



Drought and Emergency Response Management Plan

Report

Upper Hunter Water Utilities Alliance (UHWUA)

3 August 2022



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Executive summary

This Drought and Emergency Response Management Plan (DERMP) has been developed for the Upper Hunter Water Utilities Alliance (UHWUA) consisting of Singleton Council, Muswellbrook Shire Council and Upper Hunter Shire Council, in order to:

- Provide guidance to staff when managing drought and emergency events.
- Inform the community of the issues associated with drought and emergency management and the community's role during drought and emergency events.
- Have a sound DERMP in place being a part of the NSW Government Best-Practice Management requirements for water supply.

This DERMP has the following uses with relation to drought and emergency management:

- Operational plan
- Resourcing strategy
- Authorised approach, that is, staff have the confidence that the actions in this plan have been authorised in advance
- Basis for government grant applications
- Basis of a public awareness and community communication program

This plan gives authority to Council's General Manager, in consultation with Council, to declare local drought conditions and emergencies and implement the actions herein described.

The DERMP has been prepared with a view to providing the UHWUA Councils with a clear water restriction regime and a comprehensive drought and emergency management strategy. This plan has been developed as an update of the previous plans from Singleton Council, Muswellbrook Shire Council and Upper Hunter Shire Council developed in 2010, 2014 and 2014 respectively. The plan had been prepared in accordance with the NSW Government Best-Practice Management of Water Supply and Sewerage Guidelines Drought Management Checklist, NSW Water Directorate Drought Management Guidelines and aligns with the Integrated Water Cycle Management Strategies that have been developed or are currently being developed by the Councils.

The NSW Local Government PPRR (Prevention, Preparation, Response and Recovery) emergency management approach has been applied. This approach provides a strategic and systematic drought management process to reduce risk to the community and the environment.

The PPRR approach is a continuous process that involves implementing strategies before, during and after drought and emergency events. An overview of the four phases is provided below:

Drought and Emergency Impact Prevention Strategy

Drought and emergency impact prevention actions are the measures that the Councils will undertake in order to increase the water supplies' coping capacity before and during a drought and reduce or eliminate the likelihood or effects of emergency events. These actions are provided in Section 2.

Drought and Emergency Preparedness Strategy

Drought and emergency preparedness actions are the actions that the Councils will undertake to prepare for drought and emergencies, including training, system monitoring and community consultation. These actions are provided in Section 3.

Drought and Emergency Response Strategy

Within the drought and emergency response strategy are the actions that the Councils will undertake to respond to emergencies, including reducing water consumption, match the demand with the diminishing water resources, how the Councils may supplement existing water resources, if required, and the continuous monitoring the Councils will implement. The implementation and review of these actions will be the responsibility of the UHWUA Drought and Emergency Management Team. These actions are provided in Section 4, with some actions summarised below.

Drought and Emergency Triggers

Drought triggers define situations that will activate staged response strategies in relation to the severity of the drought or emergency event. The triggers shown below are determined from monitoring the UHWUA Councils' water supply systems and historical restrictions implemented across the three Councils' LGAs. The actions are described in detail in Section 4.1.2.

Table E.1 Water restriction triggers

Level	Storage trigger
Level 1 Restrictions	50% storage availability; Additional for UHSC: Merriwa and Cassilis - 2 bore pumps operate for 20 hrs/d for more than 5 consecutive days. Target Daily Usage: <ul style="list-style-type: none">– SC – 9 ML/d *– MSC – Seasonal targets<ul style="list-style-type: none">• Winter: 4-5 ML/d• Spring: 6-7 ML/d• Summer: 9-10 ML/d• Autumn: 6-7 ML/d– UHSC – Township targets *<ul style="list-style-type: none">• Merriwa and Cassilis 765 kL/d• Murrurundi 270 kL/d• Scone and Aberdeen 4.5 ML/d
Level 2 Restrictions	40% storage availability; Additional for UHSC: Merriwa and Cassilis - If level 1 restrictions have failed to keep 2 bore pumps operating < 20 hr/d (for a period of at least 4 weeks). Target Daily Usage: <ul style="list-style-type: none">– SC – 8 ML/d **– MSC – Seasonal targets<ul style="list-style-type: none">• Winter: 3.5-4.5 ML/d• Spring: 5.5-6.5 ML/d• Summer: 8-9 ML/d• Autumn: 5.5-6.5 ML/d– UHSC – Township targets**<ul style="list-style-type: none">• Merriwa and Cassilis 680 kL/d• Murrurundi 240 kL/d• Scone and Aberdeen 4.0 ML/d

Level	Storage trigger
Level 3 Restrictions	<p>30% storage availability;</p> <p>Additional for UHSC: Merriwa and Cassilis - If level 2 restrictions have failed to keep 2 bore pumps operating < 20 hr/d (for a period of at least 4 weeks) or significant equipment breakdown or major failure of bore pumps or WTP.</p> <p>Target Daily Usage:</p> <ul style="list-style-type: none"> – SC – 7 ML/d *** – MSC – Seasonal targets <ul style="list-style-type: none"> • Winter: 3-4 ML/d • Spring: 5-6 ML/d • Summer: 7-8 ML/d • Autumn: 5-6 ML/d – UHSC – Township targets *** <ul style="list-style-type: none"> • Merriwa and Cassilis 595 kL/d • Murrurundi 210 kL/d • Scone and Aberdeen 3.5 ML/d

* Target daily usage for Level 1 restrictions reduced by 10%

** Target daily usage for Level 2 restrictions reduced by 20%

*** Target daily usage for Level 3 restrictions reduced by 30%

Key water supply emergency triggers include:

- Serious supply or service problem, serious infrastructure damage (whether owned by Council or others), investigation by statutory authorities, recurring incidents.
- Serious injuries, affecting the operation of a local water facility asset, depot or office, minor building fire, short-term localised health issues, e.g. high turbidity in raw water (noting high turbidity is defined in the Council Drinking Water Quality Management Plans and varies between Councils).
- Significant or widespread impact on supply and service operations, bomb threat / search, significant asset failure or vandalism.
- Spill / emission which requires external resources to mitigate, high volume spill impacting the environment, contamination / failure of a depot storage system.
- Disruption requiring corporate / external resources to address; limited industrial action; telemetry / SCADA / IT communications failure; significant power outage.

Demand-Side Actions

Demand-side actions are those actions that Councils implement to reduce water consumption, to match the demand with the diminishing water resources. Implementing water restrictions is the main action. These details are provided in Section 4.4.

Supply-Side Actions

Supply-side actions are those actions that Councils implement to supplement the existing water resources, to match the demand. These details are provided in Section 4.5.

Drought and Emergency Management Team

A Drought and Emergency Response Management Team will be established for the UHWUA as part of the drought and emergency response and will be responsible for managing the activities implemented during drought and emergencies. Section 4.3 provides the details of the roles and responsibilities of the team.

Drought and Emergency Recovery Strategy

The drought and emergency recovery strategy sets out the actions Councils will undertake to support the affected community and the restoration actions required to return the Council's water supply operations to normal and restore community wellbeing. These actions are provided in Section 5.

Abbreviation list

Abbreviation	Abbreviation description
AGL	Australian Gas Networks Limited
AWD	Available Water Determinations
BASIX	Building Sustainability Index
DEMCS	Drought and Emergency Management Communications Strategy
DERMP	Drought and Emergency Response Management Plan
DERMT	Drought and Emergency Response Management Team
DPE	Department of Planning and Environment
DRC	Drought Recovery Coordinator
EMPLAN	Local Emergency Management Plan
FMECA	Failure Modes, Effects and Criticality Analysis
GM	General Manager
GHRWS	Greater Hunter Regional Water Strategy
HWC	Hunter Water Corporation
IT	Information Technology
IWCM	Integrated Water Cycle Management
JVA	Joint Venture Agreement
MSC	Muswellbrook Shire Council
NRAR	Natural Resources Access Regulator
NARClIM	NSW and ACT Regional Climate Modelling
OSSM	Onsite Sewage Management System
PPRR	Prevention, Preparation, Response and Recovery
RWMS	Recycled Water Management System
RPN	Risk Priority Number
STP	Sewage Treatment Plant
SC	Singleton Council
SOPs	Standard Operating Procedures
UFW	Unaccounted-for Water
UHWUA	Upper Hunter Water Utilities Alliance
UHSC	Upper Hunter Shire Council
WELS	Water Efficiency Labelling and Standards
WEMP	Water Efficiency Management Plan
WTP	Water Treatment Plant

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Appendix B	Failure Modes, Effects and Criticality Analysis (FMECA)
Appendix C	Template Water Efficiency Management Plan (WEMP)

1. Introduction

1.1 Context

This Drought and Emergency Response Management Plan (DERMP) has been developed for the Upper Hunter Water Utilities Alliance (UHWUA) consisting of Singleton Council, Muswellbrook Shire Council and Upper Hunter Shire Council, in order to:

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- Inform the community of the issues associated with drought and emergency management and the community's role during drought and emergency events.
- Have a sound DERMP in place being a part of the NSW Government Best-Practice Management requirements for water supply.

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1.2 DERMP objectives

This DERMP provides an outline of the actions that the UHWUA Councils will undertake to prevent, prepare for, respond to and recover from drought and emergency events. The objective of the plan is to:

- Ensure that timely warning can be provided to the appropriate authorities and other stakeholders (including customers) in drought and emergency events.
- Provide relevant information for use in response to a situation when water availability becomes a concern.
- Implement Best Practice Management to determine the drought and emergency triggers and demand responses to water restrictions.
- Provide procedures to Council's staff, on how to respond to and mitigate drought and emergency events.
- Document how each Council will manage the water supply schemes during water shortages and emergency events.
- Provide clear guidance to customers (residential and commercial/industrial) on their responsibilities when the Councils implement water restrictions.

Key components of this plan and guidance for implementation are shown in Figure 1.1.

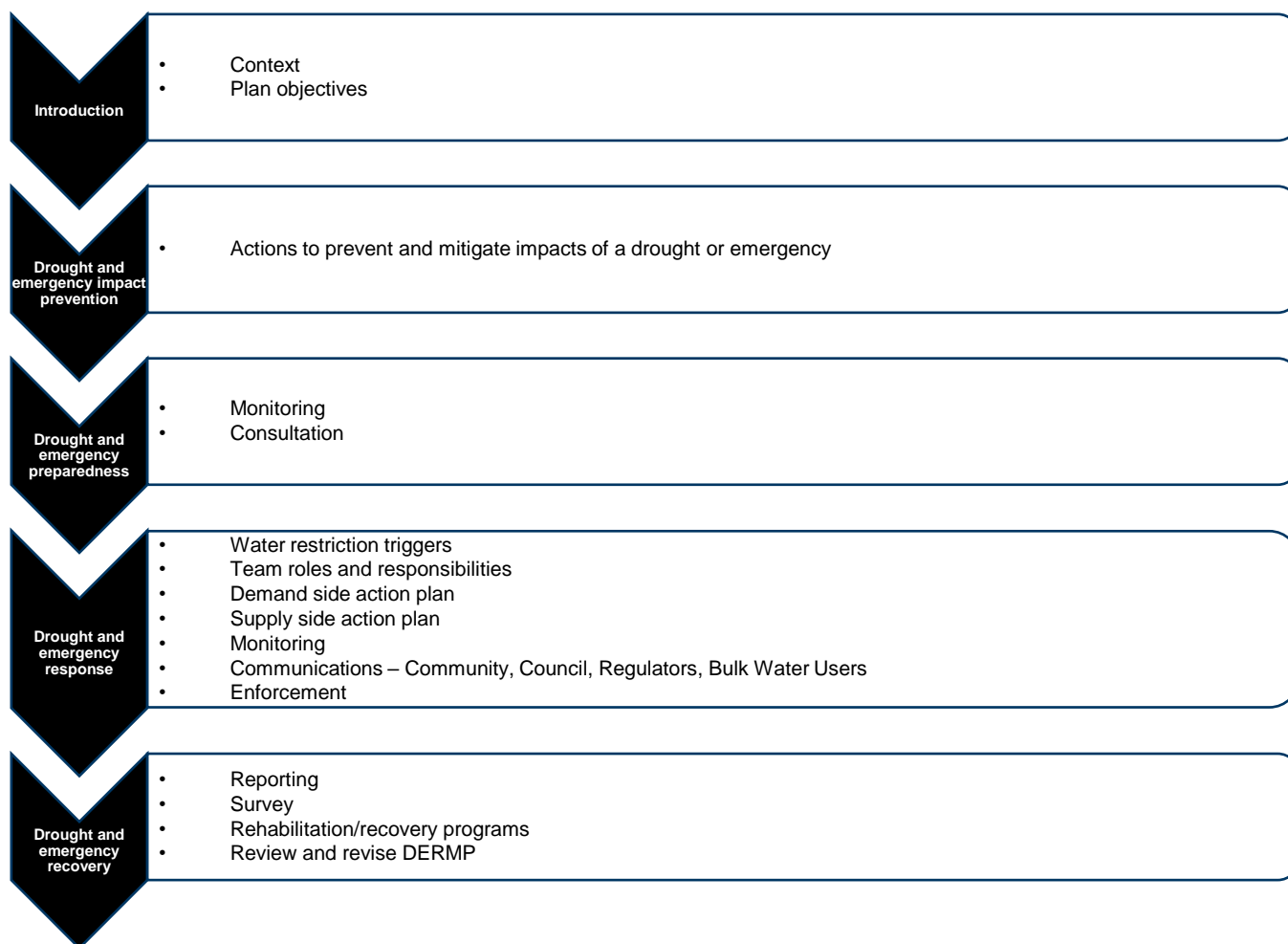


Figure 1.1 UHWUA DERP implementation

1.2.1 The prevention, preparation, response and recovery approach

This DERP is based on a four-step approach, referred to as the PPRR (Prevention, Preparation, Response and Recovery) approach. The PPRR is a continuous process that involves implementing strategies before, during and after drought and emergency events. An overview of the four phases is provided below:

- **Drought and emergency impact prevention strategy** – Actions to reduce or eliminate the likelihood or effects of drought and emergency events. These include understanding and analysing climate, water availability and past drought and emergency events and also implementing upgrade actions through capital investment.
- **Drought and emergency preparedness** – Developing strategies to be implemented before a drought or emergency event occurs, to ensure effective response and recovery.
- **Drought and emergency response strategy** – Actions to control and/or minimise the impacts of the drought and emergency events, including implementing demand side and supply side actions, such as water restrictions.
- **Drought and emergency recovery strategy** – Actions to assist the Councils to return to normal supply conditions and assist the Councils and community to recover from the impacts of drought and emergency events.

2. Drought and emergency impact prevention strategy

2.1 Overview

Drought and emergency impact prevention actions are proactive measures that Councils can undertake in order to prevent or delay water shortages due to drought. Preventative actions may be implemented prior to drought and emergencies or during drought-declared periods. This is determined at Council's discretion.

This section provides a summary of the key activities and strategies that the Councils are undertaking to manage water emergencies and demand prior to and during a drought, and the improvements being undertaken to increase water security and reduce the risk of emergency events for the future.

2.2 Impact prevention actions

2.2.1 Water conservation measures

The UHWUA Councils have implemented water conservation measures which provide simple and practical guidance that residents can implement to reduce water consumption and reduce their water bill.

At times of drought, these also serve to focus the community on water conservation and help prepare the community for the Councils' drought response, should it be required.

Proactive programs implemented by the UHWUA Council's to prevent water shortage and emergencies include:

- Water main renewals
- Water main preventative maintenance
- Active leak detection programs
- SCADA monitoring
- Water usage monitoring (bulk meters, customer meters)

The UHWUA Councils promote their water conservation campaigns to the communities through the UHWUA Councils' websites and initiatives as shown below.

2.2.2 Demand management

The UHWUA Councils incorporate demand management activities as an ongoing initiative to encourage efficient water use and ensure a secure water supply. These measures encourage common sense water use practices that develop a culture of water efficiency.

The UHWUA Councils' regulatory and planning controls support the Building Sustainability Index (BASIX) as implemented under the Environmental Planning and Assessment Act. This program aims to deliver equitable and effective water reductions across the state and applies to all residential dwelling development applications. This program also supports the Water Efficiency Labelling and Standards (WELS) scheme. Under this scheme all water using devices are rated according to AS/NZ 6400:2016, and this rating contributes to the BASIX water target savings requirements.

2.2.2.1 Singleton Council

Council's water saving strategies are summarised below and detailed on Council's website at:

<https://www.singleton.nsw.gov.au/588/Water-Saving-Strategies>

- Blue House:
 - Interactive animation including questions and tips on saving water in various locations around the house
- Saving Water in the House:
 - Bathroom
 - Kitchen and cooking
 - Laundry
 - Leaks
- Saving Water in the Garden and Yard:
 - Watering the garden and outdoors
 - Mulching and compost
 - Washing cars and other vehicles
 - Pools and spas
- Fact sheets and additional information
- Council's short-term works consist of implementing a water loss management plan 2021 – 2025 to address non-revenue water issues

2.2.2.2 Muswellbrook Shire Council

Council has the following demand management initiatives in place:

- Separate metering of existing multi-unit developments is encouraged – each unit is levied individual access charges
- Separate metering of new multi-unit developments
- Rainwater tanks are encouraged – required on new subdivisions. A rainwater tank rebate applies
- Water restrictions imposed when necessary
- Media and web site notices
- Public education program
- Implementation of Building Code program (including BASIX)
- Customer billing 3 times a year
- Full pay-for-use pricing

Council has completed a Demand Management Strategy (adopted in 2011) which assessed the feasibility of a range of initiatives, including:

- Water use efficiency
- Pricing policy
- Use of rainwater tanks
- Residential greywater reuse
- Reuse of reclaimed water
- Water sensitive urban design

Council has implemented an appropriate pricing policy and is actively encouraging the use of rainwater tanks.

This Drought Plan should be read in conjunction with Muswellbrook Shire Council's Demand Management Strategy.

Council's water conservation campaigns are summarised below:

- Pamphlets available including useful tips for rethinking water including:
 - Rethink water in the garden
 - Rethink water in the home
 - Rethink water about your water meter
 - Rethink grey water
 - Rethink water in the pool
 - Rethink water to onsite sewage management system (OSSM)
 - Rethink water pollution
 - Rethink water – bottled versus tap

2.2.2.3 Upper Hunter Shire Council

Council's water saving strategies are summarised below and detailed on Council's website at:

<https://upperhunter.nsw.gov.au/Residents/Water-and-Sewage/Water/Water-Conservation>

- Blue House:
 - Interactive animation including questions and tips on saving water in various locations around the house.
- Water efficiency audit:
 - A home audit form for residents to complete a self-assessment on their water use to encourage a reduction in water use.
- Smart water advice portal:
 - Saving water in the home
 - Saving water outdoors
 - Saving water in business
 - Additional water efficiency information videos

Council has implemented a rebate strategy for residents who install a rainwater tank (≥9000 L) on their property in addition to BASIX requirements.

2.2.3 Recycled water

The UHWUA Councils have implemented or will implement recycled water schemes to support the reduction in drinking water demand.

2.2.3.1 Singleton Council

The Recycled Water Reuse Scheme from the Singleton Sewage Treatment Plant (STP) is planned, however it is not yet operational. Excess effluent is discharged to Doughboy Hollow following UV treatment.

2.2.3.2 Muswellbrook Shire Council

The Muswellbrook Recycled Water Treatment Works (RWTW) was commissioned in late 2019. RWTW effluent is chlorinated and reused at two sites, Mt Arthur Coal Mine and Muswellbrook Golf Club. The Muswellbrook Golf Club has been receiving recycled water for irrigation since 1992. The Mount Arthur Coal Mine receives approximately 80% of the treated effluent from the RWTW. The current contract between MSC and HVEC/BHP Billiton expires 30 June 2022.

2.2.3.3 Upper Hunter Shire Council

Effluent from the Scone STP is routinely delivered to sites including the Scone Racecourse, Bhima Dam, Golf Course and Bill Rose Sports complex for irrigation or discharged to Kingdon Ponds during wet weather.

2.2.4 UHWUA System operating rules and agreements

Efficient operation of the Councils' water supply systems is an important preventative strategy for managing droughts. Due to the difficulty in predicting future drought conditions, it is important that the Councils manage their water supply storages, either surface or groundwater, to ensure they are not drawn down excessively during non-drought periods. Water extraction allowances are determined by Water NSW and have been developed as part of the NSW Water Sharing Plans.

The Hunter River is regulated by two major headwater storages, Glenbawn Dam on the Upper Hunter River and Glennies Creek Dam on Glennies Creek, as well as a number of minor dams. The volume and pattern of flows in the Hunter River system have been significantly altered by the construction and operation of these storages, which are operated by Water NSW to supply water for irrigation, town water, stock and domestic supplies, and industries.

