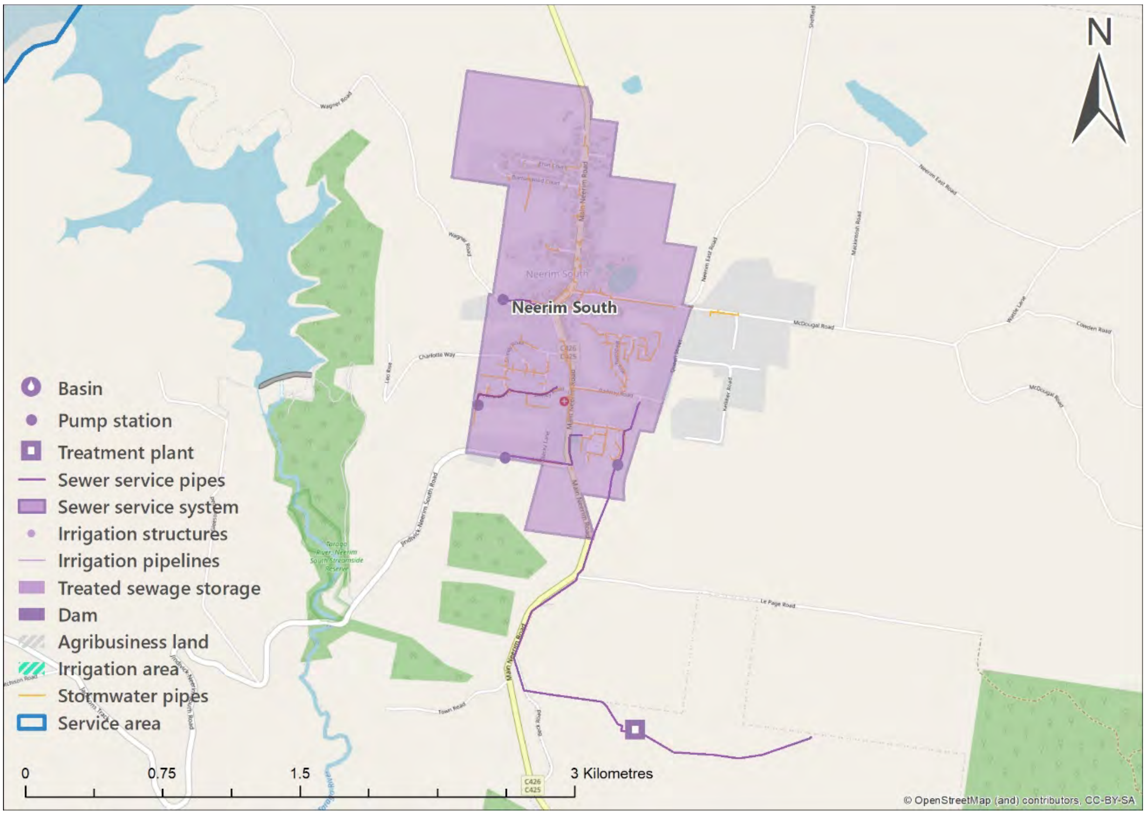


Figure 153 Neerim South sewage system

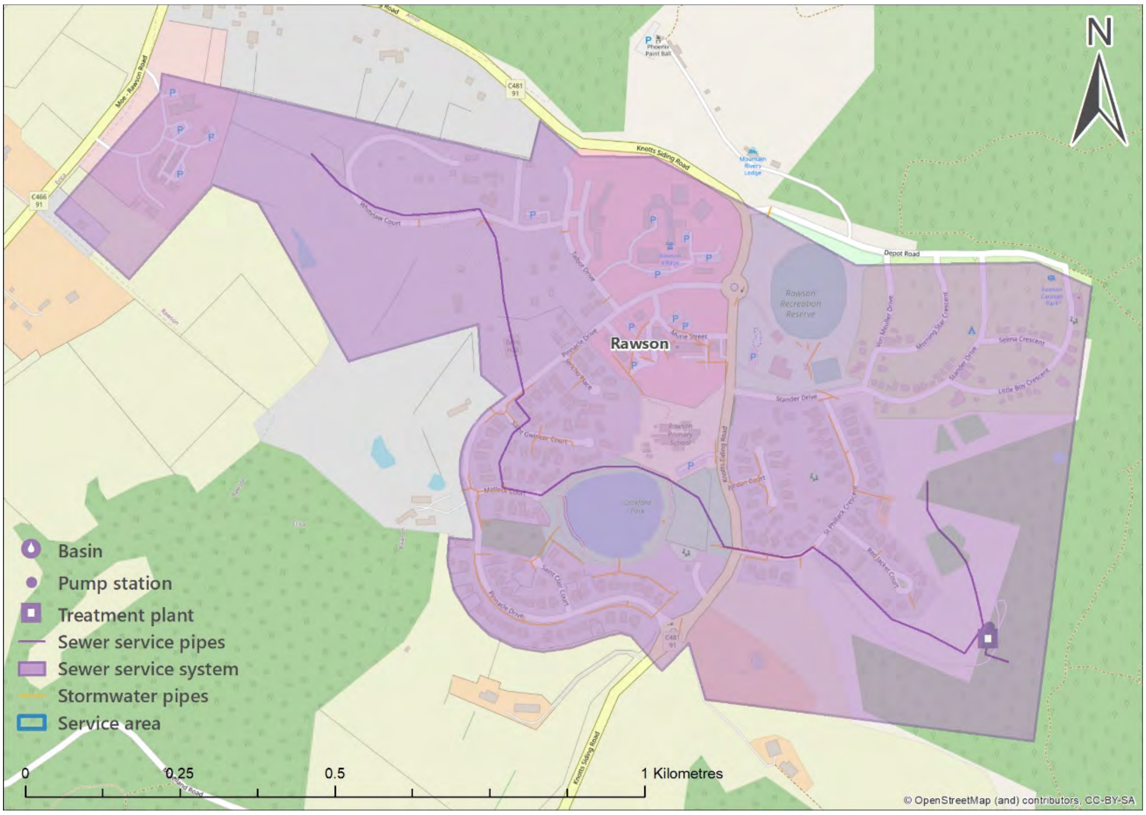


Figure 154 Rawson sewage system

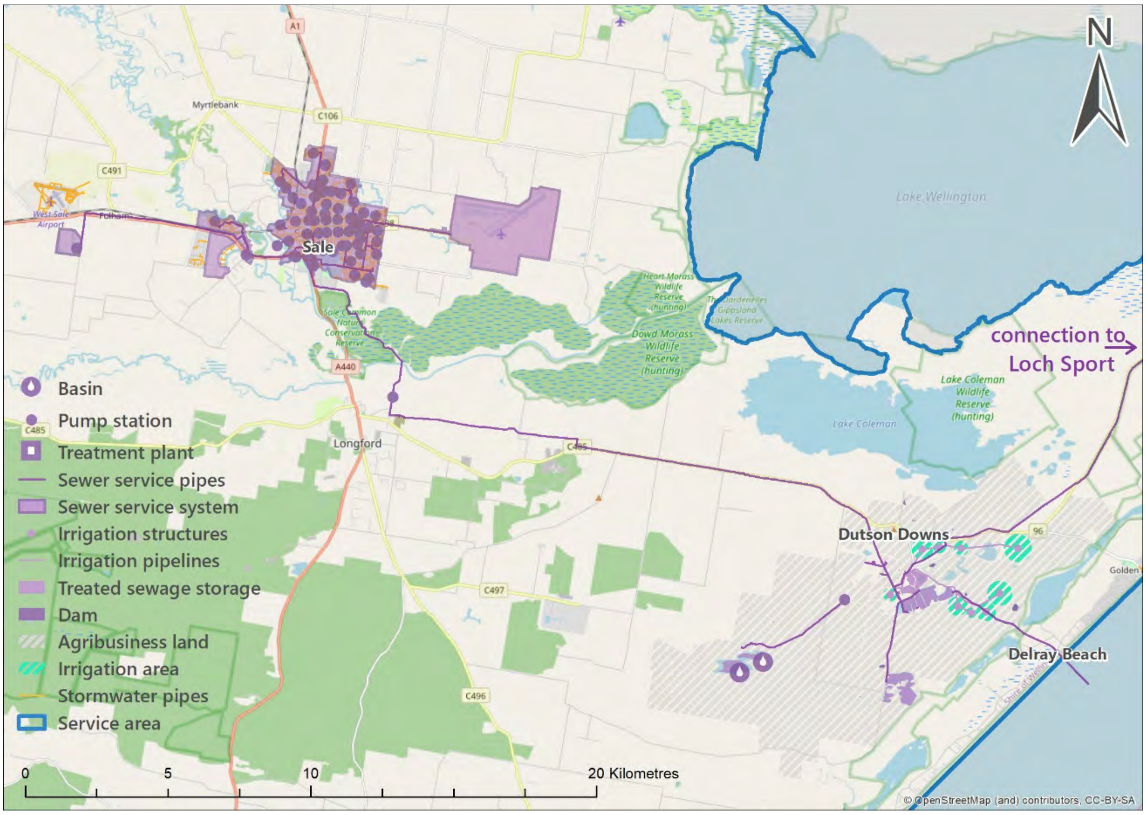


