GWMWater

Water Quality Annual Report 2020-21

2020/2021 Annual Report for Water Quality

GWMWater's vision captures a healthy environment and thriving communities to promote the productivity and liveability of the region. This vision is facilitated through a policy commitment to provide safe drinking water and a capital program that aims to deliver tailored water quality improvement projects to meet our customer's needs.

GWMWater's risk management framework for supplying safe drinking water aligns with the 12 elements in the Australian Drinking Water Guidelines and incorporates industry best practice in the delivery of drinking water. Management of water quality risk is supported by a program of regular internal audits, a SCADA based Operational Management Centre, extensive process controls, a comprehensive water quality data management system, sampling and testing program and a training and maintenance program.

GWMWater has acknowledged that climate change will most likely impact the Murray River and cause more frequent water quality events. These could include increased duration and frequency of blue green algae blooms; low water levels, bushfires impacting catchments; or floods that can give rise to black water events.

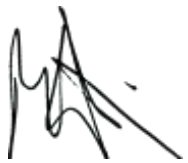
In this regard, GWMWater's plans to improve the reliability of water quality delivered to Mallee customers whose source of water is the Murray River. Planning is well advanced to deliver a pilot 'clean water' project for the Wemen pump station supplied area. This pilot includes a Dissolved Air Flotation (DAF) which will be located at the Ouyen water treatment plant. As well as supplying rural customers with cleaner water, this system will feed Underbool and Ouyen Water Treatment Plants, improving the operation and reliability of the drinking water supplies.

Additionally, upgrade of the supplies to Ultima and Moyston to drinking water are well advanced with work in the planning and design stage. Moyston will be supplied from Ararat treatment plant while Ultima will be supplied from Swan Hill treatment plant, operated by Lower Murray Water.

Supplies to Kaniva and Elmhurst are also to be upgraded to drinking water by the end of 2023, with water to be piped to Kaniva and Elmhurst to be supplied from a new water treatment plant at the town.

Preparation for construction for the East Grampians Water Supply Project is well underway, with this project to be implemented in stages up to 2023. This pipeline will provide water from Lake Fyans, Mt Cole Reservoir and the Mt William headworks. Of note, this project will supply better regulated water quality to existing GWMWater serviced towns of Wickliffe, Westmere and Streatham.

The above mentioned management systems and projects secure water supply for the region and deliver water quality improvemnets that meets customer needs, improving the overall livebility of the communities we serve.



Mark Williams
Managing Director

Section 23 of the Safe Drinking Water Act 2003 requires Grampians Wimmera Mallee Water Corporation (GWMWater) to make available for inspection by the public the results of any water quality monitoring program conducted on any drinking water supplied by GWMWater. Customers and members of the public may access drinking water quality data by contacting GWMWater either by telephone on 1300 659 961 or by the internet at www.gwmwater.org.au.

Revision	Revision Date	Details	Authorised
1	29/07/2021	Draft for internal review	Matthew Kube & Suzy McDonald
2	10/09/2021	Water Regulation review	Mark Ferguson
3	17/09/2021	Executive Manager Infrastructure review	Nalaka Vitharana
4	19/09/2021	Review by Senior Leadership Team	Senior Leadership Team
5	05/10/2021	Department of Health review	Kamal Khatri
6	13/10/2021	Managing Director review and sign off	Mark Williams
7	22/10/2021	Final copy to Department of Health	Secretary DH

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1 Introduction

Grampians Wimmera Mallee Water Corporation (trading as GWMWater) is a government-owned corporation, created by an order of the Victorian Government under the *Water Act 1989*. On 1 July 2004, GWMWater assumed the responsibilities of the predecessor organisations Grampians Water and Wimmera Mallee Water. The vision and mission of GWMWater are:

Vision
'Healthy environment, thriving community.'

Mission
'Through partnerships with our stakeholders, we will provide affordable services using our precious resources to ensure a productive and liveable region.'