The *Water Sharing Plan for the Hunter Regulated River Water Source Background Document* details the 2016 Plan Rules for the Hunter Regulated River consisting of the following:

- High Security Access Licences (21,740 ML/year) from the 2016 plan, consists of the following zones as shown in Figure 2.1:
 - Zone 1A: 5,182 ML/year
 - Zone 1B: 5,218 ML/year
 - Zone 2A: 2,809 ML/year
 - Zone 2B: 6,971 ML/year
 - Zone 3A: 1,650 ML/year

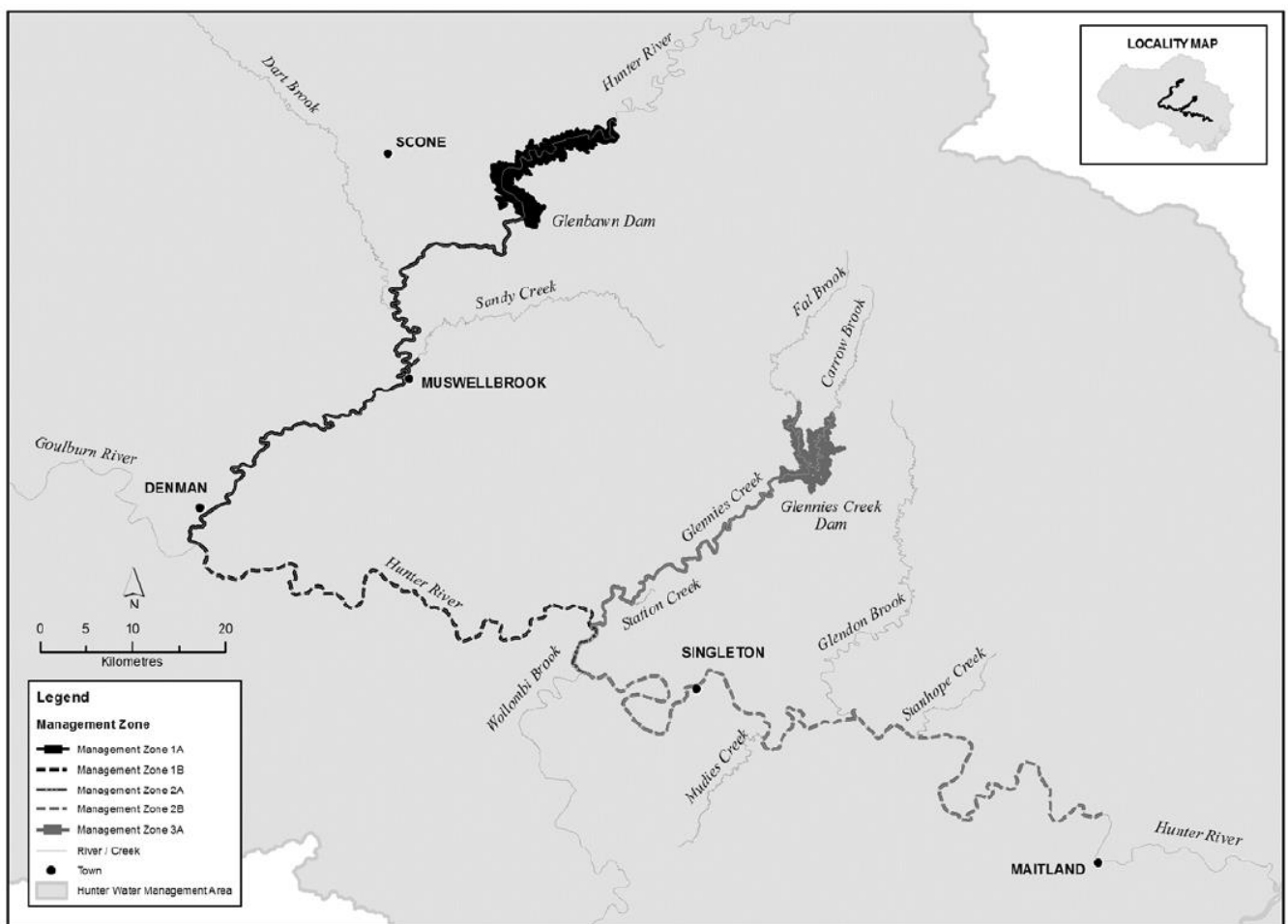


Figure 2.1 Hunter Regulated River (source, <https://legislation.nsw.gov.au>)

- Available Water Determinations (AWD):
 - Local Water Utility:
 - An AWD of 100% of the share component is made unless there is insufficient water, in which case a percentage is given. Further AWDs may be made to a total of 100% share in the year.
- Priority for extraction:
 1. Domestic and stock
 2. Local water utility (e.g. Councils)
 3. Major utility (Barnard River Scheme)
 4. Major utility
 5. High security access
 6. General security

2.2.4.1 Singleton Council

Singleton Council has two potable water supply schemes; Singleton water supply scheme and Jerrys Plains water supply scheme. The town of Branxton is supplied by Hunter Water. Singleton Council also has a number of non-potable water supply schemes.

Council has agreements with the following stakeholders:

- The Hunter – Central Rivers Water Sharing Plan – water supply entitlements and allocations
- Australian Gas Networks Limited (AGL) Macquarie Agreement – supplies Jerrys Plains
- Singleton Army Camp Agreement
- Mount Thorley Joint Venture Agreement (JVA)
- Abattoir – contract to supply water
- Deed of the agreement of the UHWUA – provides a unified approach to the sustainable delivery of water supply and sewerage services
- Hunter Water – scope of service area

The Singleton water supply scheme supplies the areas of Singleton, Mount Thorley and Broke with potable water. The Scheme is supplied from Glennies Creek Dam (Lake St Clair).

The Jerrys Plains scheme is subject to an agreement between Council and AGL Macquarie. AGL Macquarie draws raw water from the Hunter River and stores it in Plashett Dam prior to treatment. AGL Macquarie supplies treated water to the delivery point, where Council takes ownership and is responsible for distribution of water to its customers in Jerrys Plains.

The key obligations of AGL Macquarie and Singleton Council under the agreement, are provided below:

- AGL Macquarie's Obligations – Supply of Water:
 - AGL Macquarie will use its best endeavours to supply water in accordance with the agreement at no more than the Flow Rate of 4.5 L/s to the Delivery Point during the Term.
 - AGL Macquarie is not required to supply water to the Delivery Point at any specific pressure, rate or speed or time but will use its best endeavours to make water available at the Flow Rate at the same times as water is available for the use in the Bayswater Power Station.
 - Unless otherwise agreed by the parties, AGL Macquarie is required to use its best endeavours to supply no more than 32 ML of water to the Delivery Point in any 12-month period.

- Singleton Council's obligations – treated water allocation:
 - Council must, during the term, hold a high security treated water supply allocation of Hunter River water of at least 32 ML/annum.
 - For the purposes of obtaining and maintaining all necessary Approvals, Council must ensure the extraction point for water is nominated as AGL Macquarie's water pumping station on the Hunter River near Jerrys Plains.
 - On termination or expiry of the Agreement, Council must immediately do all things reasonably necessary to change the location for extraction of water to a location other than AGL Macquarie's water pumping station.

The operation of the AGL Macquarie owned Jerrys Plains Water Treatment Plant (WTP) will cease once AGL Macquarie stops operating the Liddell (past 2022) and Bayswater (past 2033) power stations. The options to maintain the supply to Jerrys Plains are to extract and treat river water, extract, and treat groundwater, or connect Jerrys Plains to the Singleton water supply at Apex reservoir.

Singleton Council's non-potable water supply schemes include:

- Glennies Creek non-potable water supply scheme – an irrigation and stock supply for property owners between Glennies Creek Dam and Council's Obanvale Water Treatment Plant. Customers of the Glennies Creek non-potable water supply scheme are covered by Council's Customer Service Plan with the exception that the water supplied will not meet the drinking water quality service standard.
- Mount Thorley non-potable water supply scheme – Council manages the bulk water supply of untreated water to three mines (Bulga Coal Mine, Mount Thorley Operations and Warkworth Mine) and Gromor Enterprises (mushroom composters). Council has entered into a Joint Venture Agreement (JVA) with Warkworth Mining Ltd, Bulga Coal management Mount Thorley Operations Pty Ltd, and Gromor Enterprises Pty Ltd for project management of the Mount Thorley Raw Water Supply Scheme. Customers of the Mount Thorley scheme are covered by Council's Customer Service Plan.
- Broke Fordwich Private Irrigation District pipeline – community funded and constructed irrigation water supply system serving members in the Broke Fordwich, Bulga and Milbrodale areas.

2.2.4.2 Muswellbrook Shire Council

The Muswellbrook Shire Council (MSC) water supply system currently provides potable water to Muswellbrook, Denman, and Sandy Hollow. Muswellbrook is supplied from regulated Hunter River downstream of Glenbawn Dam (750 GL). Denman also sources water from the Hunter River. Sandy Hollow is supplied from 2 borefields close to the unregulated Goulburn River. Muswellbrook Shire Council has plans to connect a pipeline from Denman to Hollydeen Abattoir and Sandy Hollow to improve security of supply.

2.2.4.3 Upper Hunter Shire Council

The Upper Hunter Shire Council (UHSC) water supply system currently provides drinking water to Aberdeen, Scone, Merriwa, Murrurundi and Cassilis. The water supply schemes for Aberdeen, Scone and Cassilis are provided with chlorinated unfiltered water. Murrurundi is supplied with either water from Murrurundi Dam through a membrane filtration plant or chlorinated unfiltered water from the Scone to Murrurundi Pipeline. Merriwa has a sand filtration water treatment plant (WTP).

Additional details of the water supply system are provided in Section 6.3.1.

2.2.5 Water supply emergencies

An emergency is any unplanned event that can cause deaths or significant injuries to employees, customers or the public; or that can shut down your business, disrupt operations, cause physical or environmental damage or threaten your financial standing or public image.

Water supply emergency events for the UHWUA Councils to consider include the following:

- Contamination of supply
- High raw water turbidity

- Blue-green and other harmful / cyano algae bloom alerts in raw water supply
- Algae, suspended material or other contaminants causing substantial loss of filtration capacity (where filtration ability exists)
- Fire / explosion
- Natural disaster – Flood, storm, earthquake
- Dam failure
- Hazardous materials spill or emission
- Widespread power failure affecting supply
- Major system failure – distribution mains, reservoirs, water pumping stations, water treatment plant
- Telemetry / SCADA / IT communications
- Criminal acts / security threats
- Pressure group action

A local water utility may need to increase the maximum volume of water it is permitted to take from the water source, or obtain water from a different water source, in situations where the amount of water available at the location of the nominated water supply has decreased, for reasons such as drier and hotter conditions, drought, or compromised water quality as a result of high turbidity, blue-green algae and other harmful algae blooms. This additional extraction must be authorised by a water access licence. Local water utilities may potentially access additional water by seeking to increase the extraction amount authorised by their existing water access licence, or by obtaining an additional water access licence, such as a high security water licence.

Council can apply for a new water access licence with the category 'local water utility' or sub-category 'town water supply' under s 61(1)(a) of the Water Management Act which states that:

A person may apply to the Minister for an access licence if:

- (a) *the application is for a specific purpose access licence in circumstances where:*
 - (i) *the regulations provide, or a relevant management plan provides, that an application for the licence may be made, and*
 - (ii) *the application does not contravene any restriction on the making of such an application contained in a relevant management plan.*

2.2.5.1 Singleton Council

The Rose Point Park bore and associated groundwater access license can be developed to supplement the water supply during drought. If this option is pursued, further investigations into the quality of the bore water will be required. The water could be blended with the water from the Singleton water supply scheme by connecting this water supply to Gowrie reservoir.

Emergency improvement actions from the IWCM include:

- Develop a drinking water quality specific incident and emergency response plan, including staff de-brief and learning and improving from the experience.
- Formalise a communication protocol with Water NSW.

2.2.5.2 Muswellbrook Shire Council

Emergency improvement actions from the IWCM include:

- Developing a documented strategy for public and media communication.
- Preparing communications protocols, nominate the staff members responsible in certain incidents, and communication methods and mobile phone numbers to contact them.
- Developing incident and emergency response protocols in consultation with NSW Health, Water NSW and water supply Stakeholders.
- Documenting a process for investigating incidents, evaluating emergency response plans in that incident and implementing improvements if necessary.

Groundwater as a water supply source for Muswellbrook during drought is not considered a feasible alternative to make-up any shortfall.

Council also has a groundwater entitlement of 830 ML/year with a bore at Denman. However, the water quality from the bore is very poor with high salinity and high hardness, and hence this source has not been considered as an option for emergency water supply. The sustainability and resilience of the bore yield is also unknown. Further investigation is required to determine the potential to use the bore water during periods of drought or high turbidity water events in the Hunter River.

2.2.5.3 Upper Hunter Shire Council

Emergency improvement actions include:

- Developing a drinking water quality specific incident and emergency response plan, including staff de-brief and learning and improving from the experience.
- Formalising a communication protocol with Water NSW.
- Developing a documented strategy for public and media communication.
- Preparing communications protocols, nominating the staff members responsible in certain incidents, and communication methods.

Based on recent discussions between Council and NSW Health, deepening of the Scone No. 1 and 3 groundwater bores is not an option. The Scone groundwater bores do not have adequate chlorine contact time for disinfection and UHSC is only permitted to use the bores with special permission granted from NSW Health. Council has also investigated a proposed site for a future bore for Merriwa to address the issue that extraction capacity is significantly below the peak day demand.

Further groundwater investigations are being carried out as part of IWCM process.

2.2.6 Funding strategy

The costs associated with managing the water supply during a drought and emergencies can have a significant impact on the Councils' finances, due to some of the following factors:

- Reduced revenue due to reductions in water consumption, especially during the later stages of water restrictions.
- Additional costs to the Councils to manage community awareness campaigns, increased monitoring, increased liaison with government agencies and policing of the restrictions.
- Increased expenditure associated with investigations and emergency works related with managing the demand and reduced water availability.

To assist in the administration of the costs associated with drought and emergencies, the Councils will need to ensure that sufficient funds are set aside to manage the drought and emergency management activities. All costs will also need to be tracked and available to be reported to Council and other stakeholders as required. This will also be required if any of the Councils are looking to apply for drought emergency funding or to justify the implementation of capital works programs for future drought security.

2.2.7 Improved monitoring

Implementation of online water depth monitoring in each of the groundwater aquifers extracted from by each relevant Council could be considered. Dams managed by Water NSW that supply the towns are monitored adequately.

2.2.9 Water security studies

2.2.9.1 Singleton Council

In the event of a repeat of critical drought, e.g. if the allocations were to be reduced by 25 percent, the unrestricted annual demand at Singleton past 2032, would not be met.

The Greater Hunter Regional Water Strategy (GHRWS) outlines policy infrastructure options to improve water security within the Greater Hunter. The infrastructure options identified for further investigation are construction of a two-way pipeline between Lostock Dam and Glennies Creek Dam and construction of a potable pipeline from the Hunter Water Corporation (HWC) network to Singleton. Gateway 0 and Gateway 1 reviews of the business case for the two-way pipeline between Lostock Dam and Glennies Creek Dam have been completed. This project is progressing to a Gateway 2 review for the Final Business Case. These options will improve the drought reliability of the Hunter regulated river system.

In addition to the above, at a local level, Singleton Council can develop the Rose Point Park bore water source to supplement the Singleton water supply and provide reliability during drought.

2.2.9.2 Muswellbrook Shire Council

In the event of a repeat of critical drought, e.g. if the allocation were to be reduced by 25 percent, the unrestricted annual demand at Muswellbrook would not be met by 2030. Water security risk can be addressed through the following options:

- Construction of a pipeline to obtain water from Glenbawn Dam, with or without supplementing from the Hunter River source during peak demand periods.
- Increase the amount authorised by the existing license or apply for a new access licence under s 61(1)(a) of the Water Management Act 2000.

2.2.9.3 Upper Hunter Shire Council

Council's IWCM Issues Paper (completed in 2019) identified the potential future scheme supplying water to Scone, Aberdeen, Murrurundi and villages (with the exception of Merriwa and Cassilis) from Glenbawn Dam.

The *Aberdeen WPS, Rising Main and Scone Wells Improvement Proposal Report* completed in 2020, indicated the potential deepening of the existing Scone No. 1 and 3 groundwater bores could be considered to improve security when there are poor water quality events simultaneously in Glenbawn Dam and the Hunter River. However, based on recent discussions between Council and NSW Health, deepening of the Scone No. 1 and 3 groundwater bores is not an option. Investigations are currently in progress as part of IWCM to determine the yield potential of future bore sites outside of Scone. Council is planning to investigate a proposed site for a future bore for Merriwa to address the issue that extraction capacity is significantly below the peak day demand.

Poor water quality events have occurred several times simultaneously in Glenbawn Dam and the Hunter River, leading to boil water alerts and Scone relying on the town's reservoir storage only for supply. Council is calling tenders for Stage 1 (UV disinfection) of the Scone WTP, to provide dosing improvements, with Stage 2 proposed for the future to provide full filtration to allow Glenbawn Dam water (identified as a relatively secure supply) to be accessed more reliably to a suitable quality standard.

2.2.9.4 All Councils

The Councils continue to undertake secure yield analysis of their numerous water supply systems (via the Integrated Water Cycle Management (IWCM) process), to improve understanding of the systems, and hence improve the efficiency with which each manage these resources (noting that Water NSW manage the major dams).

3. Drought and emergency preparedness

3.1 Overview

The Councils have developed action plans to ensure they are prepared to cope with the consequences of drought and emergencies and minimise the effect on their communities. These action plans include implementation plans as well as ongoing activities to prepare each Council's staff for drought and emergency situations. The benefits of being prepared for a drought and emergencies include:

- Having a pre-determined and agreed list of actions to be taken in case of drought and emergencies
- Allow Councils to promptly obtain drought relief funding
- Have well defined protocols for restriction activation and escalation

This DERMP documents the Councils' preparedness in regard to managing drought and emergency impacts on its water supply systems. The actions described in this plan have been endorsed by the Councils, therefore the appointed staff can quickly implement the predetermined drought and emergency response actions (as outlined in Section 4) and acquire the resources necessary to manage the drought and emergencies. The following sections describe some of the ongoing actions that the Councils will undertake to ensure they are prepared for drought and emergency situations.

3.2 Exercising drought and emergency management

In order to ensure the ongoing effectiveness of this plan, Councils will develop a periodic program of exercising this drought and emergency response management plan. This will be incorporated along with other emergency training programs, to prepare staff for emergency situations. As a minimum, Councils will ensure that an exercise that incorporates drought and emergency management actions, will occur biennially.

3.3 Water supply emergencies

Water supply emergency impact prevention strategies for the UHWUA Councils to prepare/update and implement include:

- Accident/Emergency Contact Numbers
- Failure Modes, Effects and Criticality Analysis (FMECA) presented in Appendix B
- Water infrastructure risk management plans
- Dam safety plans
- Fire protection and evacuation plans
- Safety and health programs
- Environmental policies
- Security procedures
- Site induction procedures
- Employee manuals
- Incident management procedures
- O&M procedures
- Material Safety Data Sheets (MSDS)
- Pandemic response plan

3.4 Data availability

All technical information relevant to the water supply system has been provided in the Sections 6 and 7 of this Plan. This ensures that in case of an emergency, all relevant key information, and links to more detailed information, are available to facilitate a prompt response. This information will be updated as part of the ongoing review of the DERMP.

3.5 Monitoring

Continuous monitoring of the water supply schemes is undertaken by each Council, to monitor and understand the performance of the water sources and manage the supply demand (along with monitoring provided by Water NSW for both major dams for several key parameters including level). Daily treated water production data for each source is monitored and recorded. Water quality is regularly monitored at each water source, water treatment plant and throughout the distribution network as part of each Council's Drinking Water Quality Management Plan and operational requirements. The Councils undertake a combination of the following routine monitoring dependent on the water supply systems:

- Stream flows
- Total water production
- Groundwater bore level
- Water quality

Algae monitoring for the two major dams is undertaken by Water NSW, with an alert sent to the relevant Councils if unacceptable levels are recorded.

During drought, the Councils continue the routine monitoring and data analysis is used to balance the supply from the available water sources and determine the need for restrictions. Regular monitoring of dam levels, stream flows, water extraction, treated water production and monitoring of actual water consumption compared to target demands are critical during drought periods. The data obtained from this monitoring provides important feedback on the effectiveness of the various drought response levels.

The following monitoring actions will also be implemented during drought:

- Daily water production for all sources will be compared to the respective target water production of the current restriction level.
- Additional water quality sampling and testing will be carried out depending on the source of water and the identified risks.
- Algae testing to be undertaken independently by UHSC at all restriction levels (in addition to weekly algae testing/reporting conducted by Water NSW) and if amber algae alert levels are maintained for an extended period.
- MSC to implement similar process to UHSC, implementing additional independent testing if unacceptable algae levels are recorded for a prolonged period.
- SC to undertake weekly algae testing, regardless of water restriction levels.

3.6 Consultation

3.6.1 Community engagement

Engagement with the community is a critical element of an effective DERMP, as it ensures customer acceptance and encourages the behavioural changes required to reduce water demand.

This DERMP has been developed with future revisions to align with the development of IWCMS. During the development of the IWCMS, Project Reference Groups will be (were) established to inform and obtain community input to the strategies. As part of this process, Council will inform (informed) the community about the DERMP and the drought action plans in place. This will assist the community to understand the critical importance of drought and emergency management actions and the need to conserve water.

For the DERMP, community engagement consists of the following:

- Individual workshops to brief Councillors from each Council on the Draft DERMP and to receive comments to incorporate into the Final DERMP.
- Final DERMP public exhibition and community consultation.

3.6.2 Government consultation

During the development of the IWCMS, the government regulatory departments in NSW will be engaged as the key stakeholders providing direction and input to the strategies developed. The DERMP and the drought action plans will form a part of the development of these strategies.

Consultation with the government departments during the preparation of the IWCMS should be undertaken in the following way:

- Department of Planning and Environment (DPE) Water for review and approval of the IWCM and the DERMP. DPE will also be involved in decision making during restrictions.
- Local Public Health Unit for review of the DERMP and will be involved in decision making during restrictions, when alternative or emergency supplies are considered that may impact on the water quality of the drinking water.

4. Drought and emergency response strategy

4.1 Drought and emergency strategy activation plan

4.1.1 Overview

The drought and emergency response strategy will normally be activated in an event when the water supply is affected due to natural climate conditions or an emergency incident. The main scenarios that would activate a drought and emergency management response, including the introduction of supply restrictions, are water scarcity and emergency events.

4.1.2 Drought triggers

The drought restriction regime consists of 3 restriction levels.

Triggers are the situations that will activate the drought response strategy. The triggers are based on progressive reductions in water availability. The drought triggers for the region managed by UHWUA have been based on the Upper Hunter water supply system. The objective of these triggers is to ensure there is always sufficient water availability for the basic needs of the community. The regional approach for the implementation of drought restrictions provides uniformity and consistency between Councils and allows for flexibility in implementation.

The triggers for implementing drought restrictions are provided in Table 4.1. These triggers initiate demand-side actions which are expected to reduce the demand to a target daily demand.

For the storage dams, restrictions will be lifted when the dam levels reach 10% or greater than the current restriction level e.g. Level 1 restrictions will be lifted once dam levels return to 60% as shown in Table 4.1. The easing of water restrictions will not be implemented where it is likely that the revised restriction will not be sustained for more than one month before tighter restrictions need to be re-imposed.