Figure 155 Sale and Loch Sport sewage system

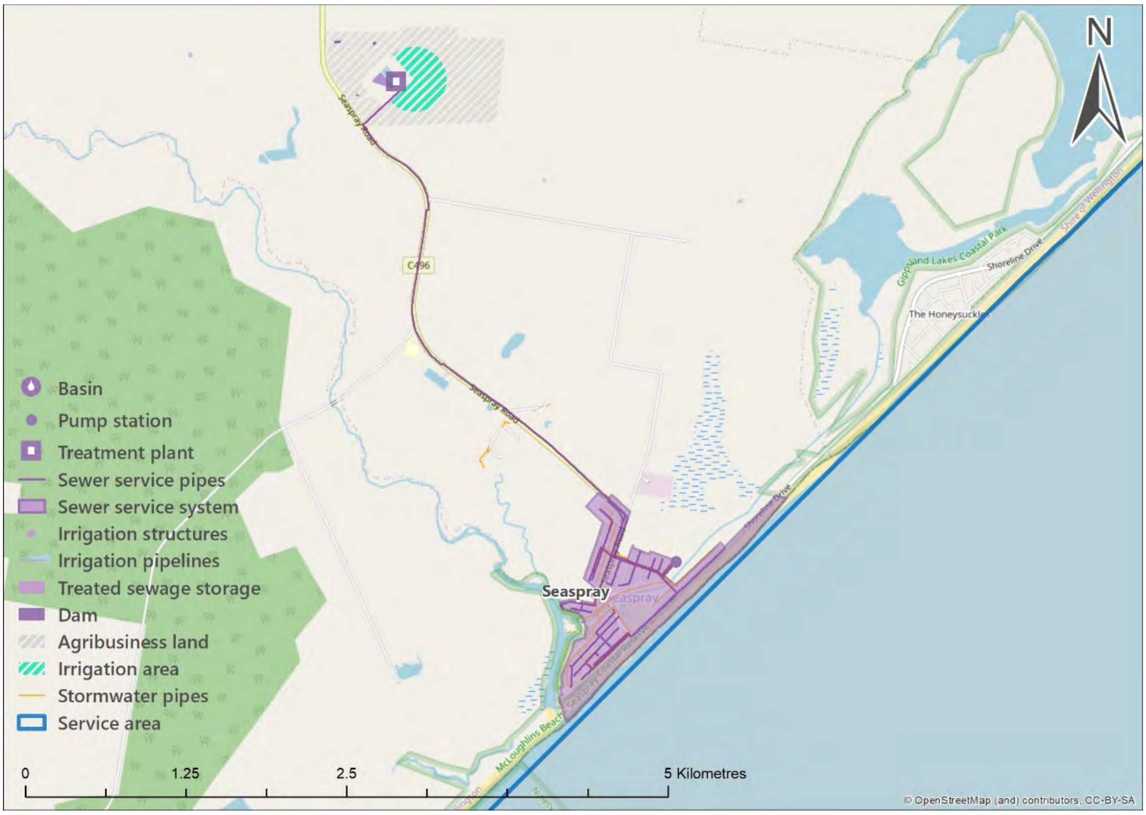


Figure 156 Seaspray sewage system

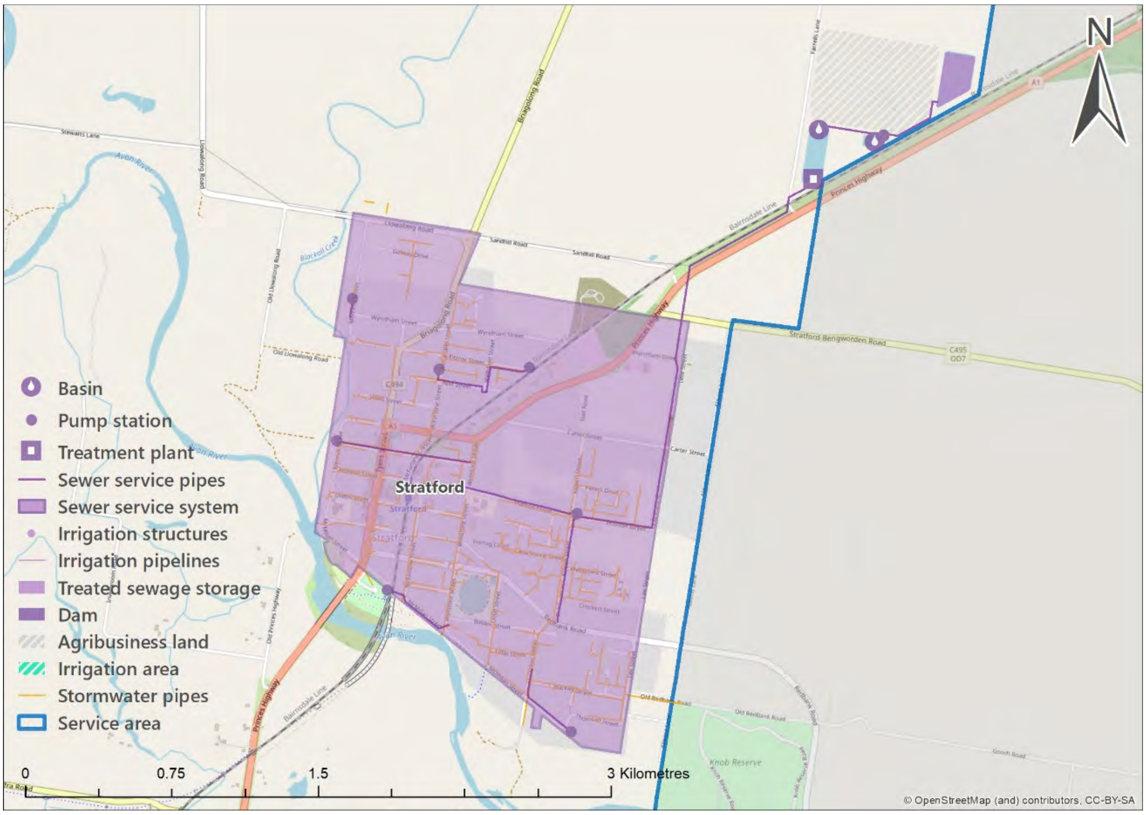


Figure 157 Stratford sewage system