GWMWater provides water services to a population of around 61,500 customers living in 71 urban areas throughout the region. Domestic and stock water supplies are provided to 11,000 rural customers living throughout the region. The region covers an area of 62,000 km^2, with a population density of less than one person/km^2.

GWMWater employs approximately 180 people throughout its operational region, with the corporate office being located in Horsham, Victoria.

1.1 *Safe Drinking Water Act 2003*

1.1.1 Background

The *Safe Drinking Water Act 2003* (the Act) and the Safe Drinking Water Regulations 2015 (the Regulations) is the legislative framework for assuring drinking water quality in Victoria.

The Act is based on:
a) Adoption of 'catchment-to-tap' risk management obligations.
b) Standards are applicable to all drinking water samples for key water quality criteria.
c) Information disclosure obligations for water suppliers.
d) Adoption of systemic community consultation processes.

This approach is consistent with regulatory best practice for the management of complex and inter-dependent risks.

1.1.2 Purpose and Outline

The Act:
a) Requires water suppliers and water storage managers to prepare and implement Risk Management Plans (RMP) to manage risk in relation to drinking water and some types of non-potable water.
b) Provides for the auditing of those plans by approved auditors.
c) Requires water suppliers to ensure that the drinking water they supply meets quality standards specified by the regulations.

d) Requires water suppliers to disclose to the public information concerning the quality of drinking water.
e) Provides for the variation, after community consultation, of water quality standards that relate only to aesthetic factors.
f) Requires the reporting of known or suspected contamination of drinking water to the Department of Health (DH).

1.1.3 Definitions

The Act provides the following definitions for water quality classification:

Drinking Water
Water that is intended for human consumption or for purposes connected with human consumption, such as the preparation of food or the making of ice for consumption or for the preservation of unpackaged food, whether or not the water is used for other purposes.

Regulated Water
Regulated water is defined as water that is not drinking water but may in circumstances be mistaken as being drinking water according to Section 6 (2) in the Act.

1.1.4 Safe Drinking Water Regulations 2015

This annual report includes the specific requirements from the Regulations.

The objective of the Regulations is to give effect to key aspects of the Act. In particular, the Regulations:
a) Specifies the major elements to be incorporated in risk management plans.
b) Specifies the standards relating to the quality of drinking water supplied to customers by water suppliers.
c) Specifies criteria for approval of auditors.
d) Specifies details to be included in annual reports.

1.1.5 *Health Fluoridation Act 1973*

The *Health Fluoridation Act 1973* governs the addition of fluoride to drinking water. Fluoridation of drinking water supplies requires a preventive risk management approach. For this purpose, the Code of practice for fluoridation of drinking water supplies, second edition (2018) supports utilities in the adoption and safe operation of fluoride addition to drinking water supplies.

1.2 Australian Drinking Water Guidelines 2011

The Australian Drinking Water Guidelines 2011 (ADWG) provide a framework for the management of drinking water supplies and is designed to assure safety at point of use. The ADWG has been developed after consideration of the best available scientific evidence.

The ADWG provides an authoritative reference of what comprises safe, good quality water, how it can be achieved and how it can be assured. The ADWG is concerned with both health and aesthetic quality.

The ADWG is the authoritative reference of what constitutes safe, good quality water, and aligns with the Victorian's Safe Drinking Water Regulatory Framework. The ADWG and Safe Drinking Water Regulations are consistent with the Act, and provide a basis for determining the quality of water to be supplied to consumers in all parts of Australia. These need to consider the diverse array of regional or local factors, and consider economic, political and cultural issues, including customer expectations and willingness and the ability to pay.

The ADWG are intended for use by the Australian community and all agencies with responsibilities associated with the supply of drinking water, including catchment and water resource managers, drinking water suppliers, water regulators and health authorities.

1.3 GWMWater Drinking Water Quality Policy

GWMWater is committed to managing its water supply to provide safe drinking water that meets the ADWG, other regulatory and consumer expectations. For this purpose, GWMWater has a drinking water quality policy (Figure 1-1) that provides the framework for managing the risks involved in harvesting, treating and distributing drinking water.

drinking water quality policy

GWMWater

GWMWater is committed to managing its water supply effectively to provide a safe high quality drinking water that consistently meets the Australian Drinking Water Guidelines and consumer and other regulatory requirements.

