South Gippsland Water

Drought Preparedness Plan

Final

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Executive Summary

The purpose of a Drought Preparedness Plan (DPP) is to provide a ready reference for South Gippsland Water to use for operational guidance. The DPP summarises key information about the supply system and details the important actions to be taken in preparing for and responding to water shortages. These water shortages can be due not only to drought, but also to other extreme circumstances such as water quality and emergency events. This DPP was prepared in accordance with State Government guidelines for preparing DPPs (DELWP, 2021a). It supersedes the previous plan dated April 2017.

This DPP outlines how South Gippsland Water will prepare for and respond to drought for each supply system in the South Gippsland Water region, as listed in Table ES-1, as well as a process for post-drought review and regular update of the DPP. It incorporates the outcomes of customer consultation to date, and presents the communication tools developed to prepare the community for the recurring possibility of drought. This DPP meets the requirements for Drought Response Plans under the Statement of Obligations issued to all water corporations in Victoria (Minster for Environment, Climate Change and Water, 2015) and is compatible with South Gippsland Water's Water Restriction By-Law (South Gippsland Water, 2012).

Table ES-1 South Gippsland Water's Supply Systems

Supply System	Towns Supplied
Northern Towns	
Ruby Creek	Leongatha, Koonwarra
Southern Towns and connected Northern Towns	
Lance Creek	Wonthaggi, Cape Paterson, Inverloch, Poowong, Loch, Nyora, Korumburra
Central Towns	
Tarwin River East Branch	Dumbalk
Tarwin River	Meeniyan
Deep Creek/Foster Dam	Foster
Battery Creek	Fish Creek
Agnes River	Toora, Welshpool, Port Welshpool, Port Franklin, Barry Beach Port
Eastern Towns	
Tarra River	Yarram, Alberton, Port Albert, Devon North

Contents

1. Introduction

The purpose of a Drought Preparedness Plan known from here on as the DPP is to provide a ready reference for South Gippsland Water (South Gippsland Water) to use for operational guidance. The DPP summarises key information about the supply system and details the important actions to be taken in preparing for and responding to water shortages. These water shortages can be due not only to drought, but also other extreme circumstances such as water quality and emergency events. This DPP was prepared in accordance with State Government guidelines for preparing DPPs (DELWP, 2021a). Core requirements under those guidelines are summarised in Section 1.1. This DPP supersedes the previous DPP dated April 2017.

DPPs have been prepared for each of the water supply systems listed in Table 1-1. A map showing the location of the towns can be found in Figure 1-1.

Table 1-1 South Gippsland Water's Supply Systems

Supply System	Towns Supplied	Section of DPP
Northern Towns		
Ruby Creek	Leongatha, Koonwarra	5
Southern Towns and connected Northern Towns		
Lance Creek	Wonthaggi, Cape Paterson, Inverloch, Poowong, Loch, Nyora, Korumburra	6
Central Towns		
Tarwin River East Branch	Dumbalk	7
Tarwin River	Meeniyan	8
Deep Creek/Foster Dam	Foster	9
Battery Creek	Fish Creek	10
Agnes River	Toora, Welshpool, Port Welshpool, Port Franklin, Barry Beach Port	11
Eastern Towns		
Tarra River	Yarram, Alberton, Port Albert, Devon North	12

This DPP is based on information available in November 2021. This plan is a dynamic document which is refined as more information becomes available. It is therefore important to regularly revise and update the DPP, including adapting South Gippsland Water's drought response as needed to the particular circumstances of any individual drought.

1.1 Core requirements for the DPP

Core requirements for the preparation of a DPP in Victoria are provided in the Department of Environment, Land, Water and Planning (DELWP) 2020 Urban Water Strategy (UWS) guidelines. The mandatory requirements, paraphrased from DELWP (2020) are that the DPP must:

- Be provided as an appendix to the UWS;
- Cover both drought preparedness and drought response;

- Define how South Gippsland Water has and will continue to engage with customers, communities and stakeholders on planning and preparing for water shortages;
- List priority community assets that might require water to be made available during periods of water shortage, and how they will be watered during water restrictions (i.e., water use plans, exemptions and alternative water);
- Where alternative water is identified as a source, document how South Gippsland Water will work with the responsible asset manager (e.g., local council) to access the alternative water source;
- Identify proposed exemptions under each relevant stage of water restrictions; and
- Include principles for determining what are exempt users and a timeframe for determination on the submissions for exemptions.

Figure 1-1 Locality Map of South Gippsland Water's Supply Systems

2. Drought Preparedness

2.1 Introduction

South Gippsland Water has prepared itself and engaged with the community about the possibility of drought in the short-term, and acknowledges the inevitability of drought in the long-term as part of climate variability. This section of the DPP outlines the "business-as-usual" activities being undertaken by South Gippsland Water as part of its preparations for potential water shortages that can arise from drought, including engagement with customers. It includes:

- An overview of South Gippsland Water's planning cycle for drought preparedness (Section 2.2);
- The objectives of the DPP (Section 2.3);
- Customer consultation on drought preparedness and response (Section 2.4);
- Technical investigations to improve drought preparedness undertaken since the previous DPP (Section 2.5); and
- Common technical assumptions underpinning the DPP (Section 2.6).

2.2 Drought Planning Cycle

South Gippsland Water has a regular cycle of planning to prepare for drought, as illustrated in Figure 2-1. This planning operates on several time scales including:

- Ongoing active monitoring of supply system water availability, water consumption, prevailing climate and streamflow conditions, and forecast climate and streamflow conditions;
- An annual assessment of the likelihood of drought and South Gippsland Water's likely need to respond to potential water shortages, as part of South Gippsland Water's Annual Water Outlooks, published in November each year; and
- A five-yearly review and update of the DPP as part of South Gippsland Water's Urban Water Strategy, with interim update within 12 months of lifting any period of water restriction, or within 12 months of any major change in supply system works. This five-yearly review accounts for any changes in water consumption and water availability due to population growth and climate change, and any updates to State Government guidance for drought planning.

Figure 2-1 South Gippsland Water's Drought Planning Process Timeline

2.3 Setting Objectives

2.3.1 General

As part of its preparation for drought, South Gippsland Water has established a set of objectives for the DPP. These objectives also allow the effectiveness of the DPP to be evaluated.

There are essentially three types of objectives that need to be considered in a DPP. These are:

- Strategic: which address overall drought preparedness;
- Planning: which are specifically related to the planning process; and
- Operational: which translate the strategic and planning objectives into specific operational objectives.

These are outlined in turn in the following sections.

2.3.2 Strategic Objective

To ensure a systematic, timely and efficient preparation for and response to drought, and to minimise its impact on customers by:

- Ensuring timely warning of any water shortages which might occur during future droughts and being ready to deal with such shortages when they occur;
- Preparing South Gippsland Water's customers for the possibility of drought, incorporating customer preferences into South Gippsland Water's planned response to water shortages, and communicating that plan to customers; and
- Identifying any long-term planning issues, in the process of preparing a DPP, that should be considered in developing South Gippsland Water's Urban Water Strategy.

2.3.3 Planning Objectives

To ensure that in the **short term** the DPP:

- Identifies the necessary steps to be taken throughout a drought including clear triggers that instigate specific actions;
- Is subject to regular review as the system develops and as more information becomes available during the pre-drought phase; and
- Is reviewed throughout the course of drought and adjusted where necessary, and that all actions taken are evaluated after the end of the drought.

and that in the **long term**:

- South Gippsland Water determines any changes to total levels and patterns of demand and consumer expectations in relation to desirable levels of service, so that it can make an assessment of whether the system will be able to perform satisfactorily during future droughts.

2.3.4 Operational Objectives

To ensure that in the **short term**:

- A minimum level of service is provided in all droughts for unrestrictable in-house and commercial/industrial use. This component of demand is what would be provided to customers under Stage 4 restrictions under South Gippsland Water's water restriction by-law;
- The most efficient use is made of water resources during periods of water shortage, and that minimum flows are maintained to meet any downstream operational commitments (e.g., environmental requirements); and
- A reliable assessment of drought status is provided so that South Gippsland Water is aware what stage of a drought they are in and how severe the drought is likely to be.

and that in the **long term**:

- Variability in supply is managed from year to year with reference to South Gippsland Water's Annual Water Outlook of water supply availability;
- South Gippsland Water maintains a record of past drought experience; and
- South Gippsland Water delivers an agreed (target) level of service of a 90% likelihood of not requiring restrictions in any given year in the long-term, and a 93% likelihood of not requiring severe (Stages 3 or 4) restrictions in any given year in the long-term.

2.4 Customer Consultation

2.4.1 Communication Material

South Gippsland Water regularly promotes permanent water savings rules, particularly in the lead up to summer and during the summer months.

South Gippsland Water has prepared a range of drought preparedness and drought response material for communication with customers. These are available on South Gippsland Water's website https://www.sgwater.com.au so that they can be viewed by customers at any time, regardless of whether the region is in drought or not. These include:

- The current status of water restrictions in each township. This is listed online at https://www.sgwater.com.au/services/water/water-restrictions/
- The Annual Water Security Outlooks indicating the likelihood of restrictions over the coming months. These are available at https://www.sgwater.com.au/services/water/water-security-outlooks/
- Permanent water saving rules, which are the Statewide rules permanently in force on the use of hand-held hoses, watering residential or commercial gardens and lawns, watering public gardens, lawns and playing surfaces, the use of fountains and water features, and the cleaning of hard surfaces with water. These rules are summarised at https://www.sgwater.com.au/services/water/permanent-water-saving-rules/ which includes a link to South Gippsland Water's Permanent Water Saving Plan that provides the regulatory detail supporting the implementation of the permanent water saving rules.
- A series of fact sheets applicable to each stage of restriction, clearly outlining what actions are restricted or prohibited at each stage of restriction (see Figure 2-2). These are available at https://www.sgwater.com.au/services/water/water-restrictions/. These fact sheets are designed to be accessible to a non-technical audience and describe Stages 1-4 restrictions as "Alert", "Save", "Just Enough" and "Critical" water restrictions respectively.

Figure 2-2 South Gippsland Water's Water Restriction Fact Sheets

- An Exemption Application Form and a Water Use Plan Application Sportsground Form, so that customers can apply for exemptions to both the permanent water saving rules and temporary water restrictions. These are available at https://www.sgwater.com.au/services/water/water-restrictions/

- A detailed restriction schedule, restriction definitions, and South Gippsland Water's water restriction by-law. These are available at https://www.sgwater.com.au/services/water/water-restrictions/

2.4.2 Assessing Exemptions

South Gippsland Water has application forms available for customers to apply for exemptions to both the Permanent Water Saving Rules and temporary water restrictions. The principles for assessing those applications are provided in the application forms and in South Gippsland Water's Permanent Water Savings Plan.

South Gippsland Water does not have a pre-approved list of community or private assets that would be exempted from water restrictions. This is because the principles for assessing exemptions include consideration of the water supply conditions at the time of the application. This allows South Gippsland Water to respond to applications adaptively after considering the current water resource position and outlook.

An Environmental Improvement Plan has been prepared for providing short-term recycled water to water tankers (e.g., for dust suppression, weed spraying, and roadworks) from South Gippsland Water's recycled water facilities (RMCG, 2015). A site-specific Environmental Improvement Plan has been prepared for supplying recycled water to the Toora Football Oval (RMCG, 2016), which receives 2-3 ML of recycled water during summer for irrigation. A 100 kL recycled water tank was installed at the Meeniyan Recreation Reserve after completion of an Environmental Improvement Plan for that location (KBR, 2014). An Environmental Improvement Plan has also been prepared for recycled water supply to the Foster Recreation Reserve and Foster Golf Course (KBR, 2018), with potential future supply pending recycled water quality improvement works at the Foster wastewater treatment plant, scheduled for around 2024.

The principles for assessing applications for exemptions include (South Gippsland Water, 2011; 2015a; 2015b):

- **Public health and safety:** Where the exemption is necessary to avoid any adverse effect on public health or safety (e.g., requirements for human health, stock and animal health, firefighting, and vehicle safety).
- **Medical:** Where an exemption is sought on medical grounds. In this case, the application must be certified by a medical practitioner.
- **Livelihood:** Where it is necessary to avoid an inequitable or disproportionately adverse impact upon the livelihood of the applicant.
- **Current water resource position and outlook:** When assessing applications, South Gippsland Water will take into account the potential impact of the exemption on water availability and the level of water restriction for the community.

Applicable only to the permanent water saving rules, South Gippsland Water may also grant temporary exemptions for the use of water for the establishment of warm season grasses (South Gippsland Water, 2011).

When considering the approval of water use plans South Gippsland Water also takes into account (South Gippsland Water, 2011):

- **Water savings:** The water savings that could be achieved from the water use plan relative to those from water restrictions.
- **Cumulative effect of similar water use plans:** The impact on the water supply system of the water use plan and other water use plans reasonably anticipated by South Gippsland Water for similar uses of water.
- **Community support:** Whether the water use plan would be generally supported by all of South Gippsland Water's customers within the same supply system.
- **Best practice water efficiency:** Whether the water use plan can be considered to demonstrate best practice or highly efficient water use for a given water use purpose.
- **Broader public health benefit:** Whether the water use plan would provide a broader public health benefit.

The timeframe for assessing applications for exemptions and water use plans will depend on the nature of the applications. Under South Gippsland Water's customer charter (South Gippsland Water, 2019b), enquiries made in writing to South Gippsland Water will receive a response within 10 working days. This response can include acknowledgement of receipt of the application, and an indicative timeframe for a decision on the application if it is likely to be longer than 10 working days. Any applications for exemptions to South Gippsland Water's Permanent Water Savings Plan must be assessed within a reasonable timeframe under the requirements of the plan (South Gippsland Water, 2011).

2.4.3 Identifying customer preferences

South Gippsland Water engages with its Community Advisory Committee (CAC) as needed to obtain community input and gauge community feedback on any given issue. The terms of reference for the CAC are defined by South Gippsland Water (2021) and were prepared in line with the Victorian Public Service Code of Conduct (VPSC, 2021). Under these terms of reference, the CAC meets at least four times per year with responsibilities to advise, advocate, assist and participate in strategic planning processes. The invitation to apply to join the CAC is made through a public expression of interest process, including invitations to the region's Gunaikurnai and Bunurong traditional owners.

As part of the development of South Gippsland Water's Urban Water Strategy, the CAC was engaged to provide input on drought response options in August 2021. The outcomes of that consultation were:

- A general preference to continue to invest in water savings through community awareness and targeted leak reduction, in preference to water restrictions;
- If water shortages occur, a clear preference for mild water restrictions over water carting; and
- A clear preference to avoid severe water restrictions and water carting, noting that water carting is more feasible for smaller towns than larger towns.

2.5 Technical Investigations

Since the publication of the previous DPP, South Gippsland Water has undertaken several specific technical investigations to support the further development and refinement of the DPP.

2.5.1 Benefits of permanent water saving measures

Permanent water saving measures were first introduced by South Gippsland Water in 2006, and then reviewed and formalised in December 2011. Since that time (from 2011/12 to 2019/20), the number of customers serviced by South Gippsland Water has increased by 25%, but raw water use has only increased by 18%. It is difficult to isolate the precise effect of permanent water saving measures on water use in South Gippsland Water's supply systems. However, it is noted over the post-Millennium Drought period from 2008/09 to 2019/20 that per capita water use peaked in the year in which the permanent water saving measures were introduced (part way through 2011/12), and is now 5% lower than it was in that year. This observed reduction in per capita demand is likely to be due to a combination of permanent water saving measures plus other factors, such as more water efficient housing design in new developments, changes in major industrial water use, more water efficient appliances in existing homes, and water use behaviour change.

2.5.2 Leongatha contingency supply measures

Since the 2017 DPP was published, South Gippsland Water has undertaken further investigations into the viability of the contingency supply measures for Leongatha.

Preliminary investigations were undertaken into supplementary supply options for Leongatha in South Gippsland Water (2017a; 2019a). These included supply from the Tarwin River, groundwater, Coalition Creek Reservoir, water carting, and supply from the Lance Creek System via Korumburra, with sub-options on the above with different water treatment arrangements and pipeline routes. These studies considered the operational risks associated with the individual elements of each option, estimated costs, likely seasonal water availability, and option pre-requisites.

An example of the operational risk assessment outcomes is shown in Figure 2-3.

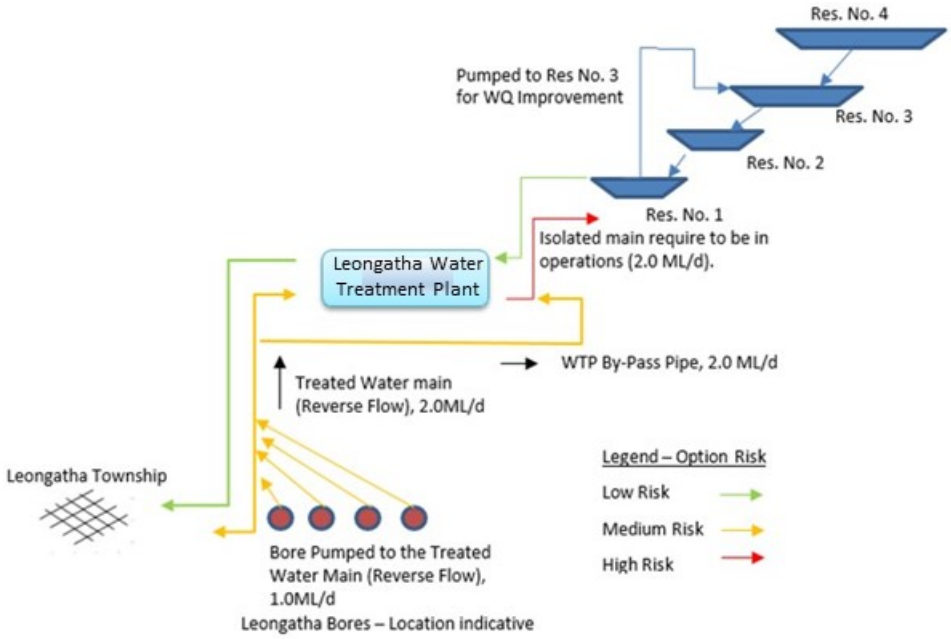


Figure 2-3 Example supplementary supply option (from 8 available) risk assessment for Leongatha from South Gippsland Water (2017a)

Under the Leongatha bulk entitlement, South Gippsland Water is allowed to divert up to 6 ML/d between May and November from Coalition Creek, with a minimum passing flow requirement of 10 ML/d. The diversion location is 2 km upstream of the Coalition Creek gauging station (Coalition Creek at Leongatha - Spencers Road Bridge, 227264). The diversion location is shown in Appendix A. Water was diverted from this location historically during the Millennium Drought under different (temporary) passing flow arrangements. Analysis in HARC (2021a) for the development of South Gippsland Water's Urban Water Strategy indicated that under the current (higher) passing flow arrangements, it is likely that there would be negligible water available to divert from this location in a drought year. This option is therefore not considered viable as a contingency supply measure for Leongatha during drought under current legal entitlements to water at that location.

2.5.3 Integrated water management

Investigations into alternative water sources associated with integrated water management have been undertaken for Korumburra (South Gippsland Water and South East Water, 2014), for the Bass Coast Shire Council (2019) covering Wonthaggi, Cape Paterson and Inverloch, and for the Wellington Shire Council (2020) covering Yarram, Port Albert, Alberton and Devon North. A stormwater management strategy has also been prepared for the Shamrock Springs development in Leongatha (Beveridge Williams, 2019).

An Environmental Improvement Plan has been prepared for the use of recycled water from South Gippsland Water's wastewater treatment plants by water tankers for activities such as dust suppression and roadworks (RMCG, 2015). This includes specifications for intended uses in accordance with EPA guidelines. A site-specific Environmental Improvement Plan has been prepared for recycled water supply to the Toora Football Oval (RMCG, 2016), the Meeniyan Recreation Reserve (KBR, 2014), and potential future supply to the Foster Recreation Reserve

and Foster Golf Course (KBR, 2018). Recycled water is currently used from the Tarraville, Inverloch, Toora, Leongatha, Korumburra, Waratah Bay and Meeniyan Wastewater Treatment Plants. These are discussed in more detail in the individual action plans for each supply system.

2.6 Technical Assumptions

2.6.1 Assumed water consumption for the DPP

Water consumption data under long-term climate variability has been derived for South Gippsland Water's 2021/22 UWS. This consumption data has also been used for South Gippsland Water's DPP. The level of consumption assumed for the life of the current DPP is set for the year 2026/2027 level of development, which is the final year of the DPP prior to its next scheduled update. The growth projections from the UWS have been adopted to estimate year 2026/27 level of development demand. Demands over the life of the DPP may be slightly higher or lower than anticipated, depending on the rate of growth or decline in demand for water in each individual supply system. South Gippsland Water will continue to track water use across their systems.

When designing drought response triggers, a typical drought year demand has been assumed, which is when the DPP is most likely to be enacted. The year 2006/07 climate conditions were selected as representative of climate conditions in a drought year. The demands presented in this DPP are therefore based on the projected year 2026/27 level of development under drought conditions.

The DPP for individual supply systems should be updated when required if significant deviations from anticipated demands, either in magnitude or pattern, occur prior to the next scheduled update.

Demand is referred to as restrictable and unrestrictable throughout this DPP. The unrestrictable demand describes the water required to meet critical human water needs plus unrestrictable commercial and industrial demands. The Water Act (Section 86A) defines critical human water needs as the minimum amount of water required to meet:

- Core human consumption requirements in urban and rural areas; and
- Those non-human consumption requirements that a failure to meet would cause prohibitively high social, economic or national security costs.

Commercial and industrial demands across South Gippsland Water's supply areas include a number of facilities with a large range in typical water consumption rates. Significant water uses include for dairy processing in Leongatha and for food processing in Korumburra. Smaller commercial and industrial operations include abattoirs at Poowong and Wonthaggi, the marine terminal at Barrys Beach, and dairy processing at Toora.

2.6.2 Assumed effect of water restrictions on demand

South Gippsland Water currently has a four-stage restriction by-law. This targets discretionary (or restrictable) use, whilst protecting unrestrictable industrial and in-house use. Estimates of

the average reduction in demand for each stage of restriction are shown in Table 2 1, which is sourced from a technical paper from a VicWater Technical Working Group on Water Savings Assessment (TWGWSA, 2005) based on data for Melbourne.

Table 2-1 Assumed reduction in restrictable demand at each stage of restriction

Restriction Stage	% reduction in restrictable demand
1	14%
2	44%
3	67%
4	100%

Restrictable demand is defined as the demand that is above the unrestrictable demand. Whilst there are expected to be differences in the total water savings achieved under each stage of restriction for different towns, the reduction in restrictable demand is reasonably consistent across different towns. This was confirmed in Neal et al. (2010), which highlighted that even though there were some local variations in the reduction in restrictable demand for towns across several water utilities in Victoria, the relationship in Table 2-1 was considered the best available at the current time. Neal et al. (2010) also commented that one water utility had noticed that Stage 1 restrictions reduced the restrictable demand by a greater extent when they followed more severe restrictions (i.e., when restrictions were being eased). This relationship in Table 2-1 may need to be revised if South Gippsland Water's water restriction by-law is changed in the future.

Recent analysis for a town supplied by Barwon Water with a high seasonal tourist population indicated that reductions in demand from restriction were much lower during the peak holiday periods in December and January (HARC, 2021b). It was speculated that this could be due to both the higher number of tourists increasing in-house water use, and lower awareness of local water restriction rules by tourists. This analysis suggests that reductions in demand in holiday periods due to restrictions in South Gippsland Water's supply systems with high visitor numbers during those holiday periods (e.g., Inverloch and Cape Paterson) could be lower than anticipated in Table 2-1.

2.6.3 Assumed baseline climate conditions

Climate conditions according to DELWP's 2020 *Guidelines for Assessing the Impact of Climate Change on Water Availability in Victoria* have been adopted for this DPP. Climate data prior to 1975 was adjusted to have the same characteristics as the period from 1975 to date, and an allowance was then made for the estimated range of potential climate impacts due to historical climate change from the mid-1990s to date. This creates a long-term climate series that represents the current levels of greenhouse gas emissions. All adjustments for high, medium and low climate change scenarios are then applied to this derived current climate scenario.

2.7 Pre-drought Actions

A number of pre-drought actions are recommended for South Gippsland Water to be prepared for drought if it occurs. These include:

- Ensuring responsibilities for drought planning and management are assigned, particularly for identifying the onset of drought and maintaining this DPP. This includes provision of training to customer service staff and operators, as well as fostering drought education across the organisation on an ongoing basis;
- Ongoing monitoring of diversion volumes, storage volumes, groundwater levels and supply to customers, and collation of this information in South Gippsland Water's databases;
- Checking the seasonal climate outlook produced by the Bureau of Meteorology, which provides a three-month forecast of the likelihood of exceeding median rainfall conditions (http://www.bom.gov.au/climate/outlooks/#/rainfall/median/seasonal/0). The seasonal climate outlook will contribute to South Gippsland Water's Annual Water Outlook, produced in November each year and published on South Gippsland Water's website on 1 December each year. Additional, improved or extended climate, streamflow and soil moisture outlook products are under development by the Bureau of Meteorology, and may become available over the life of this DPP. At the time of writing this DPP, no seasonal or 7-day streamflow forecasts were available in South Gippsland Water's supply catchments from the Bureau of Meteorology;
- Pre-drought consultation to be undertaken with key stakeholders such as local councils, major customers and any specific groups likely to be impacted by possible water restrictions. Any key community spaces that require exceptions, such as sporting facilities, will be confirmed. Alternate water sources will be identified to help manage the maintenance of key community infrastructure;
- Continuing to participate in DELWP forums and technical working groups on drought response, and updating the DPP in response to any changes in guidance from DELWP;
- Undertake any preparatory work on emergency supply options to ensure that the necessary equipment and contractors are available as South Gippsland Water heads into drought. Preliminary discussions about the availability of groundwater drillers and water carters leading into drought are advised. Preparatory work for individual supply systems is presented in the action plan for each supply system;
- Maintaining a communication strategy and material for use in communicating drought response actions to customers in drought. This includes consideration of choices of media for consultation with customers, and easy to understand summaries of what each stage of water restriction means for customers, particularly any commercial accommodation centres;
- Updating this DPP as required, for example due to changes in system configuration or operation, or significant changes in the number or type of consumers being supplied. Drought Preparedness Plans are dynamic in nature and will only be appropriate for a particular system for a short period of time. DELWP (2020) recommends that DPPs be formally updated every 5 years, which would next occur in 2026/27. Water corporations are obliged to review and update their DPPs within 12 months of the augmentation of any supply system (DELWP, 2020). A number of changes to supply system configuration have been proposed in the 2021/2022 Urban Water Strategy for South Gippsland Water. If these actions are implemented prior to the next scheduled update of the DPP, then the sections of the DPP affected by those changes should be updated; and

- Assess IWM opportunities and implement prior to drought conditions. These could include IWM opportunities for rural stock and domestic users, incentive plans for appliance upgrades, rainwater tank installation and greywater reuse.

3. Drought Response

3.1 Drought Actions

Drought actions are the mechanism that ensure critical human water needs are met during periods of water shortage. Drought actions have been tailored to each supply system and are presented in the action plan for each supply system. The communication plan for South Gippsland Water during drought is common to all supply systems and is outlined below.