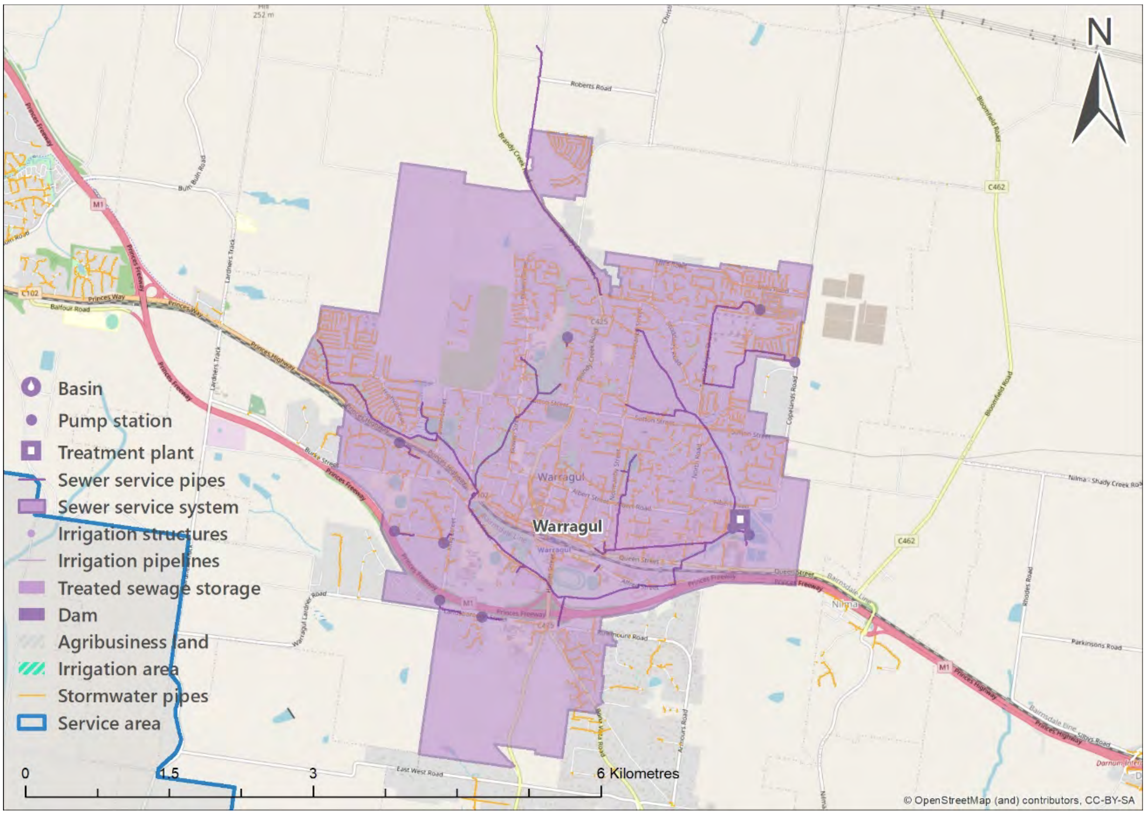


Figure 158 Warragul sewage system

Figure 159 Willow Grove sewage system

Appendix E

Sewage treatment process diagrams

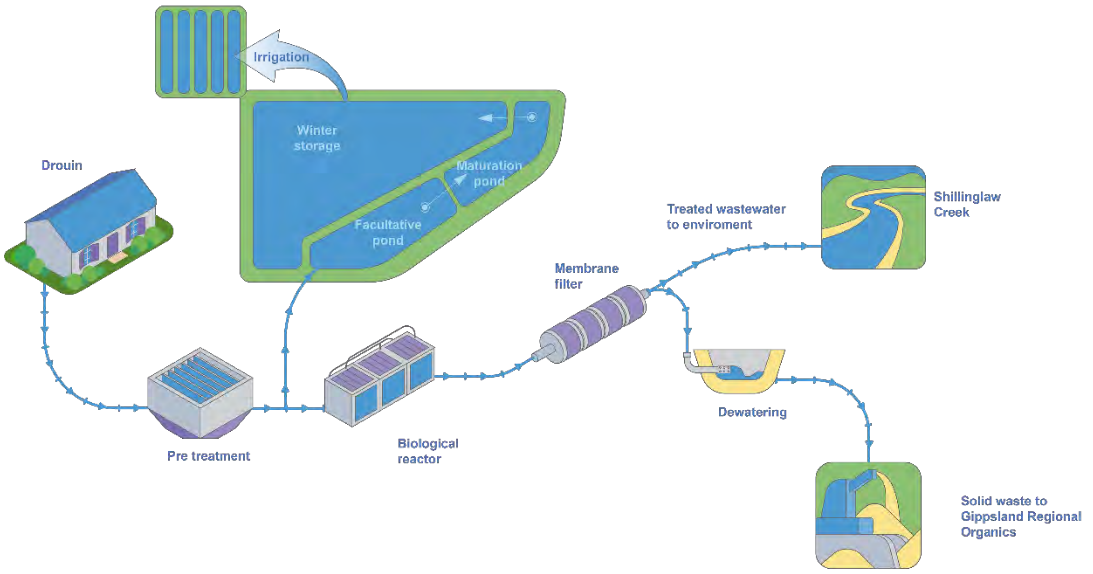