To achieve this, in partnership with stakeholders and relevant agencies, GWMWater will:

- **Manage water quality** at all points along the delivery chain from catchment to the customers' tap.
- Use a **risk based approach** in which potential threats to water quality are identified and balanced.
- Integrate the **needs and expectations** of our customers, stakeholders, regulators and employees into our planning.
- Establish **regular monitoring** of the quality of drinking water and effective reporting mechanisms to provide relevant and timely information and promote confidence in the water supply and its management.
- Develop appropriate **contingency planning** and incident response capability.
- Participate in appropriate **research and development** activities to ensure continued understanding of drinking water quality issues and performance.
- Contribute to the debate on setting industry **regulations and guidelines**, and other standards relevant to public health and the water cycle.
- **Continually improve** our performance against corporate commitments and stakeholder expectations.

The organisation will implement and maintain a water quality management system consistent with the Australian Drinking Water Guidelines to effectively manage the risks to drinking water quality.

All GWMWater employees involved in the supply of drinking water are responsible for understanding, maintaining and continuously improving the water quality management system.

Mark Williams
Managing Director

Peter Vogel
Chairman

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Figure 1-1 Statement for GWMWater's Drinking Water Quality Policy.

1.4 Characterisation of the System

GWMWater's operational area is shown in Figure 1-2. Key components of the water supply system include:

1. Headworks system, comprising the area in and around the Grampians Ranges and the Wimmera River. The main storages are Lake Bellfield, Taylors Lake, Lake Wartook and Rocklands Reservoir. The total catchment area is 400,000 hectares with a maximum reservoir operating capacity of 522,000 megalitres.
2. GWMWater provides water to the majority of towns through two extensive pipeline systems.
    a. The Wimmera Mallee Pipeline (WMP) system, as follows:
        i. Supply Systems 1,2,3,4,6 and the South West Loddon Pipeline, all originate from the Grampians headworks and consist of 9270 kilometres of pipeline; and
        ii. Supply System 5, draws water from the Murray River and consists of approximately 860 kilometres of pipeline.
    b. The Northern Mallee Pipeline (NMP) system consisting of 3,390 kilometres of pipeline which draws water from the Murray River.
3. A total of 1,390 kilometres of reticulation pipeline servicing the 71 urban water supplies.
4. Thirty-two towns receive water that is classified as drinking water (Table 1-1).
5. The fully treated water is supplied by 15 water treatment plants owned and operated by GWMWater, and a further 4 water treatment plants operated under a Build, Own, Operate and Transfer (BOOT) agreement. These BOOT plants are located at Halls Gap, Ararat, Great Western and Stawell, and as of 23 June 2014 have been operated by Trility, an independent private sector owner and operator.
6. GWMWater also supplies regulated water to 39 towns (Table 1-2).
These supplies are harvested from a range of sources, including surface water and groundwater. Regulated supplies have low-level or no treatment, and is not intended for human consumption, drinking or food preparation.

1.5 Source of Water

GWMWater sources water from a range of surface water catchments, rivers and groundwater aquifers across the region. The catchments located within National Parks and State Forest are co-managed with Parks Victoria and the Department of Land, Water and Planning (DELWP). GWMWater also works in partnership with the Catchment Management Authority, local government, Goulburn Murray Water, Coliban Water, and Wannon Water to address issues affecting water quality in the catchments from where water is sourced.

The Safe Drinking Water Regulations 2015 require water suppliers to detail the methodology used to quantify microbial hazards in source waters. GWMWater conducted

sanitary surveys and vulnerability assessments of raw water source based on the drinking water source assessment and treatment requirements: manual for the application of Health-Based Treatment Targets, developed by Water Services Association of Australia (WSAA). GWMWater has a Hazard Analysis and Critical Control Points (HACCP) Plan for operation of the water treatment plants and supply system to ensure the delivery of safe drinking water. Sanitary surveys, vulnerability assessment and HACCP are continuously reviewed, audited and improved.