Table 4.1 Water restriction triggers

Level	Storage trigger (to impose restrictions)	Storage trigger (to lift restrictions)
Level 1 Restrictions	50% storage availability. Additional for UHSC: Merriwa and Cassilis - 2 bore pumps operate for 20 hrs/d for more than 5 consecutive days. Target Daily Usage: <ul style="list-style-type: none">– SC – 9 ML/d *– MSC – Seasonal targets<ul style="list-style-type: none">• Winter: 4-5 ML/d• Spring: 6-7 ML/d• Summer: 9-10 ML/d• Autumn: 6-7 ML/d– UHSC – Township targets *<ul style="list-style-type: none">• Merriwa and Cassilis 765 kL/d• Murrurundi 270 kL/d• Scone and Aberdeen 4.5 ML/d	60% storage availability. Merriwa and Cassilis - 2 bore pumps operate < 20 hr/d for more than 10 consecutive days.

Level	Storage trigger (to impose restrictions)	Storage trigger (to lift restrictions)
Level 2 Restrictions	<p>40% storage availability.</p> <p>Additional for UHSC: Merriwa and Cassilis - If level 1 restrictions have failed to keep 2 bore pumps operating < 20 hr/d (for a period of at least 4 weeks).</p> <p>Target Daily Usage:</p> <ul style="list-style-type: none"> – SC – 8 ML/d ** – MSC – Seasonal targets <ul style="list-style-type: none"> • Winter: 3.5-4.5 ML/d • Spring: 5.5-6.5 ML/d • Summer: 8-9 ML/d • Autumn: 5.5-6.5 ML/d – UHSC – Township targets** <ul style="list-style-type: none"> • Merriwa and Cassilis 680 kL/d • Murrurundi 240 kL/d • Scone and Aberdeen 4.0 ML/d 	<p>50% storage availability.</p> <p>Merriwa and Cassilis - 2 bore pumps operate < 20 hr/d for more than 10 consecutive days.</p>
Level 3 Restrictions	<p>30% storage availability;</p> <p>Additional for UHSC: Merriwa and Cassilis - If level 2 restrictions have failed to keep 2 bore pumps operating < 20 hr/d (for a period of at least 4 weeks) or significant equipment breakdown or major failure of bore pumps or WTP.</p> <p>Target Daily Usage:</p> <ul style="list-style-type: none"> – SC – 7 ML/d *** – MSC – Seasonal targets <ul style="list-style-type: none"> • Winter: 3-4 ML/d • Spring: 5-6 ML/d • Summer: 7-8 ML/d • Autumn: 5-6 ML/d – UHSC – Township targets *** <ul style="list-style-type: none"> • Merriwa and Cassilis 595 kL/d • Murrurundi 210 kL/d • Scone and Aberdeen 3.5 ML/d 	<p>40% storage availability;</p> <p>Merriwa and Cassilis - 2 bore pumps operate < 20 hr/d for more than 10 consecutive days or significant equipment, bore pumps, WTP return to operation.</p>

* Target daily usage for Level 1 restrictions reduced by 10%

** Target daily usage for Level 2 restrictions reduced by 20%

*** Target daily usage for Level 3 restrictions reduced by 30%

4.2 Emergency triggers

Key water supply emergency triggers for activating Drought and Emergency Response Management Team (DERMT) are:

- Serious supply or service problem, serious infrastructure damage (whether owned by Council or others), investigation by statutory authorities, recurring incidents.
- Serious injuries, affecting the operation of a local water facility asset, depot or office, minor building fire, short-term localised health issues.
- Significant or widespread impact on supply and service operations, bomb threat / search, significant asset failure or vandalism.
- Spill / emission which requires external resources to mitigate, high volume spill impacting the environment, contamination / failure of a depot storage system.
- Disruption requiring corporate / external resources to address, limited industrial action, telemetry / SCADA / IT communications failure, significant power outage.

When emergencies occur, action must be taken to mitigate the effects on the water supply and to ensure that a reliable water supply is available to meet the health and safety needs of the community. A coordinated response to the emergency event from the UHWUA Councils will be required if assistance is requested from a member Council or if the emergency extends over shire boundaries. The Emergency response documentation for each Council to refer to includes:

- Business Continuity Plan
- Local Emergency Management Plan (EMPLAN)
- Dams Safety Plan
- Standard Operating Procedures (SOPs)
- Communication Plan

4.3 Drought management team roles and responsibilities

4.3.1 Activation and setting restriction levels

Each Council's General Manager (GM), in consultation with their Council, can proclaim this drought and emergency response management plan to be in force once the GM determines that Trigger Level 1 has been reached. The GM has the authority to change the restriction levels, on the advice of the Chair of the DERMT.

4.3.2 Drought and emergency response management team

The appointed DERMT is outlined in Table 4.2.

Table 4.2 *DERMT roles and preliminary responsibilities*

Role	SC Staff Responsible	MSC Staff Responsible	UHSC Staff Responsible	Responsibilities
Chair	Director of Planning and Infrastructure Services / Operations and Planning	Director of Planning and Infrastructure Services / Operations and Planning	Director of Planning and Infrastructure Services	<ul style="list-style-type: none"> – Coordinate the activities of the team – Communicate with each GM and Councils – Organise regular DERMT meetings – Communicate with government agencies – high level – Determine completion of the response phase and commenced recovery, in conjunction with DERMT
Incident Manager	Manager Water and Sewer	Manager Water and Sewer	Manager Water and Sewer	<ul style="list-style-type: none"> – Monitor and assess data – Provide an assessment of the situation – Brief the DERMT chair – Allocate roles to team members – Prioritise tasks and response actions – Ensure adequate resources available – Communicate with government agencies and major customers – operational level – Stand in as Chair if Chair unavailable – Monitor effectiveness of actions – Coordinate review of incident and update of the DERMP as required

Role	SC Staff Responsible	MSC Staff Responsible	UHSC Staff Responsible	Responsibilities
Communications Manager	Manager Community Partnerships	Manager Community Partnerships	Senior Communications Advisor	<ul style="list-style-type: none"> – Support the DERMT with all customer communications – Prepare communications material as appropriate – Issue media statements and interviews as appropriate – Maintain media database including social networks – Monitor and manage social networks communication – Develop and Implement DERMP Communications Strategy
Technical Administrative Support	Water and Sewer Engineer – Treatment / Water Quality Officer	Water and Sewer Engineer – Treatment / Water Quality Officer	Water and Sewer Engineer – Treatment	<ul style="list-style-type: none"> – Update all appropriate data on a daily basis once the DERMP is activated by the GM of each Council – Support the Incident Manager in the provision of technical data required to monitor and assess – Support the Incident Manager by providing the technical information required to assess the situation
Restrictions Compliance Officer	TBD by Chair	TBD by Chair	TBD by Chair	<ul style="list-style-type: none"> – Compliance and enforcement monitoring – Community advice and warnings – Issuing fines for violation of water restrictions
Administrative Support	Water and Sewer Administration Officer	Water and Sewer Administration Officer	Infrastructure Services Administration Officer	<ul style="list-style-type: none"> – Attend and maintain meeting minutes for all meetings of the DERMT – Prepare weekly progress report for distribution to DERMT members and Customer First team – Provide all general administrative support to the DERMT, first line of contact – Maintain Water Restriction approval/exemption records
Support Team	Varied	Varied	Varied	<ul style="list-style-type: none"> – Support the Incident Manager and chair as required – Would normally include the following people but would be determined by the Chair or Incident Manager as required – Team Leader Water Treatment – Water and Sewer Process Engineer

4.4 Demand-side action plan

4.4.1 Water restrictions

Water restrictions are an effective and low-cost strategy for responding to drought. Water restrictions aim to reduce water demand of Council's customers through regulating the type and duration of water-using activities. If not specifically mentioned, the restrictions of each level apply to all the higher levels. As outlined in Section 4.1.2, water restriction triggers are determined by levels in the two major storage dams. Water restrictions will generally be imposed on a UHWUA shire-wide basis to ensure equity across a unified customer base and for ease of understanding and administration of the restrictions. At Level 3, variations to this may be considered by the GM, in exceptional circumstances.

4.4.2 Demand targets

The demand targets, as listed in Table 4.3, have been provided by each Council.

Table 4.3 Demand targets during water restrictions

Level	Singleton	Muswellbrook	Upper Hunter
Permanent	- - -		
1	9 ML/d *	Winter 4-5 ML/d Spring 6-7 ML/d Summer 9-10 ML/d Autumn 6-7 ML/d	Merriwa and Cassilis 765 kL/d * Murrurundi 270 kL/d * Scone and Aberdeen 4.5 ML/d *
2	8 ML/d **	Winter 3.5-4.5 ML/d Spring 5.5-6.5 ML/d Summer 8.5-9.5 ML/d Autumn 5.5-6.5 ML/d	Merriwa and Cassilis 680 kL/d ** Murrurundi 240 kL/d ** Scone and Aberdeen 4.0 ML/d **
3	7 ML/d ***	Winter 3-4 ML/d Spring 5-6 ML/d Summer 8-9 ML/d Autumn 5-6 ML/d	Merriwa and Cassilis 595 kL/d *** Murrurundi 210 kL/d *** Scone and Aberdeen 3.5 ML/d ***

* Target daily usage for Level 1 restrictions reduced by 10%

** Target daily usage for Level 2 restrictions reduced by 20%

*** Target daily usage for Level 3 restrictions reduced by 30%

4.4.3 Demand side actions

Council will implement a number of actions and water restrictions to ensure the demand targets are met. These actions, as well as the customer water use restrictions, are summarised in Table 4.4. If not specifically mentioned, the restrictions of each level apply to all higher levels. For example, washing down walls or paved surfaces of any kind is prohibited for Level 1, so they are also prohibited for all higher levels.

Failure to achieve the target demand at a particular restriction level within three weeks, may require adoption of the next more stringent level, even if a trigger level is not reached. The decision to introduce more stringent levels will be made by the DERMT using the information available at that time.

Severe water restrictions will only occur in very rare circumstances, due to the potentially high costs this can impose on residential amenities and commercial businesses.

During these restrictions, all outdoor watering will be banned, and this will have a major impact on lawns and gardens. Commercial businesses may also be impacted as some activities have higher level restrictions imposed.

In the event that emergency water restrictions do not sufficiently reduce demands, water rationing will be considered by the Councils, to limit usage to only essential uses. For residential properties, a minimum essential supply requirement of 120 L/p/day or less may be achievable. Commercial businesses and industries may be required to reduce water consumption to minimal essential use.

Table 4.4 Residential water restriction demand side actions

Trigger Level	Level	Demand Side Activity
50% storage availability; Merriwa and Cassilis - 2 bore pumps operate > 20 hrs/d.	Level 1 Restrictions	No washing down walls or paved surfaces Washing cars with bucket and rinse with trigger hose on lawn only Topping up private and public swimming pools/spas only permitted between 0500-0700 and 1600-1800 hrs First fill of private and public swimming pools/spas only with council permission Large water (>10ML/year) users must prepare a WEMP
40% storage availability; Merriwa and Cassilis - If level 1 restrictions have failed to keep 2 bore pumps operating < 20 hr/d (for a period of at least 4 weeks).	Level 2 Restrictions	Watering of lawns not permitted for residential, and non-residential Large water users must implement their WEMP All non-residential business (>5ML/year) must prepare WEMP Hosing of vehicles, boats or building not permitted
30% storage availability; Merriwa and Cassilis - If level 2 restrictions have failed to keep 2 bore pumps operating < 20 hr/d (for a period of at least 4 weeks) or significant equipment breakdown or major failure of bore pumps or WTP.	Level 3 Restrictions	No filling of private swimming pools or spas or garden water features, including first fill No washing of vehicles, boats or buildings permitted Inflatable or temporary children's pools not permitted Public car and truck wash facilities not permitted All non-residential business's (>5ML/year) must implement their WEMP

A template Water Efficiency Management Plan (WEMP) is provided in Appendix C.

4.5 Supply-side action plan

When drought occurs, actions must be taken to mitigate the effects of water shortage and to ensure that a reliable water supply is available to meet the health and safety needs of the community. These actions aim to support the restrictions as well as prepare for worsening situations.

4.5.1 Staged action-plan

Drought management supply-side actions should be implemented by the Councils while the community takes action to reduce water demand, during water restrictions. The supply-side actions are proposed to be implemented within a timeframe so that water supply is sufficient to sustain the estimated water demand at the particular water restriction level. Table 4.5 provides a list of the actions that the Councils can consider, to sustain the estimated water demand.

Table 4.5 Supply-side action plan

Level	Supply side activity
Water Conservation Measures	<ul style="list-style-type: none"> Continued implementation of drought preparedness activities, short- and long- term projects and education (Blue House) Review DERMP and ensure it is up to date Exercise DERMP and update as required Prepare Community Awareness Campaign

Level	Supply side activity
Level 1 Restrictions	<ul style="list-style-type: none"> – Preparatory measures that activate the DERMP and its components – Establish the DERMT – Commence regular (2 monthly) liaison with regulators – Commence community awareness and education campaign – Increase monitoring of stream flows (ML/d), dam levels, aquifer levels, etc. daily
Level 2 Restrictions	<ul style="list-style-type: none"> – Increase liaison with key government stakeholders – Step-up community awareness and education campaign with regular reminders – Commence policing of water restrictions and issuing warnings and fines for violations – Applications to DPE Water regarding water carting funding assistance, as required – Water carting from sustainable supply to smaller water supply areas, if required – Implement procedures for effluent recycled water carting for all non-essential potable water uses (e.g., dust suppression, road construction) if possible
Level 3 Restrictions	<ul style="list-style-type: none"> – Focus on policing of water restrictions and issuing warnings and fines for violations of water restrictions – Regular (monthly) liaison with Regulators – Step-up community awareness and education campaign with weekly reminders – Commence discussion about water reductions in consumption with large commercial users – Discuss options for exemption from Water Sharing Plans with DPE Water and the Natural Resources Access Regulator (NRAR) if dams are offline due to water quality
Emergency Water Conservation Measures	<ul style="list-style-type: none"> – All out communications program to reduce all usage to absolute minimum levels, including residents reducing shower time, washing and evaporative cooling – Increased focus on discussions with and policing of water restrictions for commercial businesses and continue regular (weekly) meetings with these users – Further rationing of potable water for stock watering and continue regular (weekly) meetings with these users – Regular (weekly) liaison with Regulators – Implement emergency response / supply options in liaison with DPE Water – Closure of non-essential and high-water dependent services – Water carting from sustainable supply to smaller water supply areas, if required

4.5.2 Water carting

Water carting may be necessary to provide basic town water needs during an emergency. It is anticipated that such arrangements will only be for a short period and water rationing will also be implemented in line with restrictions.

Singleton Council has water carters that access their supply (under Water Carters Policy POL/10066.1). A register of water carters is maintained by the Trade Waste Officer and the Environmental Health Officer. Databases for water carters servicing the Muswellbrook and Upper Hunter Shire Councils are maintained by the individual Councils.

UHSC has developed an online application procedure for water carting. It is recommended that Singleton and Muswellbrook Shire Councils also implement an online application procedure.

During drought, it is likely that these water carters will be heavily utilised for topping up of rainwater tanks for residential domestic use and they may not all be available for use. The Councils have a number of towns with existing reticulated supplies that have a normal population of less than 1000 people, with a demand that could possibly be sustained through water carting. These are listed below.

- Singleton Council:
 - Jerrys Plains
- Muswellbrook Shire Council:
 - Sandy Hollow

- Upper Hunter Shire Council:
 - Murrurundi
 - Parkville, Wingen and Blandford (if connected in the future)
 - Cassilis

DPE Water have historically provided assistance toward the costs for water cartage (i.e. Murrurundi). DPE Water can provide assistance with the initial assessment of options for water carting and an application will need to be made by Council to DPE Water to receive funding. This should be included as an agenda item in regular meetings with the regulators to ensure Council is prepared for obtaining financial assistance, prior to undertaking any carting.

4.6 Monitoring during drought

All monitoring during a drought will be carried out as per the monitoring listed in Section 3.5.

4.7 Communications

A Communications action plan should be developed to provide guidance to the DERMT on what communications are to be undertaken prior to and during water restrictions and emergency events.

One of the most important aspects of emergency response is communications, which are required with a wide variety of internal and external parties. The handling of this aspect can have a major bearing on the effectiveness of the response, and perceptions about the UHWUA Councils, and so needs to be tightly controlled.

The key principles of communication during an emergency response include:

- Check adequacy of facilities and resources
- Gather, assess and check facts
- Inform key stakeholders at an early stage
- Develop communications strategy and key messages

The emergency response and communications are to be undertaken with consideration of the individual Council Business Continuity Plans (if available).

4.7.1 Community

A comprehensive Drought and Emergency Management Communications Strategy (DEMCS) should be developed by the Councils. The purpose of this communications strategy is to:

- Communicate the restriction levels, expected water use behaviours at each restriction level, any enforcement measures and relevant emergency information.
- Provide general information on how to use water wisely and implement everyday water conservation measures.
- Provide general information to the community on what each Council is doing to conserve water and specific actions during drought and emergency situation.

The communications strategy would also provide the details to be communicated at each level of water restrictions, such as:

- The channels of communication to be utilised, such as website, media releases etc.
- The target audience.
- The specific messages and issues to be communicated.

The specific messages that would be developed within the DEMCS are listed below:

- Restriction levels and what they mean, for residential or commercial business users.
- Background and the need for conservation or restrictions.
- What is each Council doing to manage the water supply?

- What requires exemptions and how to obtain an exemption.
- How to obtain further information, such as Customer First Contact or FAQ on website.

The Councils would maintain all contact details, including contact lists, for all community communications requirements.

The Water and Sewer Section of each Council will ensure that town centre entrance signs advertise the correct level of restrictions.

4.7.2 Council

Each Council will undertake the following communication activities, within each Council, to ensure that staff and Council are aware of the requirements during water restrictions and emergencies and to ensure each Council is demonstrating compliance to the public:

- Communications through internal media such as intranet, staff newsletters and email.
- Detailed and regular briefings to the Customer Service Centre and the provision of information prompts for managing Customer enquiries.
- Liaison with Infrastructure Delivery Section to ensure awareness of restrictions and emergencies and their particular application (e.g. irrigation of sporting fields, water for road construction etc.).
- Priority 1 attendance upon customer reported water leaks.
- Enforcement of restrictions in response to customer complaints.
- Water carting from mains flushing, once into higher restrictions categories if operationally possible.

4.7.3 Regulators

Advanced notifications are provided to the following relevant agencies in respect of impeding and implementing restrictions:

- DPE Water – regarding progress through restrictions, emergency supply options, technical advice and attendance through teleconference to regular meetings throughout the implementation of restrictions.
- NSW Health, Local Public Health Unit – regarding health impacts upon residential and commercial business customers, water quality, restriction levels and monitoring of water quality for emergency supply options.
- Water NSW – regarding water access licences and regulations.

Contact details are maintained as part of Council's Drinking Water Quality Management Plan contact list for all stakeholders, including the regulators.

4.7.4 Large water users

Larger water users will be contacted and, in some cases, engaged through regular meetings, during water restrictions. These are listed below:

- Approved drinking water carters – will be contacted on an individual basis, upon the implementation of water restrictions, and as restrictions levels increase. This will ensure they understand the appropriate use of drinking water during restrictions.
- Large commercial consumers – will be engaged initially on an individual basis upon implementation as per the restrictions table, to discuss opportunities to reduce water consumption and further engagement will occur upon implementing increasing levels of restrictions.
- Agricultural users – will be engaged through a working group upon implementation of Level 3 restrictions, to discuss opportunities to reduce water consumption and further engagement will occur upon implementing increasing levels of restrictions and the potential to impose water rationing at emergency levels.

The SC top ten large water users are shown in Table 4.6 below.

Table 4.6 SC top ten large water users

Rank	Major customer	Water usage (ML/yr)
1	Defence Force	3,909
2	Shellden Abattoir	292
3	Mercy Nursing Home	62
4	Greenhouse / Nursery	19
5	Saxonvale Coal Mine	18
6	Alroy Oval / Singleton Heights Preschool	15
7	Singleton Square Shopping	14
8	Singleton Gym and Swim	13
9	Thrifty Car Wash	10
10	Bloomfield Coal Mine	10

The UHSC top ten large water users are shown in Table 4.7 below.

Table 4.7 UHSC top ten large water users

Rank	Major customer	Water usage (ML/yr)
1	JBS Australia Pty Limited	379
2	Scone Saleyards	39
3	Aberdeen Golf Club	29
4	Scone High School	14
5	Scone Park Sports Field	9
6	Elizabeth Park Scone	8
7	Merriwa Oval	8
8	Hammond Care Scone	7
9	Merriwa Pool	7
10	Scone Pool	7

Contact details are maintained as part of Council's Drinking Water Quality Management Plan contact list for all stakeholders.

4.8 Enforcement

The *Local Government Act 1993* and *Local Government Regulations 2005* confer on Councils the authority to prevent waste or misuse of water generally and specifically to prevent water use "contrary to a Council notice restricting the use of water" (Section 637 of the Act and Sections 159-160 of the Regulation). A water authority has a number of legal avenues available for the misuse of water, including formal warnings, fines, installation of flow restriction devices and cut off of supply (Clause 144 of the *Local Government (General) Regulation 2005*). It is recommended that the UHWUA Councils develop an agreed methodology for consistent enforcement of restrictions and tools to be used across the region.

To ensure compliance of daily usage targets implemented by the UHWUA, it is recommended that Councils improve the level of communication to all users. Possible communication strategies include:

- Increased advertising, with an emphasis on what the daily usage targets in the region are to establish greater awareness.
- Additional online resources that highlight regional usage compared to set daily targets.
- Greater correspondence with major water users (top 20) to ensure compliance of daily targets.

Singleton Council adopted a Water Restriction Enforcement Policy in 2021.

5. Drought and emergency recovery strategy

The drought recovery process will be implemented only when Level 3 or emergency measures have been lifted by the Councils. The process will commence when the General Manager's agree, in consultation with Council, to remove all water restrictions and hence have revoked drought conditions. A Drought Recovery Coordinator (DRC) may be appointed by the DERMT to oversee the recovery process and in this instance, the DERMT will cease to operate. The DERMT members will however assist the DRC, as required.

The DERMT / DRC recovery responsibilities are recommended to include:

- Preparing a response report, including recommended actions, to be submitted to the GM and Council for endorsement, within 8 weeks of the drought conditions being revoked.
- Assessing the remaining drought impacts and determining the appropriate personnel to coordinate the recovery activities.
- Implement a drought recovery and emergency survey, detailed below, following a drought that implemented water restrictions at Level 3 or emergency measures.
- Develop rehabilitation/recovery programs based on the drought recovery strategy, including determining areas appropriate for government financial assistance.
- Review of the DERMP.