Figure 160 Drouin sewage treatment process

Figure 161 Heyfield sewage treatment process

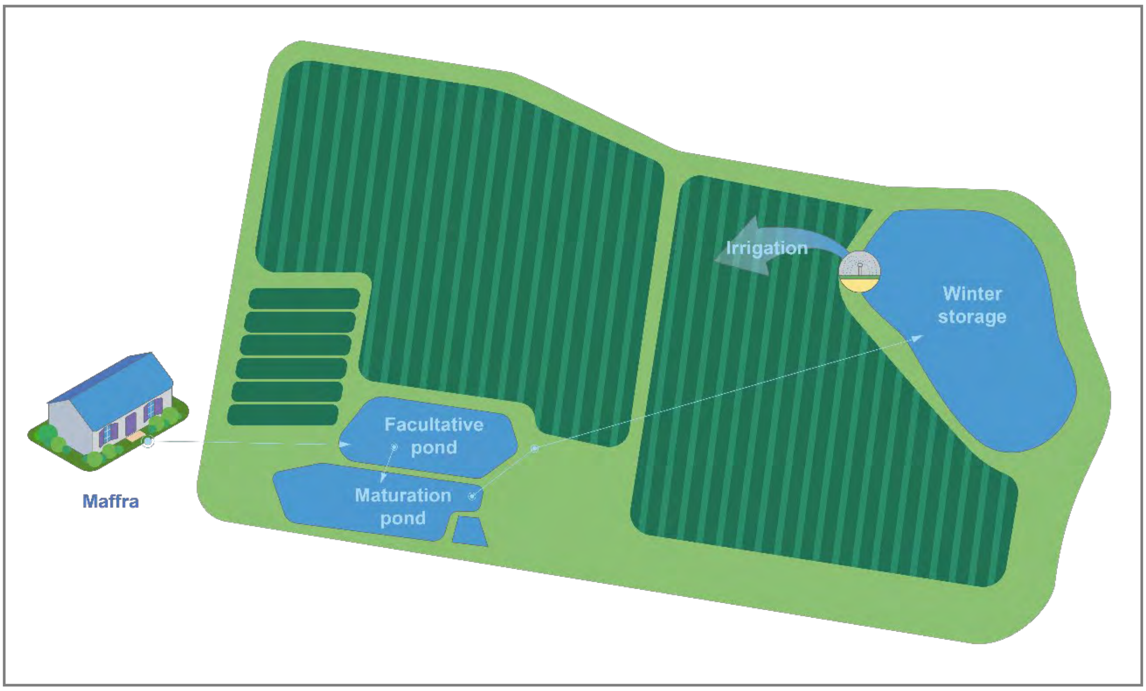


Figure 162 Maffra sewage treatment process

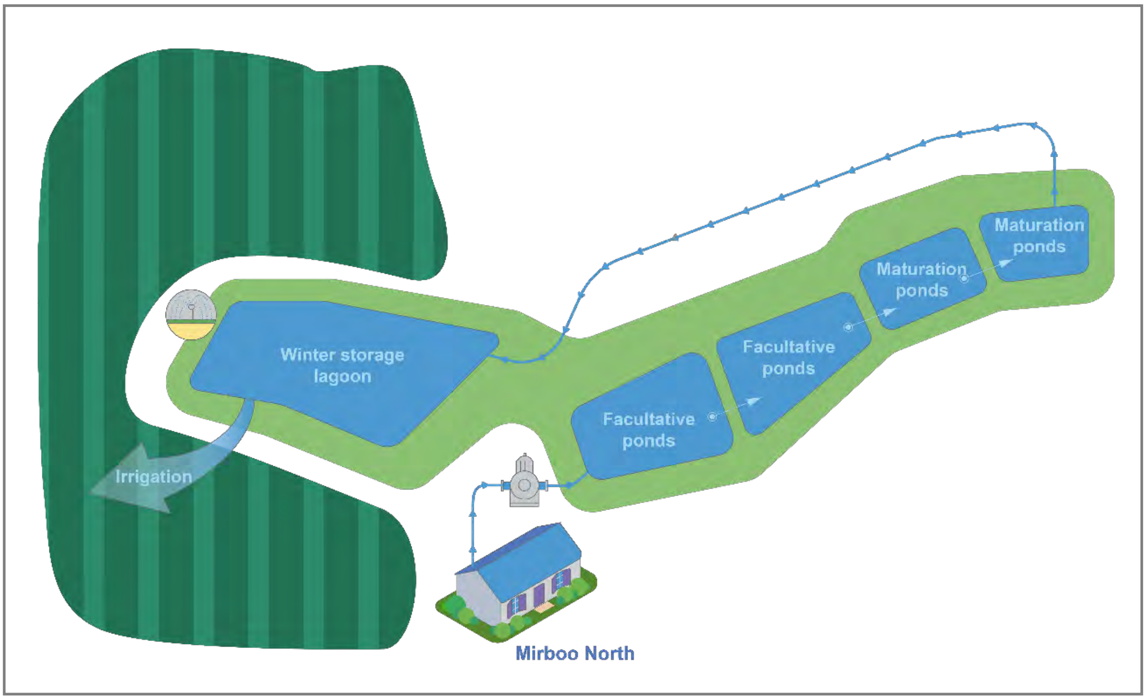