3.2 Communication Plan

Communication with customers during drought will most commonly be through South Gippsland Water's website, as well as direct mail and customer newsletters, prepared and distributed by South Gippsland Water. This is due to the fact that most media outlets in South Gippsland broadcast to a wider region than one specific water supply system. Wider regional communication via media such as social media, television or newspapers may be appropriate to convey water conservation messages and general storage level information, however specific system information and updates are better provided on a system-by-system basis.

Communication leading into drought would be implemented as part of increased general awareness of South Gippsland Water's Annual Water Outlooks.

When communicating with customers, it is important to convey the following messages:

- given falling water supplies and seasonally rising demands, there is a strong possibility that restrictions will need to be introduced;
- there will be public and private costs associated with the introduction of restrictions; and
- there will be inconvenience associated with restrictions.

The messages should point to the following specific uses of water that can reduce demand without significant loss of amenity:

- use of water efficient appliances;
- reduction of obvious non-essential usage;
- use of drought tolerant plants in gardens;
- installation of private water supplies, such as rainwater tanks; and
- re-use of grey water.

Communication during drought is important to make sure consumers are fully aware of the details of each stage of restriction as those restrictions are implemented. To assist with this, the following strategies are recommended:

- Directly mail/email consumers. It is advisable that some pre-printed leaflets which explain the details of the four stages of restriction be available for mailing to consumers, including links to more detailed information on South Gippsland Water's website. This can include an information kit which reinforces methods for conserving water around the house. The

impact of this message will be greater if it is delivered independent of the delivery of water bills, but will incur greater cost if delivered independently. If emergency measures are required, South Gippsland Water should communicate with its customers urging them to limit water usage to essential use only.

- Provide a regular update/advertisement on the state of the storages and the current level of water restrictions on social media.
- Update signage on town entry signs or on local billboards to remind tourists and residents that the area is in drought, to conserve water, and that water restrictions apply.
- Work with local newspapers (if circulating) regarding the forecast duration and severity of the drought, and the actions being implemented to minimise the impact to customers should also be undertaken.
- In dealing with the media it is good practice to nominate one person to be responsible for all liaisons. If using radio or television, care should be taken to avoid confusion with other water authorities if the radio or television station covers a wide area. If drought is widespread, the campaign should be in conjunction with other water authorities.
- Set up a toll-free phone number to answer queries and to enable community policing of restrictions.
- Start monitoring compliance with water restrictions. The level of patrolling should be progressively increased as the severity of the drought increases. Water users who do not adhere to the water restriction by-law can be warned or prosecuted depending on the severity and frequency of the breach.

In addition to the above, for Stage 4 restrictions, the serious nature of the situation should be conveyed to all consumers through direct mail, social media and the relevant local newspaper (if circulating). Consumers should be made aware of what plans South Gippsland Water are putting in place to combat the dry conditions and maintain the minimum level of service.

3.3 Review and Adjustment of trigger levels during drought

The proposed trigger levels for the different drought response actions are based on the best information available at the time of preparing the DPP. However, it is possible that the events that actually occur during the next drought will be somewhat different than expected. For example, if South Gippsland Water's consumers do not respond to requests for demand reduction as anticipated, then it may be necessary for South Gippsland Water to bring forward or defer actions as required. Similarly, climate conditions may vary from drought to drought. As a drought progresses, South Gippsland Water will need to closely monitor supply system behaviour at each level of restriction in order to adjust its plan of action accordingly.

4. Drought Review

4.1 Introduction

At the conclusion of a drought, a number of common actions are proposed to ensure that any lessons learnt during the drought are captured to improve South Gippsland Water's ability to manage future droughts. This information should be recorded during and immediately after the drought in a consolidated report so that it is available to incorporate into this DPP.

4.2 Evaluation of Objectives

The first part of the review process should be to assess the suitability of the objectives. There are three components to the objectives (i.e., strategic, planning and operational) and each of these needs to be critically reviewed to determine if the objectives were appropriate and achievable. If they were not, some comment needs to be made as to why, and new objectives set for the next drought.

4.3 Evaluation of Actions

There have been a number of actions identified for staged demand reduction and supply augmentation as the supply situation worsens for each demand centre. In most droughts, only a few of the actions will need to be implemented. The timing and effectiveness of each action needs to be assessed and documented. The clarity of the drought response triggers should also be evaluated.

4.4 Impact of Restrictions on the Community

Community response to the imposition of restrictions should be sought through South Gippsland Water's Customer Advisory Committee. Were there other things that could have been done to help reduce demand for water? Domestic consumers could also be surveyed to determine the economic and social impacts of restrictions. Was there enough warning that restrictions were to be imposed? Was the right mix of media used to disseminate information on when the restrictions were to begin, and what was and was not allowed? Were the restrictions too severe? Did they last too long? Were people confused by the number of restrictions? What attitude did people have during the drought? Was there any significant plant loss? Was there any major inconvenience caused by the lower stages of restrictions?

4.5 Impact on South Gippsland Water Staff

Staff from South Gippsland Water should also be interviewed to determine how they coped with the additional burden of drought. In particular, it will be important to identify any issues that came up that were not identified prior to the drought, and were not taken into account in the DPP. Were the restrictions easy to enforce? Were the limited watering times causing problems for supervision? Did the staff feel alienated from the community? Was the additional work load unreasonable? Do staff have any suggestions for improvements to the DPP?

4.6 Revision after implementing restrictions

Water corporations are obliged to review and update their Drought Preparedness Plans within 12 months of the lifting of any period of water restrictions (DELWP, 2020).

4.7 System specific actions

System specific post-drought actions have been identified in the action plan for each supply system in the following chapters of this DPP.

4.8 Exemptions

South Gippsland Water will liaise with stakeholders and the community on exemptions for any public spaces, community areas and sporting facilities that may be relevant during periods of drought. South Gippsland Water will continue to work with these stakeholders to confirm the exemptions for each system as they arise.

4.9 Alternative water sources

How accessible and effective were alternative water sources to maintain community assets during periods of water restriction? Could these alternative water sources become a permanent supply source to reduce the demand for potable water from South Gippsland Water's supply systems? What protocols and procedures were put in place to access the alternative water source?

5. Plan for Leongatha and Koonwarra

5.1 Supply System

Leongatha and Koonwarra derive their water supply by gravity from four reservoirs on Ruby Creek. This is supplemented by supply from three groundwater bores, with a fourth bore available but not currently operated. The four reservoirs have a combined capacity of 1,911 ML with no dead storage. The capacity and construction history for each storage is shown in Table 5-1.

The Ruby Creek system is also the supply source for the local dairy and associated steam generation plant, and some rural water users. Figure 5-1 shows a schematic representation of the system. The Coalition Creek supply included Figure 5-1 is not used due to low reliability in drought years, as discussed further under the available drought actions in Section 5.6.2.

Table 5-1 Leongatha water supply reservoirs

Reservoir	Year constructed	Capacity (ML)
Reservoir No. 1	1906	19
Reservoir No. 2	1928	84
Reservoir No. 3 (Hyland)	1960	671
Reservoir No. 4 (Western)	1980	1,137
Total		1,911

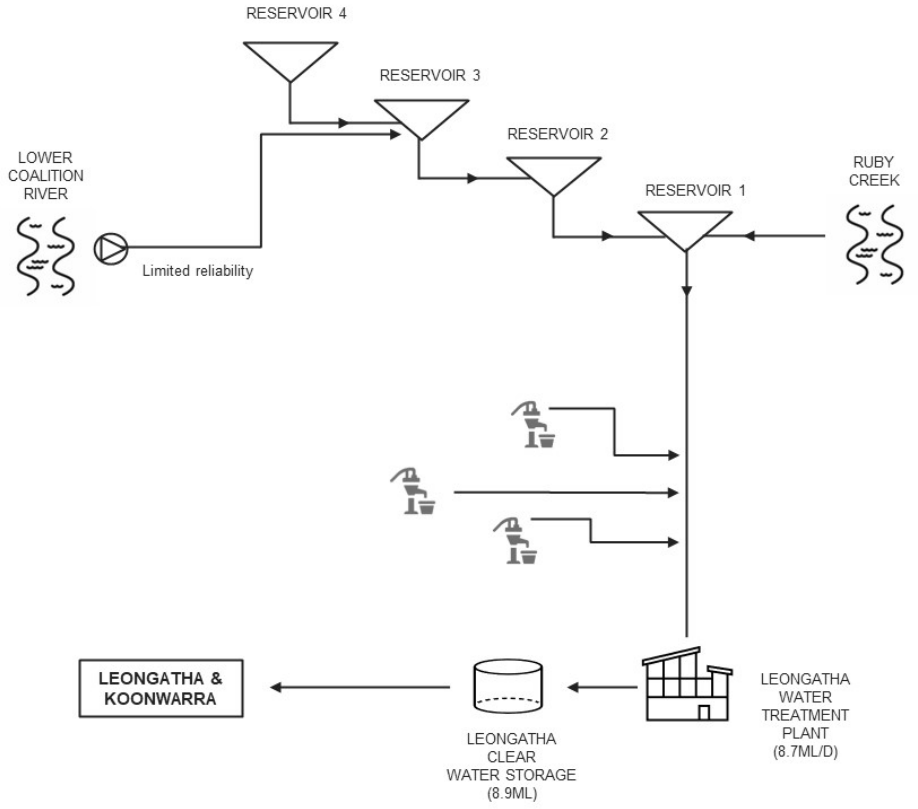


Figure 5-1 Leongatha Water Supply System Schematic

5.2 Bulk Entitlements and Groundwater Licences

The bulk entitlement for Leongatha allows South Gippsland Water to divert up to a maximum of 2,476 ML/year from Ruby Creek, subject to the provision of minimum passing flows. The daily bulk entitlements and minimum passing flows are shown in Table 5-2.

Table 5-2 Bulk entitlement volume for primary supply to Leongatha

Source	Maximum annual volume (ML/year)	Maximum diversion rate (ML/day)	Minimum Passing Flow
No.1 Reservoir No. 2 Reservoir Hyland Reservoir Western Reservoir	2,476	17.3	The minimum of 0.5 ML/day or the catchment inflow to Western Reservoir

Under the Leongatha bulk entitlement, South Gippsland Water is also allowed to divert up to 6 ML/day between May and November from Coalition Creek, with a minimum passing flow of 10 ML/day. The diversion location, shown in Appendix A, is 2 km upstream of the Coalition Creek (Spencers Road) gauging station.

As outlined in Section 2.5.2, water was diverted from this location historically during the Millennium Drought under different (temporary) passing flow arrangements. Analysis in HARC (2021a) for the development of South Gippsland Water's Urban Water Strategy indicated that under the current (higher) passing flow arrangements, it is likely that there would be negligible water available to divert from this location in a drought year. This option is therefore not considered viable as a contingency supply measure for Leongatha during drought under current legal entitlements to water at that location.

The available groundwater supply to Leongatha is listed in Table 5-3. In this table, the limit on bore production is the maximum that the bores can produce, based on historic pumping from these sources independent of legal entitlements to this water. The groundwater supply to Leongatha is currently complex and difficult to operate, with South Gippsland Water (2017b) providing additional technical guidance on extraction, measuring and monitoring procedures for the bores. The rules governing the operation of these bores incorporate the licence conditions on the groundwater licence issued by Southern Rural Water. A total of 441.25 ML/year can be pumped from the currently operational bores, at a total daily extraction rate of 0.65 ML/day after taking into account the limits specified on the licence and the production capacity of the individual bores. These bores can only be used when the volume in Leongatha's raw water storages drops below 75% of capacity (i.e., 1,433 ML) from October to December or below 50% of capacity (i.e., 956 ML) from March to May, with no pumping permitted from June to September. Critically, bores can only be operated for 12 hours a day.

The Racecourse Road groundwater bore is also listed in Table 5-3, but is not currently connected to South Gippsland Water infrastructure, so no supply from this bore is assumed as

part of current operation. Re-establishing supply from this bore is listed as an available drought action in Section 5.6.2.

Table 5-3: Groundwater limits for Leongatha

Bore name (and licence number)	Annual limit in licence (ML/year)	Daily limit in licence (ML/day)	Limit on bore production (ML/day)	Reduction due to 12hrs on 12 hrs off rule (ML/day)
Currently operational bores:				
Wild Dog (S9025900/2)	310.25	0.85	0.75	0.4
Condolucci (S9025900/2)	40.0	0.25	Not available	0.05
Van Ecks (S9026806/1)	91.25	0.25	0.4	0.2
Total	441.25	1.35	Not available	0.65
Currently non-operational bores:				
Racecourse Rd (S9027805/2)	273.75	0.75	0.7	0.35
Bore pumping triggers for all bores	During the period Oct-Dec: Leongatha raw water storages at 75% of capacity triggers bore pumping to start and stop During the period March-May: Leongatha raw water storages <50% of capacity triggers the start of bore pumping, and >75% of capacity triggers the end of bore pumping			

5.3 Consumption

The typical drought year raw water demand in each month of the year that is used in the development of this DPP is shown in Table 5-4. The unrestrictable demand is the component of demand typically used for in-house and industrial/commercial water use and is not affected by the imposition of water restrictions. The unrestrictable demand in Table 5-4 assumes unrestricted supply to the Saputo Australia Dairy factory and steam generation plant during drought.

Table 5-4: Average monthly raw water consumption for a typical drought year

Month	Typical drought year demand (ML/month)	Unrestrictable demand (ML/month)	Restrictable demand (ML/month)
July	126	101	25
August	130	102	27
September	135	114	20
October	140	113	26
November	141	120	21
December	148	111	37
January	154	117	36
February	159	108	51
March	152	108	44
April	146	104	41
May	139	101	38
June	126	99	27
TOTAL (ML/year)	1,694	1,299	395

The Saputo Australia Dairy factory currently treats and reuses its wastewater in a 1 ML/day plant. It has limited ability to increase its plant capacity. In the event that the dairy factory's treatment plant cannot be operated, the dairy factory increases its demand on the South Gippsland Water potable water system. In 2015, the treatment plant was out of operation for two months which resulted in minor additional demand (estimated to have been not more than ~20-30 ML) on the South Gippsland Water system, with any future outages likely to be of short duration only. There is currently no agreement in place to limit extractions by the dairy factory from the South Gippsland Water system.

5.3.1 Community Assets

Community assets (open space) within Leongatha and Koonwarra that could require water during periods of drought include the Leongatha Football Ground at the Leongatha Recreation Reserve, and the Leongatha Golf Course. These community assets are currently supplied through the SGW supply system. During the Millennium Drought the Golf Course trucked raw water from the SGW treatment plant stand pipe. These assets were identified through initial consultation with local council.

5.4 Level of Service Objective

The performance of the supply system during drought was assessed using a water balance model over a long-term baseline climate sequence from January 1950 to June 2020 (HARC, 2021a). If the restriction triggers are implemented in accordance with this current DPP, the long-term likelihood of not requiring restrictions in any given year is estimated to be between 63% and 81% at the year 2020 level of demand. This range reflects uncertainty in the effect of historical climate change on supply system inflows and net evaporation.

These results do not meet South Gippsland Water's agreed (target) level of service objective under. South Gippsland Water's minimum level of service objective to provide the

unrestrictable demand of 1,299 ML/year in Table 5-4 was not met at the 2020 level of demand, with the maximum modelled annual shortfall ranging from approximately 20-140 ML/yr.

5.5 Review of Past Drought Experience

Since 1997/98, South Gippsland Water has experienced conditions drier than the long-term average. The two most recent periods of restriction are listed below.

2005/06 – Stage 1 restrictions were introduced at Leongatha in July 2005. These restrictions remained in place until October 2005, when restrictions were lifted. The total duration of restrictions over this period was three months. The minimum storage reached during this period was 731 ML (38% of capacity) on 25 July 2005. Restrictions were first implemented when the total storage volume was at 735 ML (38% of capacity), which was below the 2003 DPP Stage 1 trigger of 990 ML in July.

2006/07-2007/08 – After five months without restrictions, Stage 2 restrictions were re-introduced at Leongatha in March 2006. These restrictions were increased to Stage 3 later that month, before reaching Stage 4 in July 2006. Restrictions were eased to Stage 2 in October 2007. Stage 2 restrictions remained in place until January 2008, when restrictions were lifted. The total duration of restrictions over this period was 23 months. The minimum storage reached during the drought was 205 ML (11% of capacity) on 5 June 2007. Restrictions were first implemented when the storage volume was at approximately 750 ML (39% of capacity), which was below Stage 1 trigger for March of 800 ML in the 2003 DPP.

During the 2006/07 drought, temporary pumping occurred from the Tarwin River West Branch to Korumburra and Leongatha under a Ministerial qualification of rights. The volume of water pumped from the Tarwin River West Branch was 867 ML from November 2006 to December 2007. The split of water supplied to Korumburra versus Leongatha was not recorded; however South Gippsland Water estimated that most of the water was diverted to Leongatha rather than Korumburra.

Groundwater supply from the Racecourse Road bore at Leongatha was also provided to Korumburra during the 2006/07 drought. The volume of water pumped from the Leongatha groundwater bores to Leongatha and Korumburra was 384 ML in 2006/07 and 166 ML in 2007/08. The split of water supplied to Korumburra versus Leongatha was not recorded, however South Gippsland Water estimated that all of the water from the Wild Dog, Condolucci and Van Ecks bores was supplied to Leongatha only, with only a portion of the Racecourse Road bore supply provided to Korumburra rather than Leongatha. The supply from the Tarwin River West Branch was formalised into a qualification of rights to the Meeniyan bulk entitlement on 13 June 2008 prior to being incorporated into an amendment to the Korumburra and Leongatha bulk entitlements on 19 October 2010. The sunset clause on that supply source was 30 June 2020 so there is no longer a legal entitlement to this supply, and the pipeline and pump station used to supply from the Tarwin River West Branch to Leongatha have been deemed inoperable and no longer suitable for use.

Since the end of restrictions in August 2007, no further restrictions have been implemented.

5.6 Drought Response Plan

5.6.1 Pre-Drought Actions

Pre-drought actions common to all supply systems are presented in Section 2.7. There are no additional pre-drought actions specific to Leongatha other than to ensure that the system storages are as full as possible leading into drought, including contingency supply reservoirs around Korumburra that could be accessed. Early warning signs for this supply system would be low inflows to the reservoirs, which could be assessed by examining changes in the volume in these reservoirs and behaviour in the upstream flow gauge Ruby Creek @ Arawata (number 227249B) and the nearby streamflow gauge (number 227227) on Wilkur Creek. Low spring rainfall combined with lower than average storage levels would provide an indication of impending drought.

Water resource modelling undertaken for South Gippsland Water's 2021/22 Urban Water Strategy indicates that if the Leongatha storages do not refill over winter/spring, this can lead to very low water storage levels over the following summer/autumn period.

5.6.2 Available Drought Actions

A range of actions are available to South Gippsland Water at Leongatha during drought. These actions have been divided into actions likely to be feasible during drought, and other actions that have been considered but which are less likely to be feasible. A summary of the likely feasibility of each option is shown in Table 5-5. In the 2006/07 drought water restrictions, groundwater supply and supply from the Tarwin River West Branch were implemented.

Table 5-5: Likely feasibility of drought actions for Leongatha

Action	Likely feasibility during drought
Restrictions	High
Groundwater bores	High
Reuse of treated wastewater	High (for permitted uses)
Reducing industrial water demand	Medium
Temporary connection to Bellview Creek Reservoir (prior to any potential future permanent connection)	Medium
Transfer of allocation from Meeniyan	Low
Coalition Creek	Low
Purchase of water from other water users	Low
Water carting	Low
Integrated Water Management opportunities	Low
Rainwater tanks	Low
Use of grey water	Low
Changed tariffs during drought	Low
Tarwin River West Branch	Not feasible

Each option is discussed briefly below.

Restrictions: Imposition of staged water restrictions in accordance with South Gippsland Water's by-law for restricting water use will serve to reduce demand. The reduction in restrictable demand anticipated at each stage of restriction was previously presented in Section 2.6.2, which can be used in combination with Table 5-4 to estimate likely water savings during drought. Note that due to the high industrial water demand at Leongatha, the water savings that can be achieved from restrictions represent a relatively small component of total demand, relative to that achievable in other towns in South Gippsland.

Groundwater: Leongatha can be supplied from currently operating groundwater bores at up to 0.65 ML/day to provide an annual volume up to 441 ML/year, subject to the operating rules previously presented in Section 5.2, and subject to renewal of some of the water transfer infrastructure, as planned to occur as part of South Gippsland Water's Urban Water Strategy. Beyond this volume a further 0.35 ML/day up to an annual volume of 274 ML/year is potentially available from the Racecourse Road bore, but the bore and associated pipework would need to be made operational.

The area surrounding South Gippsland Water's existing bores at Leongatha is within the Leongatha Groundwater Management Area. A permissible consumptive volume of 6,500 ML/year has been set for this area and current licensed entitlement is only 1,803 ML/year (DELWP, 2021b), which suggests that new licences could be made available for emergency response. Pump test and water quality results from the existing Leongatha bores are documented in SKM (2008), with several other locations trialled unsuccessfully before selecting the Racecourse Road bore in Leongatha South. When SGW was supplying from groundwater bores in the 2006-2008 period, it impacted groundwater access for nearby farms, resulting in the current restrictions on access being introduced into South Gippsland Water's groundwater licence. Southern Rural Water aims to process permanent transfers of groundwater licence within 14 days and to assess new groundwater licence applications within 60 days (SRW, 2021). The time to construct, test and develop a new bore could be in the order of weeks if a drill rig is available.

Reuse of treated wastewater: In 2019/20 there was 663 ML of Class B effluent discharged to the Little Ruby Creek from the Leongatha Wastewater Treatment Plant, with no reuse (DELWP, 2021b). Class B effluent is suitable for most agricultural applications, but is not suitable for drinking. Treated wastewater may be a suitable alternative supply for municipal garden or sports ground watering during drought. South Gippsland Water has a standpipe at the Leongatha Wastewater Treatment Plant that is available for approved customers. Historically this water has been used for weed spraying, road works and dust suppression.

Reducing industrial water demand: The dairy and associated steam generation plant is a major source of demand for potable water in Leongatha. The owner of the dairy has implemented alternative water supply options using innovative on-site reuse techniques, which has the capacity for 1 ML/day to be reused. During drought, South Gippsland Water should discuss forecast water use with the dairy operators and the potential to reduce demand.

Temporary connection to Bellview Creek Reservoir: An above-ground pipeline could be laid from Bellview Creek Reservoir to No. 4 reservoir as a temporary measure, prior to any potential future permanent connection. To implement this option, water will be retained in Bellview Creek

Reservoir, including the possibility of temporarily raising the target water level in the reservoir above its reduced maximum operating level at the start of drought. This option would no longer be available if Bellview Creek Reservoir were to be permanently connected to Leongatha, as is being considered as part of South Gippsland Water's 2021/22 Urban Water Strategy.

Purchase of water from other water users or from Meeniyan: Whilst there may be potential to supplement supply to Leongatha through transfer of allocations from other diverters on the Tarwin River West Branch or from South Gippsland Water's Meeniyan bulk entitlement, the infrastructure needed to harvest that water from the Tarwin River West Branch is no longer operable.

Tarwin River West Branch and Coalition Creek: South Gippsland Water no longer has a legal entitlement to supply from the Tarwin River West Branch at Koonwarra. The infrastructure that was previously used to supply Leongatha from the Tarwin River West Branch is obsolete and difficult to operate, with sections of the pipeline having been removed. This option is no longer considered viable due to its legal and operational constraints, and environmental flow considerations. South Gippsland Water has a legal entitlement for supply to Leongatha from Coalition Creek (2km upstream of the Spencers Road streamflow gauge) from May to November, but analysis in HARC (2021a) indicated that it was likely that negligible water would be available for diversion from this location in an extreme drought. The diversion location is shown in Appendix A. These options were also previously explored in South Gippsland Water (2017a; 2019a).

Water Carting: Based on the estimated number of trips that would need to be made to supply Stage 4 demands (Table 5-6), water carting is considered infeasible.

Table 5-6: Water carting for Leongatha and Koonwarra

Tanker size	Approximate no. of trips per day to provide Stage 4 (unrestrictable) demand
15 kL	240
27 kL	130

Integrated Water Management (IWM) **Opportunities:** The Leongatha golf course and football oval are the main water users that could take advantage of IWM opportunities, either as a long-term supply option or as a short-term option for supply during drought. This could include onsite dams, stormwater runoff, groundwater or reuse of Class B effluent from Leongatha Town Wastewater Treatment Plant. A property development at Shamrock Springs on the western edge of Leongatha proposed approximately 8 ML of permanent pool volume in wetlands and sediment basins (Beveridge Williams, 2019). Stormwater harvesting options for Leongatha are being explored as part of South Gippsland Water's 2021/22 Urban Water Strategy development.

Rainwater Tanks: Rainwater tanks can have significant benefits to consumers in average to high rainfall years when the tanks are regularly refilled by rainfall events. They may be an effective alternative source of water in short duration droughts, and have the advantage that they can generate supply as soon as it rains with negligible initial losses at the start of a rainfall event. They will however have limited or no value in long-term droughts when rainfall is very

low or zero for several weeks or months. The benefits of existing rainwater tanks are already incorporated into the demand estimates in this DPP.

Use of grey water: Grey water is water from clothes washers, bathtubs, showers and bathroom sinks. Grey water can be used by individual customers to maintain garden watering during periods of water restriction, however there can be health risks associated with the use of grey water.

5.6.3 Drought Action Triggers

Triggers for action during drought are based on the total volume in the Ruby Creek Reservoirs, as shown in Table 5-7 and Figure 5-2. These triggers are for the current system arrangement and assume:

- No inflows to the reservoirs;
- An unrestricted demand of 1,299 ML/year and a restrictable demand of 395 ML/year;
- Six months of supply from the Stage 1 trigger until the storage is emptied, including two months under Stage 3 and two months under Stage 4 restrictions; and
- No dead storage.