5.1 Drought and emergency recovery survey

The drought recovery survey is recommended following the implementation of water restrictions at Level 3 or emergency measures. This survey will be developed to evaluate the physical, emotional, social, and economic impact of the drought and determine the recovery process required to restore the community to normal operations. The survey will assess the following criteria in order to determine the recovery actions required:

- **Ownership:** Determine the ownership of private and public assets and the source of assistance that may be available.
- **Severity of impact:** Develop a scale that measures the severity of social, economic, and financial impact of the drought or emergency.
- **Time to recover:** Determine a timeframe required to recover from the drought or emergency impact.
- **Cost of Impact:** Determine the financial loss due to the drought or emergency impact.
- **Resources required:** Determine all resources required to complete the recovery process.

With the outcomes of the survey, Councils will be able to identify appropriate resources to address the recovery needs to restore the community to normal social and economic activities.

Councils will not compensate private customers for costs for financial losses caused by the drought.

Emergency recovery documentation includes:

- UHSC Detailed Investigation Report – Accident Major Incident
- UHSC Information Technology (IT) Disaster Recovery Plan

6. Water supply schemes

6.1 Location

The UHWUA includes the Singleton, Muswellbrook Shire, and Upper Hunter Shire Council areas. The region being managed by the UHWUA covers approximately 16,400 square kilometres and has a population of 53,185 people (2016 census). All Council areas are located in the Hunter Valley and the area of interest spans from Singleton in the southeast to Murrurundi in the north-west (approximately 115 km between these towns).

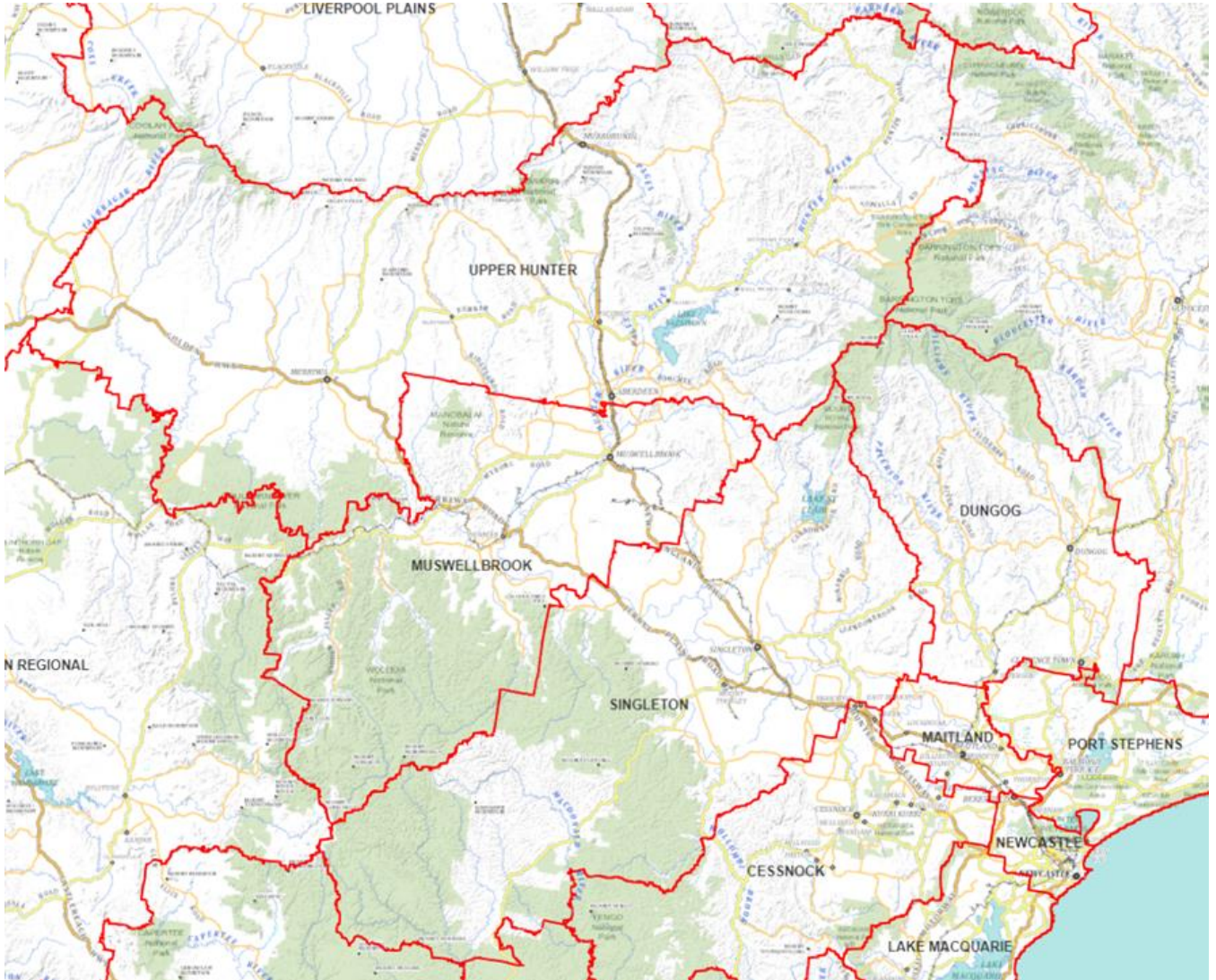


Figure 6.1 Singleton, Muswellbrook Shire, and Upper Hunter Shire LGAs

Singleton Council supplies water to the Singleton township and surrounding areas.

Muswellbrook Shire Council supplies water to the towns of Muswellbrook, Denman, and Sandy Hollow.

Upper Hunter Shire Council supplies water to Aberdeen, Merriwa, Murrurundi, Scone and Cassilis.

6.2 Existing water supply schemes

Singleton Council's water supply is sourced from Glennies Creek Dam and includes a series of eight reservoirs and five water pumping stations across the network. Water runs under gravity from the Glennies Creek Dam offtake to the Obanvale Water Treatment Plant, where it is treated and pumped to the various storage reservoirs in the region.

Muswellbrook Shire Council owns/operates three water treatment plants that supply treated water to the towns in the region. The towns of Muswellbrook and Denman both source water from the Hunter River downstream of Glenbawn Dam. Two borefields close to the unregulated Goulburn River are utilised to supply water to Sandy Hollow. The Muswellbrook water supply network includes six storage reservoirs, with Denman and Sandy Hollow both having one storage reservoir each.

Upper Hunter Shire Council has a variety of water supply schemes given the distance between towns within the Council region. The water supply schemes are summarised below:

- **Aberdeen:** Water is sourced from either the Scone to Aberdeen pipeline fed from the three reservoirs in Scone or via the infiltration gallery on the Hunter River at Aberdeen. One supplementary bore is always used when Hunter River supplies Aberdeen. Chlorination is used for treatment prior to distribution. Three low level reservoirs and one high level reservoir are used for storage.
- **Merriwa:** Three bores are used for supply, with three storage reservoirs available. Water is passed through the Merriwa Water Treatment Plant prior to distribution to customers.
- **Murrurundi:** Water is supplied primarily from the Scone to Murrurundi pipeline (which includes three water pumping stations), as well as three river inlets on the Pages River which is stored in Murrurundi Dam. A membrane WTP with dosing lagoon is used for treatment prior to distribution. Note the dosing lagoon and WTP is not used when the Scone to Murrurundi pipeline is in use. One reservoir is used for storage.
- **Scone:** Water is supplied from either Glenbawn Dam or by the infiltration gallery on the Hunter River at Aberdeen. Four low level reservoirs and one high level reservoir are used for storage. Chlorination is used for treatment prior to distribution.
- **Cassilis:** Water is supplied from two bores, with four storage reservoirs available. Chlorination is used for treatment prior to distribution.

6.3 Water sources

6.3.1 UHWUA water sources

The Hunter Regulated River Water Source is treated as a surface water source in the Water Sharing Plan. The Hunter River is divided into five management zones as follows:

- **Zone 1A:** Hunter River from Glenbawn Dam to Goulburn River Junction.
- **Zone 1B:** Hunter River from Goulburn River Junction to Glennies Creek Junction.
- **Zone 2A:** Hunter Rive from Glennies Creek Junction to Wollombi Brook Junction.
- **Zone 2B:** Hunter River from Wollombi Brook Junction to downstream extent of the Hunter Regulated River.
- **Zone 3A:** Glennies Creek.

Singleton Council

Raw water for the Singleton Council area is sourced from Glennies Creek Dam. Singleton town supply consists of a gravity system from the Glennies Creek Dam offtake. There is a pumping station available at the site however it is only required if dam storage level drops below 25% of capacity. Glennies Creek Dam has a storage capacity of 283,000 ML, with a major use of regulating flows for the Hunter River downstream. An additional eight reservoirs provide 25 ML of storage for the Singleton region. In a significant drought event, Singleton Council has the opportunity to develop the Rose Point Park bore water source as a supplementary option to the existing Singleton water supply to improve supply reliability.

Raw water delivery for Singleton is at a maximum 500 L/s (under high storage conditions). The Obanvale Treatment Plant can process up to 30 ML/day. Treatment is undertaken via a filtration process in which alum and other filter aids are added to the water to cause flocculation of suspended particles. Chlorination also occurs to remove bacteria, with fluoride and lime also being added.

Muswellbrook Shire Council

Water supply to the Muswellbrook and Denman townships is sourced from the regulated Hunter River flows downstream of Glenbawn Dam. Glenbawn Dam has a capacity of 750,000 ML with an additional 120,000 of flood storage available. There are six reservoirs across the town of Muswellbrook providing an additional storage capacity of 23 ML. The Denman supply scheme includes one storage reservoir with a capacity of 5 ML. The township of Sandy Hollow sources raw water from two bore fields in close proximity to the unregulated Goulburn River. There is one storage reservoir in this region with a capacity of 0.2 ML.

Muswellbrook supply is treated in a water softening and filtration plant, with Denman water supply undergoing initial sand filtration followed by treatment in a membrane filtration Water Treatment Plant. Supply for the township of Sandy Hollow is treated by ozone-oxidisation with macrolite and carbon filtration.

Upper Hunter Shire Council

Aberdeen sources water from the Scone to Aberdeen pipeline fed from the three reservoirs in Scone. An alternative source is via the infiltration gallery on the Hunter River at Aberdeen. One supplementary bore is always used when the Hunter River supplies Aberdeen. Aberdeen has 3 low level and one high level reservoir with a total capacity of 4.85 ML.

Scone raw water can be sourced from the Glenbawn Dam and pumped to the Brushy Hill Reservoir / Balance Tank where it is chlorinated and gravitates to Barton Street Reservoirs. Scone has a total of 4 low level and one high level reservoirs with a total capacity of 13.4 ML. The pipeline noted above was constructed in 2012.

Scone can also receive water from an infiltration gallery on the Hunter River at Aberdeen before being chlorinated. Scone also has back-up groundwater bores, however, the bores do not have adequate chlorine contact time for disinfection and UHSC is only permitted to use the bores with special permission granted from NSW Health. In the 2019 – 2020 drought, the bores were unusable as the aquifer dropped below the intake level.

Merriwa supply is sourced from three groundwater bores that access both artesian and sub-artesian groundwater. Merriwa has 2.7 ML of additional storage capacity from three reservoirs.

The town of Cassilis sources raw water from two groundwater bores, with four reservoirs providing an additional 0.4 ML of storage capacity for the region.

Raw water for the township of Murrurundi is sourced from either the Scone to Murrurundi pipeline (in operation since 2020) or the Pages River which is stored in Murrurundi Dam. The dam is a storage reservoir with no catchment area. Murrurundi dam has a capacity of 150 ML and there is an additional storage reservoir within the supply network providing another 1.65 ML storage capacity. There are two balance tanks along the Scone to Murrurundi Pipeline with a total capacity of 0.7 ML.

Water supplied for Aberdeen, Scone, Murrurundi (including Scone to Murrurundi pipeline) and Cassilis is treated through chlorination only. The Merriwa water supply is treated by a conventional filtration WTP and the Murrurundi water supply is treated by an ultra-filtration (UF) membrane WTP prior to distribution.

The towns of Parkville, Wingen and Blandford along the Scone to Murrurundi pipeline alignment may possibly be connected to this system in the near future.

6.3.2 Potential sources

The three Councils have engaged consultants to assess water supply opportunities throughout the region with a variety of potential water sources being identified. The Singleton groundwater access license is associated with the Rose Point Park bore and is classed as a Hunter unregulated and alluvial water source (emergency). The current entitlement is 4,090 ML/year, meaning this bore could be utilised to supplement the existing water supply network in drought conditions.

A potential pipeline transfer system between the existing Lostock Dam and Glennies Creek Dam provides another opportunity for improving water security in the Singleton region through increased storage capacity. Preliminary investigations are also being undertaken regarding connecting the Singleton supply network to the Hunter Water Supply Scheme at Branxton. This connection would reduce the draw on Glennies Creek Dam. A river offtake supply for Jerrys Plains, to replace the current supply from AGL's Bayswater plant that will be decommissioned in coming years, is currently being investigated.

For the Muswellbrook Shire region, a potential source that has been investigated is utilising Glenbawn Dam as the primary raw water source for Muswellbrook Shire. This option would involve maintaining the existing Hunter River intake for the region as a supplementary supply which can be used during emergencies. Other options for Muswellbrook include utilising Glenbawn Dam only as a supplementary supply and a combination of the Hunter River and Glenbawn Dam both as primary raw water sources.

The purchasing of additional high security entitlements may provide increased water security for Muswellbrook Shire during drought periods. However, these entitlements are not guaranteed during extreme drought periods as they are not the same priority as 'Local Water Utility' licenses. Another potential supply source for Muswellbrook is connection to Hunter Water supply through an extension of the potential potable pipeline from Singleton through to Muswellbrook. This source would require the construction of an additional 50 km of pipeline.

Groundwater provides another potential source for the Muswellbrook Shire region. A desktop study has indicated that bores within the Muswellbrook area would yield a flow rate of approximately 10 L/s. Further investigation is required to assess the quality of this water, however even if it were appropriate for potable use the yield would not meet the required shortfall. Muswellbrook Shire Council does hold groundwater entitlements of 830 ML/year from a bore in Denman. Water quality from this bore is also unknown therefore it cannot be confirmed if it would be appropriate for use during drought events.

In Upper Hunter Shire:

- Groundwater investigations at Murrurundi (undertaken during Level 6 restrictions and prior to the pipeline from Scone being completed) only yielded very low flows from test bores, less than 2 L/s. Therefore, development of a permanent back-up supply was not investigated further.
- If the Denman to Sandy Hollow Pipeline is installed, the design is understood to allow for future connection for an approximately 35 km long pipeline to Merriwa.
- Further groundwater investigations are to take place under IWCM process.

6.4 Water demand

6.4.1 Water pricing

The Councils have implemented water supply pricing structures in line with the Best-Practice Management of Water Supply and Sewerage Guidelines. Customers in all Council areas are subject to an annual access charge. The access charge applied to customers in Upper Hunter Shire Council is dependent on water meter size for all user types. Each Council utilises a two-tiered usage pricing system where residential customers are subject to a step price increase when usage exceeds the high-water consumption threshold.

The Singleton Council high-water consumption threshold is 450 kL/yr. Muswellbrook and Upper Hunter Shire Councils adopt a high-water consumption threshold of 350 kL/yr. Non-residential customers in Muswellbrook Shire are subject to a flat-rate usage charge. Upper Hunter Shire Council applies variable step allocation for water consumption periods, with 75 kL per quarter allocated for the winter/autumn seasons and 100 kL per quarter allocated for the spring and summer seasons.

Water rates are sent out quarterly and include average consumption data to provide effective consumption and pricing information to customers.

6.4.2 Water users

The non-residential sector is quite significant in the UHWUA water supply zone. Several large industrial and institutional water customers operate in the region.

The defence force base in the Singleton Council region is a major institutional user, with a daily use of approximately 10,709 kL/day. Agricultural connections are mostly used for domestic and stock watering purposes. Extended dry periods and seasonal temperature and rainfall patterns do result in peaks in demands occurring in the rural supply areas. Agricultural consumption increases during drought as potable water reliance increases where other cattle watering supplies may have dried up. As the drought worsens, water supply to local saleyards and Sheldons abattoir may also increase as property owners start to de-stock properties.

Many of the commercial businesses, such as the abattoir in Singleton and the abattoir in Scone, will need to continue to utilise potable water to ensure they continue to operate business as usual. The correctional services are a large consumer, and it may be possible to reduce consumption through reduced internal consumption, during a drought event.

A summary of projected occupied dwellings by reservoir zone and towns within the Singleton, Muswellbrook and Upper Hunter Shire Council water supply systems is provided in Table 6.1, Table 6.2 and Table 6.3 respectively.

Table 6.1 *Growth in residential connections by pressure zone in Singleton Council area*

Zone	2021	2026	2031	2036	2041	2046
Rixs Creek and CWT Reservoir Zone	97	192	269	325	411	523
Apex Reservoir Water Supply Area	140	266	392	522	605	646
Retreat Reservoir Water Supply Area	17	34	49	62	75	86
Rural, No Water Supply	5	9	14	17	21	24
Total	260	501	723	927	1,112	1,278

Table 6.2 *Growth in residential connections by town in Muswellbrook Shire Council area*

Town	2021	2026	2031	2036	2041	2046
Muswellbrook	302	85	87	89	90	92
Denman	86	11	12	12	12	12
Sandy Hollow	2	1	1	1	1	1
Total	390	97	100	101	104	106

Table 6.3 *Growth in residential connections by town in Upper Hunter Shire Council area*

Town	2021	2026	2031	2036	2041	2046
Aberdeen	22	21	19	9	9	9
Cassilis	0	0	1	0	0	0
Merriwa	24	21	19	11	12	12
Scone	60	54	46	22	37	37
Murrurundi and Villages	15	14	13	4	4	4
Total	121	110	98	46	62	62

6.4.3 Current water usage

Water usage for the Hunter River catchment area is provided in the Water Sharing Plan for the Hunter Regulated River Water Source Background Document (2017). Water usage under each license entitlement varied significantly between 2004/05 to 2015/16. The highest license usage in this period was from regulated river (general security) license holders followed by major water utility and supplementary water use. A summary of water usage by license type between 2004/05 to 2015/16 is provided in Figure 6.2.

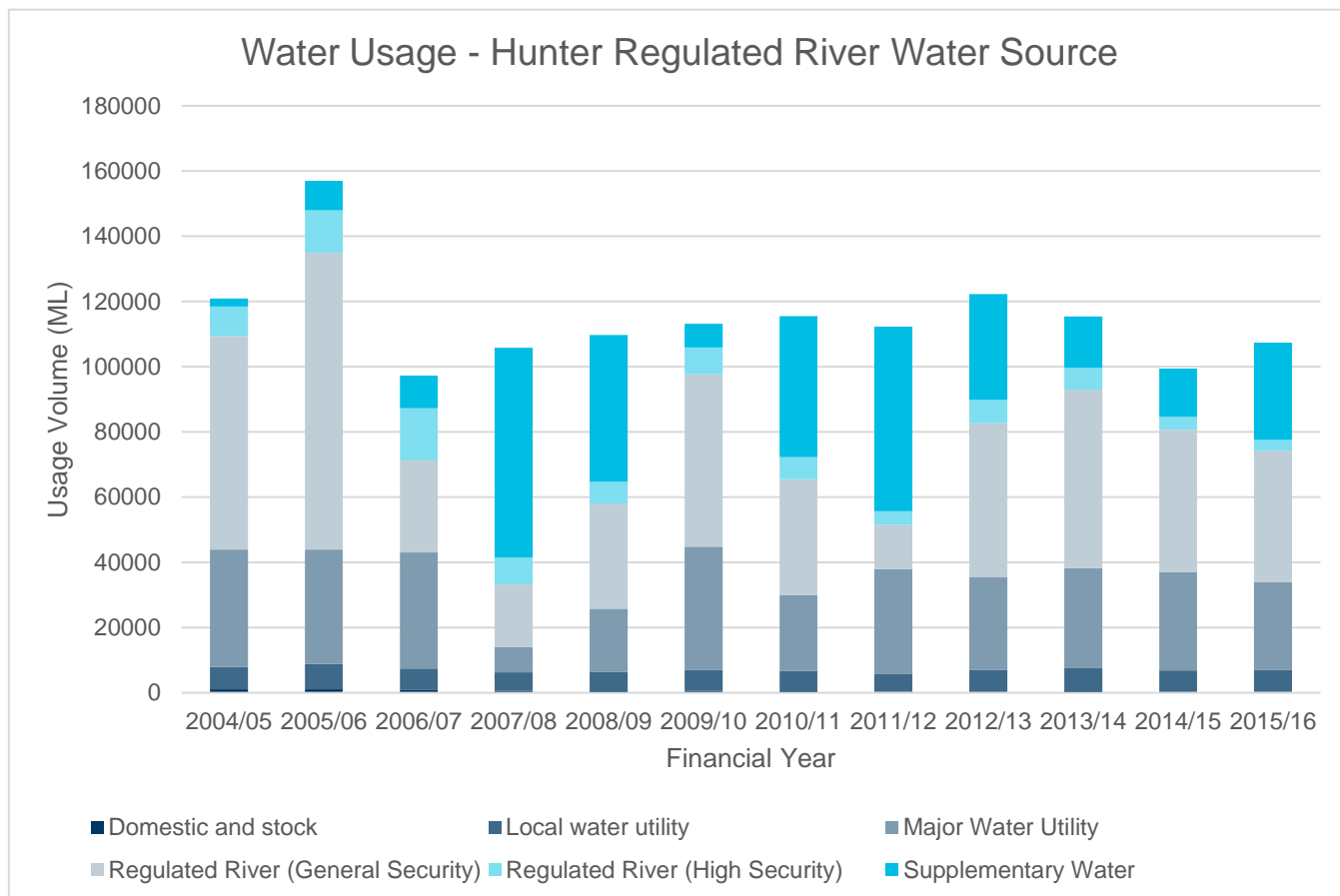


Figure 6.2 Water Usage by License Type (Water Sharing Plan for the Hunter Regulated River Water Source Background Document - 2017)

Average consumption for the Hunter Regulated River Water Source over this period was 114,675 ML/yr. Water usage has been relatively stable in the region since 2007/08.