Figure 163 Mirboo North sewage treatment process

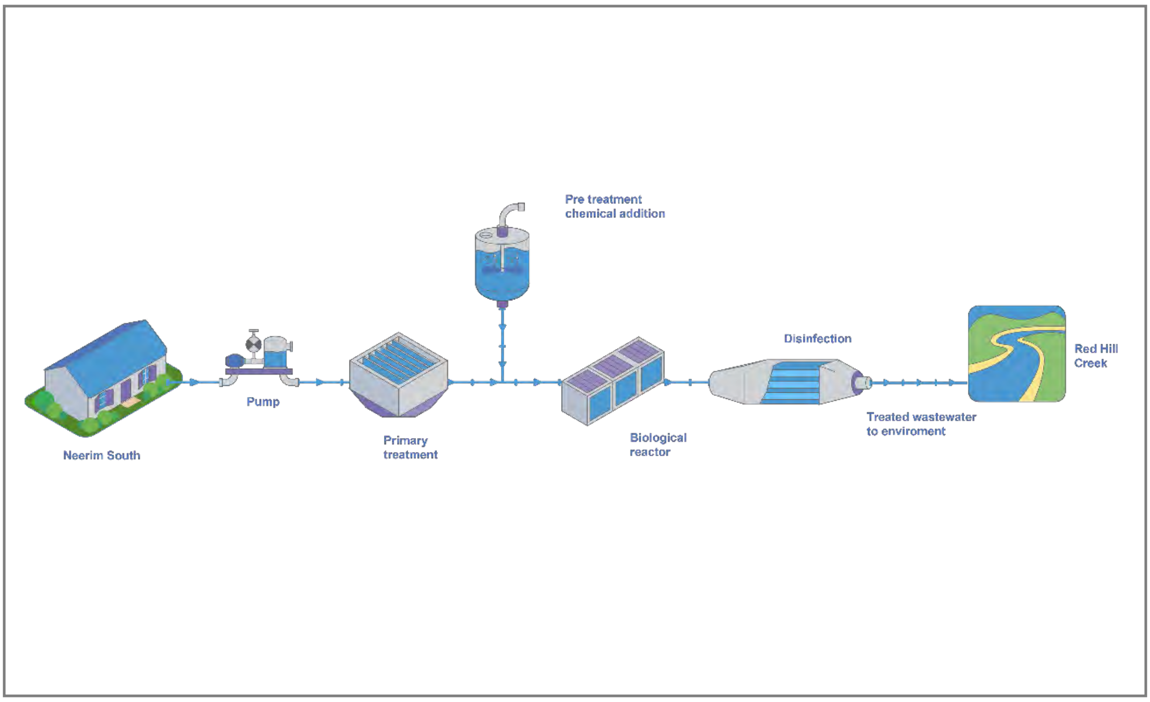


Figure 164 Neerim South sewage treatment process

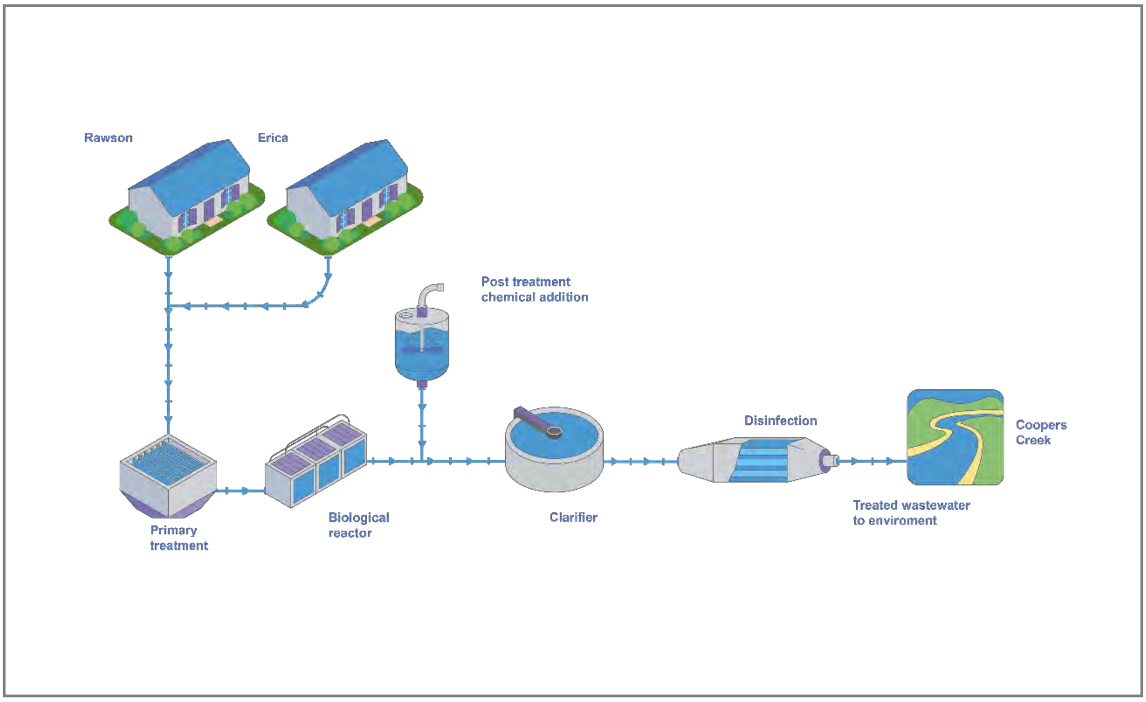