Table 1-1 and Table 1-2 provide a summary of the source waters by water supply for both drinking water and regulated water.

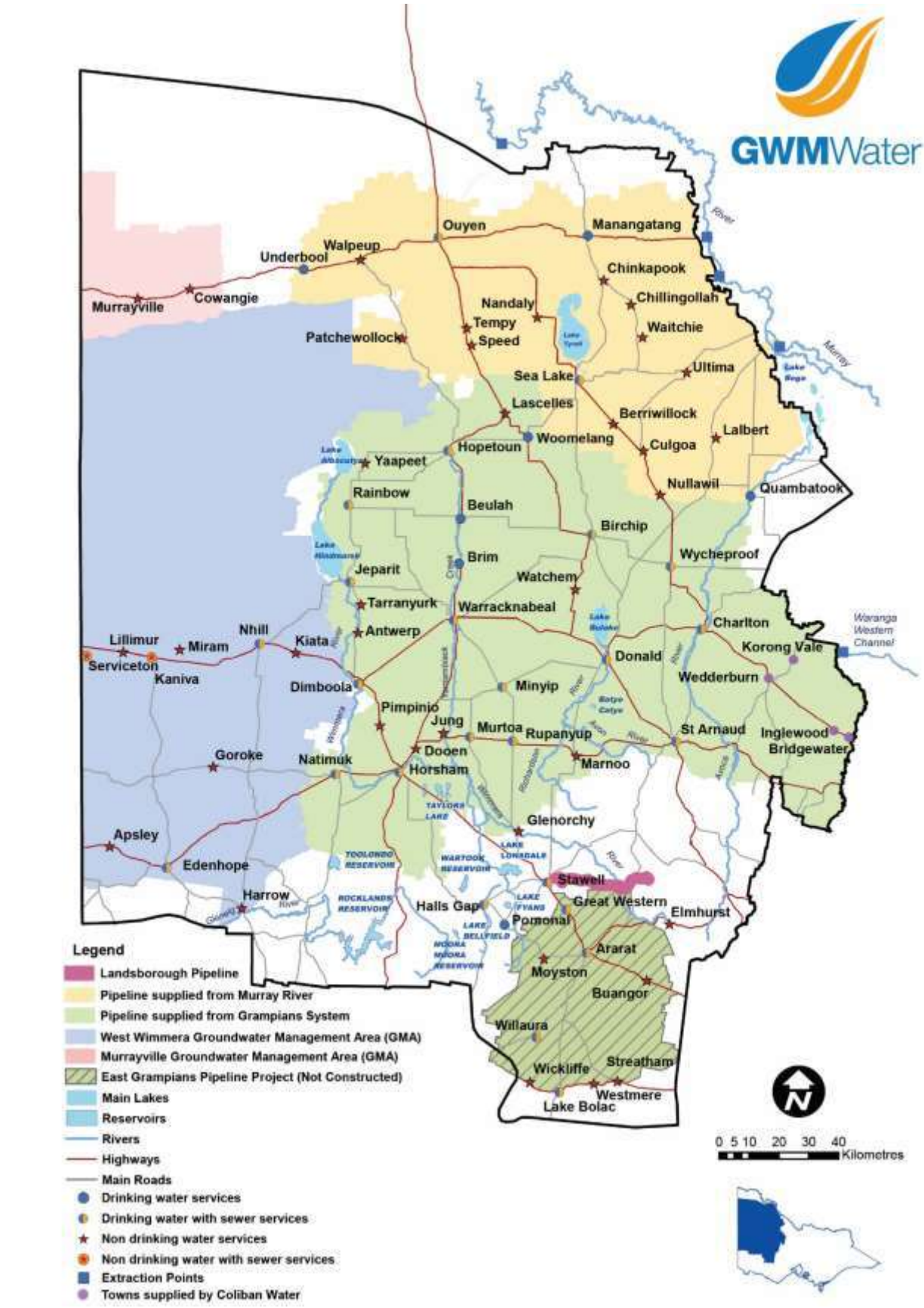

Figure 1-2 GWMWater's Operational Area.