6.4.4 Current water usage by sector

The average water usage data for each council between 2016/17 to 2020/2021 is provided in Table 6.4.

Table 6.4 Water usage per Source and Type of Use

Source	Residential	Commercial	Industrial	Rural	Institutional	Parks	UFW	Total (ML)
Singleton	1,608	607	265	-	97	-	240	2,817
Muswellbrook	1,418	335	44	-	118	76	262	2,253
Upper Hunter	1,001.2	233	423.2	8.3	293.8	125	431.4	2,405
Total (ML)	4,027	1175	732.2	8.3	293.8	201	933.4	7,475

Based on available data for the Upper Hunter catchment water supply system, residential use accounts for approximately 65% of water consumption. Water usage by sector is highlighted in Figure 6.3.

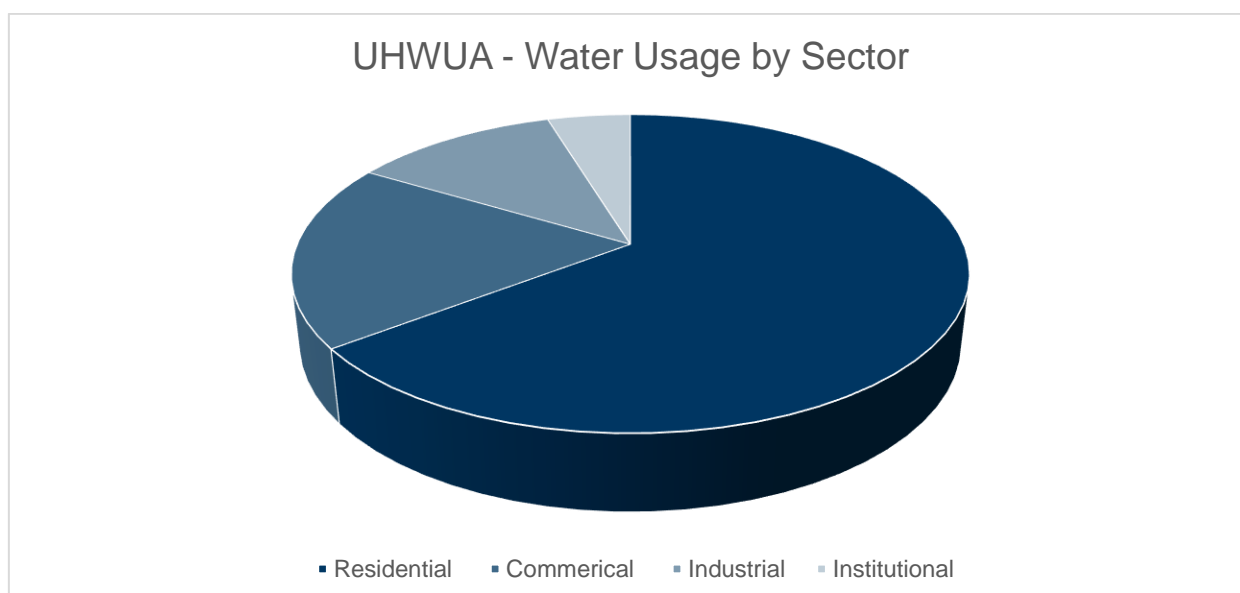


Figure 6.3 Water Usage by Sector

6.4.5 Residential end use

The estimated average residential consumption for the Singleton, Muswellbrook and Upper Hunter Shire Council water supply systems in 2020-21 was 230 kL/yr, 235 kL/yr and 194 kL/yr respectively sourced from the *2020-2021 NSW Water and Sewerage Benchmarking Report*.

6.4.6 Highest non-residential consumers

The most significant water dependent non-residential consumers in the Singleton and Upper Hunter LGAs are listed in Table 6.5.

Table 6.5 Highest Non-Residential Users

Business	Supply System
Defence Force	Singleton
Abattoir (Shellden Pty Ltd)	Singleton (separate supply agreement)
Swimming Pools	Singleton/Muswellbrook Shire
Hospitals	Singleton/Muswellbrook Shire/Upper Hunter Shire
Primo Meats Abattoir (Now Named Jbs Australia Scone)	Upper Hunter Shire
Saleyards	Upper Hunter Shire
Aberdeen Golf Club	Upper Hunter Shire

6.4.7 Rural demands

Some of the towns across the council areas provide water for limited agricultural use such as stock watering but this volume is relatively small.

6.4.8 Unaccounted for water

The Unaccounted-for Water (UFW) has been estimated for the Upper Hunter catchment supply by determining the difference between the volume of water produced and the total consumption. This may be due to leakage or illegal connection of unbilled data. The previous DERMPs for each council region indicate that approximately 11% of water produced in the UHWUA managed region is unaccounted for. Water loss management in the UHWUA system provides an opportunity for Councils to improve future secure yield capacity as well as improve drought response management.

6.5 Rainfall and temperature

Typically, the climate zone is temperate (no dry season) with an average annual rainfall of 620 mm to 1600 mm (depending on location within catchment). The Upper Hunter experiences extended periods of below average rainfall, while the Lower Hunter is influenced more by coastal rain and shorter drought periods.

Hunter River Catchment

Average Annual Rainfall (1961-1990)

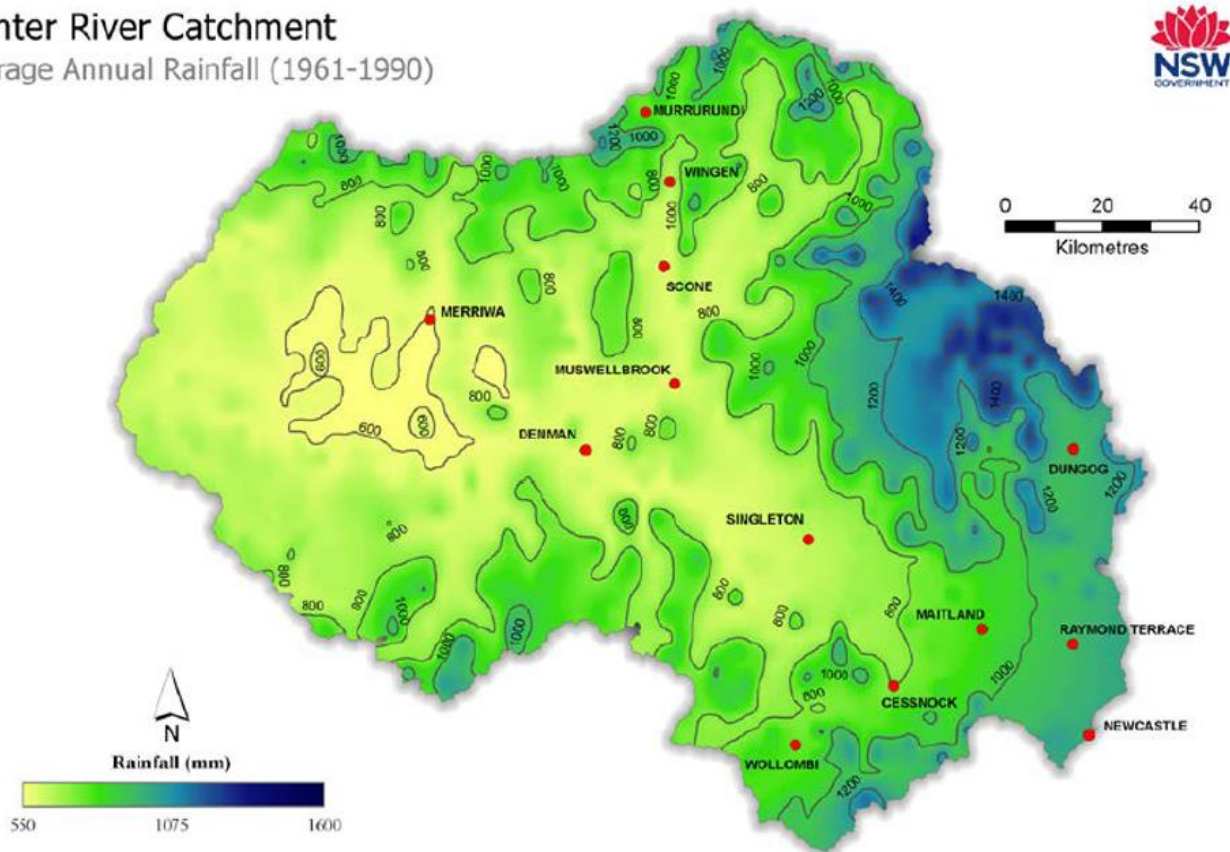


Figure 6.4 Average Annual Rainfall: 1961-1990 (Water Sharing Plan for the Hunter Regulated River Water Source Background Document 2017)

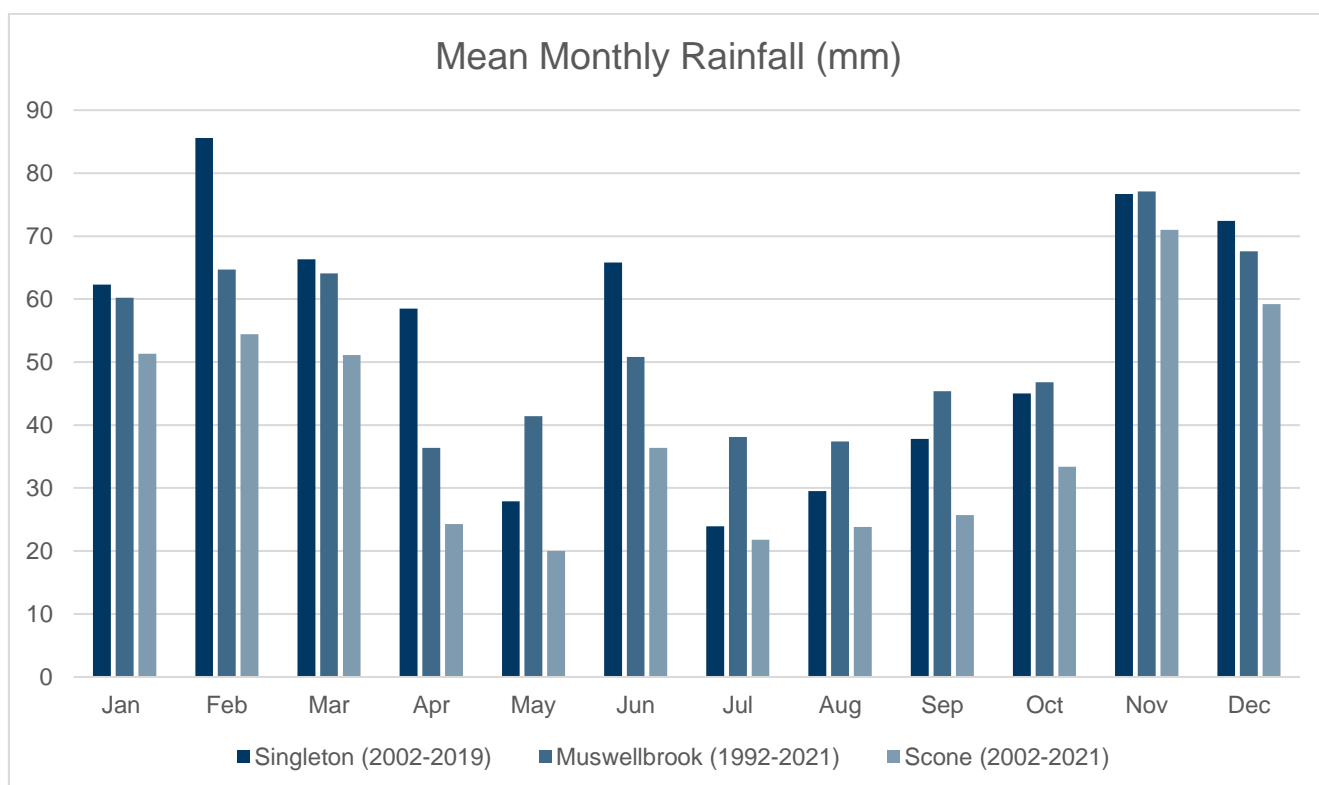


Figure 6.5 Mean Monthly Rainfall (BOM)

Typically, the temperature across the region varies from a mean maximum of 32 °C and a mean minimum temperature of 4 °C. The mean maximum and minimum temperatures for Singleton are shown in Figure 6.6 and Figure 6.7 respectively.

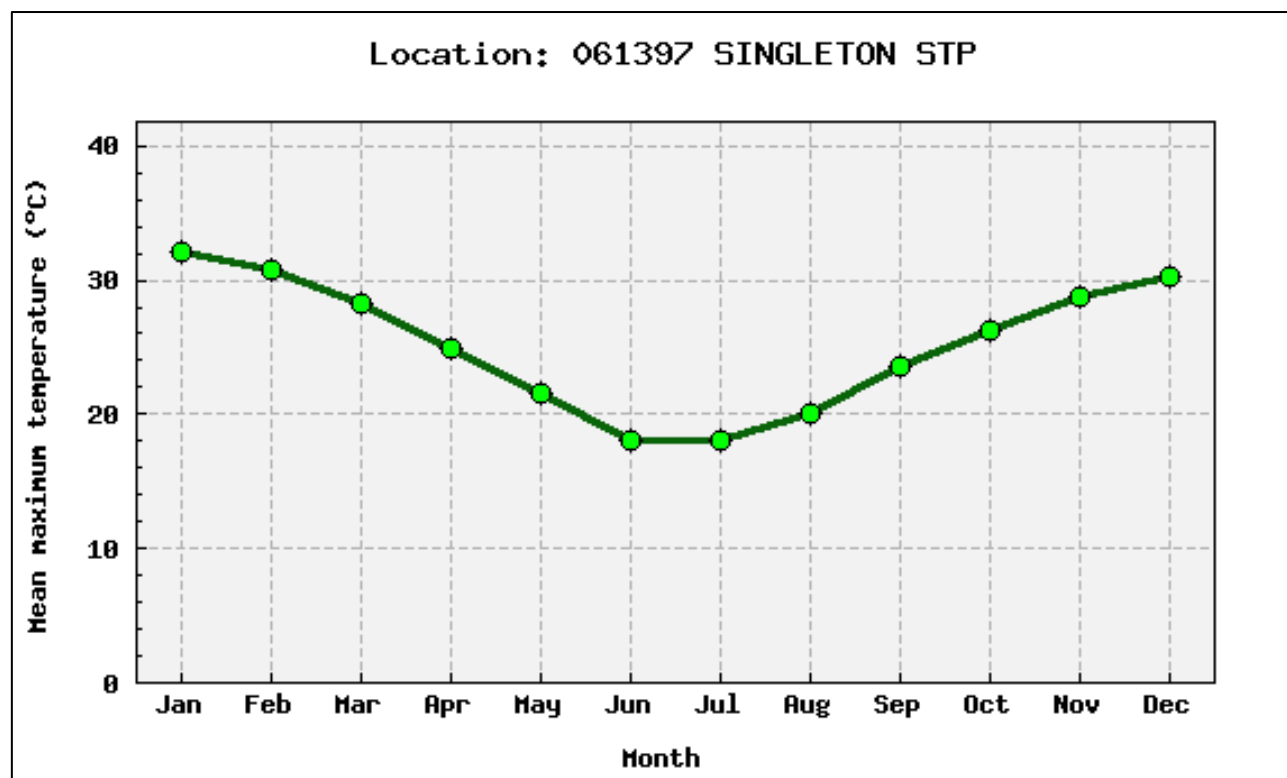


Figure 6.6 Singleton Mean Maximum temperature 2002 to 2019 (BOM)

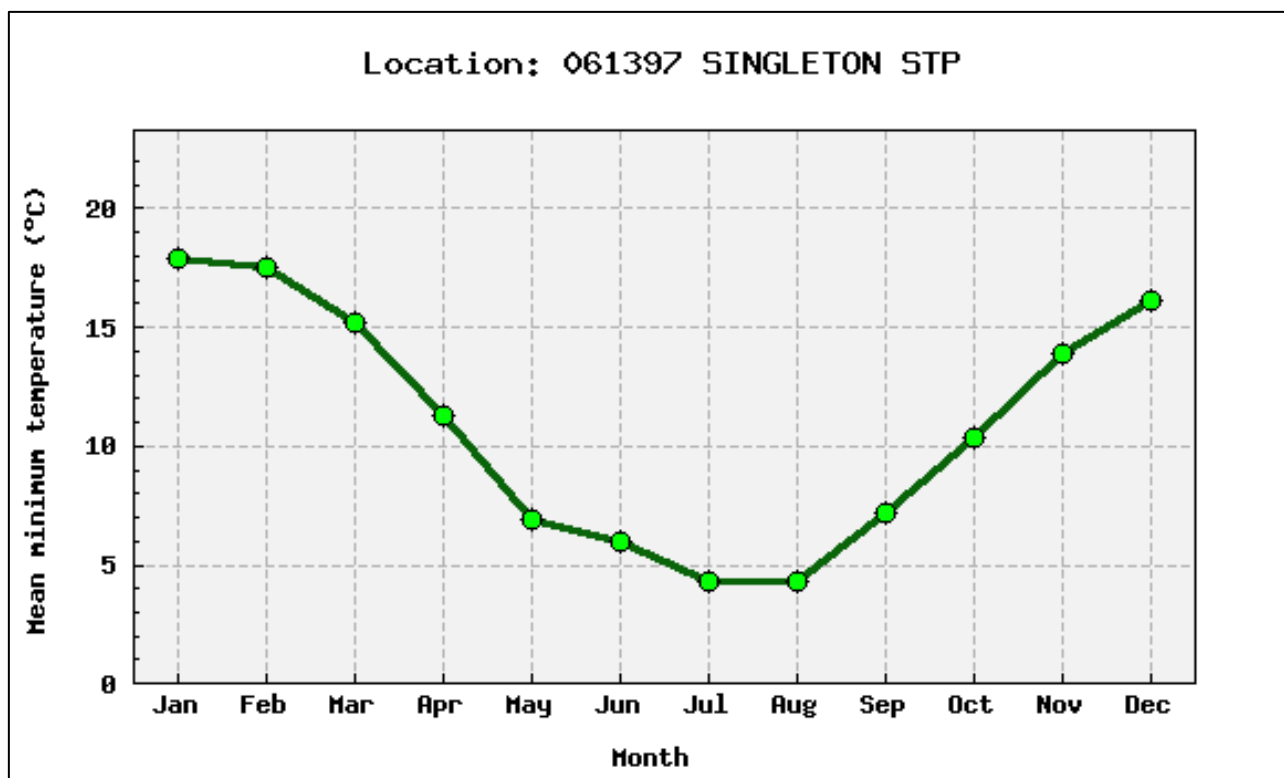


Figure 6.7 Singleton Mean Minimum temperature 2002 to 2019 (BOM)

6.6 Climate change

The Hunter catchment's climate is highly variable with periods of severe drought and flood. The catchment is situated within a transitional zone between winter dominated rainfall in the south and summer dominated rainfall in the north. Annual rainfall in the region ranges from 620 mm to 1600 mm depending on location. The Upper Hunter region experiences long periods of below average rainfall.

The key climactic changes from the NSW and ACT Regional Climate Modelling (NARClIM) climate projections for the Hunter Catchment include the following:

- Average temperatures will continue to increase in all seasons (very high confidence).
- Decreases in summer, winter, and spring rainfall are projected. Autumn rainfall is projected to increase significantly in the near future (to 2039).
- An increase in high fire danger days throughout summer.
- A significant increase in days of extreme temperature ($>35^{\circ}\text{C}$) – an additional 5.77 days in summer projected in the future.
- On annual and decadal basis, natural variability in the climate system can act to either mask or enhance any long-term human induced trend, particularly in the next 20 years and for rainfall.

These factors, along with increasing rainfall variability, will result in an increase in per capita demands for potable water in the Singleton, Muswellbrook Shire, and Upper Hunter Shire regions for all outside end-uses.

6.7 Drought restrictions history

Historical records for previous drought restrictions have not been maintained in detail. The details that are available are provided in Table 6.6. Records that the worst drought for the Singleton region was experienced between 1937-1949. During this period, the Hunter River ceased to flow at Singleton for longer than 6 months. It should be noted that the towns of Merriwa and Cassilis in the Upper Hunter Shire have been less impacted by drought as they are supplied by groundwater.

Table 6.6 Drought restrictions history

Muswellbrook Shire Council	Upper Hunter Shire Council	Singleton Council
<p>Muswellbrook: Level 1 restrictions briefly in 2006</p> <p>Sandy Hollow: Level 1 restrictions between Aug 2002 and Feb 2003</p> <p>Denman: Interrupted level 1 restrictions between 2003 and 2006 Currently under level 1 restrictions, experienced level 2 restrictions during 2020</p>	<p>Murrurundi: Level 1 restrictions Dec 2009 and Jan 2014, dam level fell to 75%. Restrictions increased to Level 5 in Feb 2014, due to high algal concentrations (water was trucked into Murrurundi from Scone) Level 1- restrictions May 2021 to the foreseeable future Level 2- restrictions October 2017, June 2021 Level 4- restrictions November 2017, February to May 2018 Level 5- restrictions December to January 2017, May 2018 Level 6- restrictions July 2018, July 2019, March 2020</p> <p>Scone: Summer 2002/03 – four months of level 1 restrictions Summer 2003/04 – three months of level 1 and two weeks of level 2 restrictions Autumn 2004 – two day of level four restrictions due to pump failure Summer 2004/05 – three months of level 1 restrictions December 2009 – level 1 restrictions</p> <p>Merriwa/Cassilis/Scone/Aberdeen/Murrurundi: Level 1 - restrictions July 2019 Level 1 - restrictions March and June 2020 (Merriwa and Cassilis) Level 2 – restrictions March and June 2020 (Scone, Aberdeen and Murrurundi) Level 1 - restrictions May to June 2021 (all towns in shire)</p>	<p>Restrictions imposed for six months during a severe drought in 1981 - 1982</p> <p>Prior to 1992, several short-term restrictions due to reduced supply capability</p> <p>Summer 2008-2009 - Singleton Level 3 restrictions - Glennies Creek Dam down to 30%</p> <p>March 2020 Level 2 water restrictions reduced to Level 1 restrictions from May 2021</p>

6.8 Effects of restrictions on water demand

An analysis undertaken on the recent restriction data and water usage data demonstrates that restrictions have an impact on reducing water demand for the three Councils.