Figure 165 Rawson sewage treatment process

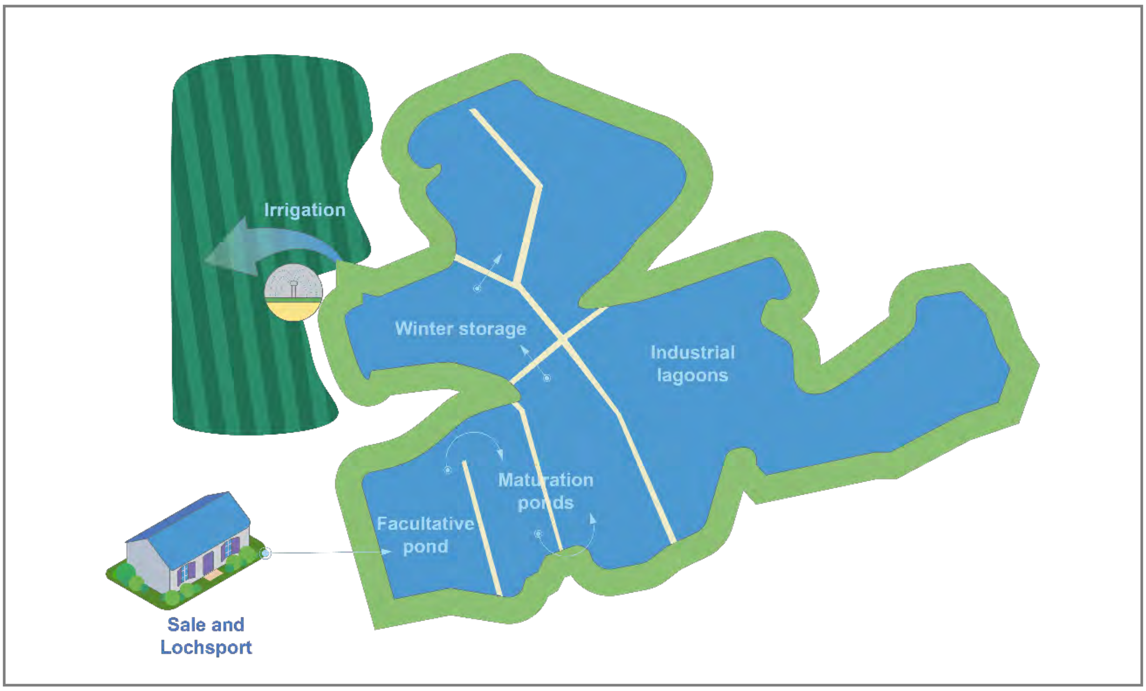


Figure 166 Sale sewage treatment process

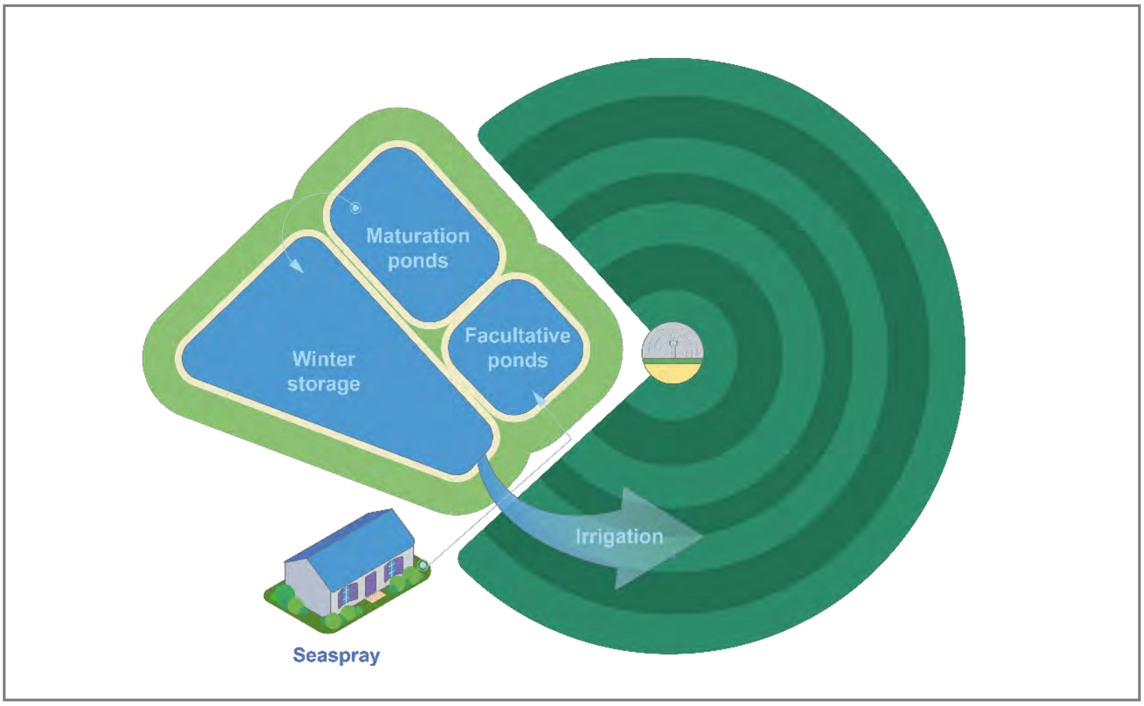


Figure 167 Seaspray sewage treatment process