Table 5-7 Restriction Triggers for Leongatha and Koonwarra

Start of month	Trigger Storage Volume in Coalition Creek Reservoir, Ness Gully Reservoir, and Bellview Reservoir Combined (ML)			
	STAGE 1	STAGE 2	STAGE 3	STAGE 4
January	923	753	611	484
February	901	738	593	464
March	882	714	576	449
April	864	705	560	437
May	856	703	560	428
June	858	712	568	437
July	876	728	588	453
August	895	748	604	472
September	907	763	622	486
October	926	768	629	494
November	929	772	626	497
December	937	769	626	489

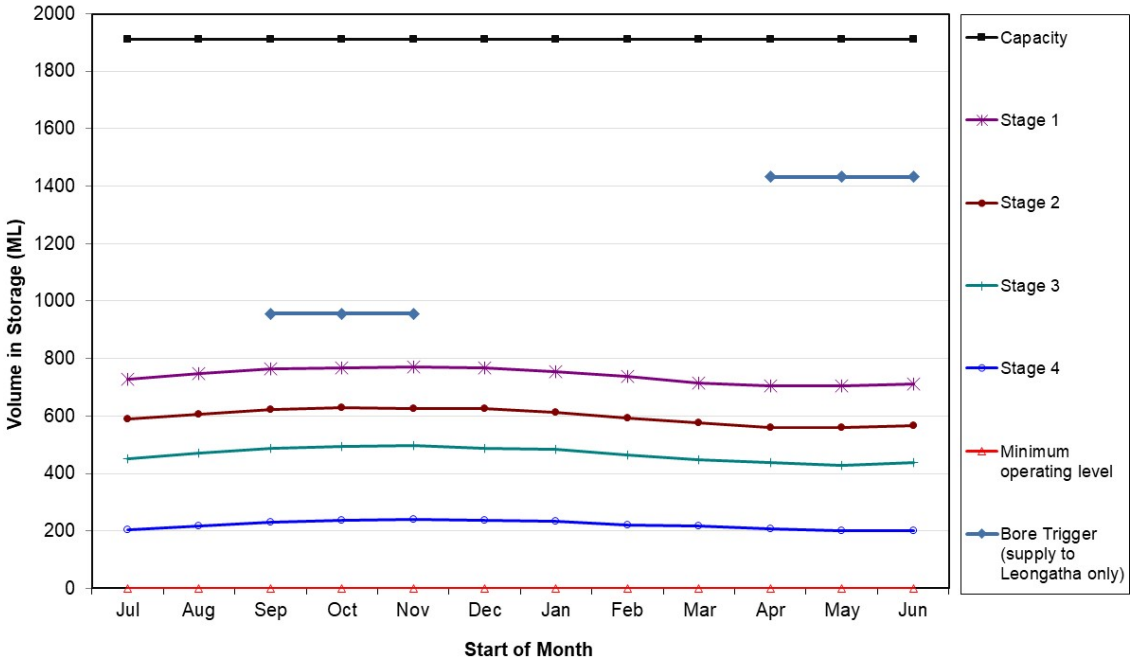


Figure 5-2 Drought response triggers for Leongatha

Restriction exit triggers will be flexibly implemented by South Gippsland Water based on forward estimates of supply availability and anticipated net evaporation and demand. The decision to lift restrictions should also take into account the likelihood of returning to restrictions in the near future and the community's timeframe for adapting to changes in restriction level.

5.6.4 Drought Action Plan

Action 1 – General Awareness

Trigger	Action
The trigger for this action is based on seasonal climate forecasts and current water availability in South Gippsland Water's supply systems	▪ **Implement communication plan** previously outlined in Section 3.2. ▪ **Continue ongoing pre-drought actions** identified in Section 2.7. ▪ **Utilise currently operational groundwater bores** as permitted under licence conditions. ▪ **Ensure that Bellview Creek Reservoir is maintained as full as possible** if this contingency supply measure could be required.

Action 2 – Introduce Stage 1 restrictions

Trigger	Action
The Volume in Ruby Creek storages falls between the Stage 1 and Stage 2 restriction rule values (Table 5-7, Figure 5-2).	▪ **Introduce Stage 1 restrictions**. Note that the decision on the appropriate stage of restriction will depend on circumstances at the time, such as the climate outlook, supply availability and customer demand behaviour relative to the restriction trigger design assumptions in Section 5.6.3. ▪ **Implement communication plan** previously outlined in Section 3.2. ▪ **Liaise with Saputo Dairy Australia** to discuss any options for reducing dairy factory and steam generation plant demand ▪ **Track streamflow, storage, groundwater and demand behaviour** relative to restriction triggers. ▪ **Re-iterate the availability of recycled water** to existing approved customers and consider promoting its availability to other potential customers.

Action 3 – Introduce Stage 2 restrictions

Trigger	Action
Volume in Ruby Creek storages falls between the Stage 2 and Stage 3 restriction rule values (Table 5-7, Figure 5-2).	▪ **Introduce Stage 2 restrictions**. Note that the decision on the appropriate stage of restriction will depend on circumstances at the time, such as the climate outlook, supply availability and customer demand behaviour relative to the restriction trigger design assumptions in Section 5.6.3. ▪ **Implement communication plan** previously outlined in Section 3.2. ▪ **Track streamflow, storage, groundwater and demand behaviour** relative to restriction triggers. ▪ **Liaise with Saputo Dairy Australia** to discuss any options for reducing dairy factory and steam generation plant demand ▪ **Undertake preliminary investigations into supply from existing unused groundwater bores** (Racecourse Road) and **Bellview Creek Reservoir**.

Action 4 – Introduce Stage 3 restrictions

Trigger	Action
Volume in Ruby Creek storages falls between the Stage 3 and Stage 4 restriction rule values (Table 5-7, Figure 5-2).	▪ **Introduce Stage 3 restrictions.** Note that the decision on the appropriate stage of restriction will depend on circumstances at the time, such as the climate outlook, supply availability and customer demand behaviour relative to the restriction trigger design assumptions in Section 5.6.3. ▪ **Implement communication plan** previously outlined in Section 3.2. ▪ **Track streamflow, storage, groundwater and demand behaviour** relative to restriction triggers. ▪ **Finalise investigations into supply from existing unused Leongatha groundwater bores** (Racecourse Road) and **Bellview Creek Reservoir.**

Action 5 – Introduce Stage 4 restrictions

Trigger	Action
Volume in Ruby Creek storages falls below the Stage 4 restriction rule values (Table 5-7, Figure 5-2).	▪ **Introduce Stage 4 restrictions.** Note that the decision on the appropriate stage of restriction will depend on circumstances at the time, such as the climate outlook, supply availability and customer demand behaviour relative to the restriction trigger design assumptions in Section 5.6.3. ▪ **Implement communication** plan previously outlined in Section 3.2. ▪ **Liaise with Saputo Dairy Australia** to discuss any options for reducing dairy factory and steam generation plant demand ▪ **Track streamflow, storage, groundwater** and demand behaviour relative to restriction triggers. ▪ **Implement supply from alternative source** to maintain South Gippsland Water's minimum level of service. The alternative source is expected to be groundwater. ▪ **Plan emergency measures** if volume in the Ruby Creek storages is expected to drop below the minimum supply level. ▪ **Commence works to reinstate supply from existing unused Leongatha groundwater bores** (Racecourse Road) **and/or Bellview Creek Reservoir** if investigations deem this appropriate.

Action 6 – Emergency measures

Trigger	Action
Volume in Ruby Creek storages falls below minimum supply level	▪ **Implement communication plan** previously outlined in Section 3.2. ▪ **Implement emergency measures** as required to maintain essential water use.

5.6.5 Post-Drought Actions

Post-drought actions common to all supply systems are presented in Section 4. There are no additional post-drought actions specific to Leongatha and Koonwarra, other than to comment on the effectiveness of the two alternative supply options if implemented.

6. Plan for Wonthaggi, Cape Paterson, Inverloch, Korumburra, Poowong, Loch and Nyora

6.1 Supply system

The source of supply for Wonthaggi, Cape Paterson, Inverloch, Korumburra, Poowong, Loch and Nyora is the 4,200 ML Lance Creek Reservoir, with supplementary supply available from the Melbourne Water Supply System. The reservoir dead storage is 960 ML but is reduced to 200 ML when a temporary pump is installed, as occurred in 2006/07. Treated water supply to the Northern Towns (Korumburra and Poowong/Loch/Nyora) is pumped from the Korumburra Transfer Pump Station at the Lance Creek Water Treatment Plant. Treated water supply to the Southern Towns (Wonthaggi, Inverloch and Cape Paterson) is via gravity. The emergency supply from the Powlett River to Lance Creek Reservoir is no longer used and the diversion pumps were removed in 2015/16.

A schematic of the supply system is shown in Figure 6-1.

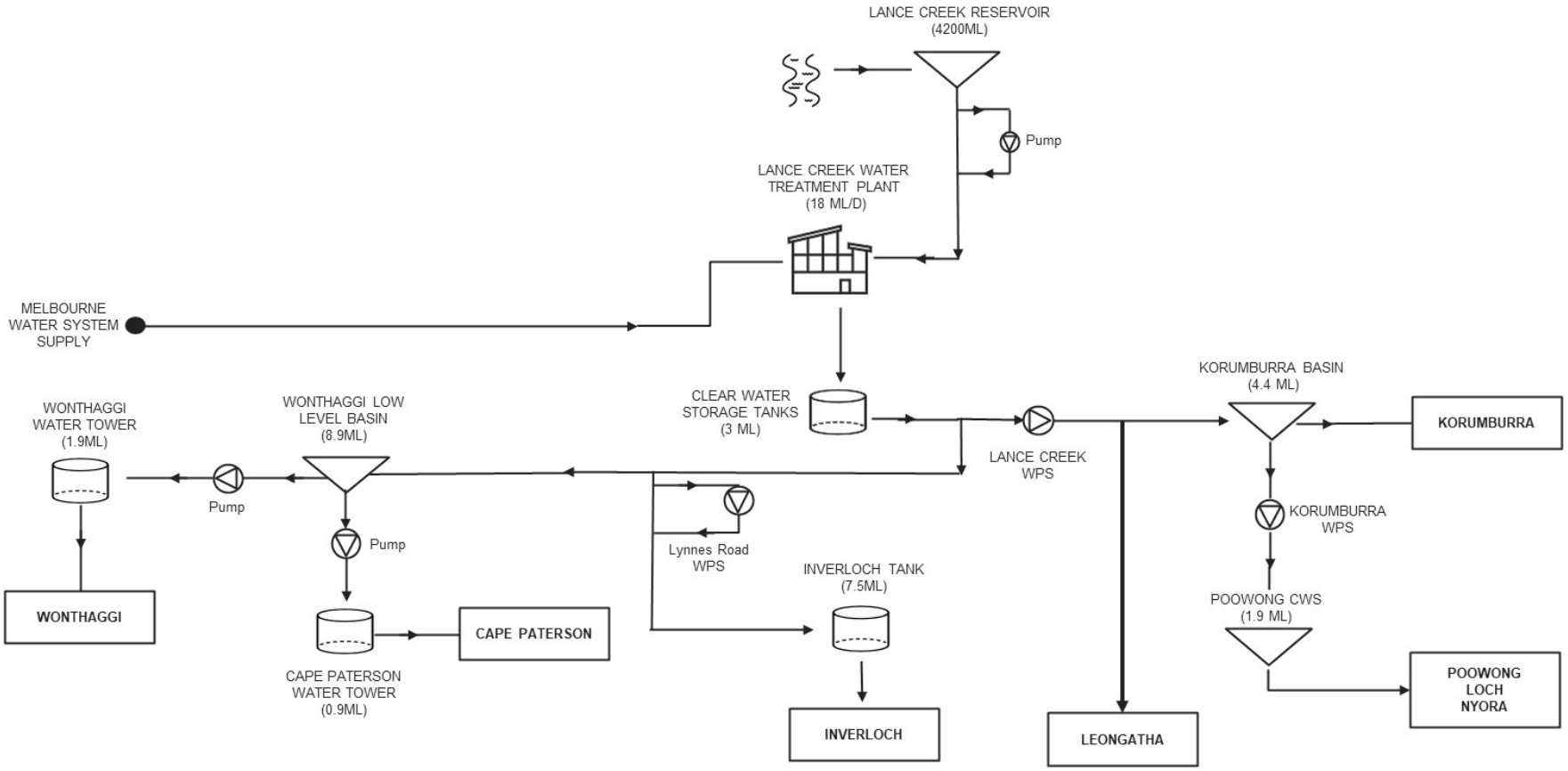


Figure 6-1 Lance Creek Supply system schematic

6.2 Bulk entitlements

The bulk entitlement for Wonthaggi/Inverloch allows South Gippsland Water to divert up to a maximum of 3,800 ML/year from Lance Creek, subject to the provision of minimum passing flows. South Gippsland Water has an entitlement for up to 1,000 ML/year from the Melbourne Water Supply System, however in any given year this volume can be lower because it is subject to seasonal allocations, or higher because of carryover of unused allocations from previous years. There is also an entitlement of 1,800 ML/year from the Powlett River (temporarily used in past droughts), 420 ML/year from Little Bass River (formerly supplying Poowong, Loch and Nyora) and 1,000 ML/year from Coalition, Ness and Bellview Creeks (formerly supplying Korumburra), but these supply sources are not currently operational for these supply areas. The bulk entitlement details are shown in Table 6-1 and Table 6-2.

Table 6-1 Bulk entitlement volume for Lance Creek

Source	Maximum annual volume (ML/year)	Maximum diversion rate (ML/day)	Minimum Passing Flows and Seasonal Allocations
Lance Creek Reservoir	3,800	35	100 ML/year when Lance Creek storage greater than 3,000 ML in December (wet years).
Greater Yarra System (Thomson River Pool)	1,000	7.0 (from Cardinia Reservoir) or 9.2 (from the Victorian Desalination Project)	Availability is subject to seasonal allocations and unused allocations carried over from previous years
Powlett River	1,800	10	Powlett River pumps have been decommissioned and are not expected to be used. If these pumps are reinstated, Table 6-2 specifies passing flows for winterfill diversions (Jun to Nov) only. Flow available for diversion is 0 ML/day during other months (Dec to May)
Little Bass Reservoir	420	2.7	Minimum of 0.5 ML/day or the inflow to Little Bass Reservoir
Coalition Creek Reservoir (No. 1 Reservoir)	1,000	4.8	Minimum of 0.6 ML/day or the inflow to Coalition Creek Reservoir
Ness Gully Reservoir (No. 2 Reservoir)		1.6 (Jun-Aug) 0.0 (Sep-May)	Minimum of 0.6 ML/day or the inflow to Ness Gully Reservoir
Bellview Creek Reservoir (No. 3 Reservoir)		3.0	Minimum of 1.0 ML/day or the inflow to Bellview Creek Reservoir

Table 6-2 Powlett River daily bulk entitlement

Flow in the Powlett River upstream of offtake, F (ML/day)	Flow available for diversion (ML/day)	Minimum passing flow (ML/day)
> 17	10	F – 10
12 – 17	5	F – 5
≤ 12	0	F

6.3 Consumption

The typical drought year demand in each month of the year that is used in the development of this DPP for the whole of the Lance Creek system (including northern and southern towns) is shown in Table 6-3. The unrestrictable demand is the component of demand typically used for in-house and industrial/commercial water use and is not affected by the imposition of water restrictions. Typical drought year demands for Korumburra, Poowong/Loch/Nyora and Wonthaggi/Cape Paterson/Inverloch are presented individually in Appendix B.

Table 6-3: Average monthly raw* water consumption for a typical drought year for the whole of the Lance Creek System

Month	Typical drought year demand (ML/month)	Unrestrictable demand (ML/month)	Restrictable demand (ML/month)
July	228	224	4
August	234	224	11
September	244	224	20
October	263	224	39
November	271	224	47
December	302	224	78
January	348	224	124
February	387	224	163
March	332	224	108
April	293	224	69
May	266	224	42
June	232	224	8
TOTAL (ML/year)	3,398	2,685	712

*raw water from Lance Creek and treated water from the Melbourne Water Supply System

6.3.1 Community Assets

Community assets (open space) within the Lance Creek Water Supply System that could require water during periods of drought include:

- the Football Oval at Poowong;
- the Korumburra Recreation Reserve; and
- the Korumburra Golf Course and Korumburra Football Oval. The golf course is currently supplied by raw water from Coalition Creek Reservoir and uses approximately 9 ML/year. The football oval uses approximately 2 ML/year.

These assets were identified through initial consultation with local council.

6.4 Level of Service Objective

The performance of the supply system during drought was assessed using a water balance model over a long-term baseline climate sequence from January 1913 to March 2020 (HARC, 2021a). If the restriction triggers are implemented in accordance with this current DPP, the long-term likelihood of not requiring restrictions in any given year is estimated to be greater than

99% at the year 2020 level of demand. These results meet South Gippsland Water's agreed level of service objective. South Gippsland Water's minimum level of service objective to provide the unrestrictable demand of 2,685 ML/year in Table 6-3 was also met at the 2020 level of demand.

6.5 Review of Past Drought Experience

The Lance Creek Supply System has changed considerably since past drought events, with the connection to the Melbourne Water Supply System and the connection of Korumburra and Poowong/Loch/Nyora. In the context of the current supply system configuration, many elements of South Gippsland Water's past drought experience are therefore no longer as relevant as they previously were.

Since 1997/98, South Gippsland Water has experienced conditions drier than the long-term average. For Wonthaggi, Cape Paterson and Inverloch, Stage 1 restrictions were in place from June to September 2005. In November 2006, Stage 1 restrictions were introduced and progressively increased to Stage 4 by March 2007, with restrictions lifted in August 2008. The minimum storage reached during the 2006/07 drought was 411 ML (10% of capacity) on 18 June 2007, which is above the dead storage of 200 ML, but below the level at which the temporary pump is needed to access supply. Temporary supply from the Powlett River at Wonthaggi was also implemented during this event as a drought response measure. The total volume transferred to Westernport Water (via the no longer active connection between Lance Creek Reservoir and Candowie Reservoir) during the 2006/07 drought was 613 ML from September 2006 to April 2007.

Since the end of restrictions in August 2008, no further restrictions have been implemented. In 2010 South Gippsland Water secured the option to access water from the Melbourne Water Supply System, with a connection to Cardinia Reservoir allowing for a maximum transfer of between 7.6 ML/day (when supplied from Cardinia Reservoir) and 9.2 ML/day (when the Victorian Desalination Plant is operating).

With Westernport Water's augmentation of the Bass River supply in 2009 and the granting of a bulk entitlement to that authority in 2010 for the supply of up to 1,000 ML from the Melbourne water supply system, supply to Westernport Water from the Lance Creek Reservoir no longer occurs.

Water quality (algal blooms) in Lance Creek Reservoir can deteriorate in the warmer months of the year. South Gippsland Water manages this by drawing more water seasonally from the Melbourne Water Supply System when water quality in Lance Creek Reservoir is poor.

Prior to its connection to the Lance Creek System, Korumburra experienced periods of water restriction in 2002/03, 2003/04, 2005/06, 2006/07, 2012/13, 2015/16, 2016/17 and 2017/18. In the most recent drought periods, contingency supplies were sourced from the Tarwin River at Koonwarra. Groundwater supply to Korumburra also occurred during the 2006/07 drought, as described in Section 5.5. The pipeline routes taken during those previous droughts are shown in Appendix A.

Prior to its connection to the Lance Creek System, Poowong/Loch/Nyora experienced periods of water restriction in 2002/03, 2006/07 and 2015/16. In the 2006/07 drought, approximately 9 ML of water was carted from South Gippsland Water's groundwater bore near Korumburra to Little Bass Reservoir. In 2015/16, supplementary water was obtained from a farm dam (owned by a local farmer) to provide alternate water supply to the Poowong Abattoir (12 ML) in order to extend South Gippsland Water's raw water storage during this event.

6.6 Drought Response Plan

6.6.1 Pre-Drought Actions

Pre-drought actions common to all supply systems are presented in Section 2.7. Additional pre-drought actions specific to the Lance Creek supply system include agreeing on operational arrangements with the Bulk System Transfer Operator (Melbourne Water), as per Clause 9.1 of South Gippsland Water's bulk entitlement. South Gippsland Water should also ensure that Lance Creek Reservoir is as full as possible leading into drought. Early warning signs for this supply system would be low inflows to Lance Creek Reservoir, which could be assessed by examining changes in the volume in storage and behaviour in the nearest active streamflow gauge (number 227236) on the much larger Powlett River. Low spring rainfall combined with lower-than-average storage levels would provide an indication of impending drought. Low early season allocations from the Melbourne Water Supply System would also be an indicator of impending drought in that supply source.

For Poowong, Loch and Nyora, the drivers for seasonal and inter-annual variability in demand are not well understood. Demands should continue to be monitored and analysed to better understand the underlying drivers of demand in this supply system, in particular industrial/commercial demands.

6.6.2 Available Drought Actions

A range of actions are available to South Gippsland Water for the Lance Creek System during drought. These actions have been divided into actions likely to be feasible during drought and other actions that have been considered but which are less likely to be feasible. A summary of the likely feasibility of each option is shown in Table 6-4. In previous droughts, response options that have been implemented included water restrictions, supply from the Powlett River at Wonthaggi, use of the temporary pump in Lance Creek Reservoir, groundwater supply to Korumburra, tankered groundwater supply to Poowong/Loch/Nyora, supply from the Tarwin River to Korumburra, and purchase of water from another user for the Poowong abattoir.

Table 6-4: Likely feasibility of drought actions for towns supplied from the Lance Creek System

Action	Likely feasibility during drought
Supply from the Melbourne Water Supply System	High
Restrictions	High
Use of temporary pump in Lance Creek Reservoir	High
Purchase of water from other water users to Poowong/Loch/Nyora	High (limited amount, 15 ML)
Reuse of treated wastewater	Medium
Water carting (to Poowong/Loch/Nyora)	Medium
Supply from Powlett River (to Wonthaggi)	Low
Purchase of water from other users to Korumburra, Wonthaggi, Cape Paterson and Inverloch	Low
Water carting to Korumburra, Wonthaggi, Cape Paterson and Inverloch	Low
Rainwater tanks	Low
Wonthaggi coal mines	Low
Use of grey water	Low
Changed tariffs during drought	Low
Stormwater	Low
Supply from Tarwin River West Branch (to Korumburra)	Not feasible
Groundwater bores (to Korumburra)	Not feasible
Groundwater to Poowong, Loch, Nyora, Wonthaggi, Cape Paterson and Inverloch	Not feasible

Each option is discussed briefly below.

Supply from the Melbourne Water Supply System: South Gippsland Water has a Bulk Entitlement to access 1,000 ML/year of treated water from the Melbourne Water Supply System, subject to seasonal allocations and the carryover of unused allocations from the previous year. Infrastructure capacities limit the maximum extraction rate to 7.0-9.2 ML/day, and carryover is limited to two times South Gippsland Water's annual entitlement volume. Operational rules are in place, which include 1 ML/day of throughflow to maintain chlorine residuals, and maximum supply from the Melbourne Water Supply System when volumes fall below the triggers presented in the following sub-section of this DPP. During periods of severe drought, South Gippsland Water may receive an allocation from the Melbourne Water Supply System that is much less than the actual Bulk Entitlement volume. South Gippsland Water could also temporarily purchase allocations from other users in the Melbourne Water Supply System, if available, to increase its available supply.

Restrictions: Imposition of staged water restrictions in accordance with South Gippsland Water's by-law for restricting water use will serve to reduce demand. The reduction in restrictable demand anticipated at each stage of restriction was previously presented in Section 2.6.2, which can be used in combination with Table 6-3 to estimate likely water savings during drought.

Use of Temporary Pump in Lance Creek Reservoir: Below a volume in storage of 960 ML, a temporary pump must be used to access water in the reservoir, as was done in 2006/07. This will allow South Gippsland Water to access the volume in storage down to the minimum supply

level of 200 ML. If the pump is tested before the volume in storage of 960 ML is reached, there is no lead time to implement this option.

Purchase of water from other water users: There may be potential to supplement supply to Poowong, Loch and Nyora through supply from a nearby farm dam. Discussions would need to be held with the individual landholder for any use from this dam. The dam has a capacity of 10 to 15 ML and can be supplied at rate of about 0.5 ML/day. The supply pipeline is in place. A temporary diesel pump needs to be installed at the farmer's dam and an assessment of water quality is also required. This option was implemented to supply water to the Poowong Abattoir in 2015/16. Purchase of water from other users would not be an option for potable water supply to Korumburra, due to the difficulty in transporting the water to the Lance Creek Water Treatment Plant. For Wonthaggi, Cape Paterson and Inverloch, the availability of water to purchase from farm dams upstream of Lance Creek Reservoir would need to be investigated.

Groundwater to Korumburra: Korumburra has previously been supplied from the Racecourse Road bores at Leongatha at up to 0.5 ML/day, however the infrastructure used to transfer this water has been removed and would need to be set up again if implementing this option. Experience during 2006/07 was that this supply was complex and difficult to operate. The operating rules for the bores are specified in South Gippsland Water's licence (Section 6.2), which prevent pumping in January and February, and in other months unless the volume in storage is below specified triggers. The area surrounding South Gippsland Water's existing bores at Leongatha is within the Leongatha Groundwater Management Area. A permissible consumptive volume of 6,500 ML/year has been set for this area and current licensed entitlement is only 1,693 ML/year (DSE, 2011c), which suggests that new licences could be made available. The area around Korumburra is in an unincorporated area where no cap on groundwater licences has been set, however yields from the Korumburra Group cretaceous age bedrock sediments in this area are poor at less than 1 L/s with salinities between 1500-3000 mg/L. Pump test and water quality results from the existing Leongatha bores are documented in SKM (2008) and preliminary investigations into water available in the coal mines around Korumburra are documented in SKM (2007a). The volume of water in the Coal Creek mine was regarded as highly uncertain (25-785 ML depending on mine void assumptions), water quality was unknown, and there was risk of subsidence if drilling in areas around mine shafts and fault lines. As such, this is not considered suitable as not a viable long term supply option.

Groundwater to Wonthaggi, Cape Paterson and Inverloch: The area surrounding Lance Creek Reservoir, Wonthaggi, Cape Paterson and Inverloch is within an unincorporated area, which means that new groundwater licences can be issued in this area. A number of bores have been drilled in the region with groundwater salinities ranging from 1,000-3,000 mg/L. Eleven bores were drilled by the Department of Minerals and Energy approximately 16-18 km northeast of Inverloch in 1984, where yield was suitable, but quality highly variable. Further investigation would be required to find suitable sites for groundwater extraction, which could take several months. A desktop review was undertaken in SKM (2007b) of groundwater supply potential at Inverloch. The town was supplied from groundwater around 1945 to 1950 from a disused bore located between Surf Parade and the foreshore, close to Wave Street. SKM (2007b) indicated that potential for groundwater supply from the Strzelecki Formation was low due to poor yields. The prospect of supply from the Tertiary and Quaternary aged sediments overlying the Strzelecki Group are likely to represent a better prospect for town water supply.

Information on yield and quality from these sediments is limited, and the aquifers are relatively thin, which means that they could be depleted quickly, with an additional risk of sea water intrusion.

Groundwater to Poowong, Loch and Nyora: The extent of groundwater availability at Poowong, Loch and Nyora has not been extensively investigated by South Gippsland Water. Investigations completed in 2007 using drill rigs near the Poowong reservoir area indicated that the there are no groundwater resources available at a reasonable depth. Groundwater may be available in other areas in the Poowong, Loch, Nyora region, however it requires significant pipe works to bring it to the treatment plant. The area to the east of Nyora is in an unincorporated area, which means that new groundwater licences can be issued without having to purchase a licence from an existing licence holder. The area to the west of Nyora is in the Koo Wee Rup Water Supply Protection Area, which means that South Gippsland Water would need to purchase a groundwater licence from an existing licence holder to extract from this area.

Southern Rural Water aims to process permanent transfers of groundwater licence within 14 days and to assess new groundwater licence applications within 60 days (SRW, 2021). The time to construct, test and develop a new bore could be in the order of weeks if a drill rig is available.