6.9 Failure modes, effects, and criticality analysis

A failure modes, effects, and criticality analysis (FMECA) is a process used to determine the critical maintenance or renewals required for assets in a water distribution network. The determination of critical failure modes in the water supply systems allow Councils to target and refine maintenance plans, capital expenditure plans, and investigative activities to address the potential failures. A FMECA Workshop was undertaken by GHD on 29 October 2021 for each of the network supply schemes managed by the UHWUA. The result of the analysis provides the Councils with a detailed register of the consequences of asset failure throughout the networks and identifies the corrective actions required to control the risks.

The risk of asset failure was assessment used the Risk Priority Number (RPN). The RPN for each asset is a measure of design/process risk and is calculated using the following inputs:

- Likelihood of failure Occurrence
- Consequence of failure Severity
- Predictability of failure Detectability

A RPN > 33 suggests that Councils investigate the possibility to renew or replace the asset based on:

- Condition (Poor grade 4)
- Total Maintenance cost in last 5 years > than 60 % of replacement value
- Remaining Life less than 5 years
- Spares availability (long lead time, obsolescence)

A summary of the most critical assets for each supply network in the UHWUA based of the FMECA (noting some with RPN's below 33 were added to the list for various reasons) is provided in Table 6.7 below.

Table 6.7 *Summary of FMECA results*

Council	Supply Scheme	Asset	RPN
Singleton	Glennies Creek	Rix's Reservoir	36
	Jerrys Plains	Sodium Hypochlorite Dosing	32
Muswellbrook Shire	Muswellbrook	Common Reservoir Acasia Reservoir	18
	Denman	Denman Reservoir	36
	Sandy Hollow	Sandy Hollow Reservoir	24
Upper Hunter Shire	Aberdeen	Aberdeen Chlorine Dosing Plant	60
	Merriwa	Transfer Mains	30
	Murrurundi	Transfer Mains to Murrurundi Pages River Offtakes (1 & 2)	32
	Scone	Chlorination for Scone to Aberdeen/Scone (Gundy Road)	60
	Cassilis	Chlorine Analyser	60

Refer to Appendix B for the FMECA for the UHWUA Councils.

7. Regulatory framework

Legislative requirements relating to management of water supplies during drought include:

- *Local Government Act, 1993* - provides the legal framework for the system of local government in NSW. The Act confers service functions on Councils including the provision, management and operation of water supply facilities. Section 637 of the Act permits Council to apply a penalty to a person who wilfully or negligently wastes or misuses water from a public water supply. From s637, the maximum penalty for a person who wilfully or negligently wastes or misuses water from a public water supply or causes any such water to be wasted is 20 penalty units. At the time of this report, one penalty unit is equivalent to \$110.
- Part 6 Division 1 Clause 137 of the *Local Government (General) Regulation, 2005* permits Council to restrict water supply (by public notice published in a newspaper circulating within the council's area) if Council considers that the available stored water is insufficient to allow unrestricted consumption. Schedule 12 of the Regulation details the penalty notice offences applicable under the Local Government Act, 1993. At the time of this report breaches of section 637 of the Local Government Act, 1993 attract a penalty notice of \$220.
- *Water Management Act 2000* - the key NSW water legislation for the sustainable management of water. The Act promotes the sharing of responsibility for the sustainable and efficient use of water between water users.
- Public Health Act 2010 and Regulations - The main objectives are to promote, protect and improve public health, to control the risks to public health, to promote the control of infectious diseases and to prevent the spread of infectious diseases.
- *Work Health and Safety Act, 2011 and Regulation.*

The NSW Best Practice Management of Water Supply and Sewerage Framework were developed by the NSW Government to demonstrate compliance with the Australian Government's National Competition Policy and the National Water Initiative. The framework and guidelines have been developed to aid Local Water Utilities to achieve best-practice management. Complying with the guidelines is mandatory to be considered "Fit for the Future" and provides incentives. The framework requires six main criteria, of which those listed below are relevant to the Recycled Water Management System (RWMS):

- Strategic Business Planning
- Pricing (including Liquid Trade Waste Policy)
- Water Conservation
- Performance Reporting
- Integrated Water Cycle Management

In 2021, Singleton and Muswellbrook Councils finalised their IWCMS (Upper Hunter Shire pending), as required by the DPE Water. In developing the IWCMS, issues and options for future demand management of the water supply were (will be) addressed.

Other related guidelines and standards include:

- Water Supply and Sewerage Strategic Business Planning and Financial Planning Checklist (NSW Office of Water, 2014)
- Drought Management Guidelines (Water Directorate, 2003)
- AS NZS ISO 31000-2009 Risk management - Principles and guidelines
- Australian Drinking Water Guidelines (NHMRC/NRMMC, 2004)
- NSW Health Guidelines for Water Carters (NSW Health, 2005)
- Backflow and Cross Connection Prevention Guidelines (NSW Water Directorate, 2010)
- Penalty Notices – Fixed Penalty Handbook for Local Councils (Infringements Processing Bureau, NSW Police Service)

7.1 Council powers

Councils deliver water under the provisions of the *NSW Local Government Act 1993*. Some aspects of the water business are carried out under the provisions of the *NSW Water Management Act 2000*. Councils are empowered to restrict water supply (e.g. by public notice published in a newspaper circulating within the LGA) under the *Local Government (General) Regulation 2005*.

The *NSW Local Government Act 1993*, Section 637 identifies that “a person who wilfully or negligently wastes or misuses water from a public water supply, or caused any such water to be wasted, is guilty of an offence” of which a maximum penalty of 20 units applies.

Consumers who are identified breaching water restrictions may have their supply restricted or cut off by any of the Councils in accordance with Clause 144 of the *Local Government (General) Regulation 2005*.

This plan is administered by the UHWUA Councils. During drought periods, this plan will be overseen by the Drought and Emergency Response Management Team (see Section 4.2).

7.2 Department of Planning and Environment

7.2.1 General

Under the *Local Government Act 1993*, the Minister is responsible for approving local water utilities operating water and sewerage schemes. The Minister has delegated this function to the NSW Government Department of Planning and Environment, Water (DPE Water).

DPE Water regulates and supports regional NSW's local water utilities in their provision of safe, secure and sustainable water supply and sewerage services. Their role includes setting policy, planning, infrastructure and regulatory priorities across regional NSW. They also provide expert strategic advice and technical support for local water utilities and other stakeholders.

DPE Water monitor the performance of local water utilities and are the approval authority for water supply dams and water treatment works. The Councils will work closely with DPE Water when implementing and managing ongoing Water Restrictions.

DPE Water provides a management framework for local water utilities to ensure the effective delivery of essential water services. The NSW Best Practice Management of Water Supply and Sewerage Framework is administered by DPE Water. DPE Water also manages and implements significant water infrastructure programs, such as the Safe and Secure Water Program.

7.2.2 Water sharing plans

The DPE is responsible for planning, policy development, and regulatory frameworks for regional water in NSW. It develops, assesses, and recommends changes to NSW's water legislation, water sharing/water resource plans and water management rules. These plans, rules and legislation form the regulatory framework that all water users and operators must work within.

The DPE ensures equitable sharing of surface and groundwater resources through the development of Water Sharing Plans. Water Sharing Plans are developed by DPE and in conjunction with community. They determine the environmental needs for a water system and allocate water volume licences to users. These plans provide the licence extraction allowances for Council's Water Supply.

By setting the rules for how water is allocated for the next 10 years, a water sharing plan provides a decade of security for the environment and water users. This not only ensures that water is specifically provided for the environment through a legally binding plan, but also allows licence holders, such as irrigators, who require large volumes of water to plan their business activities.

In accordance with the *Water Management Act 2000*, which is administered by DPE, the Councils can apply to the minister for an exemption to the water sharing plan.

Councils manage their water supplies according to the following Water Sharing Plans:

- Water Sharing Plan for the Hunter Regulated River Water Source.

The NRAR is directed by an independent board and sits within DPE. The NRAR is responsible for compliance with and enforcement of the regulatory framework for water including water management rules, and licence and approval conditions.

7.3 NSW Health

The Minister for Health has responsibility for the administration of health legislation within NSW. The Minister for Health has powers to issue orders and direct public authorities to take action to prevent public health risks in drinking water supplies.

NSW Health is the NSW state government agency responsible for monitoring and managing public health and improving public health through regulation and promotion. Its major role is to provide public health guidance and advice to other state and local government authorities.

7.4 Firefighting requirements

In spite of the water restriction actions, preference will be provided to accommodating firefighting requirements.

In the event that the emergency conditions last for more than 3 days, fire services will be directed to arrange alternate water source (e.g. water tankers) if appropriate.

8. Recommendations

To improve the success of the DERMP implementation, the following actions are recommended:

- Consultation with the government departments during the preparation of the IWCMs should be undertaken, such as the Department of Planning and Environment (DPE) Water for review and approval of the IWCM and the DERMP. DPE will also be involved in decision making during restrictions; and Local Public Health Unit for review of the IWCM and DERMP.
- It will be necessary to develop clear, consistent guidelines supported by tools and resources.
- Further improvements to Failure Modes, Effects and Criticality Analysis (FMECA) include distinguishing assets/procedures relating to drought and emergency supply.
- There may be a need to consider exemptions or lower reduction in water use where it is not possible to achieve the target reductions (e.g. for health and/or safety reasons).
- Businesses will be encouraged to develop and build cooperative personal relationships with their respective Council (through ongoing demand management programs).
- Reporting requirements to be streamlined where possible.
- Recognition of businesses achieving water savings.
- Enforcement actions to be agreed between all Councils and enforced equally across the region.
- Develop an agreed methodology for consistent enforcement of restrictions and tools to be used across the region.
- Develop a Drought Management Communications Strategy (DMCS) for each Council.
- Develop/update Communications Action Plan for each Council.
- Develop/update Water Restriction Enforcement Policy for each Council.
- Develop/update Business Continuity Plan for each Council.
- Develop/update Standard Operating Procedures (SOP's) for emergency events.
- Develop/update water restriction webpages and social media pages.
- Develop online application procedure for water carters.
- Consider identifying and stocking critical spares or aligning with a larger nearby water utility or suppliers to stock critical spares.
- Review after periods of water restrictions and emergencies to assess the effectiveness and identify areas for improvements.
- Continually review the effectiveness of the drought management procedures within this plan, while considering alternative measures that may be more effective.
- Further investigation needs to be undertaken by Muswellbrook Shire Council to confirm the sustainability and resilience of groundwater yields and quality.
- Improve monitoring by implementation of online water depth monitoring in each of the groundwater aquifers.
- Consider adopting a program such as Smart Water Choices utilised by Hunter Water to promote short-term actions for the management of water demand throughout the region.
- Adopted a Water Efficiency Management Plan (WEMP) similar to one utilised by Hunter Water to manage efficient water use by businesses throughout the region. A template WEMP is provided in Appendix C.

9. References

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- CSIRO 2015. Climate Change in Australia, CSIRO & Bureau of Meteorology
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- Local Government (General) Regulation 2005 (NSW) from <https://legislation.nsw.gov.au/view/whole/html/2020-10-27/sl-2005-0487>
- DPE 2017. Water Sharing Plan for the Hunter Regulated River Water Source Background Document
- DPI Water 2003. Draft Guidelines, Assuring future urban water security, Assessment and Adaption guidelines for NSW local water utilities
- DPI Water 2016. 2015-2016 NSW Water and Sewerage Benchmarking Report
- DWE 2007. Best Practice Management of Sewer and Sewerage Guidelines 2007, DWE
- GHD 2020, Aberdeen WPS, Rising Main and Scone Wells Improvement Proposal Report
- Muswellbrook Shire Council 2020, Business Continuity Plan, Muswellbrook Shire Council
- NHMRC/NRMMC 2011. Australian Drinking Water Guidelines
- NSW Office of Water 2014. Water Supply and Sewerage Strategic Business Planning and Financial Planning Checklist
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- NSW Water Directorate 2016. Drought Management Guidelines
- Singleton Council 2019. Business Continuity Sub Plan - Water Network and Treatment, Singleton Council
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- Singleton Council 2021. Singleton Council Drinking Water Management System Drinking Water Manual, Singleton Council
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- Upper Hunter Shire Council 2013. UHSC IT Disaster Recovery Plan, Upper Hunter Shire Council
- Upper Hunter Shire Council 2017. Detailed Investigation Report – Accident Major Incident, Upper Hunter Shire Council
- Upper Hunter Shire Council 2019. Accident / Emergency Contact Numbers, Upper Hunter Shire Council
- Upper Hunter Shire Council 2021. Incident Management Procedures, Upper Hunter Shire Council

10. Scope and limitations

This plan has been prepared by GHD for Upper Hunter Water Utilities Alliance (UHWUA) and may only be used and relied on by UHWUA for the purpose agreed between GHD and UHWUA as set out in this report.

GHD otherwise disclaims responsibility to any person other than the UHWUA arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this plan were limited to those specifically detailed in the plan and are subject to the scope limitations set out in the plan.

The opinions, conclusions and any recommendations in this plan are based on conditions encountered and information reviewed at the date of preparation of the plan. GHD has no responsibility or obligation to update this plan to account for events or changes occurring subsequent to the date that the plan was prepared.

The opinions, conclusions and any recommendations in this plan are based on assumptions made by GHD described in this plan. GHD disclaims liability arising from any of the assumptions being incorrect.

Appendices

Appendix A

DPI Water Best Practice Management Guidelines – Drought Management Plan Checklist



Appendix D - Drought Management

Check List – August 2007

A comprehensive drought management plan details the demand and supply issues to be addressed during drought conditions and includes adoption of a schedule of trigger points for the timely implementation of appropriate water restrictions. Appropriate drought management planning will ensure that town water supplies with significant storage do not fail in times of drought.

Drought management planning includes documenting basic data on water demands, rainfall, evaporation, records of past droughts, the existing water supply system, and its water resources, and strategies to achieve the objective of having sufficient water to satisfy the basic needs of the community.

This check list is essentially a road map to assist LWUs to quickly implement sound drought management planning. LWUs should have a sound drought management plan in place and be ready to implement their plan when drought conditions arise.

Drought Management – Check List

Topic	Outcome Achieved
1. Executive Summary	<input checked="" type="checkbox"/> Covers all major issues, objectives, planning, strategies and monitoring for existing essential supplies of water to the service area(s). <input checked="" type="checkbox"/> Includes a summary of the drought management plan and an adopted schedule of trigger points for timely implementation of appropriate water restrictions.
2. Background	A. <input checked="" type="checkbox"/> Includes the existing water supply system(s) in the service area(s) and a locality map. B. <input checked="" type="checkbox"/> Includes history of past droughts. C. <input checked="" type="checkbox"/> Includes information on the impact of past droughts on water services, eg. restrictions, effect of restrictions on demands, any emergency sources identified, etc.
3. Objectives	A. <input checked="" type="checkbox"/> Identifies key objectives required to maintain a basic/restricted supply to all users. There is a need to consider social and environmental impacts. B. <input checked="" type="checkbox"/> Tailor strategies relevant to the service areas. C. <input checked="" type="checkbox"/> Endorse and implement a plan that minimises the risk of the community running out of water.



Drought Management – Check List

Topic	Outcome Achieved
4. Data	<p>A. <input checked="" type="checkbox"/> Identification of all communities served by the LWU's reticulated water supply, those with private reticulated water services and those with no reticulated water services within the service area(s).</p> <p>B. <input checked="" type="checkbox"/> Identification of any properties, businesses, other LWUs etc. that may seek water in times of drought.</p> <p>C. <input checked="" type="checkbox"/> Identification of all water requirements. Identify the normal and minimum potable and non-potable water requirements.</p> <p>D. <input checked="" type="checkbox"/> Identify water dependent industry/businesses, any fire fighting requirements and opportunities for recycled water use.</p> <p>E. <input checked="" type="checkbox"/> Includes a description and plan of all water supply schemes in the service area(s).</p> <p>F. <input checked="" type="checkbox"/> Includes height/storage volume and height/surface area graphs for all water supply dams and weirs.</p> <p>G. <input checked="" type="checkbox"/> Historical performance of rivers, dams, weirs and bores in previous droughts.</p> <p>H. <input checked="" type="checkbox"/> Includes the average rainfall figures and evaporation rates.</p>
Note: All data to be specified on a daily basis.	
5. Plan	<p>A. <input checked="" type="checkbox"/> Demand management options.</p> <p>B. <input checked="" type="checkbox"/> Restriction strategies including means and methods for the enforcement of restrictions and the expected results of imposing restrictions.</p> <p>C. <input checked="" type="checkbox"/> Adopted schedule of trigger points for the timely implementation of appropriate water restrictions in order to minimise the risk of failure in times of drought.</p> <p>D. <input checked="" type="checkbox"/> Availability of alternative water sources (including estimated costs and times to implement).</p> <p>E. <input checked="" type="checkbox"/> Water cartage options.</p> <p>F. <input checked="" type="checkbox"/> Identify legislation, local laws and council policies affecting the contingency arrangements.</p> <p>G. <input checked="" type="checkbox"/> Links to water sharing plans/committees, water management plans/committees, irrigators, etc.</p>



Drought Management – Check List

Topic	Outcome Achieved
	<p>H. <input checked="" type="checkbox"/> Impact of extraction on downstream stakeholders.</p> <p>I. <input checked="" type="checkbox"/> Impact of reduced flows in watercourses.</p> <p>J. <input checked="" type="checkbox"/> Level of prediction and intervention.</p> <p>K. <input checked="" type="checkbox"/> Identify human resource requirements.</p>
6. Monitoring During Drought	<p>A. <input checked="" type="checkbox"/> Daily monitoring of demands.</p> <p>B. <input checked="" type="checkbox"/> Daily monitoring of water supply sources (dams, bores and streams).</p> <p>C. <input checked="" type="checkbox"/> Monitoring impact of restrictions on consumption</p> <p>D. <input checked="" type="checkbox"/> Monitoring the electrical conductivity, alkalinity and algae levels in the water sources.</p>
7. Consultation	<p><input checked="" type="checkbox"/> Comprehensive media strategy and public consultation.</p> <p><input checked="" type="checkbox"/> Regular consultation with appropriate government agencies (DWE, DECC, NSW Health etc).</p>
8. Operation of Drought Management Plan (DMP)	<p>A. <input checked="" type="checkbox"/> DMP should discuss, analyse and identify any impact on other regions and localities ie. upstream, downstream or conjunctive water users.</p> <p>B. <input checked="" type="checkbox"/> DMP should demonstrate a sustainable strategy that considers all other stakeholders.</p> <p>C. <input checked="" type="checkbox"/> DMP documents an agreed procedure for progressive implementation of water restrictions.</p>

REFERENCE

Drought Management Guidelines, NSW Local Government Water Directorate, December 2003.

For further information and assistance, please contact Stephen Palmer, Manager Planning on 8281 7331 or Stephen.Palmer@dwe.nsw.gov.au

Appendix B

Failure Modes, Effects and Criticality Analysis (FMECA)



Failure Modes, Effects and Criticality Analysis (FMECA) - Upper Hunter Shire Council (UHSC) Water Systems