Table 1-1- Water Source for Drinking Water Supplies.

Locality	Source Water	Water Storages	Treatment Plant	Population
Ararat	Surface water (Lake Fyans, Mt Cole & Langi Ghiran Reservoirs)	Copes Hill and Olivers Gully earthen storages (raw)	Ararat WTP	7790
Beulah	Grampians Headworks (WMP)	2 x lined steel tanks (treated)	Warracknabeal WTP	370
Birchip	Grampians Headworks (WMP)	1 x lined earthen storages (raw) 2 x lined steel tanks (treated)	Birchip WTP	790
Brim	Grampians Headworks (WMP)	2 x lined steel tanks (treated)	Warracknabeal WTP	190
Charlton	Grampians Headworks (WMP)	1 x lined earthen storages (raw) 2 x lined steel tanks (treated)	Charlton WTP	1180
Dimboola	Grampians Headworks (WMP)	2 x lined earthen storages (raw)	Dimboola WTP	1950
Donald	Grampians Headworks (WMP)	2 x lined steel tanks (treated)	St Arnaud WTP	1690
Edenhope	Groundwater (bores)	Fed directly from bores (raw)	Edenhope WTP	1060
Great Western	Surface water (Lake Fyans)	1 x earthen storage (raw) 1 x lined steel tanks (treated)	Great Western WTP	450
Halls Gap	Surface water (Lake Bellfield, Dairy Creek)	Lake Bellfield and Dairy Creek earthen storages (raw) 1 x concrete tank (treated)	Halls Gap WTP	480
Hopetoun	Grampians Headworks (WMP)	1 x lined earthen storages	Hopetoun WTP	610
Horsham	Surface and bore water (Lake Wartook and Laharum Bores)	1 x earthen storage (raw) 1 x concrete tank (treated) 1 x concrete storage (treated)	Mt Zero WTP	16360
Jeparit	Grampians Headworks (WMP)	2 x lined steel tanks (treated)	Rainbow WTP	380
Lake Bolac	Surface water (Mt William Creek, Stony Creek, Masons Creek) & Groundwater (bores)	1 x lined steel tank (raw) 1 x lined steel tanks (treated)	Willaura WTP	370
Manangatang	Surface water (Murray River via NMP)	1 x lined steel tank (raw) 1 x lined steel tank (treated)	Manangatang WTP	270
Minyip	Grampians Headworks (WMP)	2 x lined steel tanks (treated)	Murtoa WTP	590
Murtoa	Grampians Headworks (WMP)	2 x lined earthen storages (raw) 1 x lined steel tank (treated)	Murtoa WTP	970
Natimuk	Surface and bore water (Lake Wartook and Laharum bores)	1 x lined steel tank (treated)	Mt Zero WTP	580
Nhill	Grampians Headworks (WMP)	3 x lined steel tanks (treated) 1x elevated tank (treated)	Dimboola WTP	2460
Ouyen	Surface water (Murray River via NMP)	2 x earthen storages (raw) 1 x lined steel tank	Ouyen WTP	1340
Pomonal	Surface water (Lake Bellfield)	1 x concrete tank (treated)	Halls Gap WTP	360
Quambatook	Surface water (Goulburn & Loddon Rivers) via Normanville Pipeline	1 x earthen storage (raw) 1 x concrete tower (treated)	Quambatook WTP	280
Rainbow	Grampians Headworks (WMP)	2 x lined earthen storages (raw)	Rainbow WTP	770
Rupanyup	Grampians Headworks (WMP)	2 x lined steel tanks (treated)	Murtoa WTP	600
Sea Lake	Grampians Headworks (WMP)	2 x lined steel tanks(treated)	Warracknabeal WTP	720
St Arnaud	Grampians Headworks (WMP)	Volcano lined & St Arnaud earthen storage (raw) 3 x concrete tanks (treated)	St. Arnaud WTP	2290