Reuse of treated wastewater: South Gippsland Water operates wastewater treatment plants at Wonthaggi, Cape Paterson, Inverloch and Korumburra. In 2019/20 there was 1,612 ML of Class C effluent produced from the Wonthaggi, Cape Paterson and Inverloch Plants, and 846 ML of Class B effluent produced from the Korumburra plant. Of this, none was reused, however 20-30 ML has previously been used to irrigate crops for cattle fodder on a farm at Inverloch. Class C effluent is only suitable for a small range of agricultural and industrial applications such as livestock grazing and golf courses. Class B effluent is suitable for most agricultural and industrial applications. Both classes are not suitable for drinking. Treated wastewater may be a suitable alternative supply for municipal garden or sports ground watering during drought. South Gippsland Water has a standpipe at the Korumburra Wastewater Treatment Plant that is available for approved customers. Historically this water has been used for weed spraying, road works and dust suppression. In addition to this standpipe, the Inverloch and Wonthaggi storage lagoons are listed as a distribution location for recycled water to water tankers as part of South Gippsland Water's Environmental Improvement Plan (RMCG, 2015). Wastewater from Poowong, Loch and Nyora is sent to South East Water's Lang Lang treatment plant and re-used in the adjacent farms, and hence is not available for local reuse.

Water Carting: Based on the estimated number of trips that would need to be made to supply Stage 4 demands (Table 6-5), water carting is considered infeasible for the Lance Creek System as a whole, as well as for South Gippsland Water's southern towns (Wonthaggi, Cape Paterson, Inverloch) and Korumburra. Water carting from Korumburra has been undertaken to Poowong, Loch and Nyora in the past, with fewer numbers of trips required if only carting to this sub-system. Given that Korumburra is now connected to the same supply system as Poowong/Loch/Nyora, another source of treated water would be required if only carting water to Poowong/Loch/Nyora.

Table 6-5: Water carting for Lance Creek System

Tanker size	Estimated no. of trips per day to provide Stage 4 (unrestrictable) demand
Total Lance Creek System	
15 kL	490
27 kL	270
Poowong, Loch and Nyora only	
15 kL	36
27 kL	20

Powlett River: South Gippsland Water can divert at up to 10 ML/day from the Powlett River at Wonthaggi. This water is only available in winter (Jun to Nov), so it could be used as an additional supply source in dry winters to minimise drawdown in Lance Creek Reservoir, and to recover quickly from drought in June and July. However, the infrastructure required to operate this supply has been removed.

Tarwin River West Branch: Supply from the Tarwin River West Branch at Koonwarra to Korumburra was implemented in previous droughts, but South Gippsland Water no longer has an entitlement to access this water. Experience during previous drought periods was that this supply was complex and difficult to operate.

Rainwater Tanks: Rainwater tanks can have significant benefits to consumers in average to high rainfall years when the tanks are regularly refilled by rainfall events. They may be an effective alternative source of water in short duration droughts, and have the advantage that they can generate supply as soon as it rains with negligible initial losses at the start of a rainfall event. They will however have limited or no value in long-term droughts when rainfall is very low or zero for several weeks or months. The benefits of existing rainwater tanks are already incorporated into the demand estimates in this DPP.

Wonthaggi Coal Mines: Harvesting of water from the Wonthaggi Coal Mines was investigated in SKM (2006) and subsequently dismissed as a feasible option due to poor water quality in the mines.

Use of grey water: Grey water is water from clothes washers, bathtubs, showers and bathroom sinks. Grey water can be used by individual customers to maintain garden watering during periods of water restriction, however there can be health risks associated with the use of grey water.

Stormwater: A number of rural stock and domestic users within the Poowong, Loch and Nyora system are connected to mains supply. While these users have a relatively low water use, there is some scope to reduce rural demands through demand substitution from non-potable water sources, if available. The feasibility of this has not been investigated.

6.6.3 Drought Action Triggers

Triggers for action during drought are based on the total volume in Lance Creek Reservoir, as shown in Table 6-6 and Figure 6-2. These triggers have been designed with the assumption

that the connection to the Melbourne Water Supply System will be utilised to minimise the need for restrictions. These triggers assume:

- No catchment inflow to Lance Creek Reservoir during drought;
- An unrestricted demand of 3,398 ML/year and a restrictable demand of 712 ML/year;
- Access to 1 GL/year from the Melbourne Water Supply System, consisting of each year's seasonal allocation plus available carryover from previous years.
- The connection to the Melbourne Water Supply System is preferred over the use of the temporary pump in Lance Creek Reservoir. The trigger for obtaining supply from the Melbourne Water Supply System has been set at 2,500 ML above the Level 1 restriction trigger.
- Four months of supply from the Stage 1 trigger until the dead storage of 200 ML is reached.

The resulting restriction triggers are presented below. It should be noted that these assumptions generate restriction triggers that are close together, relative to demands. This has implications for the practical management by operators (it may be difficult to differentiate between the different stages of restrictions). It also may create an operational risk in the event of failure of the connection to the Melbourne Water Supply System. In the event of failure of this connection, urgent reinstatement is required in order to prevent the introduction of severe restrictions.

Table 6-6 Restriction Triggers for the Lance Creek Supply System

Start of month	Trigger Storage Volume in Lance Creek Reservoir (ML)				
	Trigger to source from Melbourne Water Supply System	STAGE 1	STAGE 2	STAGE 3	STAGE 4
January	3,675	1,175	876	604	373
February	3,608	1,108	858	611	368
March	3,478	978	768	580	371
April	3,366	866	694	517	353
May	3,304	804	646	494	341
June	3,280	780	626	481	339
July	3,306	806	634	483	339
August	3,353	853	665	494	343
September	3,428	928	699	514	348
October	3,510	1,010	759	535	360
November	3,567	1,067	794	564	363
December	3,649	1,149	839	590	371

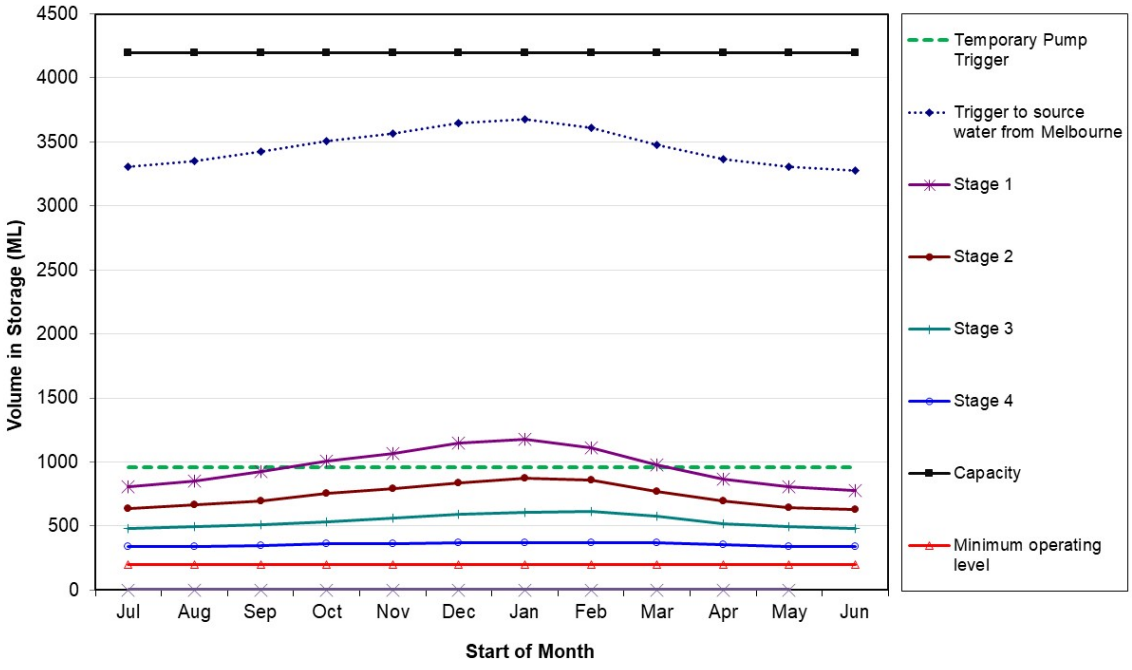


Figure 6-2 Drought response triggers for the Lance Creek Supply System

Restriction exit triggers will be flexibly implemented by South Gippsland Water based on forward estimates of supply availability and anticipated net evaporation and demand. The decision to lift restrictions should also take into account the likelihood of returning to restrictions in the near future and the community's timeframe for adapting to changes in restriction level.

6.6.4 Drought Action Plans

Action 1 – General Awareness

Trigger	Action
The trigger for this action is based on seasonal climate forecasts and current water availability in South Gippsland Water's supply systems	▪ **Implement communication plan** previously outlined in Section 3.2.

Action 2 – Supply from the Melbourne Water Supply System

Trigger	Action
Volume in Lance Creek Reservoir falls below the trigger for sourcing water from the Melbourne (Table 6-6, Figure 6-2).	▪ **Supply from the Melbourne Water Supply System.** ▪ **Implement communication plan** previously outlined in Section 3.2. ▪ **Track streamflow, storage, supply from the Melbourne Water Supply System**, and demand behaviour relative to restriction triggers. ▪ **Test temporary pump for accessing water below 960 ML** in Lance Creek Reservoir.

Action 3 – Operate Temporary Pump

Trigger	Action
Volume in Lance Creek Reservoir falls below 960 ML.	▪ **Operate the temporary pump** to access water in Lance Creek Reservoir below 960 ML.

Action 4 – Introduce Stage 1 restrictions

Trigger	Action
Volume in Lance Creek Reservoir falls between the Stage 1 and Stage 2 restriction rule values (Table 6-6, Figure 6-2).	▪ **Implement restrictions as required** to balance supply and demand. ▪ **Implement communication plan** previously outlined in Section 3.2. ▪ **Track streamflow, storage, supply from the Melbourne Water Supply System**, and demand behaviour relative to restriction triggers.

Action 5 – Introduce Stage 2 restrictions

Trigger	Action
Volume in Lance Creek Reservoir falls between the Stage 2 and Stage 3 restriction rule values (Table 6-6, Figure 6-2).	▪ **Implement restrictions as required** to balance supply and demand. ▪ **Implement communication plan** previously outlined in Section 3.2. ▪ **Track streamflow, storage, supply from the Melbourne Water Supply System**, and demand behaviour relative to restriction triggers.

Action 6 – Introduce Stage 3 restrictions

Trigger	Action
Volume in Lance Creek Reservoir falls between the Stage 3 and Stage 4 restriction rule values (Table 6-6, Figure 6-2).	▪ **Implement restrictions as required** to balance supply and demand. ▪ **Implement communication plan** previously outlined in Section 3.2. ▪ **Track streamflow, storage, supply from the Melbourne Water Supply System**, and demand behaviour relative to restriction triggers. ▪ **Undertake preliminary investigations into emergency supply measures** if volume in the Lance Creek Reservoir is expected to drop below the minimum supply level. These could include purchasing additional allocations from other users on the Melbourne Water Supply System.

Action 7 – Introduce Stage 4 restrictions

Trigger	Action
Volume in Lance Creek Reservoir falls below the Stage 4 restriction rule values (Table 6-6, Figure 6-2).	▪ I**mplement restrictions** as required to balance supply and demand. ▪ **Implement communication plan** previously outlined in Section 3.2. ▪ **Track streamflow, storage, supply from the Melbourne Water Supply System**, and demand behaviour relative to restriction triggers. ▪ **Finalise investigations into emergency measures** if volume in the Lance Creek Reservoir is expected to drop below the minimum supply level.

Action 8 – Emergency measures

Trigger	Action
Volume in Lance Creek Reservoir falls below minimum supply level	▪ **Implement communication plan** previously outlined in Section 3.2. ▪ **Implement emergency measures** as required to maintain essential water use.

6.6.5 Post-Drought Actions

Post-drought actions common to all supply systems are presented in Section 4. There are no additional post-drought actions specific to the Lance Creek System, other than to comment on the effectiveness of the alternative supply options if implemented.

7. Plan for Dumbalk

7.1 Supply system

Dumbalk receives water directly from the east branch of the Tarwin River via a pump station which is located adjacent to the river. The pump station transfers water to the water treatment plant via a 150 mm diameter rising main. The capacity of the pumped diversion is 0.7 ML/day (21.3 ML/month). The water treatment plant has a capacity of 0.6 ML/day (18.3 ML/month). A schematic of the Dumbalk water supply system is shown in Figure 7-1.

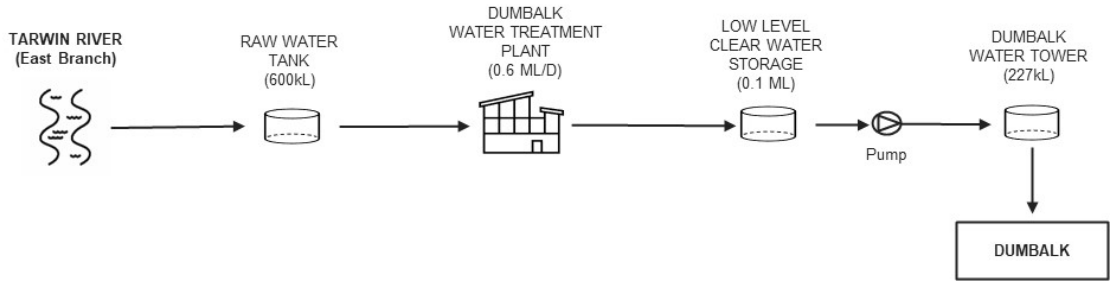


Figure 7-1 Dumbalk water supply system schematic

7.2 Bulk entitlements

The bulk entitlement for Dumbalk allows South Gippsland Water to divert up to a maximum of 100 ML/year from the Tarwin River East Branch. There are no minimum passing flows required. The daily bulk entitlement limit is shown in Table 7-1.

Table 7-1 Bulk entitlement volume for Dumbalk

Source	Maximum annual volume	Maximum diversion rate	Minimum passing flows
Tarwin River at Dumbalk	100 ML/year	0.72 ML/day	None

7.3 Consumption

The typical drought year demand in each month of the year that is used in the development of this DPP is shown in Table 7-2 for Dumbalk. The unrestrictable demand is the component of demand typically used for in-house and industrial/commercial water use and is not affected by the imposition of water restrictions. In a relatively small water supply system such as Dumbalk, the unrestrictable demand is likely to be sensitive to supply system losses, which may vary from year to year.

Table 7-2: Average monthly raw water consumption for a typical drought year for Dumbalk

Month	Typical drought year demand (ML/month)	Unrestrictable demand (ML/month)	Restrictable demand (ML/month)
July	0.9	0.8	0.1
August	0.9	0.8	0.1
September	1.2	0.8	0.4
October	1.6	0.8	0.7
November	1.5	0.8	0.7
December	1.6	0.8	0.7
January	1.9	0.8	1.1
February	2.0	0.8	1.2
March	1.9	0.8	1.1
April	1.5	0.8	0.7
May	1.3	0.8	0.4
June	0.9	0.8	0.1
TOTAL (ML/year)	17.3	9.9	7.4

7.3.1 Community Assets

There are no community assets (open space) in the Dumbalk Supply System that have been identified as requiring water during periods of drought. This was identified through initial consultation with local council.

7.4 Level of Service Objective

The performance of the supply system during drought was assessed using a water balance model over a long-term baseline climate sequence from January 1950 to June 2020 (HARC, 2021a). If the restriction triggers are implemented in accordance with this current DPP, the long-term likelihood of not requiring restrictions in any given year is estimated to be 80-91% at the year 2020 level of demand. This range reflects uncertainty in the effect of historical climate change on supply system inflows and net evaporation. These results meet South Gippsland Water's agreed level of service objective under projected historical year 2020 low climate change scenarios, but not under the year 2020 medium and high climate change scenario. South Gippsland Water's minimum level of service objective to provide the unrestrictable demand of 10 ML/year in Table 7-2 was met at the 2020 level of demand.

The minimum recorded flow at the Dumbalk streamflow gauge (227226) occurred in April 2003, when a flow of 0.32 ML/day was recorded. With the current restriction triggers, this would have triggered Stage 2 restrictions, but just avoided Stage 4 restrictions. A lower value was recorded in February 2010, but was based on an extrapolated rating table that appears to have been a low accuracy reading that is inconsistent with flows on previous and subsequent days.

7.5 Review of Past Drought Experience

Since 1997/98, South Gippsland Water has experienced conditions drier than the long-term average. The most recent period of restriction is listed below.

2006/07 – Stage 2 restrictions (of 4 stages) were introduced at Dumbalk in February 2007 and increased to Stage 4 in March 2007. These restrictions remained in place until July 2007, when restrictions were lifted. The total duration of restrictions over this period was 5 months. The minimum value recorded at streamflow gauge 227226 on the Tarwin River East Branch at Dumbalk upstream of South Gippsland Water's offtake was 0.9 ML/day on 26 February 2007, which is well above the peak seasonal demand for water of less than 0.1 ML/day. Stage 2 restrictions were first implemented when the flow at the gauge dropped to 1.3 ML/day, which was below the voluntary restriction trigger of 3.0 ML/day but above the Stage 4 restriction trigger of 0.3 ML/day in the 2003 DPP. Streamflows fluctuated significantly and dropped to less than 2 ML/day on six separate occasions between December 2006 and April 2007.

Since the end of restrictions in July 2007, no further restrictions have been implemented. No changes to the supply system have been made in recent years.

A base flow recession curve for the Tarwin River East Branch upstream of South Gippsland Water's urban offtake is shown in Figure 7-2. This is relevant to understand how streamflow may drop during periods of low flows and to forecast the likely need for restrictions. The base flow recession constant on the master recession curve is estimated to be 0.93, which means that the flow in the river would be expected to halve around every 9 days. This relationship has been fitted to flows below 10 ML/day. Figure 7-2 highlights some variability in low flow

behaviour between different low flow events; hence the master recession curve should only be used as a broad guide to likely streamflow behaviour in the absence of rainfall.

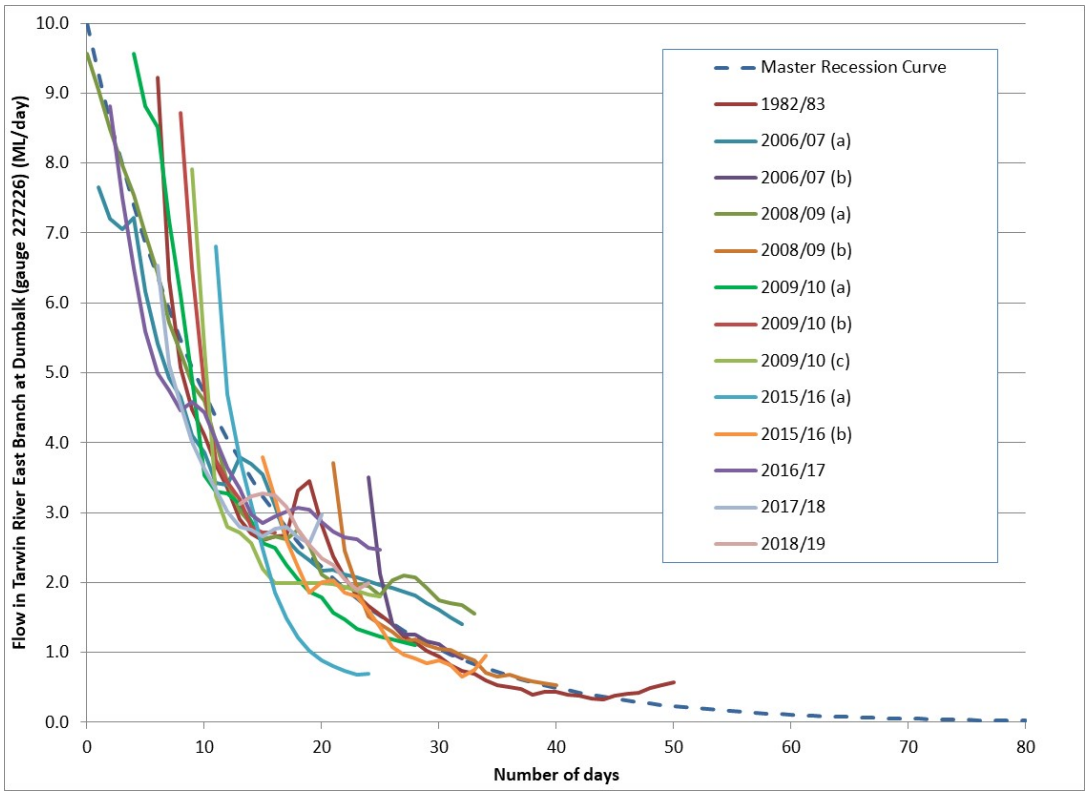


Figure 7-2 Dumbalk base flow master recession curve

7.6 Drought Response Plan

7.6.1 Pre-Drought Actions

Pre-drought actions common to all supply systems are presented in Section 2.7. There are no additional pre-drought actions specific to Dumbalk. Decreasing flows in the Tarwin River and the Tarwin River East Branch would provide an indication of impending drought.

7.6.2 Available Drought Actions

A range of actions are available to South Gippsland Water at Dumbalk during drought. These actions have been divided into actions likely to be feasible during drought and other actions that have been considered but which are less likely to be feasible. A summary of the likely feasibility of each option is shown in Table 7-3. In the 2006/07 drought, water restrictions were implemented.

Table 7-3: Likely feasibility of drought actions for Dumbalk

Action	Likely feasibility during drought
Restrictions	High
Groundwater bores	High
Water carting	High
River storage	Low
Reuse of treated wastewater	Low
Purchase of water from other water users	Low
Rainwater tanks	Low
Use of grey water	Low
Changed tariffs during drought	Low

Each option is discussed briefly below.

Restrictions: Imposition of staged water restrictions in accordance with South Gippsland Water's by-law for restricting water use will serve to reduce demand. The effectiveness of restrictions in this supply system will be limited due to its small storage capacity, but will help to minimise the cost of emergency supply measures. The time available between the Stage 2 and Stage 4 restriction triggers is estimated to be in the order of two weeks in the absence of rainfall. The reduction in restrictable demand anticipated at each stage of restriction was previously presented in Section 2.6.2, which can be used in combination with Table 7-2 to estimate likely water savings during drought.

Groundwater: A bore pump test was undertaken on bore number 61664 at Dumbalk in 1998 (SKM, 1998). The conclusions from the test were that it was capable of yielding around 1.5 l/s (0.13 ML/day). SKM (1998) also stated that a new bore could be capable of producing 3-6 l/s. The area around Dumbalk is in an unincorporated area where no cap on groundwater licences has been set. Southern Rural Water aims to process permanent transfers of groundwater licence within 14 days and to assess new groundwater licence applications within 60 days (SRW, 2021). The time to construct, test and develop a new bore could be in the order of weeks if a drill rig is available.

Water Carting: Tankers could be used to cart treated water to Dumbalk from the Foster supply system. The estimated number of trips that would need to be made to supply Stage 4 demands is presented in Table 7-4. The point at which the carted water would enter the supply system would need to be investigated further. If tankers are available and the carted water can be delivered into the supply system, the lead time for implementing this option is several days.

Table 7-4: Water carting for Dumbalk

Tanker size	Approximate no. of trips per day to provide Stage 4 (unrestrictable) demand
15 kL	2
27 kL	1

River storage: Under the conditions of the bulk entitlement for Dumbalk, South Gippsland Water is not permitted to pump water from river pools after the flow in the river has ceased. In

order to pump river pools, South Gippsland Water would need to apply for a Ministerial qualification of rights, which would be unlikely to be granted unless all other planned contingency supply options have been exhausted.

Reuse of treated wastewater: Dumbalk does not have a wastewater treatment plant, so there is no opportunity to use locally treated wastewater during drought.

Purchase of water from other water users: Private diverters are located along the Tarwin River East Branch upstream of South Gippsland Water's offtake at Dumbalk. Summer diversion licences could be purchased from other water users during drought; however the availability of water under those licences during a dry summer is expected to be low. According to the local management plan for the South Gippsland Basin (SRW, 2013), private diverters would be banned from taking water when flow is below 16 ML/day at Meeniyan (which is equivalent to a volume much higher than 1 ML/day at Dumbalk). This means that any diversion licences purchased from rural water users would be subject to a ban on diversions before South Gippsland Water's bulk entitlement for Dumbalk is affected by low flows. Hence private diversion licences would not add to South Gippsland Water's supply at low flows without additional storage.

Rainwater Tanks: Rainwater tanks can have significant benefits to consumers in average to high rainfall years when the tanks are regularly refilled by rainfall events. They may be an effective alternative source of water in short duration droughts, and have the advantage that they can generate supply as soon as it rains with negligible initial losses at the start of a rainfall event. They will however have limited or no value in long-term droughts when rainfall is very low or zero for several weeks or months. The benefits of existing rainwater tanks are already incorporated into the demand estimates in this DPP.

Use of grey water: Grey water is water from clothes washers, bathtubs, showers and bathroom sinks. Grey water can be used by individual customers to maintain garden watering during periods of water restriction, however there can be health risks associated with the use of grey water.

7.6.3 Drought Action Triggers

Restriction triggers for Dumbalk are shown in Table 7-5. These restrictions should only be introduced when the flow in the Tarwin River drops below 1.0 ML/day upstream of the Dumbalk offtake and climate forecasts indicate that dry conditions are expected to continue. Stages 1 and 3 have not been included because streamflows are expected to fall quickly at low flow rates. These triggers assume that streamflow will halve over a period of 9 days in the absence of rainfall.

Table 7-5 Restriction Triggers for Dumbalk

Flow in Tarwin River u/s of offtake (ML/day)	Stage of Restriction
1.0	Stage 2
0.3	Stage 4

Restriction exit triggers will be flexibly implemented by South Gippsland Water based on forward estimates of supply availability and anticipated demand. The decision to lift restrictions should also take into account the likelihood of returning to restrictions in the near future and the community's timeframe for adapting to changes in restriction level.

7.6.4 Drought Action Plans

Action 1 – General Awareness

Trigger	Action
The trigger for this action is dry seasonal climate forecasts and low river flow conditions across the region	▪ **Implement communication** plan previously outlined in Section 3.2. ▪ **Continue ongoing pre-drought** actions identified in Section 2.7. ▪ **Track streamflow and demand behaviour** relative to restriction triggers. ▪ **Undertake preliminary investigations into water carting** and supply from groundwater.

Action 2 – Introduce Stage 2 restrictions

Trigger	Action
Flow in the Tarwin River East Branch at Dumbalk falls below 1 ML/day (Table 7-5) and is expected to continue to fall.	▪ **Introduce Stage 2 restrictions**. Note that the decision on the appropriate stage of restriction will depend on circumstances at the time, such as the climate outlook, supply availability and customer demand behaviour relative to the restriction trigger design assumptions in Section 7.6.3. ▪ **Implement communication plan** previously outlined in Section 3.2. ▪ **Track streamflow and demand behaviour** relative to restriction triggers. ▪ **Finalise investigations into water carting** and supply from groundwater.

Action 3 – Introduce Stage 4 restrictions

Trigger	Action
Flow in the Tarwin River East Branch at Dumbalk falls below 0.3 ML/day (Table 7-5) and is expected to continue to fall.	▪ **Introduce Stage 4 restrictions.** Note that the decision on the appropriate stage of restriction will depend on circumstances at the time, such as the climate outlook, supply availability and customer demand behaviour relative to the restriction trigger design assumptions in Section 7.6.3. ▪ **Implement communication plan** previously outlined in Section 3.2. ▪ **Track streamflow and demand behaviour** relative to restriction triggers. ▪ **Implement supply from alternative source** to maintain South Gippsland Water's minimum level of service.