Figure 168 Stratford sewage treatment process

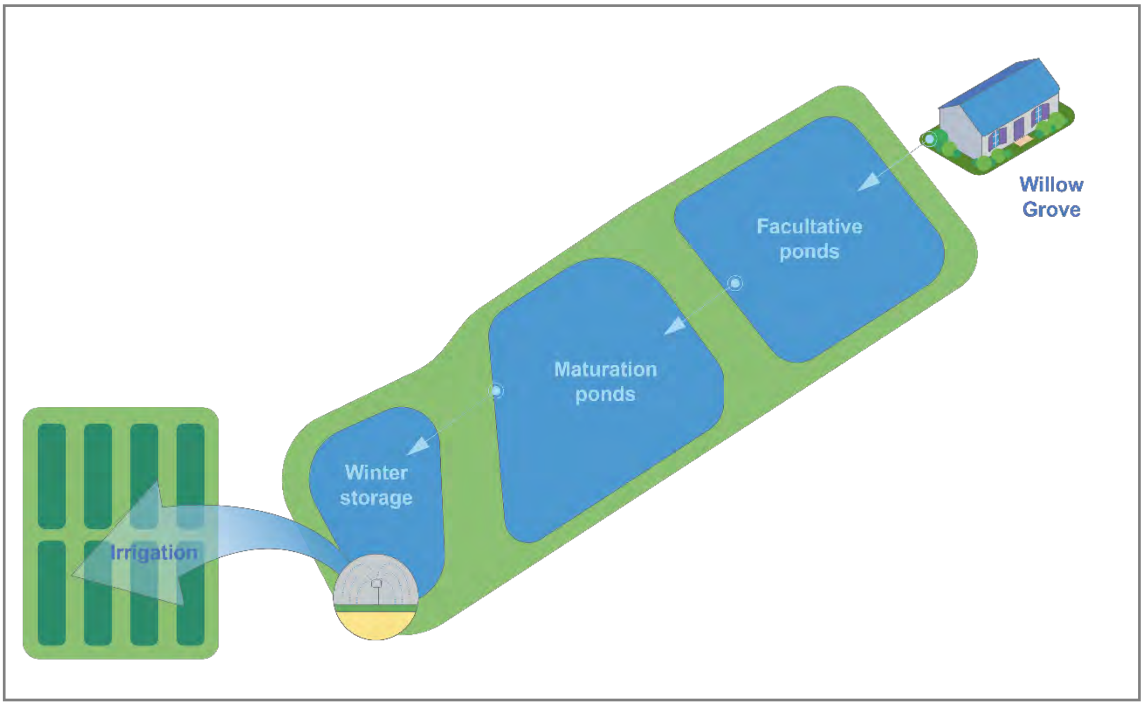


Figure 169 Willow Grove sewage treatment process

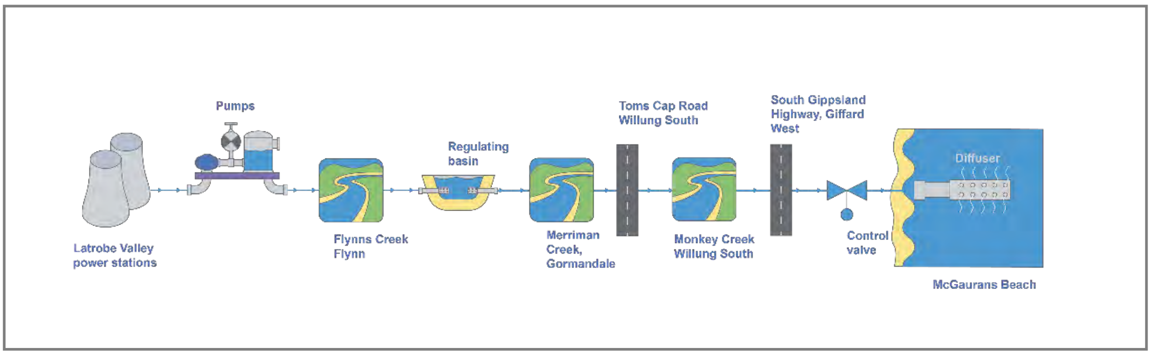


Figure 170 Saline water outfall pipeline