Locality	Source Water	Water Storages	Treatment Plant	Population
Stawell	Surface water (Lake Fyans, Lake Bellfield, Fyans Creek)	3 x earthen storages (raw) 1 x concrete tank (treated)	Stawell WTP	6210
Underbool	Surface water (Murray River via NMP)	2 x earthen storages (raw) 1 x lined steel tank (treated)	Underbool WTP	210
Warracknabeal	Grampians Headworks (WMP)	2 x lined earthen storages (raw) 2 x lined steel tank (treated)	Warracknabeal WTP	2610
Willaura	Surface water (Mt William Creek, Stony Creek, Masons Creek) and Groundwater (bores)	2 x earthen storages at Willaura and Mt Pleasant (raw) 1 x lined steel tank (treated)	Willaura WTP	300
Woomelang	Grampians Headworks (WMP)	2 x lined steel tanks (treated)	Warracknabeal WTP	230
Wycheproof	Grampians Headworks (WMP)	2 x lined steel tanks (treated)	Charlton WTP	660

WMP – Wimmera Mallee Pipeline **NMP – Northern Mallee Pipeline**

Table 1-2 - Water Source for Regulated Water Supplies.

Water Supply	Source Water	Raw Water Storage	Population
Antwerp	Grampians Headworks (WMP)	2 x poly lined steel tanks	70
Apsley	Groundwater (bores)	1 x elevated steel tank	310
Berriwillock	Surface water (Murray River via NMP)	2 x earthen storages	210
Buangor	Surface water (McLeods Creek)	1 x earthen storage	120
Chillingollah	Surface water (Murray River via NMP)	1 x concrete tank	10
Chinkapook	Surface water (Murray River via NMP)	1 x concrete tank	40
Cowangie	Groundwater (bores)	1 x elevated tank	40
Culgoa	Surface water (Murray River via NMP)	1 x earthen storage	110
Dooen	Grampians Headworks (WMP)	2 x poly tanks	270
Elmhurst	Surface water (Hickmans Creek)	1 x earthen storage	210
Glenorchy	Grampians Headworks (WMP)	2 x elevated steel tanks	140
Goroke	Groundwater (bores)	2 x elevated steel tanks	340
Harrow	Groundwater (bores) & surface water (Glenelg River)	2 x poly lined steel tanks	220
Jung	Grampians Headworks (WMP)	2 x poly lined steel tanks	270
Kaniva	Groundwater (bores)	1x elevated concrete tank	700
Kiata	Groundwater (bores)	2 x concrete tanks	70
Lalbert	Surface water (Murray River via NMP)	2 x poly lined steel tanks	170
Lascelles	Grampians Headworks (WMP)	2 x lined steel tanks	100
Lillimur	Groundwater (bores)	1x elevated steel tank	120
Marnoo	Grampians Headworks (WMP)	1 x earthen storage	140
Miram	Groundwater (bores)	1 x elevated steel tank	40
Moyston	Surface water (Mt William, Stony and Masons Creeks) and Groundwater (bores)	1 x earthen storage	390
Murrayville	Groundwater (bores)	1 x elevated tank	310
Nandaly	Surface water (Murray River via NMP)	1 x concrete tank	40
Nullawil	Surface water (Murray River via NMP)	2 x lined steel tanks	100
Patchewollock	Surface water (Murray River via NMP)	2 x earthen storages	150
Pimpinio	Grampians Headworks (WMP)	2 x lined earthen storages 1 x elevated tank storage	210
Serviceton	Groundwater (bores)	1 x elevated steel tank	130
Speed	Surface water (Murray River via NMP)	1 x concrete tank	90
Streatham	Groundwater (bores)	1 x earthen storage	180
Tarranyurk	Grampians Headworks (WMP)	2 x lined steel tanks	30
Tempy	Surface water (Murray River via NMP)	1 x steel tank 1 x concrete tank	60
Ultima	Surface water (Murray River via NMP)	2 x poly lined steel tanks	200
Waitchie	Surface water (Murray River via NMP)	1 x concrete tank	50
Walpeup	Surface water (Murray River via NMP)	2 x earthen storages	180
Watchem	Grampians Headworks (WMP)	2 x poly lined steel tanks	130
Westmere	Groundwater (bores)	1 x earthen storage	40
Wickliffe	Surface water (Mt William, Stony and Masons Creeks) and Groundwater (bores)	1 x earthen storage	130
Yaapeet	Grampians Headworks (WMP)	2 x poly lined steel tanks	90