Action 4 – Emergency measures

Trigger	Action
River flow ceases	▪ **Implement communication plan** previously outlined in Section 3.2. ▪ **Implement emergency measures** as required to maintain essential water use, such as water carting.

7.6.5 Post-Drought Actions

Post-drought actions common to all supply systems are presented in Section 4. There are no additional post-drought actions specific to Dumbalk, other than to comment on the effectiveness of the two alternative supply options if implemented.

8. Plan for Meeniyan

8.1 Supply system

Meeniyan's water supply is taken directly from the Tarwin River at Meeniyan (downstream of the streamflow gauge Tarwin River at Meeniyan, 227202). A pump station located adjacent to the river transfers water via a 150 mm diameter pipe to a small water storage basin (5.9 ML) located south of the town centre. A schematic of the Meeniyan water supply system is shown in Figure 8-1.

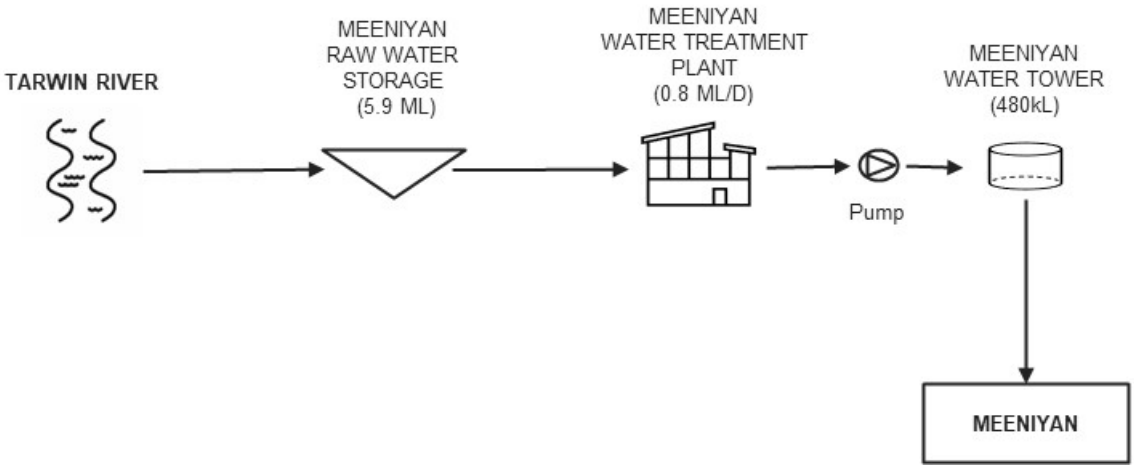


Figure 8-1 Meeniyan Water Supply System Schematic

8.2 Bulk entitlements

The bulk entitlement for Meeniyan allows South Gippsland Water to divert up to a maximum of 200 ML/year from the Tarwin River. There are no minimum passing flows required. The daily bulk entitlement limit is shown in Table 8-1.

Table 8-1 Bulk entitlement volume for the Tarwin River at Meeniyan

Source	Maximum annual volume	Maximum diversion rate	Minimum passing flows
Tarwin River at Meeniyan	200 ML/year	1.3 ML/day	None

8.3 Consumption

The typical drought year demand in each month of the year that is used in the development of this DPP is shown in Table 8-2 for Meeniyan. The unrestrictable demand is the component of demand typically used for in-house and industrial/commercial water use and is not affected by the imposition of water restrictions.

Table 8-2: Average monthly raw water consumption for a typical drought year for Meeniyan

Month	Typical drought year demand (ML/month)	Unrestrictable demand (ML/month)	Restrictable demand (ML/month)
July	3.2	2.8	0.3
August	3.5	2.8	0.6
September	4.0	2.8	1.1
October	4.4	2.8	1.6
November	4.3	2.8	1.4
December	4.7	2.8	1.9
January	5.4	2.8	2.5
February	5.7	2.8	2.9
March	5.0	2.8	2.2
April	4.6	2.8	1.7
May	4.1	2.8	1.3
June	3.0	2.8	0.2
TOTAL (ML/year)	52	34	18

8.3.1 Community Assets

The Meeniyan Recreation Reserve and Meeniyan Golf Course are connected to a reuse scheme supplied by South Gippsland Water. These assets were identified through initial consultation with local council and an Environmental Improvement Plan was prepared to outline the conditions under which the use of recycled water for this asset can occur (KBR, 2016).

8.4 Level of Service Objective

The performance of the supply system during drought was assessed using a water balance model over a long-term baseline climate sequence from January 1950 to June 2020 (HARC, 2021a). If the restriction triggers are implemented in accordance with this current DPP, the long-term likelihood of not requiring restrictions in any given year is estimated to be 93-99% at the year 2020 level of demand. This range reflects uncertainty in the effect of historical climate change on supply system inflows and net evaporation. These results meet South Gippsland Water's agreed level of service objective. South Gippsland Water's minimum level of service objective to provide the unrestrictable demand of 34 ML/year in Table 8-2 was also met at the 2020 level of demand.

The minimum recorded flow occurred at the streamflow gauge upstream of Meeniyan (227202) was in February 2007, when a flow of 4.2 ML/day was recorded. With the current restriction triggers, this would have triggered Stage 2 restrictions, but not Stage 4 restrictions.

8.5 Review of Past Drought Experience

Since 1997/98, South Gippsland Water has experienced conditions drier than the long-term average. The most recent periods of restriction are listed below.

2005/06-2007/08 – Stage 2 restrictions (of 4 stages) were introduced at Meeniyan in February 2007 and increased to Stage 4 in March 2007. These restrictions remained in place until July 2007, when restrictions were lifted. The total duration of restrictions over this period was 5 months.

Since the end of restrictions in July 2007, no further restrictions have been implemented. No changes to the supply system have been made in recent years.

A base flow recession curve for the Tarwin River upstream of South Gippsland Water's urban offtake is shown in Figure 8-2. This is relevant to understand how streamflow may drop during periods of low flows and to forecast the likely need for restrictions. The base flow recession constant on the master recession curve is estimated to be 0.98, which means that the flow in the river would be expected to halve around every 33 days. This relationship has been fitted to flows below 15 ML/day. Figure 8-2 highlights some variability in low flow behaviour between different low flow events; hence the master recession curve should only be used as a broad guide to likely streamflow behaviour in the absence of rainfall. Some of the data collected in the 2006/07 drought is also affected by urban diversions upstream at Koonwarra, which would have caused the streamflow to drop faster than would otherwise be the case.

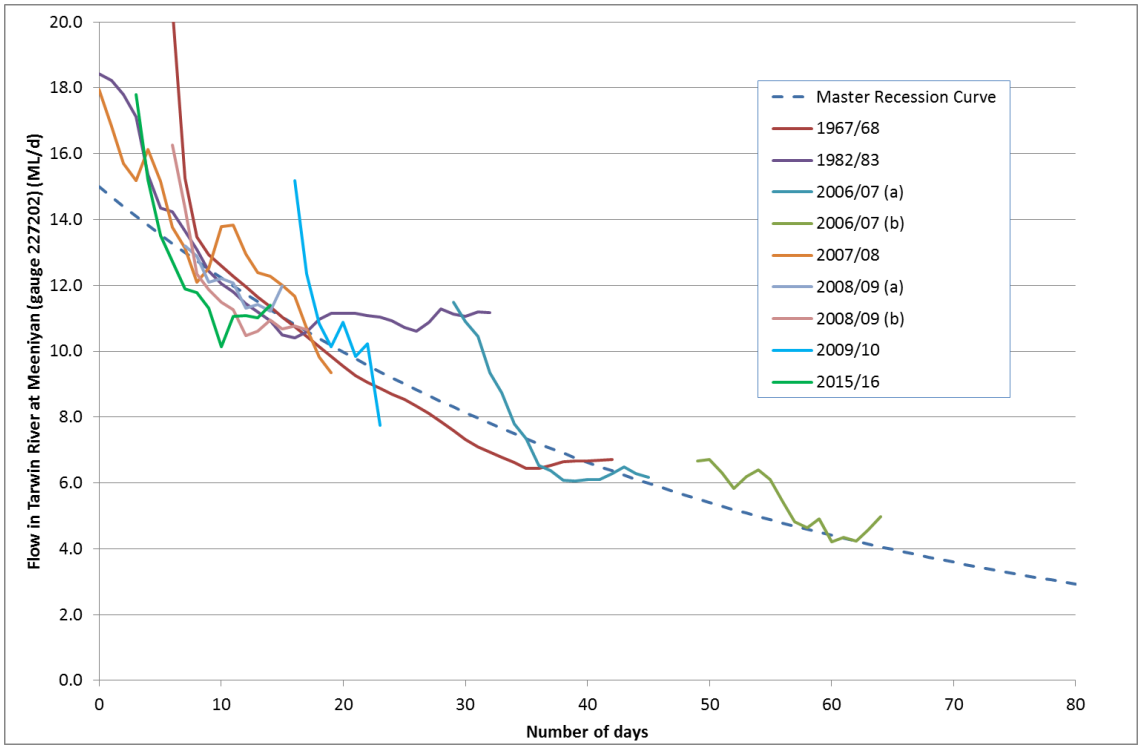


Figure 8-2 Meeniyan base flow master recession curve

8.6 Drought Response Plan

8.6.1 Pre-Drought Actions

Pre-drought actions common to all supply systems are presented in Section 2.7. There are no additional pre-drought actions specific to Meeniyan. Decreasing flows in the Tarwin River would provide an indication of impending drought.

8.6.2 Available Drought Actions

A range of actions are available to South Gippsland Water at Meeniyan during drought. These actions have been divided into actions likely to be feasible during drought and other actions that have been considered but which are less likely to be feasible. A summary of the likely feasibility of each option is shown in Table 8-3. In the 2006/07 drought, water restrictions were implemented.

Table 8-3: Likely feasibility of drought actions for Meeniyan

Action	Likely feasibility during drought
Restrictions	High
Water carting	High
Groundwater bores	Unknown
Reuse of treated wastewater	Low
River storage	Low
Purchase of water from other water users	Low
Rainwater tanks	Low
Use of grey water	Low
Changed tariffs during drought	Low

Each option is discussed briefly below.

Restrictions: Imposition of staged water restrictions in accordance with South Gippsland Water's by-law for restricting water use will serve to reduce demand. The effectiveness of restrictions in this supply system will be limited due to its small storage capacity, but will help to minimise the cost of emergency supply measures. The time available between the Stage 2 and Stage 4 restriction triggers is estimated to be in the order of 4-5 weeks in the absence of rainfall. The reduction in restrictable demand anticipated at each stage of restriction was previously presented in Section 2.6.2, which can be used in combination with Table 8-2 to estimate likely water savings during drought.

Water Carting: Tankers could be used to cart treated water to Meeniyan from the Foster supply system. The estimated number of trips that would need to be made to supply Stage 4 demands is presented in Table 8-4. The point at which the carted water would enter the supply system would need to be investigated further. If tankers are available and the carted water can be delivered into the supply system, the lead time for implementing this option is several days.

Table 8-4: Water carting for Meeniyan

Tanker size	Approximate no. of trips per day to provide Stage 4 (unrestrictable) demand
15 kL	6
27 kL	3

Groundwater: The availability of groundwater at Meeniyan has not been assessed in this DPP. The area around Meeniyan is in an unincorporated area where no cap on groundwater licences has been set. The minimum time to assess a new groundwater licence is not specified by Southern Rural Water. Southern Rural Water aims to process permanent transfers of groundwater licence within 14 days and to assess new groundwater licence applications within 60 days (SRW, 2017). The time to construct, test and develop a new bore could be in the order of weeks if a drill rig is available.

River storage: Under the conditions of the bulk entitlement for Meeniyan, South Gippsland Water is not permitted to pump water from river pools after the flow in the river has ceased. In order to pump river pools, South Gippsland Water would need to apply for a Ministerial qualification of rights, which would be unlikely to be granted unless all other planned contingency supply options have been exhausted.

Reuse of treated wastewater: During the 2019/20 period, the Meeniyan wastewater treatment plant treated 46 ML of wastewater. Of this, 3 ML was reused. Treated wastewater is already utilised at the Meeniyan Recreation Reserve to irrigate the oval and playing surface. The Meeniyan wastewater treatment plant was not listed as a distribution location for short-term use of recycled water by water tankers in South Gippsland Water's Environmental Improvement Plan (RMCG, 2015).

Purchase of water from other water users: Private diverters are located along the Tarwin River upstream of South Gippsland Water's offtake at Meeniyan. Summer diversion licences could be purchased from other water users during drought; however the availability of water under those licences during a dry summer is expected to be low. According to the local management rules for the Tarwin River (SRW, 2013), private diverters would be banned from taking water when flows are below 16 ML/day at Meeniyan. This means that any diversion licences purchased from rural water users would be subject to a ban on diversions before South Gippsland Water's bulk entitlement for Meeniyan is affected by low flows. Hence private diversion licences would not add to South Gippsland Water's supply at low flows without additional storage.

Rainwater Tanks: Rainwater tanks can have significant benefits to consumers in average to high rainfall years when the tanks are regularly refilled by rainfall events. They may be an effective alternative source of water in short duration droughts, and have the advantage that they can generate supply as soon as it rains with negligible initial losses at the start of a rainfall event. They will however have limited or no value in long-term droughts when rainfall is very low or zero for several weeks or months. The benefits of existing rainwater tanks are already incorporated into the demand estimates in this DPP.

Use of grey water: Grey water is water from clothes washers, bathtubs, showers and bathroom sinks. Grey water can be used by individual customers to maintain garden watering during periods of water restriction, however there can be health risks associated with the use of grey water.

8.6.3 Drought Action Triggers

Restriction triggers for Meeniyan are shown in Table 8-5. These restrictions should only be introduced when the flow in the Tarwin River drops below 5.0 ML/day upstream of the Meeniyan offtake and climate forecasts indicate that dry conditions are expected to continue. Stages 1 and 3 have not been included because streamflows are expected to fall quickly at low flow rates. These triggers assume that streamflow will halve over a period of 33 days in the absence of rainfall.

Table 8-5 Restriction Triggers for Meeniyan

Flow in Tarwin River u/s of offtake (ML/day)	Stage of Restriction
5	Stage 2
1.3	Stage 4

Restriction exit triggers will be flexibly implemented by South Gippsland Water based on forward estimates of supply availability and anticipated demand. The decision to lift restrictions should also take into account the likelihood of returning to restrictions in the near future and the community's timeframe for adapting to changes in restriction level.

8.6.4 Drought Action Plans

Action 1 – General Awareness

Trigger	Action
The trigger for this action is dry seasonal climate forecasts and low river flow conditions across the region	▪ **Implement communication plan** previously outlined in Section 3.2. ▪ **Continue ongoing pre-drought actions** identified in Section 2.7. ▪ **Track streamflow and demand behaviour** relative to restriction triggers. ▪ **Undertake preliminary investigations into water carting** and supply from groundwater.

Action 2 – Introduce Stage 2 restrictions

Trigger	Action
Flow in the Tarwin River at Meeniyan falls below 5 ML/day (Table 8-5) and is expected to continue to fall.	▪ **Introduce Stage 2 restrictions.** Note that the decision on the appropriate stage of restriction will depend on circumstances at the time, such as the climate outlook, supply availability and customer demand behaviour relative to the restriction trigger design assumptions in Section 8.6.3. ▪ **Implement communication plan** previously outlined in Section 3.2. ▪ **Track streamflow and demand behaviour** relative to restriction triggers. ▪ **Finalise investigations into water carting** and supply from groundwater.

Action 3 – Introduce Stage 4 restrictions

Trigger	Action
Flow in the Tarwin River at Meeniyan falls below 1.3 ML/day (Table 8-5) and is expected to continue to fall.	▪ **Introduce Stage 4 restrictions.** Note that the decision on the appropriate stage of restriction will depend on circumstances at the time, such as the climate outlook, supply availability and customer demand behaviour relative to the restriction trigger design assumptions in Section 8.6.3. ▪ **Implement communication plan** previously outlined in Section 3.2. ▪ **Track streamflow and demand behaviour** relative to restriction triggers. ▪ **Implement supply from alternative source** to maintain South Gippsland Water's minimum level of service

Action 4 – Emergency measures

Trigger	Action
River flow ceases	▪ **Implement communication plan** previously outlined in Section 3.2. ▪ **Implement emergency measures** as required to maintain essential water use, such as water carting.

8.6.5 Post-Drought Actions

Post-drought actions common to all supply systems are presented in Section 4. There are no additional post-drought actions specific to Meeniyan, other than to comment on the effectiveness of the two alternative supply options if implemented.

9. Plan for Foster

9.1 Supply System

The Foster Water Supply System is comprised of an on-stream weir (total storage capacity of 19 ML, dead storage of 5 ML) located on Deep Creek and an off-stream storage constructed in 1997 (Foster Dam capacity of 233 ML, dead storage of 10 ML). Water is diverted from Deep Creek Reservoir all year round to Foster Dam through a gravity pipeline of 3.5 ML/day capacity. When the on-stream storage stops spilling there is no transfer of water to Foster Dam or the treatment plant via the supply pipeline, although it continues to supply raw water to a rural customer. From Foster Dam, the water is pumped to the treatment plant raw water basin. The pump and pipeline capacity from the basin to Foster is 1.73 ML/day. Figure 9-1 shows a schematic representation of the supply system.

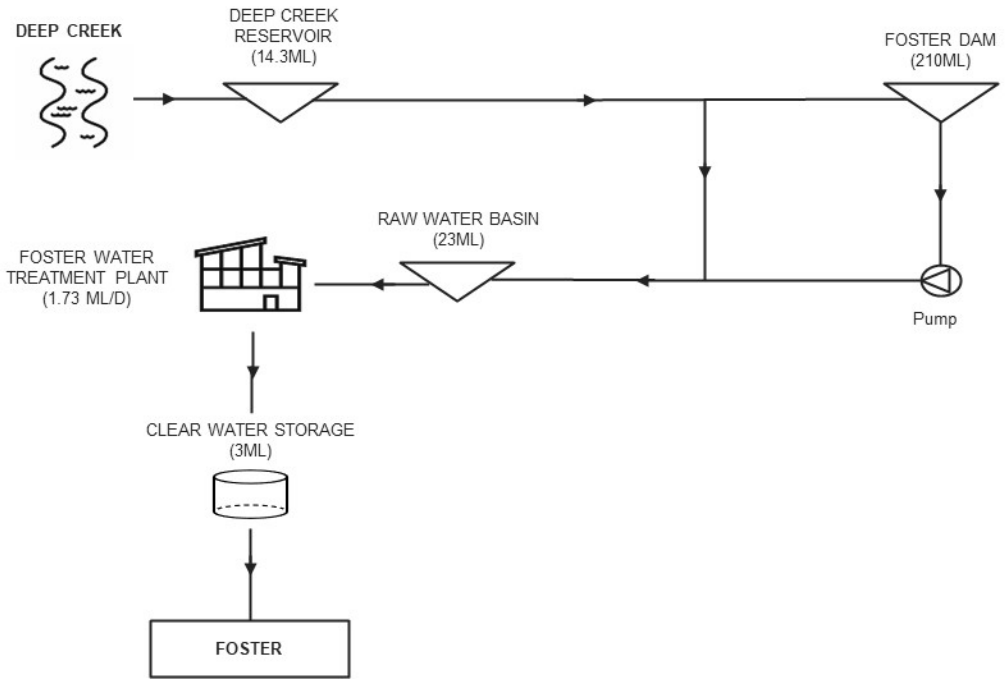


Figure 9-1 Deep Creek Water Supply System Schematic

9.2 Bulk Entitlements

The bulk entitlement for Foster allows South Gippsland Water to divert up to a maximum of 326 ML/year from Deep Creek, subject to the provision of minimum passing flows. The daily bulk entitlement limit is shown in Table 9-1.

Table 9-1 Bulk entitlement volume for Foster

Source	Maximum annual volume (ML/year)	Maximum diversion rate (ML/day)	Minimum passing flow (ML/day)
Deep Creek Reservoir	326	3.5	Minimum of 0.2 ML/day or the inflow to the reservoir

9.3 Consumption

The typical drought year demand in each month of the year that is used in the development of this DPP is shown in Table 9-2 for Foster. The unrestrictable demand is the component of demand typically used for in-house and industrial/commercial water use and is not affected by the imposition of water restrictions.

Table 9-2: Average monthly raw water consumption for a typical drought year for Foster

Month	Typical drought year demand (ML/month)	Unrestrictable demand (ML/month)	Restrictable demand (ML/month)
July	11.3	10.1	1.2
August	12.4	10.1	2.2
September	13.8	10.1	3.7
October	15.2	10.1	5.1
November	16.6	10.1	6.5
December	17.5	10.1	7.4
January	20.6	10.1	10.5
February	21.2	10.1	11.1
March	17.3	10.1	7.2
April	15.3	10.1	5.2
May	14.1	10.1	4.0
June	10.8	10.1	0.7
TOTAL (ML/year)	186	122	65

9.3.1 Community Assets

The Foster Football Club and Foster Golf Course are currently supplied from the South Gippsland Water Foster supply system. An Environmental Improvement Plan (KBR, 2018) has been prepared to potentially supply these assets from Foster Wastewater Treatment Plant Class C effluent. Use of recycled water from the Foster Wastewater Treatment Plant is pending works at the plant to improve recycled water quality, which are scheduled to occur around 2024. These assets were identified through initial consultation with local council.

9.4 Level of Service Objective

The performance of the supply system during drought was assessed using a water balance model over a long-term baseline climate sequence from January 1963 to June 2020 (HARC, 2021a). If the restriction triggers are implemented in accordance with this current DPP, the long-term likelihood of not requiring restrictions in any given year is estimated to be greater than 99% at the year 2020 level of demand. These results meet South Gippsland Water's agreed level of service objective. South Gippsland Water's minimum level of service objective to provide the unrestrictable demand of 122 ML/year in Table 9-2 was met at the 2020 level of demand.

9.5 Review of Past Drought Experience

Since 1997/98, South Gippsland Water has experienced conditions drier than the long-term average. Water restrictions have not been imposed on Foster over this period. The minimum total system storage volume reached in the 2006/07 drought was 117 ML in April 2007, which was well above the Stage 1 restriction trigger of 83 ML for that month from the 2003 DPP. No changes have been made to the supply system since 1997/98.

9.6 Drought Response Plan

9.6.1 Pre-Drought Actions

Pre-drought actions common to all supply systems are presented in Section 2.7. There are no additional pre-drought actions specific to Foster other than to ensure that the system storages are as full as possible leading into drought. Early warning signs for this supply system would be low inflows to the Deep Creek Reservoir (as measured at streamflow gauge number 227244). Low spring rainfall combined with lower than average storage levels would provide an indication of impending drought.

9.6.2 Available Drought Actions

A range of actions are available to South Gippsland Water at Foster during drought. These actions have been divided into actions likely to be feasible during drought and other actions that have been considered but which are less likely to be feasible. A summary of the likely feasibility of each option is shown in Table 9-3. In the 2006/07 drought, no drought response actions were required at Foster.

Table 9-3: Likely feasibility of drought actions for Foster

Action	Likely feasibility during drought
Restrictions	High
Water carting	Medium
Reuse of treated wastewater	Medium (after ~2024)
Purchase of water from other water users	Low
Pumping dead storage	Low
Rainwater tanks	Low
Use of grey water	Low
Changed tariffs during drought	Low
Groundwater bores	Unknown

Each option is discussed briefly below.

Restrictions: Imposition of staged water restrictions in accordance with South Gippsland Water's by-law for restricting water use will serve to reduce demand. The reduction in restrictable demand anticipated at each stage of restriction was previously presented in Section 2.6.2, which can be used in combination with Table 9-2 to estimate likely water savings during drought.

Water Carting: In a severe drought, the water supply system at Foster is likely to be more reliable than surrounding water supply systems at Toora, Fish Creek and Yarram. Treated water could be carted from the Wonthaggi supply system if water is not available locally. The estimated number of trips that would need to be made to supply Stage 4 demands is presented in Table 9-4. The point at which the carted water would enter the supply system would need to be investigated further.

Table 9-4: Water carting for Foster

Tanker size	Approximate no. of trips per day to provide Stage 4 (unrestrictable) demand
15 kL	22
27 kL	12

Reuse of treated wastewater: In 2019/20 there was 182 ML of Class C effluent generated from the Foster Wastewater Treatment Plant, all of which was discharged to the ocean. Class C effluent is only suitable for a small range of agricultural and industrial applications such as livestock grazing and golf courses. It is not suitable for drinking. Treated wastewater may be a suitable alternative supply for municipal garden or sports ground watering during drought. The Foster storage lagoon was listed as a distribution location for recycled water to water tankers as part of South Gippsland Water's Environmental Improvement Plan (RMCG, 2015), and a site-specific Environmental Improvement Plan has been prepared for the Foster Recreation Reserve and Golf Club (KBR, 2018). Recycled water use at the recreation reserve and golf club is pending works to improve the quality of recycled water, which is scheduled to occur around 2024.

Purchase of water from other water users (including Gardiners Dam): There may be potential to supplement supply to Foster through supply from nearby farm dams. Gardiners Dam was identified in the 2003 DPP as a possible source of water, subject to negotiations with the landholder.

Pumping dead storage: There is 10 ML of dead storage in Foster Dam and 5 ML in Deep Creek Reservoir. Temporary pumps could be used to access this water, however the quality of water at these low levels would need to be investigated.

Rainwater Tanks: Rainwater tanks can have significant benefits to consumers in average to high rainfall years when the tanks are regularly refilled by rainfall events. They may be an effective alternative source of water in short duration droughts, and have the advantage that they can generate supply as soon as it rains with negligible initial losses at the start of a rainfall event. They will however have limited or no value in long-term droughts when rainfall is very low or zero for several weeks or months. The benefits of existing rainwater tanks are already incorporated into the demand estimates in this DPP.

Use of grey water: Grey water is water from clothes washers, bathtubs, showers and bathroom sinks. Grey water can be used by individual customers to maintain garden watering during periods of water restriction, however there can be health risks associated with the use of grey water.

Groundwater: The availability of groundwater at Foster has not been assessed in this DPP. The area around Foster is in an unincorporated area where no cap on groundwater licences has been set. Southern Rural Water aims to process permanent transfers of groundwater licence within 14 days and to assess new groundwater licence applications within 60 days (SRW, 2021). The time to construct, test and develop a new bore could be in the order of weeks if a drill rig is available.

9.6.3 Drought Action Triggers

Triggers for action during drought are based on the total volume in Deep Creek Reservoir, Foster Dam and the raw water storage, as shown in Table 9-5. These triggers assume:

- No inflows to the reservoirs;
- An unrestricted demand of 186 ML/year and a restrictable demand of 65 ML/year;
- Six months of supply from the Stage 1 trigger until the storage is emptied, including two months under Stage 3 and two months under Stage 4 restrictions; and
- A dead storage of 5 ML in Deep Creek Reservoir and 10 ML in Foster Dam.