Job Name:		UHWUA - Drought and Emergency Response Management Plan										Client	Upper Hunter Shire Council (UHSC)									
Workshop Attendees:		Irene Chetty MSC; Tegan Annas UHSC; Karen Davies UHSC; Alexander McKeown SC; Clayton Miechel SC; Brian Oberdorf SC; Andres Munoz GHD; Tyron Cook GHD; Nathan Malcolm GHD ; Brie Fisher GHD																				
Ref.	Site	Component / Plant Name	Failure Mode	Failure Cause	Effect/Consequence	Safeguards / Current Controls	Comments	Initial Risk Rating			Current RPN (S*O*D)	Corrective Action / New Controls	Comments	Responsibility	By When	Decision / Status	Residual Risk Rating			Residual RPN (S*O*D)	Comments	
								Severity	Occurrence	Detectability								Severity	Occurrence	Detectability		
		Aberdeen Bore Pump	Failure of pumps (electrical)	Power failure to site	Pumps unable to switch 'on'	Assume no back up power source. No SCADA alarm for failure	Not wired to telemetry	2	5	5	50	Back up power - Modify for 'hardwired' generator connection aand connect to SCADA	Back up power source would need to be hard wired in	UHSC				2	5	1	10	No direct notification via SCADA is received if pump is not working. In direct notification will occur from the high lift pumps cutting out due to not enough water being received in the wet well. (The low lift pumps and aberdeen bore pump both run into the wet well and flowrate from both is needed to keep up with high lift pumps pumping out of wet well)
		Aberdeen Bore Pump	Failure of pumps (mechanical)	Damage to pumps (e.g. cavitation, typical wear-and-tear)	Pumps unable to effective function and or unable to switch on/off correctly.	Standard maintenance procedure and operations procedures. No SCADA alarm for failure	Standby pump not available. Pump not off the shelf model, typically taking 12 weeks to arrive. Pump has been replaced twice in the last 18 months.	3	4	2	24	Install a reliable pump. Connect to SCADA	Keeping critical spare too expensive	UHSC				3	4	1	12	We don't get a notificatoin that the pump itself isnt working but as it runs with the low lift pump the wet well will not recieve enough water and the high lift pumps will stop running due to not enough water
		Aberdeen Wet Well	Structural damage to the Collection well	Deterioration of well due corrosion or otherwise.	Collection Well leaking and/or rupture. Well required to be taken offline' for repairs.	Standard maintenance procedure and operations procedures.		4	2	1	8	Maintenance change - establish preventative maintenance program	No structural assessment completed	UHSC				4	2	1	8	
		Low Lift Pumps (Aberdeen)	Failure of pumps (mechanical)	Damage to pumps (e.g. cavitation, typical wear-and-tear)	Pumps unable to effective function and or unable to switch on/off correctly.	Standard maintenance procedure and operations procedures.	Standby pump available (future marked for duty/standby arrangement)	3	2	2	12	Design review - assess system under current conditions and modify design if required		UHSC				2	2	2	8	Current valve arrangement only allows for one of the duty/standby pump to be used. Upgrade to fix this likely to occur next year (2022)
		Low Lift Pumps (Aberdeen)	Failure of pumps (electrical)	Power failure to site	Pumps unable to switch 'on'	No back up power source	Switchboard so old repairs are not an option, it is unlikely an electrician would hardwire a back up power supply to pumps due to age of switchboard	3	2	2	12	Renew switchboard	Switchboard and electrics due for upgrade next year (2022)	UHSC				3	2	2	12	
		Aberdeen High Lift Pump Station	Failure of pumps (mechanical)	Damage to pumps (e.g. cavitation, typical wear-and-tear)	Pumps unable to effective function and or unable to switch on/off correctly.	Standby pump available, but currently not working on telemetry. Standard maintenance procedure and operations procedures.	Aberdeen may drawdown the 3 reservoirs and High Level Tank, however pumps must be back online before tanks can no longer supply the end user demand	2	4	1	8	Maintenance change - keep critical equipment spare	Duty standby arrangement for pumps, no other spare.	UHSC				1	3	1	3	Aberdeen reservoir system will have 1.5 days of water before pumps are required to be running again
		Aberdeen High Lift Pump Station	Failure of pumps (electrical)	Power failure to site	Pumps unable to switch 'on'	SCADA alarm for failure	SCADA would send a fault alarm notifying operators	3	3	1	9	Renew switchboard	Slightly newer than Low Lift PS. Has duty/standby. Is a critical asset to deliver to Aberdeen reservoirs. Electrical system becoming outdated, not as bad as low lift. On SCADA. Backup power can be hardwired in	UHSC				1	3	1	3	High lift pump has VSD
		Aberdeen Chlorine Dosing Plant	Dose system fault	Low / high chlorine levels outside of CCP / OCP	Unable to treat system to a drinking water standard	Back up power source to be hardwired in	No SCADA alarm present to alarm dosing outside of parameters (system not shown on SCADA). System relies on operator to check chlorine levels at reservoir (checks occur once per day). Alarm for leak detection only	4	3	5	60	Install chlorine analyser. Connect to SCADA	1 chlorine dosing pump. 2 pumps, one to Aberdeen, one to Scone. No duty/standby arrangement. Spares are available.	UHSC				2	3	1	6	Severity reduced due to monitoring and SCADA alarm
		Aberdeen Chlorine Dosing Plant	Failure to activate dosing process	Electrical, mechanical, or otherwise	Unable to treat system to a drinking water standard	Standard maintenance procedure and operations procedures. Spare pumps available	No SCADA alarm for failure. System relies on operator to check chlorine levels at reservoir (checks occur once per day)	2	4	5	40	Install No. 2 pump for chlorine dosing. Connect pumps to SCADA	1 chlorine dosing pump. 2 pumps, one to Aberdeen, one to Scone. No duty/standby arrangement. Spares are available.	UHSC				2	4	1	8	Severity reduced due to monitoring and SCADA alarm
		Aberdeen Reservoir No.1, 2, 3	Structural damage to the tank.	Deterioration of tank due corrosion or otherwise.	Balance tank leaking and/or rupture. Tank required to be taken offline' for repairs.	Standard maintenance procedure and operations procedures.	Bidirectional flow between reservoirs, each can supply the end users. No way of isolating res 1 (old res) isolation valves not operational	2	3	3	18	Maintenance change - establish preventative maintenance program	Structural assessment done a couple years ago, to be confirmed.	UHSC				2	3	1	6	
		Aberdeen Reservoir No.1, 2, 3	Damage to the tanks ancillary items such as level sensors and inlet/outlet valves.	Mechanical, electrical, or otherwise.	Inaccurate measurements in SCADA and/or incorrect flow into/out of the tank.	Routine maintenance, system control alerts, and standard operation procedures followed.	Bidirectional flow between reservoirs, each can supply the end users.	1	2	2	4	Maintenance change - keep critical equipment spare		UHSC				1	1	2	2	
		High Level Tank	Structural damage to the Tank	Deterioration of Tank due corrosion or otherwise.	Tank leaking and/or rupture. Tank required to be taken offline' for repairs.	Standard maintenance procedure and operations procedures.	Due for replacement	4	3	2	24	Maintenance change - establish preventative maintenance program	Structural assessment done a couple years ago, to be confirmed.	UHSC				2	3	1	6	
		High Level Tank Pumps 1 & 2	Failure of pumps (electrical)	Power failure to site	Pumps unable to switch 'on'	Assume no back up power source. Assume SCADA alarm for failure	Back up pump available	2	3	1	6	Back up power - Modify for 'plug-in' or 'hardwired' generator connection as needed	In process of installing new VSD. Duty/standby arrangement	UHSC				2	3	1	6	

Ref.	Site	Component / Plant Name	Failure Mode	Failure Cause	Effect/Consequence	Safeguards / Current Controls	Comments	Initial Risk Rating			Current RPN (S'O'D)	Corrective Action / New Controls	Comments	Responsibility	By When	Decision / Status	Residual Risk Rating			Residual RPN (S'O'D)	Comments
								Severity	Occurrence	Detectability							Severity	Occurrence	Detectability		
		High Level Tank Pumps 1 & 2	Failure of pumps (mechanical)	Damage to pumps (e.g. cavitation, typical wear-and-tear)	Pumps unable to effective function and or unable to switch 'on/off' correctly.	Standby pump available, however if the Harlan inline pump that was installed in 1968 has not been replaced, can assume the pump is not useable. Standard maintenance procedure and operations procedures.	Back up pump available	2	3	1	6	Maintenance change - keep critical equipment spare		UHSC			2	3	1	6	
		Rotork Valve between Res 1 and 3	Failure of valve (Mechanical)	Damage to valves	Valve unable to open/close	Isolation valve either side of the the rotork valve	Rotork valve has recently been replaced (2019)	2	3	2	12			UHSC			2	3	2	12	
		Rotork Valve between Res 1 and 3	Failure of valve (Electrical)	Power failure to site	Valve unable to open/close	Turn off valve manually	Valve not on telemetry but notification for high level in the reservoir 2 (will overflow inground res(2) before it overflows new res(3))	1	3	2	6			UHSC			1	3	2	6	
		Transfer Mains to Aberdeen Reservoirs/network	Pipeline rupture, cracking, leaking, or otherwise damaged resulting in a water egress point.	Unanticipated pressure surges, inappropriate jointing methods, ground settlement, root intrusion, pipes nearing end-of-design-life	Loss of supply to Aberdeen (reservoir provides back-up for certain period)	Standard maintenance procedure and operations procedures.		3	2	2	12	Maintenance change - establish preventative maintenance program	Main in good - fair condition	UHSC			3	1	2	6	
	Merriwa	Bore 1, 2 3 Pumps	Failure of pumps (electrical)	Power failure to site	Pumps unable to switch 'on'	Assume no back up power source	Not on SCADA. Generator can be hardwired in. Ausgrid have planned shut down 4x a year for 6hrs each	2	3	4	24	Back up power - Modify for 'hardwired' generator connection and connect to SCADA	SCADA to be put online in future (early next year for whole township). Back up elect hardwired	UHSC			2	3	1	6	
		Bore 1, 2 3 Pumps	Failure of pumps (mechanical)	Damage to pumps (e.g. cavitation, typical wear-and-tear)	Pumps unable to effective function and or unable to switch 'on/off' correctly.	Standby pump available. Standard maintenance procedure and operations procedures.	Not on SCADA. 12 weeks to obtain backup. Fault light at WTP showing WTP is not receiving water from Bore pump	2	2	3	12	Connect to SCADA	Critical spare too expensive and not practical	UHSC			2	2	1	4	
		Merriwa WTP	Power failure	Power failure to site	Loss of water production	Back up power source. No SCADA alarm for failure	Assuming back up power source such as a generator is available and can be hardwired in. Not on SCADA yet	3	2	3	18	Back up power - Modify for 'hardwired' generator connection and connect to SCADA	Halls Rd transfer pump supplied by electricity on WTP site. Cemetery tank will run out in half a day	UHSC			3	2	1	6	SCADA should be available for Merriwa WTP by May 2022
		Merriwa WTP	Failure to activate Sodium Hypochlorite Dosing	Electrical, mechanical, or otherwise	Unable to treat system to a drinking water standard	Standard maintenance procedure and operations procedures.	Not on SCADA. Manual dosing in system is possible in emergency situations	3	3	3	27	Maintenance change - keep critical equipment spare. Connect to SCADA	1 pump for chlorine dosing. Spare dosing pump available	UHSC			2	3	1	6	SCADA should be available for Merriwa WTP by May 2022
		Merriwa WTP	Tank structural failure	Deterioration of tank due corrosion or otherwise	Balance tank leaking and/or rupture	Standard maintenance procedure and operations procedures.	Not on SCADA	2	2	3	12	Maintenance change - establish preventative maintenance program		UHSC			2	2	3	12	
		Merriwa WTP	Failure of Chlorine analyser	Mechanical, electrical, or otherwise.	Loss of CCP monitoring		Not on SCADA. Manual testing available	2	2	3	12	Maintenance change - keep critical equipment spare		UHSC			2	2	1	4	SCADA should be available for Merriwa WTP by May 2022
		Merriwa WTP	Failure of pumps (mechanical)	Damage to pumps (e.g. cavitation, typical wear-and-tear)	Pumps unable to effective function and or unable to switch 'on/off' correctly.	Standby pump available. Standard maintenance procedure and operations procedures.	Not on SCADA	2	2	3	12	Maintenance change - keep critical equipment spare	Standby pumps available	UHSC			2	2	1	4	SCADA should be available for Merriwa WTP by May 2022
		Reservoir No. 1 & 2	Structural damage to the tank.	Deterioration of tank due corrosion or otherwise.	Balance tank leaking and/or rupture. Tank required to be taken 'offline' for repairs.	Standard maintenance procedure and operations procedures.	Not the only water storage providing supply to Merriwa. Not on SCADA	2	2	3	12	Maintenance change - establish preventative maintenance program		UHSC			2	2	1	4	
		Reservoir No. 1 & 2	Damage to the tanks ancillary items such as level sensors and inlet/outlet valves.	Mechanical, electrical, or otherwise.	Inaccurate measurements in SCADA and/or incorrect flow into/out of the tank.	Routine maintenance, system control alerts, and standard operation procedures followed.	Not the only water storage providing supply to Merriwa. Not on SCADA	2	2	3	12	Maintenance change - keep critical equipment spare		UHSC			1	2	3	6	
		Cemetery Reservoir	Structural damage to the tank.	Deterioration of tank due corrosion or otherwise.	Balance tank leaking and/or rupture. Tank required to be taken 'offline' for repairs.	Standard maintenance procedure and operations procedures.	Supply to garbage depot. Not on SCADA	3	3	3	27	Maintenance change - establish preventative maintenance program		UHSC			3	2	2	12	
		Cemetery Reservoir	Damage to the tanks ancillary items such as level sensors and inlet/outlet valves.	Mechanical, electrical, or otherwise.	Inaccurate measurements in SCADA and/or incorrect flow into/out of the tank.	Routine maintenance, system control alerts, and standard operation procedures followed.	Inlet/outlet valve	1	2	2	4	Maintenance change - keep critical equipment spare		UHSC			1	1	2	2	
		Transfer Mains	Pipeline rupture, cracking, leaking, or otherwise damaged resulting in a water egress point.	Unanticipated pressure surges, inappropriate jointing methods, ground settlement, root intrusion, pipes nearing end-of-design-life	Loss of supply to Merriwa	Standard maintenance procedure and operations procedures.	Mains being upgraded in February 2022	3	2	5	30	Maintenance change - establish preventative maintenance program	Old AC mains due for renewal in February 2022. No known main breaks.	UHSC			2	1	5	10	
		Boyd St Intake Pump	Failure of pumps (electrical)	Power failure to site	Pumps unable to switch 'on'	Standard maintenance procedure and operations procedures.	Not set up for generator	2	3	1	6	Maintenance change - establish preventative maintenance program	New pump installed 2021				2	2	1	4	
		Boyd St Intake Pump	Failure of pumps (mechanical)	Damage to pumps (e.g. cavitation, typical wear-and-tear)	Pumps unable to effective function and or unable to switch 'on/off' correctly.	Standard maintenance procedure and operations procedures.	No back up available, 3-4 weeks for new pump	2	2	1	4	Maintenance change - establish preventative maintenance program	New pump installed 2021				2	1	1	2	
		Pages river offtake 1&2	Valves (mechanical failure)	Typical wear and tear	Valve unable to open/close	Standard maintenance procedure and operations procedures.	Valves not used for 4 years now.	2	3	5	30	Maintenance change - establish preventative maintenance program					2	2	5	20	
		Pages river offtake 1&2	Pipeline rupture, cracking, leaking, or otherwise damaged resulting in a water egress point.	Unanticipated pressure surges, inappropriate jointing methods, ground settlement, root intrusion, pipes nearing end-of-design-life		Alternate supply via Boyd St Intake and Scone to Murrurundi Pipeline	Not regularly inspected	2	4	4	32	Maintenance change - establish preventative maintenance program					2	3	4	24	
		Alum dosing	Dose system fault	No aluminium supply for dosing.	Unable to treat system to a drinking water standard	Standard maintenance procedure and operations procedures.	Supply reserves are kept in storage in case supply isn't able to arrive in time for routine dosing. Not on SCADA	2	3	2	12	Design review - assess system under current conditions and modify design if required		UHSC			2	2	2	8	Dosing has not occurred for 4 years (since pages river offtake last used).
		Alum dosing	Failure to activate dosing process	Electrical, mechanical, or otherwise	Unable to treat system to a drinking water standard	Standard maintenance procedure and operations procedures.	Not on SCADA	2	3	3	18	Maintenance change - keep critical equipment spare	Dosing pump used. Dosing rate set m	UHSC			1	3	3	9	

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								Severity	Occurrence	Detectability							Severity	Occurrence	Detectability		
	Murrurundi	Pre treatment lagoon (dosing)	Unable to effectively dose system,	No chlorine tablet supply for dosing.	Unable to treat system to a drinking water standard	Standard maintenance procedure and operations procedures.	Supply reserves are kept in storage in case supply isn't able to arrive in time for routine dosing. Not on SCADA	2	3	3	18	Maintenance change - keep critical equipment spare		UHSC			1	1	3	3	
		Pre treatment lagoon (dosing)	Failure to activate dosing process	Electrical, mechanical, or otherwise	Unable to treat system to a drinking water standard	Standard maintenance procedure and operations procedures.	Not on SCADA. Manual dosing system used (reservoir dosing floater)	2	3	3	18	Maintenance change - keep critical equipment spare		UHSC			2	2	3	12	
		Murrurundi dam	Mixers failure	Power failure to site	Pumps unable to switch 'on'	Back up power source for entire site. No SCADA alarm for failure	If power failure to site alarm would notify of mixer failure	2	5	2	20	Back up power - Modify for 'plug-in' or 'hardwired' generator connection as needed	Manually checked and run by operator. Plug in generator available for site.	UHSC			1	3	2	6	
		Murrurundi dam	Mixers failure	Electrical, mechanical, or otherwise.	Water age/quality issues arise, may require additional dosing to correct.	Standard maintenance procedure and operations procedures.	Assuming the symbol shown in the dam on the PFD is a mixer	2	3	3	18	Design review - assess system under current conditions and modify design if required	Possible dam stratification and possible dam turn over	UHSC			2	3	2	12	
		Murrurundi dam	Pump failure	Power failure to site	Pumps unable to switch 'on'	Back up plug in generator available. Alarm on SCADA for pump failure		2	4	1	8	Connect to SCADA	Manually checked and run by operator	UHSC			1	3	2	6	
		Murrurundi dam	Pump failure	Electrical, mechanical, or otherwise.	Unable to boost flows into treatment or bypass to reservoirs	Alternate supply to reservoirs via the Scone to Murrurundi Pipeline. Standard maintenance procedure and operations procedures.	Duty standby arrangement used	2	2	1	4	Maintenance change - keep critical equipment spare		UHSC			2	2	1	4	
		Murrurundi WTP	UF membranes damaged	General wear-and-tear, clogging of membranes, etc.	System unable to correctly filter particles to pass ADWG requirements.	Alternate supply to reservoirs via the Scone to Murrurundi Pipeline. Standard maintenance procedure and operations procedures.	Membranes system on SCADA. Treatment plant operating or not appears on scada,not broken down into further components	2	3	3	18	Design review - assess system under current conditions and modify design if required	Manually checked by operator. Only operated when puling from the dam (day at the moment) to maintain membranes.	UHSC			2	3	1	6	
		Murrurundi WTP	UF membranes pre-filter pressure sensor failure	Mechanical, electrical, or otherwise.	Disruption/failure of filter		WTP automatically shuts down . Alarm sent on SCADA	2	3	1	6	Maintenance change - establish preventative maintenance program	Check reading is displayed and look for abnormal readings	UHSC			2	3	1	6	
		Murrurundi WTP	UF membranes post-filter pressure sensor failure	Mechanical, electrical, or otherwise.	Disruption/failure of filter		Not on SCADA	2	3	3	18	Maintenance change - establish preventative maintenance program	Check reading is displayed and look for abnormal readings	UHSC			2	2	3	12	
		Murrurundi WTP	Post-filter turbidity analyser failure	Mechanical, electrical, or otherwise.	Loss of CCP monitoring		Not on SCADA	2	3	3	18	Maintenance change - establish preventative maintenance program	Critical spare too expensive	UHSC			2	2	3	12	
		Murrurundi WTP	Failure of Filter backwash pump	Mechanical, electrical, or otherwise.	Disruption/failure of filter		Assume no redundancy. WTP will shut down on over pressure. Not on SCADA	2	3	2	12	Design review - assess system under current conditions and modify design if required		UHSC			2	2	3	12	
		Murrurundi WTP	Damage to Clearwater Tanks 1 and 2	Damages resulting in leakage.	Interruption to supply	Standard maintenance procedure and operations procedures	Not on SCADA	2	1	3	6	Maintenance change - establish preventative maintenance program		UHSC			2	1	3	6	
		Murrurundi WTP	Failure of chlorine dosing pumps	Mechanical, electrical, or otherwise.	Low / high chlorine levels outside of CCP / OCP	Standard maintenance procedure and operations procedures. Spare pump available	Not on SCADA	3	3	3	27	Maintenance change - establish preventative maintenance program	Manually checked by operator on routine basis. Spare pump available.	UHSC			2	3	3	18	
		Old and New Reservoirs	Structural damage to the tank.	Deterioration of tank due corrosion or otherwise.	Balance tank leaking and/or rupture. Tank required to be taken 'offline' for repairs.	Standard maintenance procedure and operations procedures.	Reservoirs feed Murrurundi supply area. Paradise land and Doughboy reservoir not in operation and no longer connected to system	2	2	3	12	Maintenance change - establish preventative maintenance program	2 Reservoir "Old" and "New". "New" is only one in use currently. "Old" is in standby arrangement.	UHSC			1	3	2	6	
		Old and New Reservoirs	Damage to the tanks ancillary items such as level sensors and inlet/outlet valves.	Mechanical, electrical, or otherwise.	Inaccurate measurements in SCADA and/or incorrect flow into/out of the tank.	Routine maintenance, system control alerts, and standard operation procedures followed.	Reservoirs feed Murrurundi supply area. Paradise land and Doughboy reservoir not in operation and no longer connected to system	3	2	2	12	Maintenance change - keep critical equipment spare		UHSC			2	2	2	8	
		Transfer Mains Scone to Murrurundi Pipeline	Pipeline rupture, cracking, leaking, or otherwise damaged resulting in a water egress point.	Unanticipated pressure surges, inappropriate jointing methods, ground settlement, root intrusion, pipes nearing end-of-design-life	Loss of supply to Murrurundi	Alternate supply via Murrurundi WTP	Pipeline commissioned 2020	2	3	4	24			UHSC			2	2	3	12	
		Scone to Murrurundi (STM) Pipeline Murrurundi to Res Pumps	Failure of pumps (electrical)	Power failure to site	Pumps unable to switch 'on'	Plug in back up generator available	WPS commissioned 2020. Power failure detected by alarm on SCADA	2	3	1	6	Maintenance change - establish preventative maintenance program		UHSC			2	3	1	6	
		Scone to Murrurundi (STM) Pipeline Murrurundi to Res Pumps	Failure of pumps (mechanical)	Damage to pumps (e.g. cavitation, typical wear-and-tear)	Pumps unable to effective function and or unable to switch 'on'/'off' correctly.	Duty assist arrangement	Both pumps need to run together. SCADA alarm	2	2	1	4	Maintenance change - establish preventative maintenance program		UHSC			2	2	1	4	
		Wingen WPS	Failure of pumps (electrical)	Power failure to site	Pumps unable to switch 'on'	Duty/assist arrangement. Generator would need to be hard wired in	WPS commissioned 2020. Power failure detected by alarm on SCADA	2	3	1	6	Maintenance change - establish preventative maintenance program		UHSC			2	3	1	6	
		Wingen WPS	Failure of pumps (mechanical)	Damage to pumps (e.g. cavitation, typical wear-and-tear)	Pumps unable to effective function and or unable to switch 'on'/'off' correctly.	Duty/assist arrangement.	Both pumps need to run together. SCADA alarm	2	3	1	6	Maintenance change - establish preventative maintenance program		UHSC			2	3	1	6	