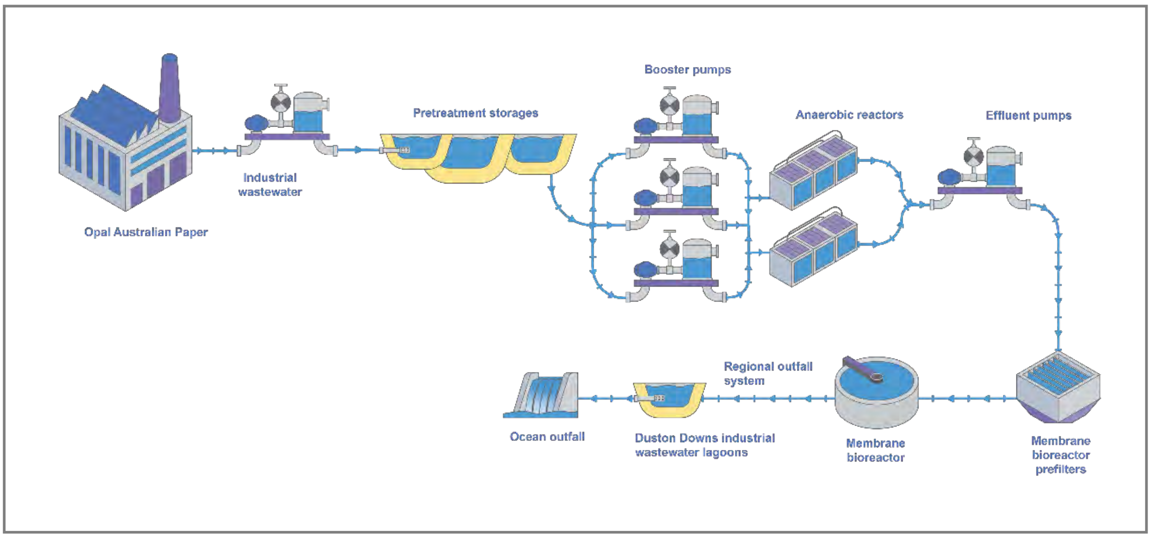


Figure 171 Gippsland Water Factory industrial wastewater treatment process

Gippsland Water

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