Table 9-5 Restriction Triggers for Foster

Start of month	Trigger Storage Volume in Deep Creek Reservoir plus Foster Dam plus Raw Water Storage (ML)			
	STAGE 1	STAGE 2	STAGE 3	STAGE 4
January	95	80	65	41
February	88	75	60	39
March	82	70	57	38
April	79	66	54	36
May	77	65	53	34
June	78	66	54	35
July	85	70	58	36
August	90	75	60	37
September	95	79	64	38
October	98	83	67	40
November	99	83	67	41
December	98	83	67	42

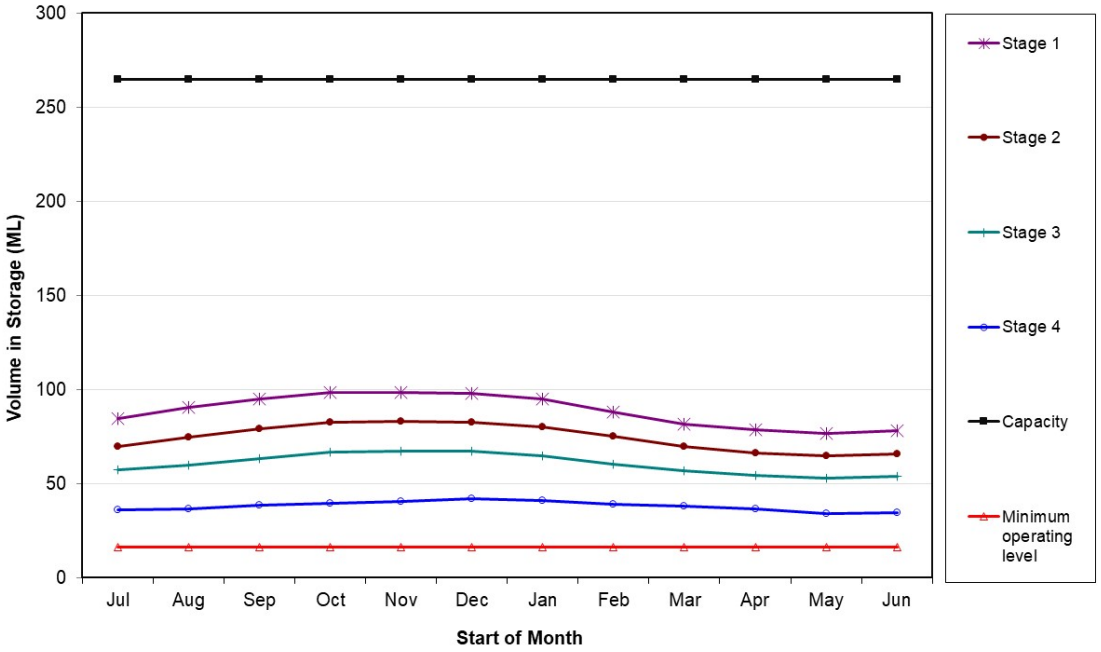


Figure 9-2 Drought Response Triggers for Foster

9.6.4 Drought Action Plan

Action 1 – General Awareness

Trigger	Action
The trigger for this action is based on seasonal climate forecasts and current water availability in South Gippsland Water's supply systems	▪ **Implement communication** plan previously outlined in Section 3.2. ▪ **Continue ongoing pre-drought actions** identified in Section 2.7.

Action 2 – Introduce Stage 1 restrictions

Trigger	Action
The volume in the Foster storages falls between the Stage 1 and Stage 2 restriction rule values (Table 9-5, Figure 9-2).	▪ **Introduce Stage 1 restrictions.** Note that the decision on the appropriate stage of restriction will depend on circumstances at the time, such as the climate outlook, supply availability and customer demand behaviour relative to the restriction trigger design assumptions in Section 9.6.3. ▪ **Implement communication plan** previously outlined in Section 2.7. ▪ **Track streamflow, storage and demand behaviour** relative to restriction triggers.

Action 3 – Introduce Stage 2 restrictions

Trigger	Action
The volume in the Foster storages falls between the Stage 2 and Stage 3 restriction rule values (Table 9-5, Figure 9-2).	▪ **Introduce Stage 2 restrictions.** Note that the decision on the appropriate stage of restriction will depend on circumstances at the time, such as the climate outlook, supply availability and customer demand behaviour relative to the restriction trigger design assumptions in Section 9.6.3. ▪ **Implement communication plan** previously outlined in Section 2.7. ▪ **Track streamflow, storage and demand behaviour** relative to restriction triggers. ▪ **Undertake preliminary investigations** into supply from Gardiners Dam and groundwater.

Action 4 – Introduce Stage 3 restrictions

Trigger	Action
The volume in the Foster storages falls between the Stage 3 and Stage 4 restriction rule values (Table 9-5, Figure 9-2).	▪ **Introduce Stage 3 restrictions**. Note that the decision on the appropriate stage of restriction will depend on circumstances at the time, such as the climate outlook, supply availability and customer demand behaviour relative to the restriction trigger design assumptions in Section 9.6.3. ▪ **Implement communication plan** previously outlined in Section 2.7. ▪ **Track streamflow, storage and demand behaviour** relative to restriction triggers. ▪ **Finalise investigations into supply** from Gardiners Dam and groundwater. One or both of these options should be made ready to implement.

Action 5 – Introduce Stage 4 restrictions

Trigger	Action
The volume in the Foster storages falls below the Stage 4 restriction rule values (Table 9-5, Figure 9-2).	▪ **Introduce Stage 4 restrictions.** Note that the decision on the appropriate stage of restriction will depend on circumstances at the time, such as the climate outlook, supply availability and customer demand behaviour relative to the restriction trigger design assumptions in Section 9.6.3. ▪ **Implement communication plan** previously outlined in Section 2.7. ▪ Track streamflow, storage and demand behaviour relative to restriction triggers. ▪ **Implement supply from alternative source** to maintain South Gippsland Water's minimum level of service. ▪ **Plan emergency measures** if storage volume is expected to drop below the minimum supply level.

Action 6 – Emergency measures

Trigger	Action
The volume in the Foster storages falls below minimum supply level	▪ **Implement communication plan** previously outlined in Section 2.7. ▪ **Implement emergency measures** as required to maintain essential water use, such as groundwater supply or water carting.

9.6.5 Post-Drought Actions

Post-drought actions common to all supply systems are presented in Section 2.7. There are no additional post-drought actions specific to Foster, other than to comment on the effectiveness of the alternative supply options if implemented.

10. Plan for Fish Creek

10.1 Supply system

The township of Fish Creek and the surrounding rural areas are supplied from a reservoir located on Battery Creek with total capacity of 123 ML and dead storage of 12 ML. The water is transferred from the storage to a treatment plant of 1.73 ML/day (52.8 ML/month) capacity through a pipeline of 1.7 ML/day (51.7 ML/month) capacity, into a 1.1 ML lined and covered clear water storage basin. The water is then supplied directly to the town via the mains pipes, and the rural demands are supplied via the same system. A schematic of the supply system is shown in Figure 10-1.

10.2 Bulk Entitlements

The bulk entitlement for Fish Creek allows South Gippsland Water to divert up to a maximum of 251 ML/year from Battery Creek. There are no minimum passing flows. The daily bulk entitlement limit is shown in Table 10-1.

Table 10-1 Bulk entitlement volume for Fish Creek

Source	Maximum annual volume (ML/year)	Maximum diversion rate (ML/day)	Minimum passing flow
Battery Creek	251	1.0 ML/day	None

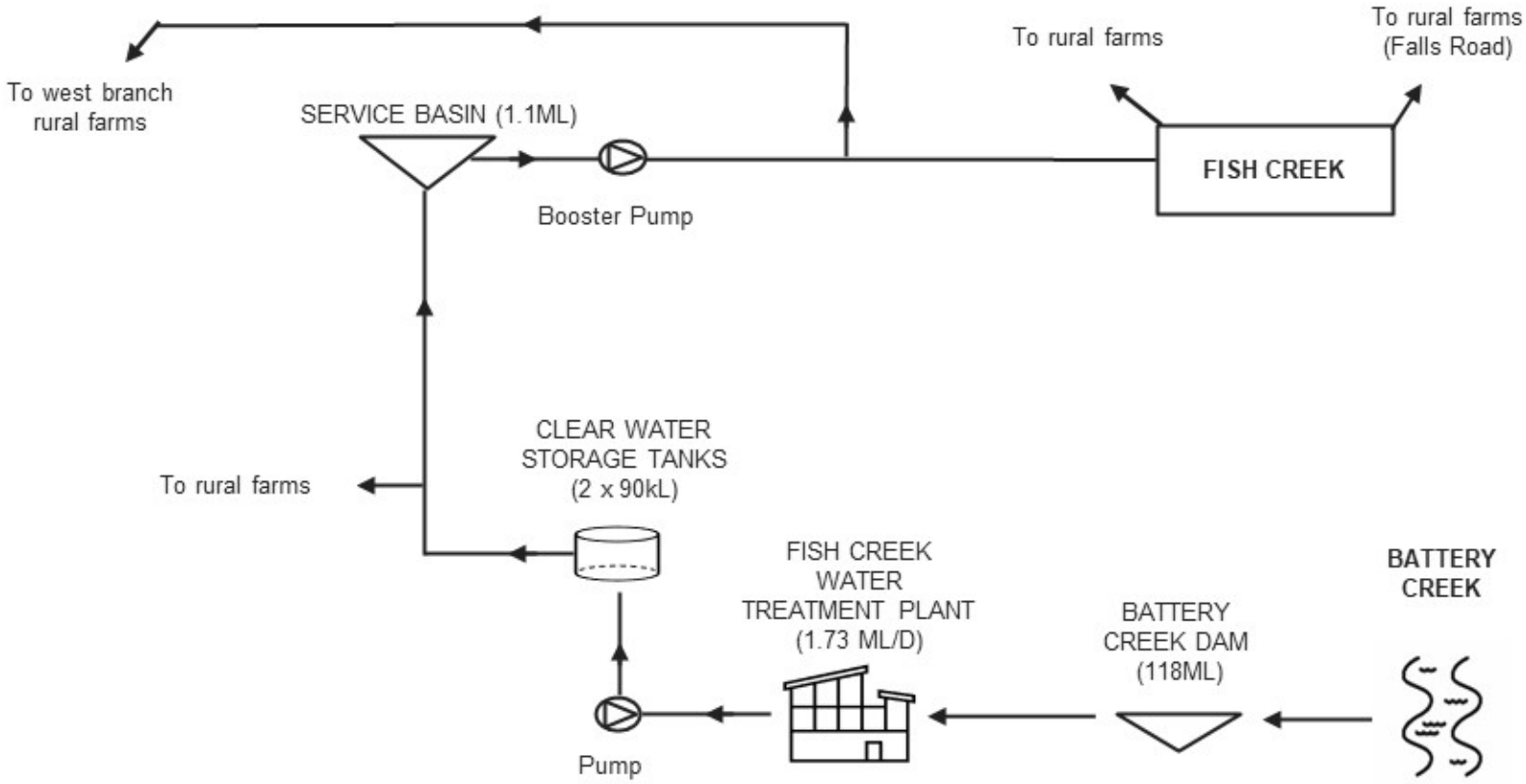


Figure 10-1 Battery Creek Water Supply System Schematic

10.3 Consumption

The typical drought year demand in each month of the year that is used in the development of this DPP is shown in Table 10-2. The unrestrictable demand is the component of town demand typically used for in-house and industrial/commercial water use and is not affected by the imposition of water restrictions. In calculating the unrestrictable rural demand, it is assumed that 75% of the rural demand is unrestrictable in a drought year. In splitting rural and town demands, it is assumed that 24% of total demand occurs in the town and 76% is from rural customers. In estimating these demands, no specific allowance has been made for higher peak demands in dry years from rural users whose on-farm supplies have been exhausted, as there was no evidence of significant increases in demand in lower rainfall years over the demand model calibration period from 2013 to 2021 (HARC, 2021a).

Table 10-2: Average monthly raw water consumption for a typical drought year for Fish Creek

Month	Typical drought year demand (ML/month)	Unrestrictable town demand (ML/month)	Restrictable town demand (ML/month)	Unrestrictable rural demand (ML/month)	Restrictable rural demand (ML/month)
July	7.9	1.8	0.1	4.5	1.5
August	8.4	1.8	0.3	4.8	1.6
September	9.3	1.8	0.5	5.3	1.8
October	10.2	1.8	0.7	5.8	1.9
November	10.4	1.8	0.7	5.9	2.0
December	11.8	1.8	1.1	6.7	2.2
January	12.7	1.8	1.3	7.2	2.4
February	13.6	1.8	1.5	7.8	2.6
March	12.4	1.8	1.2	7.1	2.4
April	11.3	1.8	0.9	6.4	2.1
May	10.0	1.8	0.6	5.7	1.9
June	7.7	1.8	0.1	4.4	1.5
TOTAL	126	21	9	72	24

10.3.1 Community Assets

There is a football oval (open space) within the Fish Creek Supply System that has been identified as potentially requiring water during periods of drought. This asset was identified through initial consultation with local council.

10.4 Level of Service Objective

The performance of the supply system during drought was assessed using a water balance model over a long-term baseline climate sequence from January 1950 to June 2020 (HARC, 2021a). If the restriction triggers are implemented in accordance with this current DPP, the long-term likelihood of not requiring restrictions in any given year is estimated to be 99% or higher at the year 2020 level of demand. This range reflects uncertainty in the effect of

historical climate change on supply system inflows and net evaporation. These results meet South Gippsland Water's agreed level of service objective under year 2020 demands. South Gippsland Water's minimum level of service objective for Fish Creek was not met, which is to provide the unrestrictable demand of 21 ML/year for the town and 72 ML/year for rural water users in Table 10-2. Maximum modelled annual shortfalls ranged from 6-7 ML/year.

10.5 Review of Past Drought Experience

Since 1997/98, South Gippsland Water has experienced conditions drier than the long-term average. This included severe restrictions (Stage 4 of 4 stages or equivalent) in 1999/2000, 2000/01, 2002/03, 2006/07, 2007/08 and 2015/16. The three most recent periods of restriction are listed below.

2005/06 – Stage 2 restrictions (of 4 stages) were introduced at Fish Creek in March 2006 and upgraded to Stage 3 restrictions later that month. These restrictions were lifted in May 2006. The total duration of restrictions over this period was 2 months. The minimum storage reached during this period of restrictions was 44 ML (36% of capacity). Restrictions were first implemented when the storage volume was at 56 ML (45% of capacity), which was roughly in accordance with the Stage 2 restriction trigger for March in the 2003 DPP of 61 ML.

2006/07 to 2007/08 – Stage 2 restrictions were introduced at Fish Creek in December 2006 and increased to Stage 4 restrictions in January 2007. These restrictions were lifted in September 2007. The total duration of restrictions over this period was 9 months. The minimum storage reached during this period of restrictions was 21 ML (17% of capacity) on 11 June 2007. Restrictions were first implemented when the storage volume was at 85 ML (69% of capacity), which was in accordance with the 2003 DPP.

In the period between September 2007 and January 2016, no further restrictions have been implemented. There have been no changes to the supply system since that time, however South Gippsland Water's WaterMap Initiative, which offered interest free loans to rural customers to reduce their reliance on South Gippsland Water's water supply system, has significantly reduced rural water demand from the system. These water users however remain connected to the supply system and could draw water from South Gippsland Water during drought.

2015/16 – Stage 1 restrictions were introduced at Fish Creek in January 2016, and then increased to Stage 2 restrictions in March. The Stage 2 restrictions were lifted in June 2016. The total duration of restrictions over this period was 6 months. The minimum storage reached during the drought was approximately 53 ML (43% of capacity) during April 2016. Restrictions were first implemented when the storage volume was at approximately 78 ML (63% of capacity). Importantly, during this drought event, there was no identifiable bounce back of demand to pre-2007 levels, which indicated that rural users who had developed their own independent supply sources did not source water from the potable water supply system to any significant extent when conditions became very dry.

10.6 Drought Response Plan

10.6.1 Pre-Drought Actions

Pre-drought actions common to all supply systems are presented in Section 2.7. Pre-drought actions specific to Fish Creek include:

- Ensuring that Battery Creek Reservoir is as full as possible leading into drought;
- Implementing actions to detect and reduce non-revenue water, which was estimated for the Urban Water Strategy to be approximately 43% of clear water demand for the Battery Creek Supply System. This includes South Gippsland Water's planned implementation of digital metering for leak detection;
- Investigating the potential to provide further opportunities for farmers supplied by South Gippsland Water to develop their own independent on-farm water supplies. South Gippsland Water successfully implemented a scheme to provide financial assistance to farmers at the end of the Millennium Drought for this purpose, which permanently reduced demand on the South Gippsland Water supply system. The likely level of uptake of any such scheme, beyond those farmers who took up the offer when it was previously provided, is currently unknown.

Early warning signs for this supply system would be low inflows to Battery Creek Reservoir, which could be assessed by examining changes in the volume in the reservoir and behaviour in the nearby streamflow gauges such as the Franklin River at Toora (number 227237) or the Tarwin River at Dumbalk (number 227226). Low spring rainfall combined with lower-than-average storage levels would provide an indication of impending drought.

10.6.2 Available Drought Actions

A range of actions are available to South Gippsland Water at Fish Creek during drought. These actions have been divided into actions likely to be feasible during drought and other actions that have been considered but which are less likely to be feasible. A summary of the likely feasibility of each option is shown in Table 10-3. In previous droughts, water restrictions were implemented at Fish Creek. No supply enhancement measures were undertaken.

Table 10-3: Likely feasibility of drought actions for Fish Creek

Action	Likely feasibility during drought
Restrictions	High
Water carting	Medium
Purchase of water from other water users	Medium
Groundwater bores	Unknown
Reuse of treated wastewater	Low
Pumping dead storage	Low
Rainwater tanks	Low
Use of grey water	Low
Changed tariffs during drought	Low

Each option is discussed briefly below.

Restrictions: Imposition of staged water restrictions in accordance with South Gippsland Water's by-law for restricting water use will serve to reduce demand. The reduction in restrictable demand anticipated at each stage of restriction was previously presented in Section 2.6.2, which can be used in combination with Table 10-2 to estimate likely water savings during drought. This DPP assumes that rural water users are not restricted when Stage 1 or 2 urban restrictions are in place, and that supply is reduced by 25% under Stages 3 or 4 urban restrictions.

Water Carting: Treated water could be carted from Foster to supply the town demands. The estimated number of trips that would need to be made to supply Stage 4 demands is presented in Table 10-4. The point at which the carted water would enter the supply system would need to be investigated further. The number of trips to supply rural users as well as the town demands would be significantly higher, as shown in Table 10-4.

Table 10-4: Water carting for Fish Creek

Tanker size	Approximate no. of trips per day to provide Stage 4 (unrestrictable) demand to Fish Creek town	Approximate no. of trips per day to provide Stage 4 (unrestrictable) demand to Fish Creek town plus rural users
15 kL	4	13
27 kL	2	7

Groundwater: The availability of groundwater at Fish Creek has not been assessed in this DPP. The area around Fish Creek is in an unincorporated area where no cap on groundwater licences has been set. Southern Rural Water aims to process permanent transfers of groundwater licence within 14 days and to assess new groundwater licence applications within 60 days (SRW, 2021). The time to construct, test and develop a new bore could be in the order of weeks if a drill rig is available.

Reuse of treated wastewater: Fish Creek does not have a wastewater treatment plant, so there is no opportunity to use locally treated wastewater during drought.

Purchase of water from other water users: There may be potential to supplement supply to Fish Creek from nearby farm dams. Discussions would need to be held with individual landholders, as well as an assessment of the ability to physically transfer that water to South Gippsland Water's treatment plant.

Accessing dead storage: There is 12 ML of dead storage in Battery Creek Reservoir. Temporary booster pumps are required if the level in the storage drops below 20 ML as there is not enough head to supply required flows into Fish Creek WTP. Those pumps could be used to access this water; however the quality of water at these low levels would need to be tested first.

Rainwater Tanks: Rainwater tanks can have significant benefits to consumers in average to high rainfall years when the tanks are regularly refilled by rainfall events. They may be an effective alternative source of water in short duration droughts, and have the advantage that they can generate supply as soon as it rains with negligible initial losses at the start of a rainfall

event. They will however have limited or no value in long-term droughts when rainfall is very low or zero for several weeks or months. The benefits of existing rainwater tanks are already incorporated into the demand estimates in this DPP.

Use of grey water: Grey water is water from clothes washers, bathtubs, showers and bathroom sinks. Grey water can be used by individual customers to maintain garden watering during periods of water restriction, however there can be health risks associated with the use of grey water.

10.6.3 Drought Action Triggers

Triggers for action during drought are based on the volume in Battery Creek Reservoir, as shown in Table 10-5 and Figure 10-2. These triggers assume:

- No inflows to the reservoir;
- An unrestricted demand of 126 ML/year and a total restrictable demand (urban and rural users) of 33 ML/year;
- Four months of supply from the Stage 1 trigger until the storage is emptied; and
- 4 ML of dead storage.

Table 10-5 Restriction Triggers for Fish Creek

Start of month	Trigger Storage Volume in Battery Creek Reservoir (ML)			
	STAGE 1	STAGE 2	STAGE 3	STAGE 4
January	55	40	24	13
February	51	38	23	13
March	43	33	21	12
April	37	28	18	11
May	33	24	16	10
June	31	22	14	9
July	34	24	15	9
August	39	27	16	10
September	44	30	18	10
October	49	33	20	11
November	54	36	21	12
December	56	40	23	12

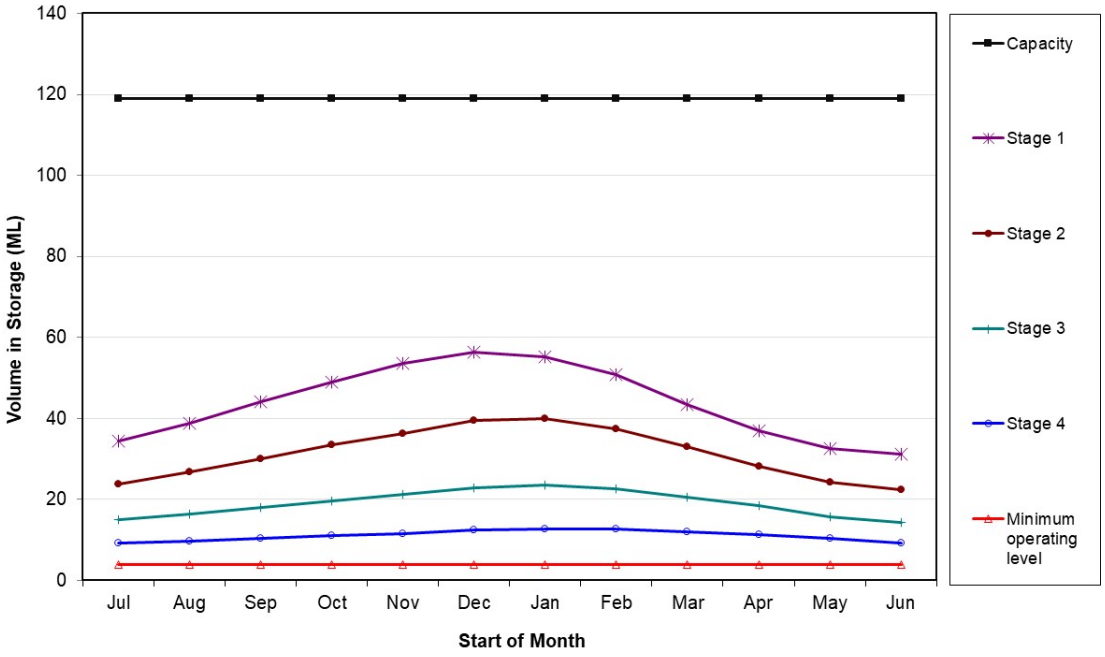


Figure 10-2 Drought Response Triggers for Fish Creek

Restriction exit triggers will be flexibly implemented by South Gippsland Water based on forward estimates of supply availability and anticipated net evaporation and demand. The decision to lift restrictions should also take into account the likelihood of returning to restrictions in the near future and the community's timeframe for adapting to changes in restriction level.

10.6.4 Drought Action Plans

Action 1 – General Awareness

Trigger	Action
The trigger for this action is based on seasonal climate forecasts and current water availability in South Gippsland Water's supply systems	▪ **Implement communication** plan previously outlined in Section 3.2. ▪ **Continue ongoing pre-drought actions** identified in Section 2.7.

Action 2 – Introduce Stage 1 restrictions

Trigger	Action
The volume in the Battery Creek Reservoir falls between the Stage 1 and Stage 2 restriction rule values (Table 10-5, Figure 10-2).	▪ **Introduce Stage 1 restrictions.** Note that the decision on the appropriate stage of restriction will depend on circumstances at the time, such as the climate outlook, supply availability and customer demand behaviour relative to the restriction trigger design assumptions in Section 10.6.3. ▪ **Implement communication plan** previously outlined in Section 2.7. ▪ **Track streamflow, storage and demand behaviour** relative to restriction triggers. It is noted that the restriction triggers assume a significant additional rural demand during severe droughts, so tracking demand behaviour will be particularly important when assessing whether to implement restrictions for this supply system.

Action 3 – Introduce Stage 2 restrictions

Trigger	Action
The volume in the Battery Creek Reservoir falls between the Stage 2 and Stage 3 restriction rule values (Table 10-5, Figure 10-2).	▪ **Introduce Stage 2 restrictions.** Note that the decision on the appropriate stage of restriction will depend on circumstances at the time, such as the climate outlook, supply availability and customer demand behaviour relative to the restriction trigger design assumptions in Section 10.6.3. ▪ **Implement communication plan** previously outlined in Section 2.7. ▪ **Track streamflow, storage and demand behaviour** relative to restriction triggers. ▪ **Undertake preliminary investigations** into water carting and groundwater.

Action 4 – Introduce Stage 3 restrictions

Trigger	Action
The volume in the Battery Creek Reservoir falls between the Stage 3 and Stage 4 restriction rule values (Table 10-5, Figure 10-2).	▪ **Introduce Stage 3 restrictions**. Note that the decision on the appropriate stage of restriction will depend on circumstances at the time, such as the climate outlook, supply availability and customer demand behaviour relative to the restriction trigger design assumptions in Section 10.6.3. ▪ **Introduce restrictions for rural water users** to reduce their consumption by 25%. ▪ **Implement communication plan** previously outlined in Section 2.7. ▪ **Ready booster pumps for use when storage drops below 20 ML.** ▪ **Track streamflow, storage and demand behaviour** relative to restriction triggers. ▪ **Finalise investigations into supply from water carting and groundwater.** One or both of these options should be made ready to implement.

Action 5 – Introduce Stage 4 restrictions

Trigger	Action
The volume in the Battery Creek Reservoir falls below the Stage 4 restriction rule values (Table 10-5, Figure 10-2).	▪ **Introduce Stage 4 restrictions.** Note that the decision on the appropriate stage of restriction will depend on circumstances at the time, such as the climate outlook, supply availability and customer demand behaviour relative to the restriction trigger design assumptions in Section 10.6.3. ▪ **Maintain restrictions for rural water users** to reduce their consumption by 25%. ▪ **Implement communication plan** previously outlined in Section 2.7. ▪ **Track streamflow, storage and demand behaviour** relative to restriction triggers. ▪ **Implement supply from alternative source** to maintain South Gippsland Water's minimum level of service. ▪ **Plan emergency measures** if storage volume is expected to drop below the minimum supply level.