WMP – Wimmera Mallee Pipeline **NMP – Northern Mallee Pipeline**

2 Quality Management System

2.1 Water Treatment

The water treatment processes utilised at the drinking water treatment plants are shown in Table 2-1.

Table 2-1 - Water Treatment Processes and Chemicals in Drinking Water Towns.

Water Sampling Localities	Treatment Processes	Chemicals that can be added	Comments
Ararat*^	Coagulation, flocculation, dissolved air flotation, filtration, disinfection, pH correction, fluoridation	Lime, potassium permanganate, powder activated carbon, aluminium sulphate (alum), polymer, chlorine, hydrofluorosilicic acid	
Beulah	Receives water from Warracknabeal WTP, booster disinfection	Chlorine	Receives water from Warracknabeal WTP.
Birchip*	Coagulation, flocculation, dissolved air flotation, filtration, disinfection, pH correction	Sulphuric acid, aluminium chlorohydrate (Megapac 23), polymer, chlorine	
Brim	Receives water from Warracknabeal WTP, booster disinfection	Chlorine	Receives water from Warracknabeal WTP.
Charlton*	Coagulation, flocculation, dissolved air flotation, filtration, disinfection, pH correction	Sulphuric acid, aluminium chlorohydrate (Megapac 23), polymer, chlorine	
Dimboola*	Coagulation, flocculation, dissolved air flotation, filtration disinfection, pH correction	Sodium hydroxide, aluminium chlorohydrate (Megapac 23), polymer, chlorine	
Donald	Receives water from St Arnaud WTP, booster disinfection	Chlorine	Receives water from St Arnaud WTP.
Edenhope*	Coagulation, flocculation, dissolved air flotation, filtration, desalination, disinfection	Aluminium chlorohydrate (Megapac 23), polymer, chlorine	
Great Western*^	Microfiltration, disinfection, pH correction	Sulphuric acid, polyaluminium chloride (PACl), polymer, sodium hydroxide, chlorine	
Halls Gap*^	Coagulation, flocculation, dissolved air flotation, filtration, disinfection, pH correction	Lime, aluminium sulphate (alum), polymer, chlorine	
Hopetoun*	Coagulation, flocculation, dissolved air flotation, filtration, disinfection, pH correction	Soda ash, aluminium chlorohydrate (Megapac 23), polymer, chlorine	
Horsham*	Powdered activated carbon dosing, coagulation, flocculation, dissolved air flotation, filtration, disinfection, pH correction, fluoridation	Lime, aluminium chlorohydrate (Megapac 23), polymer, chlorine, carbon dioxide, hydrofluorosilicic acid	
Jeparit	Receives water from Rainbow WTP, booster disinfection	Chlorine	Receives water from Rainbow WTP.
Lake Bolac	Receives water from Willaura WTP		Receives water from Willaura WTP.
Manangatang*	Coagulation, flocculation, multimedia filtration, microfiber filtration (2 µm), disinfection	Ultrion 44560 coagulant, chlorine	