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								Severity	Occurrence	Detectability							Severity	Occurrence	Detectability		
		Scone to Wingen Pumps	Failure of pumps (electrical)	Power failure to site	Pumps unable to switch 'on'	Generator can be hard wired in	Duty/assist arrangement.	2	3	1	6			UHSC			2	3	1	6	
		Scone to Wingen Pumps	Failure of pumps (mechanical)	Damage to pumps (e.g. cavitation, typical wear-and-tear)	Pumps unable to effective function and or unable to switch 'on/off' correctly.		Back up supply when WTP off-line	3	2	2	12	Back up power - Modify for 'plug-in' or 'hardwired' generator connection as needed		UHSC			2	2	2	8	
		Scone to Murrurundi Chlorinator	Dose system fault	Low / high chlorine levels outside of CCP / OCP	Unable to treat system to a drinking water standard	Back up supply when WTP off-line.	Back up supply when WTP off-line. No SCADA alarm for dosing parameters, alternative source available	4	1	4	16	Maintenance change - establish preventative maintenance program	SCADA Alarm for analyser reaching high high level	UHSC			4	1	2	8	
		Transfer Mains to Murrundi	Pipeline rupture, cracking, leaking, or otherwise damaged resulting in a water egress point.	Unanticipated pressure surges, inappropriate jointing methods, ground settlement, root intrusion, pipes nearing end-of-design-life	Loss of supply to Murrurundi			2	4	4	32		Had a few main breaks over past few months. Possible pressure related breaks when reservoir is at TWL. Spare replacement pipe etc available.	UHSC			2	2	2	8	
	Scone	Brushy Hill Reservoir	Structural damage to the tank.	Deterioration of tank due corrosion or otherwise.	Balance tank leaking and/or rupture. Tank required to be taken 'offline' for repairs.	Alternative feeds via Hunter River. Standard maintenance procedure and operations procedures.	Visual inspection is conducted Mon-Fri	4	1	2	8	Maintenance change - establish preventative maintenance program	No known conditions	UHSC			3	1	2	6	
		Brushy Hill Reservoir	Damage to the tanks ancillary items such as level sensors and inlet/outlet valves.	Mechanical, electrical, or otherwise.	Inaccurate measurements in SCADA and/or incorrect flow into/out of the tank.	Alternative feeds via Hunter River. Routine maintenance, system control alerts, and standard operation procedures followed.		2	3	2	12	Maintenance change - keep critical equipment spare		UHSC			1	3	2	6	
		Halcomb Hill Surge Tank (between togar and aberdeen)	Structural damage to the tank.	Deterioration of tank due corrosion or otherwise.	Surge tank leaking and/or rupture. Tank required to be taken 'offline' for repairs resulting in risk of pipeline failure from water hammer	Not on SCADA	Galvanised steel surge tank	3	4	4	48	Maintenance change - establish preventative maintenance program	Undertake condition assessment	UHSC			3	3	3	27	
		Halcomb Hill Surge Tank	Damage to the tanks ancillary items such as level sensors and inlet/outlet valves.	Mechanical, electrical, or otherwise.	Incorrect operation of the tank.	Not on SCADA		3	2	4	24	Maintenance change - keep critical equipment spare		UHSC			2	2	4	16	
		Dam line surge tank	Structural damage to the tank.	Deterioration of tank due corrosion or otherwise.	Surge tank leaking and/or rupture. Tank required to be taken 'offline' for repairs resulting in risk of pipeline failure from water hammer	Not on SCADA	Concrete surge tank	3	2	4	24	Maintenance change - establish preventative maintenance program	Undertake condition assessment	UHSC			3	2	3	18	
		Dam line surge tank	Damage to the tanks ancillary items such as level sensors and inlet/outlet valves.	Mechanical, electrical, or otherwise.	Incorrect operation of the tank.	Not on SCADA		3	2	4	24	Maintenance change - keep critical equipment spare		UHSC			2	2	4	16	
		Togar Reservoir	Structural damage to the tank.	Deterioration of tank due corrosion or otherwise.	Balance tank leaking and/or rupture. Tank required to be taken 'offline' for repairs.	Alternative feeds via Glenbawn Dam. Standard maintenance procedure and operations procedures.	Roof in poor condition	4	4	3	48	Design review - assess system under current conditions and modify design if required	Assess potential for reservoir to be contaminated by birds/version entering through roof defects - Circular 18 assessment	UHSC			3	1	2	6	
		Togar Reservoir	Damage to the tanks ancillary items such as level sensors and inlet/outlet valves.	Mechanical, electrical, or otherwise.	Inaccurate measurements in SCADA and/or incorrect flow into/out of the tank.	Alternative feeds via Glenbawn Dam. Routine maintenance, system control alerts, and standard operation procedures followed.		2	3	2	12	Maintenance change - keep critical equipment spare		UHSC			1	3	2	6	
		Chlorination for Scone from Aberdeen	Dose system fault	Low / high chlorine levels outside of CCP / OCP	Unable to treat system to a drinking water standard	Back up power source. SCADA alarm for failure	Levels not on SCADA	4	3	5	60	Install chlorine analyser. Connect to SCADA		UHSC			4	3	1	12	
		Chlorination for Scone from Aberdeen	Failure to activate dosing process	Electrical, mechanical, or otherwise	Unable to treat system to a drinking water standard		Back up pump available	2	4	5	40	Connect to SCADA		UHSC			2	4	1	8	
		Chlorination for Scone (Gundy Road)	Dose system fault	Low / high chlorine levels outside of CCP / OCP	Unable to treat system to a drinking water standard	Back up power source. SCADA alarm for failure (if pump doesn't not operate, no alarm turned on for dosing outside perimeters)	Back up power source such as a generator is available to be hard wired in and SCADA alarm present for failure	4	3	5	60	Install chlorine analyser. Connect to SCADA		UHSC			4	3	1	12	
		Chlorination for Scone (Gundy Road)	Failure to activate dosing process	Electrical, mechanical, or otherwise	Unable to treat system to a drinking water standard		Back up pump available	2	3	5	30	Connect to SCADA		UHSC			2	4	1	8	
		Scone Intake Pump (ABN)	Failure of pumps (electrical)	Power failure to site	Pumps unable to switch 'on'	No back up power source. Assume SCADA alarm for failure	No generator can be hard wired in (contains VSD) switchboard too old. Can be fed from Glenbawn (back up site)	4	4	1	16	Renew switchboard	HR intakes have 1 pump in old condition, part of 'Aberdeen intake upgrade'. Switchboards are oldest ones Council have. Need to confirm if genset could be hardwired into this arrangement.	UHSC			1	3	1	3	Pumpset part of upgrades to take place next year (2022)
		Scone Intake Pump (ABN)	Failure of pumps (mechanical)	Damage to pumps (e.g. cavitation, typical wear-and-tear)	Pumps unable to effective function and or unable to switch 'on/off' correctly.	No standby pump is available. Standard maintenance procedure and operations procedures.	Currently no standby pump available	2	2	1	4	Maintenance change - keep critical equipment spare		UHSC			1	2	1	2	
		Glenbawn Dam Pumps	Failure of pumps (electrical)	Power failure to site	Pumps unable to switch 'on'	Assume alarm to SCADA	Provisions to hardwire a generator	4	2	1	8	Maintenance change - establish preventative maintenance program		UHSC			4	2	1	8	
		Glenbawn Dam Pumps	Failure of pumps (mechanical)	Damage to pumps (e.g. cavitation, typical wear-and-tear)	Pumps unable to effective function and or unable to switch 'on/off' correctly.	Assume alarm to SCADA	Duty/standby arrangement	3	3	1	9	Maintenance change - establish preventative maintenance program		UHSC			3	3	1	9	
		Togar Reservoir Pump	Failure of pumps (electrical)	Power failure to site	Pumps unable to switch 'on'	Assume SCADA alarm for failure	Duty/standby arrangement. Pump refurbished 2018. No generator can be hardwired in.	2	5	1	10	Maintenance change - establish preventative maintenance program	Duty/standby arrangement.	UHSC			2	5	1	10	
		Togar Reservoir Pump	Failure of pumps (mechanical)	Damage to pumps (e.g. cavitation, typical wear-and-tear)	Pumps unable to effective function and or unable to switch 'on/off' correctly.	Duty/standby arrangement. Standard maintenance procedure and operations procedures.		2	2	1	4	Maintenance change - establish preventative maintenance program	Duty/standby arrangement.	UHSC			2	2	1	4	
		Scone Reservoirs 1, 2 and 3	Structural damage to the tank.	Deterioration of tank due corrosion or otherwise.	Balance tank leaking and/or rupture. Tank required to be taken 'offline' for repairs.	Standard maintenance procedure and operations procedures.		3	1	2	6	Maintenance change - establish preventative maintenance program	No known issues	UHSC			2	3	1	6	
		Scone Reservoirs 1, 2 and 3	Damage to the tanks ancillary items such as level sensors and inlet/outlet valves.	Mechanical, electrical, or otherwise.	Inaccurate measurements in SCADA and/or incorrect flow into/out of the tank.	Routine maintenance, system control alerts, and standard operation procedures followed.	All valves left in open position, if failure occurs it will fail on close. Still have 2 other reservoirs	1	2	2	4	Maintenance change - keep critical equipment spare		UHSC			1	2	2	4	
		High Zone Res pump station	Failure of pumps (electrical)	Power failure to site	Pumps unable to switch 'on'	No back up power source. SCADA alarm for failure		2	3	1	6	Maintenance change - establish preventative maintenance program		UHSC			1	3	1	3	

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								Severity	Occurrence	Detectability							Severity	Occurrence	Detectability		
		High Zone Res pump station	Failure of pumps (mechanical)	Damage to pumps (e.g. cavitation, typical wear-and-tear)	Pumps unable to effective function and/or unable to switch 'on/off' correctly.	No standby pump is available. Standard maintenance procedure and operations procedures.		2	3	1	6	Maintenance change - keep critical equipment spare					1	2	1	2	
		Satur Reservoirs	Structural damage to the tank.	Deterioration of tank due corrosion or otherwise.	Balance tank leaking and/or rupture. Tank required to be taken 'offline' for repairs.	Standard maintenance procedure and operations procedures.		2	1	3	6	Maintenance change - establish preventative maintenance program	No known issues				2	1	2	4	
		Satur Reservoirs	Damage to the tanks ancillary items such as level sensors and inlet/outlet valves.	Mechanical, electrical, or otherwise.	Inaccurate measurements in SCADA and/or incorrect flow into/out of the tank.	Routine maintenance, system control alerts, and standard operation procedures followed.		2	1	3	6	Maintenance change - keep critical equipment spare					2	1	2	4	
		High Scone Reservoir	Structural damage to the tank.	Deterioration of tank due corrosion or otherwise.	Balance tank leaking and/or rupture. Tank required to be taken 'offline' for repairs.	Standard maintenance procedure and operations procedures.		2	2	2	8	Maintenance change - establish preventative maintenance program					2	2	2	8	
		High Scone Reservoir	Damage to the tanks ancillary items such as level sensors and inlet/outlet valves.	Mechanical, electrical, or otherwise.	Inaccurate measurements in SCADA and/or incorrect flow into/out of the tank.	Routine maintenance, system control alerts, and standard operation procedures followed.		2	2	2	8	Maintenance change - keep critical equipment spare					2	2	2	8	
		Transfer Main Aberdeen to Scone	Pipeline rupture, cracking, leaking, or otherwise damaged resulting in a water egress point.	Unanticipated pressure surges, inappropriate jointing methods, ground settlement, root intrusion, pipes nearing end-of-design-life	Loss of supply to Scone	Alternative supply to Scone via Hunter River	Only notified when a member of the public calls in	4	4	3	48	List pipeline as a priority on mains renewal program	Aberdeen to Scone is extremely high risk pipe, old AC main has broken multiple times and runs through farmers properties.	UHSC			3	3	1	9	
		Transfer Main Glenbawn to nest of reservoirs	Pipeline rupture, cracking, leaking, or otherwise damaged resulting in a water egress point.	Unanticipated pressure surges, inappropriate jointing methods, ground settlement, root intrusion, pipes nearing end-of-design-life	Loss of supply to Reservoirs	Alternative supply to Scone via Hunter River	Alternate supply to Scone available via Hunter River	4	2	3	24	Maintenance change - establish preventative maintenance program	Glenbawn to Nest of reservoirs, has no known issues. Pipeline implemented in 2012 DN500 main.	UHSC			3	2	2	12	
		Transfer Mains Nest of reservoirs into Scone township	Pipeline rupture, cracking, leaking, or otherwise damaged resulting in a water egress point.	Unanticipated pressure surges, inappropriate jointing methods, ground settlement, root intrusion, pipes nearing end-of-design-life	Loss of supply to Scone township		Majority of trunk mains have been replaced still some old ones (70+ years)	2	2	2	8	Maintenance change - establish preventative maintenance program	Nest of reservoirs into Scone township, condition to be confirmed	UHSC			2	2	2	8	
	Cassilis	Bore Pumps 1 & 2	Failure of pumps (electrical)	Power failure to site	Pumps unable to switch 'on'	Assume no back up power source	No spares, small pumps. Generator can be hardwired in.	3	3	5	45	Back up power - Modify for 'hardwired' generator connection and connect to SCADA	One small bore is not able to feed Cassilis if the other fails.	UHSC			3	3	1	9	
		Bore Pumps 1 & 2	Failure of pumps (mechanical)	Damage to pumps (e.g. cavitation, typical wear-and-tear)	Pumps unable to effective function and/or unable to switch 'on/off' correctly.	Standby pump available. Standard maintenance procedure and operations procedures.	No spares, small pumps. Generator can be hardwired in. If one bore fails other can still be used	3	3	5	45	Connect to SCADA	One small bore is not able to feed Cassilis if the other fails.	UHSC			3	3	1	9	
		Chlorine dosing	Failure of chlorine dosing pumps	Mechanical, electrical, or otherwise.	Low / high chlorine levels outside of CCP / OCP	SCADA alarm for failure. No SCADA alarm for low/high level alarms	Dosing present, standby pump available.	4	2	5	40	Install No. 2 pump for chlorine dosing. Connect pumps to SCADA	1 pump with a spare available	UHSC			4	2	1	8	
		Chlorine dosing	Supply shortage	Unable to source chemical supply	Unable to dose the system	Storage of chemical on-site or with system authority	Enough chemical is stored on-site or with the system authority in case this scenario arises	2	1	2	4	Maintenance change - keep critical equipment spare		UHSC			1	1	2	2	
		Reservoir No.1, 2, 3, 4	Structural damage to the tank.	Deterioration of tank due corrosion or otherwise.	Balance tank leaking and/or rupture. Tank required to be taken 'offline' for repairs.	Standard maintenance procedure and operations procedures.	Routine weekly maintenance checks	2	2	4	16	Maintenance change - establish preventative maintenance program	No known issues, to be confirmed with operator	UHSC			2	2	3	12	
		Reservoir No.1, 2, 3, 4	Damage to the tanks ancillary items such as level sensors and inlet/outlet valves.	Mechanical, electrical, or otherwise.	Inaccurate measurements in SCADA and/or incorrect flow into/out of the tank.	Routine maintenance, system control alerts, and standard operation procedures followed.	Outlet valves have been replaced in 2021	2	1	4	8	Maintenance change - keep critical equipment spare		UHSC			2	1	3	6	
		Chlorine analyser	Failure of Chlorine analyser	Mechanical, electrical, or otherwise.	Loss of CCP monitoring	No SCADA alarm for low/high level alarms or analyser failure		4	3	5	60	Connect to SCADA		UHSC			4	3	1	12	
		Transfer Mains	Pipeline rupture, cracking, leaking, or otherwise damaged resulting in a water egress point.	Unanticipated pressure surges, inappropriate jointing methods, ground settlement, root intrusion, pipes nearing end-of-design-life	Loss of supply to Cassilis		Usually detected by member of public calling to notify of water leaking	2	2	5	20	Maintenance change - establish preventative maintenance program	No known issues	UHSC			2	2	4	16	

Appendix C

Template Water Efficiency Management Plan (WEMP)





Water Efficiency Management Plan

Template

Upper Hunter Water Utility Alliance (UHWUA)

3 August 2022

Project name		UHWUA - Drought and Emergency Response Management Plan 2022					
Document title		Water Efficiency Management Plan Template					
Project number		12554712					
File name		Appendix C - Template Water Efficiency Management Plan (WEMP) 2022.Docx					
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1. Introduction

Everyone in the Upper Hunter Water Utilities Alliance (UHWUA) Region are being asked to reduce the amount of drinking water they use to help secure the regions precious water supplies.

Large industrial, commercial and institutional organisations play a significant role in improving water efficiency across the region.

All organisations using more than 5ML per year, must complete a Water Efficiency Management Plan (WEMP) in partnership with the UHWUA Councils.

The WEMP is a key input into strategic water planning for the region and assists with water supply contingency planning to respond to shocks and extreme variations (e.g. major storm events, earthquake, drought, act of terrorism or unexpected asset failure).

The WEMP aims to continually improve water efficiency and identifies water saving actions in the short, medium and long term.

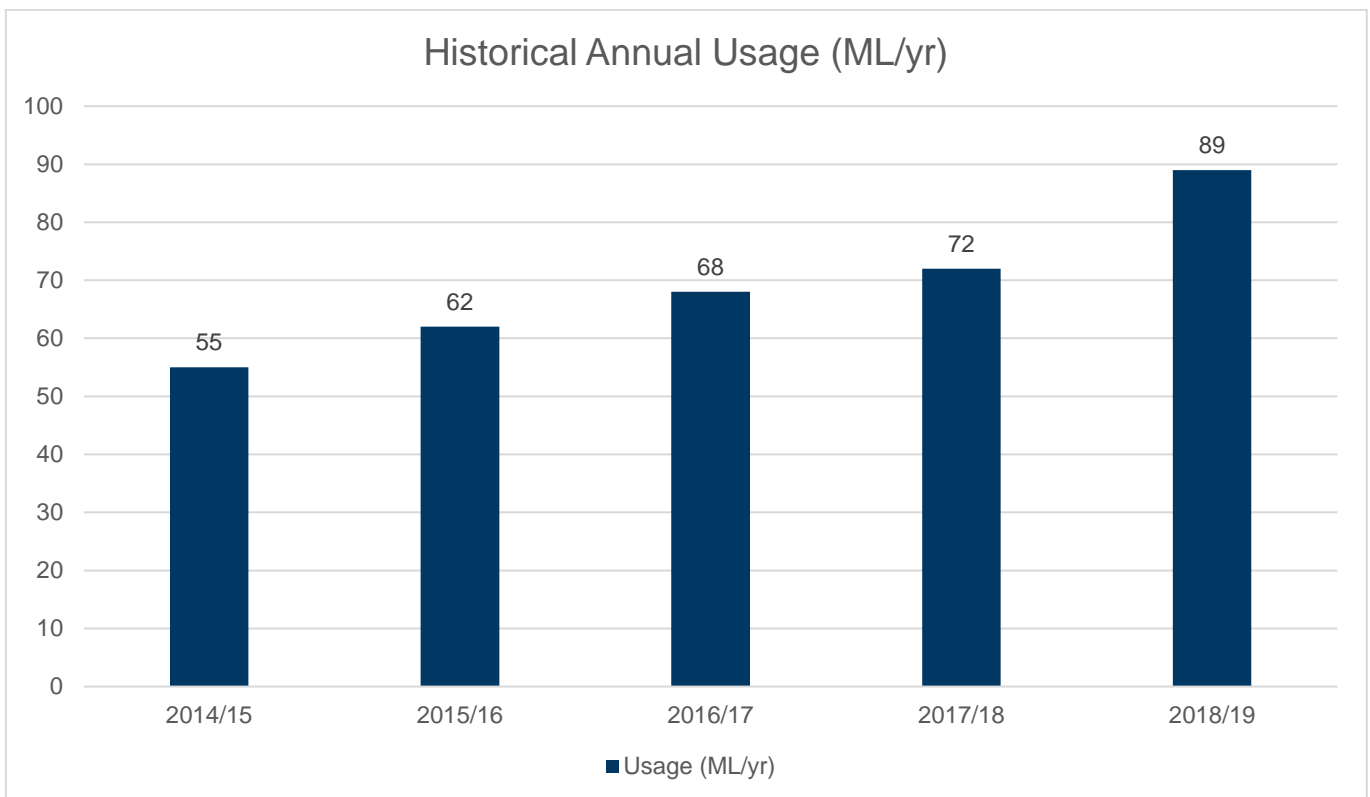
2. Customer Details

Organisation name Please show the business name as you would like it represented in marketing and communication materials		
Operating name If different from above		
Account number (on bill) If you do not have access to your bills, email: council@singleton.nsw.gov.au council@muswellbrook.nsw.gov.au council@upperhunter.nsw.gov.au		
Site address		
Core business operations at this site What is your core business? What facilities are on site?		
Details of existing water saving initiatives		
Organisation contacts	Name:	
	Position:	
	Phone:	
	Email:	
Water Management Team To ensure your WEMP is a success, it is a good idea to establish a Drought and Emergency Response Management Team (DERMT). Decide who your appropriate contact(s) are and involve key staff members who may influence or have an understanding of how water is used at your site.	Name:	Position:
Operational changes that may impact on water use over the next 5 years Are you planning on expanding or contracting operations over next 5 years?		
Peak industry body membership Are you part of a relevant peak industry body? Who are they?		
NABERS or Green Star Rating Is your building NABERS or Green Star rated?		

3. Historical Water Usage from UHWUA Councils Supply

Year	Water Use (ML/yr)	Identify Water Use Increase or Decrease	Reason e.g. nothing changed, days of operation, production rate, plant shutdown, site construction

The water use from the above table is displayed in a graph format below:



4. Water Usage Breakdown

Effective water management to identify water savings requires a good understanding of all water used on site, both potable and non-potable. For example, potable, groundwater (bore), recycled, stormwater or other non-potable sources etc.

Major Water Using Area	Water Source Potable, Recycled, Bore/Ground	Volume of Water Use (kL/day)	Percentage of Total Water Use (%)
TOTAL			

Water use shown above was determined by:

5. Action Plan

Description of Water Efficiency Measure	1.	2.	3.	4.	5.
Action(s) to be Taken e.g. Sub-metering plan Detailed audit Leak detection Install water efficient devices Encourage water efficient behaviours Recycled water / bore water / rainwater tanks					
Expected Water Savings (kL/day)					
Water Cost Savings (\$/yr)					
Expected Other Savings e.g. energy, trade waste charges. (\$/yr)					
Estimated Cost to Implement Actions (\$)					
Estimated Annual Costs (\$)					
Payback Period (yrs)					
Possible Risks/Challenges to Implementation e.g. Technical, administrative, environmental					

Further Recommendations:

6. Benchmarking and targets

Current Year	Water used (ML)	Business Activity Measure (e.g. person, tonnage, m ²)	Benchmark (eg. kL/person or kL/m ² GLA)

% reduction target	
--------------------	--

The water reduction target has been set based on:

7. UHWUA Councils and Customer Partnership

Thanks very much for working with us to complete the WEMP. Please note:

- UHWUA Councils and the customer may comment on the WEMP and/or request additional information relating to the WEMP
- UHWUA Alliance Councils and/or the customer may request a meeting as required to update the plan and report on WEMP implementation progress.
- UHWUA Councils and the customer acknowledge participation and sharing of knowledge.



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