Action 6 – Emergency measures

Trigger	Action
The volume in Battery Creek Reservoir falls below the minimum supply level	▪ **Implement communication plan** previously outlined in Section 2.7. ▪ **Implement emergency measures** as required to maintain essential water use, such as groundwater supply or water carting.

10.6.5 Post-Drought Actions

Post-drought actions common to all supply systems are presented in Section 4. For Fish Creek, in addition to commenting on the effectiveness of the alternative supply options if implemented, it is recommended that rural demand behaviour during the drought is assessed to check the assumptions around heightened rural demands during severe droughts.

11. Plan for Toora, Welshpool, Port Welshpool and Port Franklin

11.1 Supply System

The Agnes River water supply system consists of a 59 ML storage at Cooks Dam on the Agnes River, with a diversion weir located 2 km downstream of the storage. Cooks Dam is used to provide additional security to the system when the flows are low in dry periods. From the diversion weir a 4.8 ML/day pipeline supplies water to the treatment plant, which has a capacity of 3.2 ML/day. Water is then transferred to one of three clear water storages – two tanks of 1 ML and 4 ML capacity and a storage basin of 1ML capacity. Water is then distributed to customers. A schematic is shown of the system in Figure 11-1.

11.2 Bulk Entitlement

The bulk entitlement for Toora allows South Gippsland Water to divert up to a maximum of 1,617 ML/year from the Agnes River, subject to the provision of minimum passing flows. The daily bulk entitlement limit is shown in Table 11-1. South Gippsland Water is required to pass the lesser of 1 ML/day or the inflow to Cooks Dam at both Cooks Dam and the downstream offtake.

Table 11-1 Bulk entitlement volume for Toora

Source	Maximum annual volume (ML/year)	Maximum diversion rate (ML/day)	Minimum passing flow
Agnes River d/s Agnes River storage (Cooks Dam)	1617	4.8	The minimum of 1 ML/day or the flow upstream of Cooks Dam

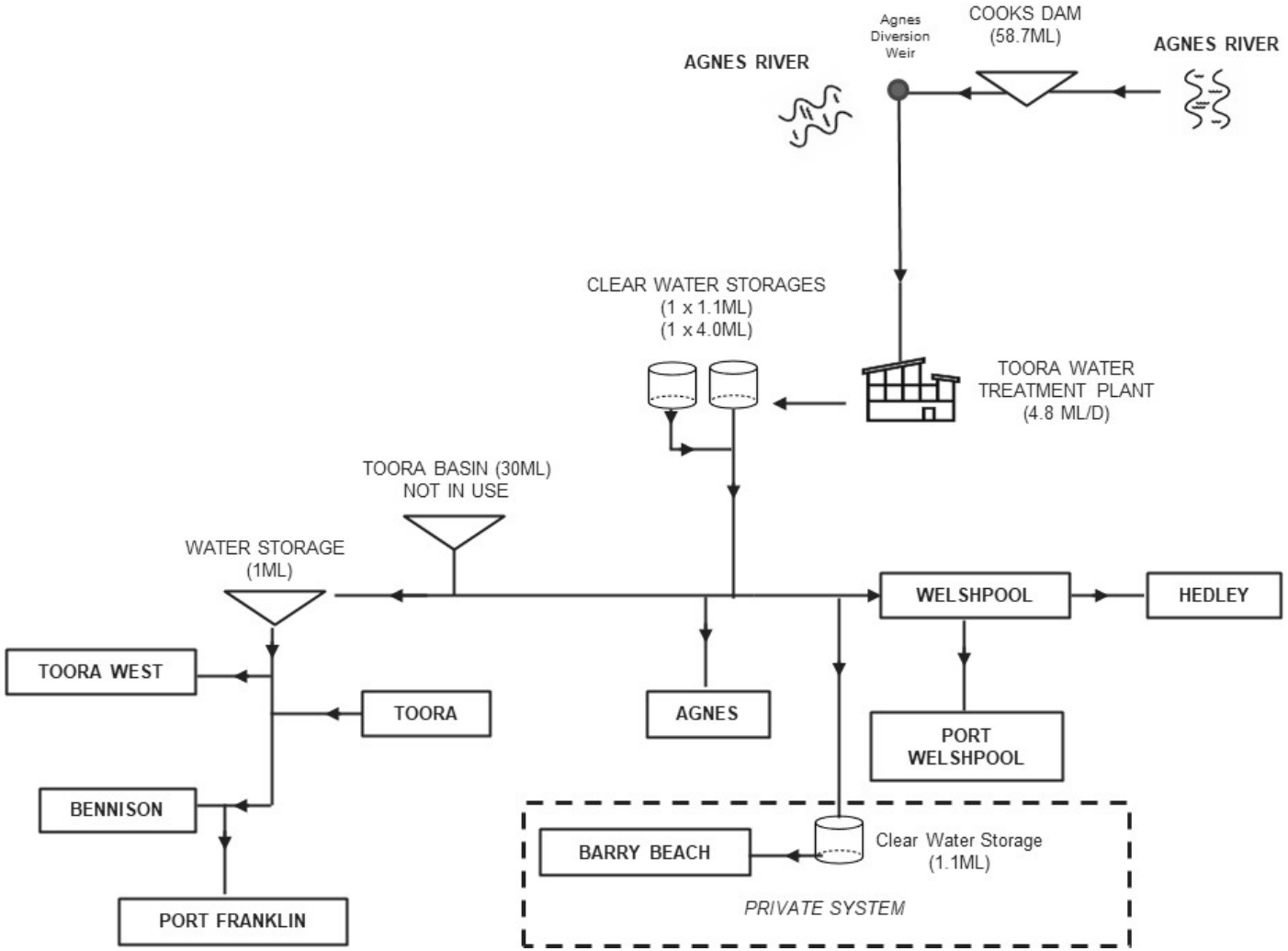


Figure 11-1 Agnes River Water Supply System Schematic

11.3 Consumption

The typical drought year demand in each month of the year that is used in the development of this DPP is shown in Table 11-2. The unrestrictable demand is the component of demand typically used for in-house and industrial/commercial water use and is not affected by the imposition of water restrictions.

Table 11-2: Average monthly raw water consumption for a typical drought year

Month	Typical drought year demand (ML/month)	Unrestrictable demand (ML/month)	Restrictable demand (ML/month)
July	36.0	32.2	3.8
August	38.7	32.2	6.5
September	39.8	32.2	7.7
October	45.0	32.2	12.8
November	51.0	32.2	18.8
December	54.9	32.2	22.7
January	55.9	32.2	23.7
February	48.3	32.2	16.2
March	43.9	32.2	11.7
April	37.4	32.2	5.3
May	36.1	32.2	3.9
June	35.0	32.2	2.9
TOTAL	522	386	136

11.3.1 Community Assets

The Toora Football Club typically uses 2-3 ML/year of recycled water during summer to irrigate the football ground, and has historically used up to 5 ML of water in a dry year. This asset was identified through initial consultation with local council and an Environmental Improvement Plan was prepared to outline the conditions under which the use of recycled water for this asset can occur (RMCG, 2016).

11.4 Level of Service Objective

The performance of the supply system during drought was assessed using a water balance model over a long-term baseline climate sequence from February 1957 to June 2020 (HARC, 2021a). If the restriction triggers are implemented in accordance with this current DPP, the long-term likelihood of not requiring restrictions in any given year is estimated to be 98% at the year 2020 level of demand. These results meet South Gippsland Water's agreed level of service objective. South Gippsland Water's minimum level of service objective to provide the unrestrictable demand of 386 ML/year in Table 11-2 was also met at the 2020 level of demand.

11.5 Review of Past Drought Experience

Since 1997/98, South Gippsland Water has experienced conditions drier than the long-term average. The most recent periods of restriction are listed below:

2000/01 – Stage 6 restrictions (of 8 stages) were implemented for a period of two weeks in March 2001. The Agnes River streamflow gauge 227211 at Toora, which is located downstream of the town offtake, measured 3.9 ML/day when restrictions were first implemented and 26 ML/day when they were lifted. The minimum flow reached over this period at the gauge was 3.8 ML/day.

2006/07 – Stage 2 restrictions (of 4 stages) were introduced at Toora in January 2007 and increased to Stage 4 in February 2007. These restrictions remained in place until June 2007, when restrictions were lifted. The total duration of restrictions over this period was 6 months. The 5-day rolling average streamflow at gauge 227211 at Toora was 3.9 ML/day when restrictions were first implemented, which was slightly in advance of the Stage 2 trigger of a 5-day rolling average of 3 ML/day from the 2003 DPP. The minimum storage reached in Cooks Dam during the drought was 53.6 ML (91% of capacity) on 15 January 2007.

Since the end of restrictions in June 2007 no further restrictions have been implemented. Since 2006/07 the supply and demand balance has been improved through a reduction in demand.

11.6 Drought Response Plan

11.6.1 Pre-Drought Actions

Pre-drought actions common to all supply systems are presented in Section 2.7. There are no additional pre-drought actions specific to Toora other than to ensure that the system storages are as full as possible leading into drought. Early warning signs for this supply system would be low inflows to Cooks Dam, which could be assessed by examining changes in the volume in the dam and behaviour in the downstream streamflow gauge on the Agnes River at Toora (number 227211). Low spring rainfall combined with lower-than-average streamflows would provide an indication of impending drought.

11.6.2 Available Drought Actions

A range of actions are available to South Gippsland Water at Toora during drought. These actions have been divided into actions likely to be feasible during drought and other actions that have been considered but which are less likely to be feasible. A summary of the likely feasibility of each option is shown in Table 11-3. In the 2006/07 drought, water restrictions were implemented at Toora.

Table 11-3: Likely feasibility of drought actions for Toora

Action	Likely feasibility during drought
Restrictions	High
Purchase of water from other water users	Medium
Water carting	Low
River storage	Low
Reuse of treated wastewater	Low
Rainwater tanks	Low
Use of grey water	Low
Changed tariffs during drought	Low
Groundwater bores	Unknown

Each option is discussed briefly below.

Restrictions: Imposition of staged water restrictions in accordance with South Gippsland Water's by-law for restricting water use will serve to reduce demand. The time available between each stage of restriction is limited in this supply system because storage volumes are small relative to demand, so only Stage 2 and Stage 4 restrictions are planned to be implemented. The reduction in restrictable demand anticipated at each stage of restriction was previously presented in Section 2.6.2, which can be used in combination with Table 11-2 to estimate likely water savings during drought.

Groundwater: The availability of groundwater at Toora has not been formally assessed in this DPP. The area to the east of Toora is in an unincorporated area where no cap on groundwater licences has been set. The area to the west of Toora is located within the Yarram Water Supply Protection Area, which is recognised to have declining groundwater levels due to existing extractions, and groundwater licences at capacity. South Gippsland Water would need to purchase a groundwater licence from an existing licence holder to drill a bore in this Water Supply Protection Area. Southern Rural Water aims to process permanent transfers of groundwater licence within 14 days and to assess new groundwater licence applications within 60 days (SRW, 2017). The time to construct, test and develop a new bore could be in the order of weeks if a drill rig is available.

Purchase of water from other water users: Private diverters are located along the Agnes River upstream of South Gippsland Water's storage at Cooks Dam and the offtake at the Agnes River Falls. Summer diversion licences could be purchased from other water users during drought, however the availability of water under those licences during a dry summer is expected to be low. According to the local management plan for the South Gippsland Basin (SRW, 2013), private diverters would be banned from taking water when the flow above the falls is below 6 ML/day. This means that any diversion licences purchased from rural water users would be subject to a ban on diversions before South Gippsland Water's bulk entitlement for Toora is affected by low flows. Hence private diversion licences are not likely to add to South Gippsland Water's supply at low flows. There may be potential to supplement supply to Toora through supply from nearby farm dams. Discussions would need to be held with individual landholders, as well as an assessment of the ability to physically transfer that water to South Gippsland Water's treatment plant.

Water Carting: Tankers could be used to cart treated water to Toora from the Foster supply system. The estimated number of trips that would need to be made to supply Stage 4 demands is presented in Table 11-4, which indicates that carting water is unlikely to be feasible for Toora. The point at which the carted water would enter the supply system would need to be investigated further. If tankers are available and the carted water can be delivered into the supply system, the lead time for implementing this option is several days.

Table 11-4: Water carting for Toora

Tanker size	Approximate no. of trips per day to provide Stage 4 (unrestrictable) demand
15 kL	70
27 kL	39

River storage: Under the conditions of the bulk entitlement for Toora, South Gippsland Water is not permitted to pump water from river pools other than Cooks Dam after the flow in the river has ceased. In order to pump river pools, South Gippsland Water would need to apply for a Ministerial qualification of rights, which would be unlikely to be granted unless all other planned contingency supply options have been exhausted.

Reuse of treated wastewater: In 2019/20 there was 59 ML of Class C effluent treated at the Toora Wastewater Treatment Plant, of which 1 ML was reused. Class C effluent is only suitable for a small range of agricultural and industrial applications such as livestock grazing and golf courses. It is not suitable for drinking. Treated wastewater may be a suitable alternative supply for municipal garden or sports ground watering during drought. The Toora storage lagoon was listed as a distribution location for recycled water to water tankers as part of South Gippsland Water's Environmental Improvement Plan (RMCG, 2015).

Rainwater Tanks: Rainwater tanks can have significant benefits to consumers in average to high rainfall years when the tanks are regularly refilled by rainfall events. They may be an effective alternative source of water in short duration droughts, and have the advantage that they can generate supply as soon as it rains with negligible initial losses at the start of a rainfall event. They will however have limited or no value in long-term droughts when rainfall is very low or zero for several weeks or months. The benefits of existing rainwater tanks are already incorporated into the demand estimates in this DPP.

Use of grey water: Grey water is water from clothes washers, bathtubs, showers and bathroom sinks. Grey water can be used by individual customers to maintain garden watering during periods of water restriction, however there can be health risks associated with the use of grey water.

11.6.3 Drought Action Triggers

Triggers for action during drought are based on the aggregate volumes in Cooks Dam plus Toora Basin, as shown in Table 11-5 and Figure 11-2. These triggers assume:

- No inflows to Cooks Dam;
- An unrestricted demand of 522 ML/year and a restrictable demand of 136 ML/year;

- One month of supply from the Stage 2 trigger until the storage is emptied, including two weeks under Stage 2 and two weeks under Stage 4 restrictions;
- No delivery losses between Cooks Dam and the South Gippsland Water offtake; and
- No dead storage.

Table 11-5 Restriction Triggers for Toora, Welshpool, Port Welshpool and Port Franklin

Start of Month	Trigger Storage Volume in Cooks Dam (ML)	
	STAGE 2	STAGE 4
January	41	17
February	38	17
March	36	17
April	34	16
May	33	16
June	33	16
July	34	16
August	35	16
September	37	16
October	39	17
November	41	17
December	42	17

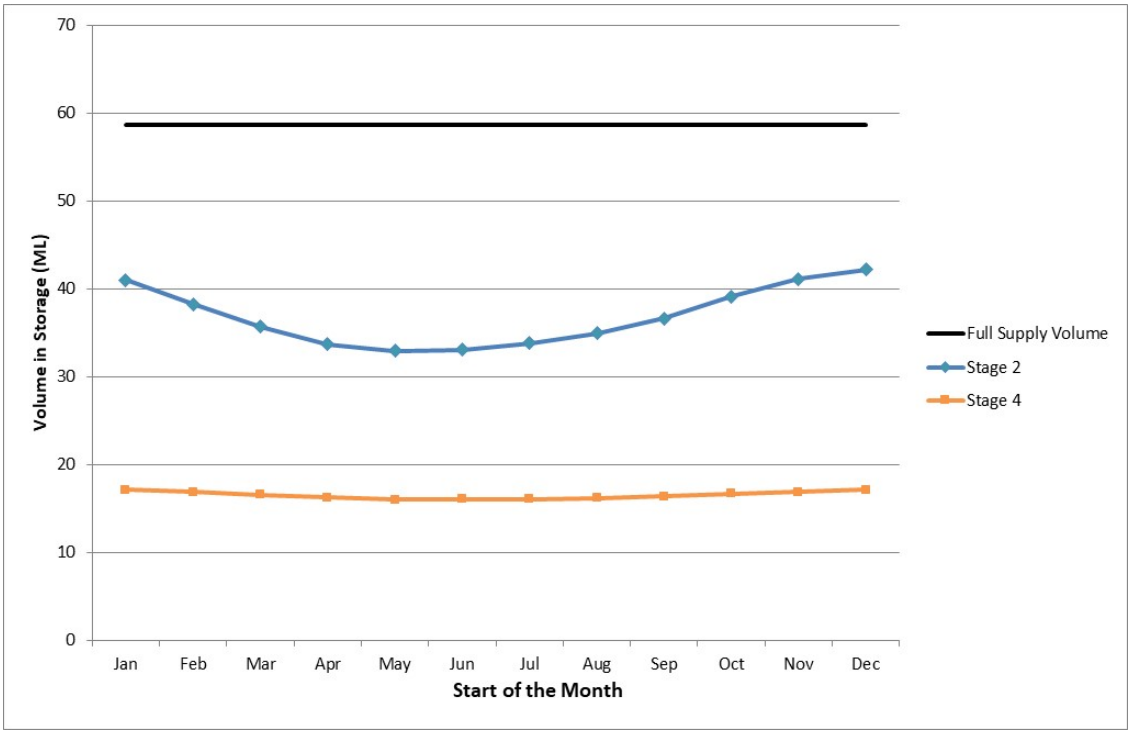


Figure 11-2 Drought Response Triggers for Toora, Welshpool, Port Welshpool and Port Franklin

Restriction exit triggers will be flexibly implemented by South Gippsland Water based on forward estimates of supply availability and anticipated net evaporation and demand. The decision to lift

restrictions should also take into account the likelihood of returning to restrictions in the near future and the community's timeframe for adapting to changes in restriction level.

11.6.4 Drought Action Plans

Action 1 – General Awareness

Trigger	Action
The trigger for this action is based on seasonal climate forecasts and current water availability in South Gippsland Water's supply systems	▪ **Implement communication** plan previously outlined in Section 3.2. ▪ **Continue ongoing pre-drought actions** identified in Section 2.7. ▪ Undertake **preliminary investigations into supply from groundwater** and **nearby farm dams**.

Action 2 – Introduce Stage 2 restrictions

Trigger	Action
The volume in Cooks Dam plus Toora Basin falls between the Stage 2 and Stage 4 restriction rule values (Table 11-5, Figure 11-2).	▪ **Introduce Stage 2 restrictions.** Note that the decision on the appropriate stage of restriction will depend on circumstances at the time, such as the climate outlook, supply availability and customer demand behaviour relative to the restriction trigger design assumptions in Section 11.6.3. ▪ **Implement communication plan** previously outlined in Section 3.2. ▪ **Track streamflow, storage and demand behaviour** relative to restriction triggers. ▪ **Finalise investigations into supply from groundwater** and nearby farm dams.

Action 3 – Introduce Stage 4 restrictions

Trigger	Action
The volume in Cooks Dam plus Toora Basin falls below the Stage 4 restriction rule values (Table 11-5, Figure 11-2).	▪ **Introduce Stage 4 restrictions.** Note that the decision on the appropriate stage of restriction will depend on circumstances at the time, such as the climate outlook, supply availability and customer demand behaviour relative to the restriction trigger design assumptions in Section 11.6.3. ▪ **Implement communication plan** previously outlined in Section 3.2. ▪ **Track streamflow, storage and demand behaviour** relative to restriction triggers. ▪ **Implement supply from alternative source** to maintain South Gippsland Water's minimum level of service.

Action 4 – Emergency measures

Trigger	Action
The volume in Cooks Dam drops below the minimum supply level	▪ **Implement communication plan** previously outlined in Section 3.2. ▪ **Implement emergency measures** as required to maintain essential water use, such as groundwater supply or water carting.

11.6.5 Post-Drought Actions

Post-drought actions common to all supply systems are presented in Section 4. There are no additional post-drought actions specific to the Agnes River supply system, other than to comment on the effectiveness of the alternative supply options if implemented.

12. Plan for Yarram, Alberton, Port Albert and Devon North

12.1 Supply System

An offtake weir on the Tarra River supplies water to the townships of Yarram, Alberton, Port Albert and rural areas in their proximity including Devon North. The river supply is supplemented by a groundwater bore during periods of low river flow. A schematic of the supply system is shown in Figure 12-1. The river supplies other parties including rural users who utilise it for domestic and stock purposes. From the offtake weir the supply gravitates to a 30 ML raw water storage. capacity respectively. From here it passes through a treatment plant and is then transferred to the covered and lined 4.9 ML clear water storage. From the clear water storage the supply gravitates to rural users in Devon North, Yarram, Alberton and Port Albert. The useable storage ("live" storage) in the system is estimated to be 31 ML. At Yarram there is a 1.5 ML capacity elevated tower. There is a 136 kL elevated tower at Port Albert that is currently not in operation. En route from the Devon North storages to Yarram, supply is provided to the community of Devon North and adjoining rural areas. Other rural supplies are provided to properties between Yarram and Port Albert. Raw water supply under specific agreement is provided to properties between the offtake weir and the Devon North raw water storage. Included in the agreement is provision requiring the consumer to install security water storage tanks with a minimum capacity of 45.4 kL. These properties are outside the South Gippsland Water's district and the supply is unchlorinated.

South Gippsland Water also operates a groundwater bore at Yarram. As of October 2021, South Gippsland Water's licence conditions allow for annual extractions of up to 214.2 ML with a maximum extraction rate of 4 ML/day. Groundwater is used during summer months and is mixed with Tarra River water.

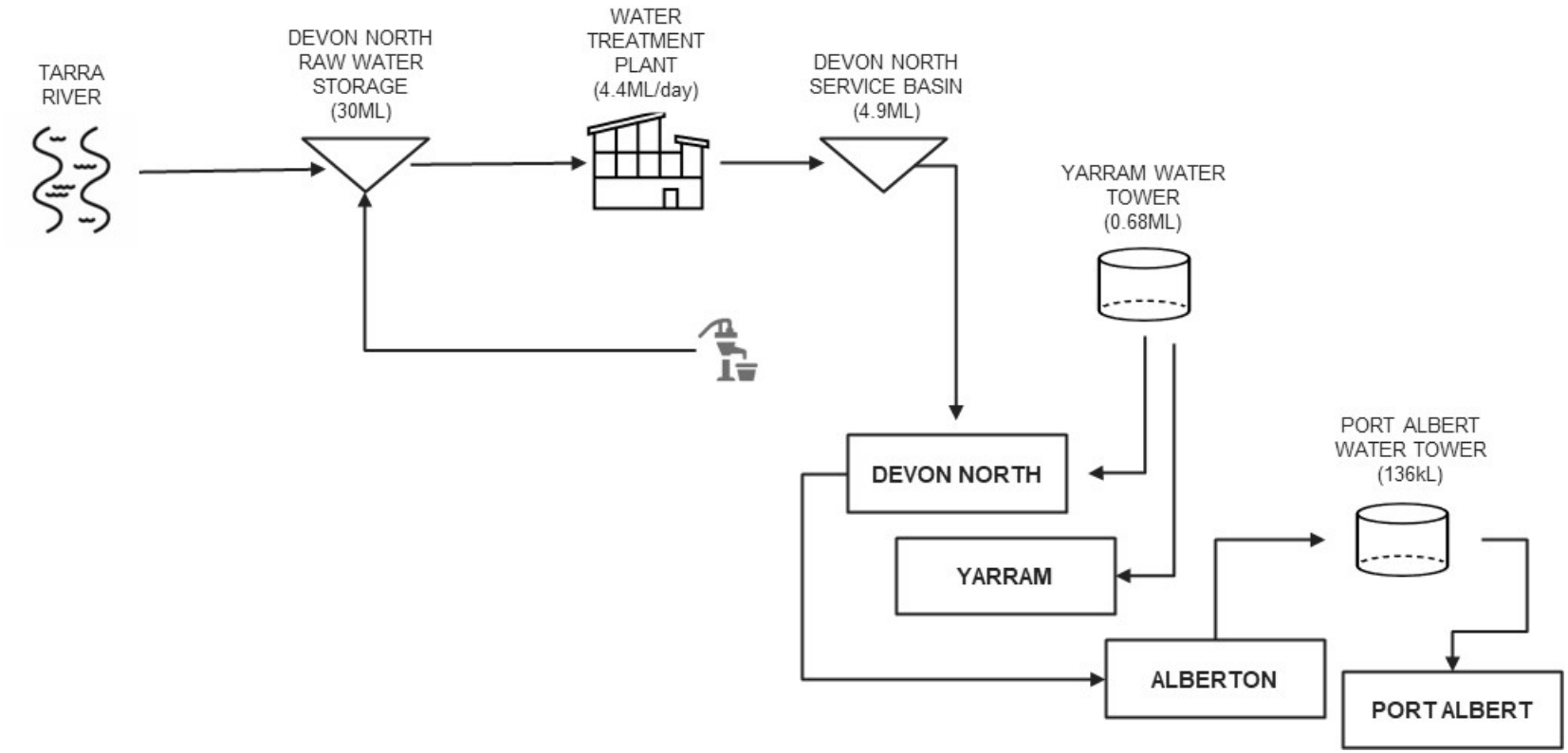


Figure 12-1 Tarra River Water Supply System schematic

12.2 Bulk Entitlements

The bulk entitlement for Yarram allows South Gippsland Water to divert up to a maximum of 853 ML/year from the Tarra River, subject to the provision of minimum passing flows. The daily bulk entitlement limit is shown in Table 12-1.

Table 12-1 Bulk entitlement volume for Yarram

Source	Maximum annual volume (ML/year)	South Gippsland Water's share of flow (E)	Minimum passing flow
Tarra River upstream of Weir (F)	853	When F ≤3 ML/day, E = 0 ML/day When 3 < F ≤ 6 ML/day, E = F-3 ML/day When 6 < F ≤ 12 ML/day, E = 0.5*F ML/day When F > 12 ML/day, E = 6 ML/day	The remainder of the river flow not allowed to be diverted under South Gippsland Water's share of flow

Details of South Gippsland Water's groundwater licence at Yarram are shown in Table 12-2. South Gippsland Water have a licence to extract up to 212.4 ML/year. Previous Urban Water Strategies have flagged an intention to purchase existing groundwater licences to provide up to 400 ML/year of groundwater licences for South Gippsland Water at Yarram. The current permissible consumptive volume from the Yarram Water Supply Protection Area is 25,317 ML/year and peak annual usage in the 2006/07 drought was only around 17,000 ML/year (SRW, 2010), which suggests that trade of currently unused licences to South Gippsland Water is likely to be readily achievable in the short-term, if South Gippsland Water wish to increase their groundwater licence. Temporary transfer of licences is also possible in the interim if required prior to permanent transfers occurring.

Table 12-2 Groundwater licence for Yarram

Location	Annual licensed volume (ML/year)	Maximum extraction rate (ML/day)
Yarram – South Gippsland Water Bore	212.4 ML as of October 2021	4

12.3 Consumption

The typical drought year demand in each month of the year that is used in the development of this DPP is shown in Table 12-3. The unrestrictable demand is the component of demand typically used for in-house and industrial/commercial water use and is not affected by the imposition of water restrictions.

Table 12-3: Average monthly raw water consumption for a typical drought year

Month	Typical drought year demand (ML/month)	Unrestrictable demand (ML/month)	Restrictable demand (ML/month)
July	32	28	5
August	36	28	8
September	33	28	6
October	44	28	17
November	41	28	13
December	46	28	18
January	48	28	20
February	38	28	11
March	39	28	11
April	32	28	4
May	31	28	3
June	29	28	1
TOTAL	449	332	117

12.3.1 Community Assets

There are no identified community assets in the Yarram Supply System that could require water supply by South Gippsland Water during periods of drought. The Yarram Golf Course has a licence to groundwater which it utilisers for watering. This was determined through initial consultation with local council and South Gippsland Water.

12.4 Level of Service Objective

The performance of the supply system during drought was assessed using a water balance model over a long-term baseline climate sequence from October 1960 to June 2020 (HARC, 2021a). There are no formal restriction triggers for this supply system, so only the minimum level of service was assessed. The results indicated that South Gippsland Water's minimum level of service objective to provide the unrestrictable demand of 332 ML/year in Table 12-3 was met under projected historical year 2020 low and medium climate change scenarios, but not under the year 2020 high climate change scenario, assuming 212.4 ML/year of available groundwater supply.

12.5 Review of Past Drought Experience

Since 1997/98, South Gippsland Water has experienced conditions drier than the long-term average. This included severe restrictions (Stage 4 of 4 stages or equivalent) in 2000/01, 2003/04, 2005/06 and 2006/07. The most recent periods of restriction are listed below.

2006/07 – Stage 2 restrictions (of 4 stages) were introduced in this supply system in October 2006. These restrictions were increased to Stage 4 in December 2006. Stage 4 restrictions remained in place until June 2007, when restrictions were lifted. The total duration of restrictions over this period was 8 months. The raw water storage did not drop below 26 ML

over this period. Stage 2 restrictions were first implemented when the 5-day rolling average flow upstream of the offtake weir was estimated to be 7.4 ML/day, which was ahead of the Stage 2 restriction trigger of 5.0 ML/day in the 2003 DPP. No record of supply from groundwater was available for that period.

2008/09 – Stage 2 restrictions were introduced in this supply system in February 2009 and increased to Stage 4 in April 2009. These restrictions remained in place until June 2009, when restrictions were lifted. The total duration of restrictions over this period was 4 months. Stage 2 restrictions were first implemented when the 5-day rolling average flow upstream of the offtake weir was estimated to be 3.8 ML/day, which was later than the Stage 2 restriction trigger of 5.0 ML/day in the 2003 DPP. Supply from groundwater over this period was 8 ML from the Yarram Golf Club bore. Very little water was extracted from the Yarram Golf Club bore because the treatment system was unable to oxidise the iron in the bore water.

Since the end of restrictions in June 2009 no further restrictions have been implemented. Since that time additional groundwater from another bore location (64 ML to date) has been purchased and demands have reduced. Up to the end of 2019/20, the maximum recorded annual groundwater extraction was 157 ML/year, which occurred from November to May in 2018/19.

A base flow recession curve for the Tarra River upstream of South Gippsland Water's urban offtake is shown in Figure 12-2. The base flow recession constant on the master recession curve is estimated to be 0.98, which means that the flow in the river would be expected to halve around every 33 days. This relationship has been fitted to flows below 15 ML/day. Figure 12-2 highlights significantly variability in low flow behaviour between different low flow events. For example, the estimated streamflow upstream of the offtake in 2008/09 drops quicker than in the other dry flow periods examined. Hence the master recession curve should only be used as a broad guide to likely streamflow behaviour in the absence of rainfall. In particular, this recession curve is based on estimated streamflow upstream of the gauge using the relationship in Section 12.6.3 with the recorded flow at Fischers, and hence is subject to uncertainty around river loss behaviour between Fischers and the offtake.

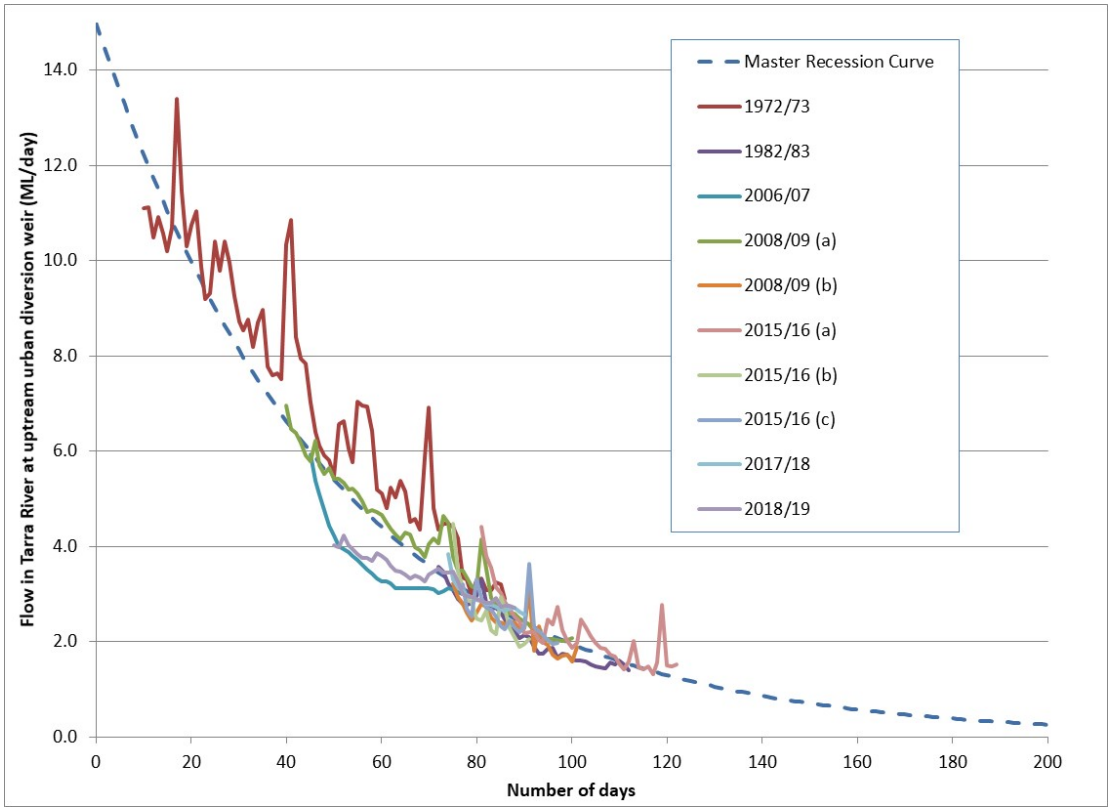


Figure 12-2 Tarra River base flow master recession curve u/s of South Gippsland Water's offtake

12.6 Drought Response Plan

12.6.1 Pre-Drought Actions

Pre-drought actions common to all supply systems are presented in Section 2.7. Additional pre-drought actions specific to Yarram include ensuring that the raw water storage is as full as possible leading into drought, and that South Gippsland Water should continue to purchase more groundwater licences as part of its long-term strategy to increase its licensed volume to 400 ML/year, consistent with South Gippsland Water's Urban Water Strategy. Early warning signs for this supply system would be low flows in the upstream streamflow gauges on the Tarra River at Fischers (number 227225) and on the Tarra River at South Gippsland Water offtake (number 227251). Low spring rainfall combined with lower-than-average storage levels across the region would provide an indication of impending drought.

12.6.2 Available Drought Actions

A range of actions are available to South Gippsland Water at Yarram during drought. These actions have been divided into actions likely to be feasible during drought and other actions that have been considered but which are less likely to be feasible. A summary of the likely feasibility of each option is shown in Table 12-4. In the 2006/07 drought, water restrictions and supply from groundwater were implemented at Yarram.

Table 12-4: Likely feasibility of drought actions for Yarram

Action	Likely feasibility during drought
Groundwater bore	High
Purchase of water from other water users	Medium
Restrictions	Medium
Water carting	Low
River storage	Low
Reuse of treated wastewater	Low
Rainwater tanks	Low
Use of grey water	Low
Changed tariffs during drought	Low

Each option is discussed briefly below.

Restrictions: Imposition of staged water restrictions in accordance with South Gippsland Water's by-law for restricting water use will serve to reduce demand. The time available between each stage of restriction is limited in this supply system because storage volumes are small relative to demand, so only Stage 2 and Stage 4 restrictions are planned to be implemented. The reduction in restrictable demand anticipated at each stage of restriction was previously presented in Section 2.6.2, which can be used in combination with Table 12-3 to estimate likely water savings during drought.

Groundwater: As of October 2021, South Gippsland Water has a groundwater licence at Yarram for 214.2 ML/year at a maximum extraction rate of 4ML/day. Groundwater is used during summer months and is mixed with Tarra River water. Groundwater pumping is activated during periods of low streamflow.

Groundwater supply potential for Yarram was most recently investigated in SKM (2009). That study looked at three potential sites around Yarram and concluded that bore yields of 1-4 ML/day were achievable at all three sites. Water quality was suitable at between 150-408 mg/L observed in the Latrobe Group Aquifer and 120-175 mg/L in the Balook Aquifer. The report also commented on the potential to affect other groundwater users, as well as the bore depth requirements if the bore is to cater for the long-term groundwater level decline currently occurring in the region. Groundwater conditions are well known in the Yarram area and exploratory drilling represents a lower risk in this area than other exploratory drilling programs conducted by South Gippsland Water elsewhere in South Gippsland.

The area around Yarram is within the Yarram Water Supply Protection Area, so no new licences are being issued by Southern Rural Water. Licences must be purchased from existing licence holders. Southern Rural Water aims to process permanent transfers of groundwater licence within 14 days and to assess new groundwater licence applications within 60 days (SRW, 2021). The time to construct, test and develop a new bore could be in the order of weeks if a drill rig is available.

Purchase of water from other water users: Private diverters are located along the Tarra River and its tributaries upstream and downstream of South Gippsland Water's diversion weir. Summer diversion licences could be purchased from other water users during drought, however

the availability of water under those licences during a dry summer is expected to be low. According to the local management rules for the South Gippsland Basin (SRW, 2013), private diverters would be banned from taking water when the flow at Yarram is below 5 ML/day. At low flows, the flow at Yarram is usually less than the flow at Fischers. This means that any diversion licences purchased from rural water users are likely to be subject to a ban on diversions before South Gippsland Water's bulk entitlement for Yarram is affected by low flows. Hence private diversion licences are not likely to add to South Gippsland Water's supply at low flows. There may be potential to supplement supply to Yarram through supply from nearby farm dams. Discussions would need to be held with individual landholders, as well as an assessment of the ability to physically transfer that water to South Gippsland Water's treatment plant.

Water Carting: Treated water could be carted from Toora or Foster to supply the town demands. The estimated number of trips that would need to be made to supply Stage 4 demands is presented in Table 12-5, which indicates that carting water is unlikely to be feasible for Yarram. The point at which the carted water would enter the supply system would need to be investigated further.

Table 12-5: Water carting for Yarram

Tanker size	Approximate no. of trips per day to provide Stage 4 (unrestrictable) demand
15 kL	60
27 kL	34

River storage: Under the conditions of the bulk entitlement for Yarram, South Gippsland Water is not permitted to pump water from river pools after the flow in the river has ceased. In order to pump river pools, South Gippsland Water would need to apply for a Ministerial qualification of rights, which would be unlikely to be granted unless all other planned contingency supply options have been exhausted.

Reuse of treated wastewater: In 2019/20 there was 110 ML of Class C effluent generated from the Tarraville Wastewater Treatment Plant servicing Yarram and Port Albert. All of this treated wastewater was used for pasture irrigation, which means that there is no opportunity to further utilise this resource during drought. Class C effluent is only suitable for a small range of agricultural and industrial applications such as livestock grazing and golf courses. It is not suitable for drinking. Treated wastewater may be a suitable alternative supply for municipal garden or sports ground watering during drought.

Rainwater Tanks: Rainwater tanks can have significant benefits to consumers in average to high rainfall years when the tanks are regularly refilled by rainfall events. They may be an effective alternative source of water in short duration droughts, and have the advantage that they can generate supply as soon as it rains with negligible initial losses at the start of a rainfall event. They will however have limited or no value in long-term droughts when rainfall is very low or zero for several weeks or months. The benefits of existing rainwater tanks are already incorporated into the demand estimates in this DPP.

Use of grey water: Grey water is water from clothes washers, bathtubs, showers and bathroom sinks. Grey water can be used by individual customers to maintain garden watering during periods of water restriction, however there can be health risks associated with the use of grey water.

12.6.3 Drought Action Triggers

Historically, triggers for action during drought were based on the estimated flow at the Tarra River Diversion weir at the South Gippsland Water offtake and the volume in the Devon North raw water basin. However, since the volume available from groundwater has increased with recent purchases of groundwater licences, it is now more relevant to draw upon groundwater resources during periods of low streamflow.

Groundwater pumping is activated when the average streamflow drops below 5 ML/day. The current groundwater licence provides the capacity to deliver more than 50 days of unrestricted demand. In this way, the need for restriction triggers will be minimised. Consistent with the actions in South Gippsland Water's Urban Water Strategy, South Gippsland Water will seek to obtain additional groundwater licences from existing licence holders. This will be undertaken in parallel with monitoring the instantaneous groundwater yields to confirm that the practical extraction rate will be sufficient to meet demands.

Restrictions may be implemented if additional groundwater resources are not available or if instantaneous yields begin to wane. South Gippsland Water will actively monitor the situation for Yarram water supply area and will manage the system in a flexible manner to allow appropriate restriction triggers to be implemented based on the supply estimates and anticipated demand.

Restriction exit triggers will also be flexibly implemented by South Gippsland Water based on forward estimates of supply availability and anticipated demand. The decision to lift restrictions should also take into account the likelihood of returning to restrictions in the near future and the community's timeframe for adapting to changes in restriction level.

12.6.4 Drought Action Plan

Action 1 – General Awareness

Trigger	Action
The trigger for this action is dry seasonal climate forecasts and low river flow conditions across the region	▪ **Implement communication plan** previously outlined in Section 3.2. ▪ **Continue ongoing pre-drought actions** identified in Section 2.7, including purchase of groundwater licences consistent with South Gippsland Water's Urban Water Strategy. ▪ **Track streamflow, storage and demand behaviour** relative to restriction triggers. ▪ **Test supply from groundwater** to ensure that it is functioning properly.

Action 2 – Initiate groundwater supply

Trigger	Action
5 day rolling average flow in the Tarra River falls below 5 ML/day and is expected to continue to fall.	▪ **Implement supply from** groundwater to maintain South Gippsland Water's minimum level of service. ▪ **Implement communication plan** previously outlined in Section 3.2. ▪ **Track streamflow, groundwater yield and demand behaviour** relative to estimates of anticipated water supply and demand.

Action 3 – Obtain additional (temporary or permanent) groundwater supplies and implement restrictions

Trigger	Action
Groundwater yields drop below volume required to meet anticipated demands.	▪ **Obtain supplementary supply from groundwater** as needed to maintain South Gippsland Water's minimum level of service. This may include permanent or temporary purchases or trade to meet short term needs, particularly if bore yields decline unexpectedly due to extreme drought or a change in bore condition. ▪ **Introduce restrictions**. Note that the decision on the appropriate stage of restriction will depend on circumstances at the time, such as the climate outlook, supply availability from the bore and river, and customer demand behaviour. ▪ **Implement communication plan** previously outlined in Section 3.2. ▪ **Track streamflow, groundwater yield and demand behaviour** relative to estimates of anticipated water supply and demand.

Action 4 – Emergency measures

Trigger	Action
The volume in the Yarram raw water basin falls below minimum supply level	▪ **Implement communication plan** previously outlined in Section 3.2. ▪ **Implement emergency measures** as required to maintain essential water use, such as groundwater supply or water carting.

12.6.5 Post-Drought Actions

Post-drought actions common to all supply systems are presented in Section 4. There are no additional post-drought actions specific to the Tarra River system, other than to comment on the effectiveness of the alternative supply options if implemented.

13. References

Bass Coast Shire Council (2019) *Integrated Water Management Plan – Strategy Document*. September 2019. Prepared by Engeny.

Beveridge Williams (2019) *Shamrock Springs, Leongatha. Stormwater Management Strategy*. February 2019. Revision C.

Department of Environment, Water and Planning (DELWP) (2020) *Guidelines for Assessing the Impact of Climate Change on Water Availability in Victoria*. Final. November 2020. ISBN 978-1-76105-298-9 (pdf/online/MS word).

Department of Environment, Water and Planning (DELWP) (2021a) *Guidelines for the development of urban water strategies*. Final. March 2021.

Department of Environment, Water and Planning (DELWP) (2021b) *Victorian Water Accounts 2019/20*. ISSN 1837-591 (print).

HARC (2021a) *South Gippsland Water Urban Water Strategy. Water Resources Modelling – Technical Report*. Draft. November 2021.

HARC (2021b) *BW Modelling Support. Apollo Bay Source Model. Memorandum*. 7/8/2021.

KBR (2016) Environment Improvement Plan (EIP) for Meeniyan Golf Club and Recreation Reserve System-Meeniyan Recycled Water Reuse Scheme.

Minster for Environment, Climate Change and Water (MECCW) (2015) *Statement of Obligations (General)*. 20/12/2015.

Neal B., Meneses C., Hughes D. and Wisener T. (2010) The Impact of Water Restrictions on Regional Urban Demand. Water Magazine. August 2010.

RMCG (2015) *Environmental Improvement Plan. Tanker Transport of Reclaimed Water for Short-term Reuse*. May 2015. Prepared for South Gippsland Water. Final.

RMCG (2016) *Toora Football Oval – Recycled Water Scheme. Environment Improvement Plan*. Prepared for South Gippsland Water. May 2016. Final.

SKM (1998) Bore Pumping Test – Dumbalk. Letter from Gordon Walker of SKM to Dao Norath of South Gippsland Water, dated 28 May 1998.

SKM (2006) Wonthaggi Coal Mine Water Use. Stage 2 Report – Preliminary Investigation into the Feasibility of Using Coal Mine Water for Potable Supply and Recharge with Urban Stormwater. Final. 31 August 2006.

SKM (2007a) Potential Groundwater Supplies around Korumburra. Final. 21 February 2007. Prepared for South Gippsland Water.

SKM (2007b) Groundwater Resource Potential in Inverloch, South Gippsland. Letter from Andrew Harrison of SKM to Graeme Watkins of South Gippsland Water, 4/4/2007.

SKM (2008) Assessment of Groundwater Licence Application at Leongatha. Prepared for South Gippsland Water.

SKM (2009) Yarram Groundwater Investigation. Augmentation of the Yarram Water Supply System. Prepared for South Gippsland Water.

South Gippsland Water (2011) *Permanent Water Saving Plan for South Gippsland Water*. 6/12/2011.

South Gippsland Water (2012) Model Water Restriction By-Law. Number 7. Issued by the Minister for Water, as Minister administering the *Water Act 1989.* http://www.sgwater.com.au/wp-content/uploads/2014/04/2012-20698-Model-Water-Restriction-By-law-number-7-SIGNED-AND-CORRECT-DATE.pdf

South Gippsland Water and South East Water (2014) *Whole of Water Cycle Management Options Analysis for Korumburra*. Final Version 4.0. 15 May 2014. Prepared by South Gippsland Water and South East Water.

South Gippsland Water (2015a) *Water Use Plan Application: Sportsgrounds Form*. HPRM: 101/002/001. Revision 02. Approved 13/8/2015.

South Gippsland Water (2015b) *Exemption Application Form*. HPRM: 101/002/001. Revision 02. Approved 13/8/2015.

South Gippsland Water (2017a) *Ruby Creek Water Supply System. Preliminary Business Case for Supplementary Supply for Leongatha*. Preliminary Draft. August 2017.

South Gippsland Water (2017b) *Leongatha Groundwater Licence BEE31909 Extraction, Measuring and Monitoring Procedure*. 15/12/2017.

South Gippsland Water (2019a) *Ruby Creek Water Supply System. Preliminary Business Case for Supplementary Supply for Leongatha. Addendum – Supply by Lance Creek via Korumburra*. Preliminary Draft. April 2019.

South Gippsland Water (2019b) *Customer Charter*. January 2019.

South Gippsland Water (2021) *Terms of Reference – Community Advisory Committee*. April 2021.

Southern Rural Water (2013) Local Management Plan South Gippsland Basin. September 2013.

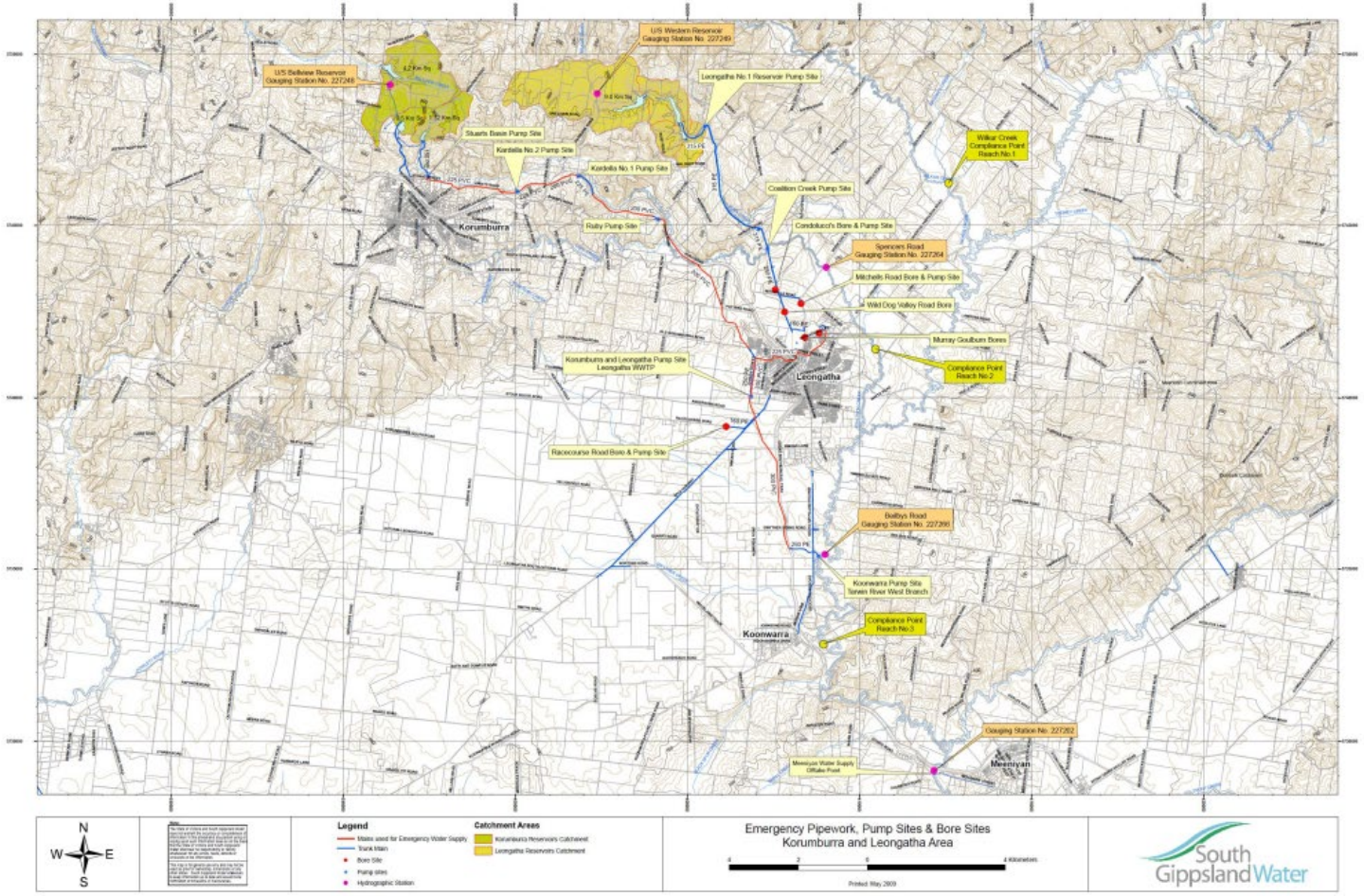
Southern Rural Water (2021) http://www.srw.com.au/water-systems/other-water-sources/groundwater/ Accessed 5/11/2021

Technical Working Group on Water Savings Assessment (TWGWSA) (2005) Water Savings from Restrictions: Technical Report. August 2005. Prepared for the Metropolitan Drought Coordination Group and the Victorian Water Industry Association

VPSC (Victorian Public Sector Commission) (2021) *Codes of Conduct* https://vpsc.vic.gov.au/ethics-behaviours-culture/codes-of-conduct/ Accessed 4/11/2021. Page last updated 1 June 2016.

Alluvium (2020) *Shire of Wellington Integrated Water Management Plan Report 0119166*. Revision 03. September 2020.

Appendix A Map of emergency pipework for past drought supply from the Tarwin River West Branch and groundwater supply for Korumburra and Leongatha



Appendix B Typical Drought Year Demands for Lance Creek Sub-Systems

The typical drought year demand in each month of the year that is used in the development of this DPP for the Lance Creek System is presented below for each sub-system. This information could be useful in the event of (i) localised contingency supply measures in response to a general water shortage across the whole supply system or (ii) a local water shortage, such as due to local infrastructure failure.

Table 13-1: Average monthly consumption for a typical drought year for Korumburra

Month	Typical drought year demand (ML/month)	Unrestrictable demand (ML/month)	Restrictable demand (ML/month)
July	73	56	16
August	73	56	16
September	73	56	16
October	73	56	16
November	73	56	16
December	73	56	16
January	73	56	16
February	72	56	16
March	73	56	16
April	73	56	16
May	73	56	16
June	73	56	16
TOTAL (ML/year)	872	676	196

Table 13-2: Average monthly consumption for a typical drought year for Poowong, Loch and Nyora

Month	Typical drought year demand (ML/month)	Unrestrictable demand (ML/month)	Restrictable demand (ML/month)
July	21.2	16.3	4.8
August	22.5	16.3	6.2
September	18.9	16.3	2.5
October	24.9	16.3	8.5
November	24.4	16.3	8.0
December	23.5	16.3	7.2
January	26.9	16.3	10.5
February	28.8	16.3	12.5
March	29.9	16.3	13.6
April	26.3	16.3	10.0
May	28.6	16.3	12.2
June	26.7	16.3	10.3
TOTAL (ML/year)	303	196	106

Table 13-3: Average monthly consumption for a typical drought year for Wonthaggi, Cape Paterson and Inverloch

Month	Typical drought year demand (ML/month)	Unrestrictable demand (ML/month)	Restrictable demand (ML/month)
July	132	103	29
August	137	103	34
September	149	103	45
October	164	103	61
November	169	103	66
December	204	103	101
January	245	103	142
February	283	103	179
March	224	103	121
April	190	103	87
May	161	103	58
June	131	103	27
TOTAL (ML/year)	2,188	1239	949