Water Sampling Localities	Treatment Processes	Chemicals that can be added	Comments
Minyip	Receives water from Murtoa WTP, booster disinfection	Chlorine	Receives water from Murtoa WTP.
Murtoa*	Coagulation, flocculation, dissolved air flotation, filtration, pH correction, disinfection	Sodium hydroxide, Aluminium chlorohydrate (Megapac 23), polymer, chlorine	
Natimuk	Receives water from Horsham WTP, booster disinfection	Chlorine	Receives water from Horsham WTP.
Nhill	Receives water from Dimboola WTP, booster disinfection	Chlorine	Receives water from Dimboola WTP.
Ouyen*	Microfiltration, disinfection	Aluminium chlorohydrate (Megapac 23), chlorine	
Pomonal	Receives water from Halls Gap WTP, booster disinfection	Chlorine	Receives water from Halls Gap WTP.
Quambatook*	Coagulation, flocculation, dissolved air flotation, filtration, granular activated carbon filtration, pH correction, disinfection	Aluminium chlorohydrate (Megapac 23), hydrochloric acid, chlorine	
Rainbow*	Coagulation, flocculation, dissolved air flotation, filtration, disinfection	Aluminium chlorohydrate (Megapac 23), chlorine	
Rupanyup	Receives water from Murtoa WTP, booster disinfection	Chlorine	Receives water from Murtoa WTP.
Sea Lake	Receives water from Warracknabeal WTP, booster disinfection	Chlorine	Receives water from Warracknabeal WTP.
St Arnaud*	Coagulation, flocculation, dissolved air flotation, filtration, pH correction, disinfection	Aluminium chlorohydrate (Megapac 23), polymer, sodium hydroxide, chlorine	
Stawell*^	Coagulation, flocculation, dissolved air flotation, filtration, disinfection, pH correction	Lime, aluminium sulphate (alum), polymer, chlorine	
Underbool*	Coagulation, flocculation, sand filters, pH correction	Hydrochloric acid, Ultrion 44560 coagulant, chlorine	
Warracknabeal*	Coagulation, flocculation, dissolved air flotation, filtration, pH correction, disinfection	Lime, aluminium chlorohydrate (Megapac 23), chlorine	
Willaura*	Coagulation, flocculation, dissolved air flotation, microfiltration, pH correction, disinfection	Soda ash, calcite, aluminium chlorohydrate (Megapac 23), sodium hypochlorite, carbon dioxide, ammonia	
Woomelang	Receives water from Warracknabeal WTP, booster disinfection	Chlorine	Receives water from Warracknabeal WTP.
Wycheproof	Receives water from Charlton WTP, booster disinfection	Chlorine	Receives water from Charlton WTP.

^ Operated by Trility under a BOOT Contract
** Localities with a Water Treatment Plant*

Table 2-2 - Water Treatment Processes and Chemicals in Regulated Towns.

Water Supply	Treatment Processes	Chemicals used in Treatment
Berriwillock	Coagulation	PolyDADMAC
Culgoa	Coagulation	PolyDADMAC
Glenorchy	Coagulation	PolyDADMAC
Jung	Coagulation, disinfection	PolyDADMAC, chlorine
Lalbert	Coagulation, disinfection	PolyDADMAC, chlorine
Marnoo	Coagulation	PolyDADMAC
Murrayville	Disinfection	Chlorine
Nullawil	Coagulation	PolyDADMAC
Ultima	Coagulation	PolyDADMAC
Walpeup	Disinfection	Chlorine
Watchem	Coagulation, disinfection	PolyDADMAC, sodium hypochlorite, hydrochloric acid

2.2 Water Treatment Changes

2.2.1 Manangatang

The Manangatang WTP has historically been supplied water directly from the Murray River via a pipeline. Seasonal changes in pipeline velocities remobilises sediment and variations in Murray River water quality have impacted the operation of the Manangatang WTP. Minor works were conducted to connect the raw water pipe to a raw water tank prior to being fed to the WTP. This provides a buffer to allow water with a more consistent quality to be supplied to the WTP significantly reducing operator intervention required and significantly increasing plant reliability.

2.2.2 Willaura

The Willaura WTP, a membrane microfiltration plant, has historically required regular operator intervention, particularly when elevated green (non-toxic) algae occurred in the raw water storages and adversely impacted the quality of raw water being supplied to the WTP. A Dissolved Air Flotation (DAF) unit has been added as a pre-treatment step to the membranes. The addition of the DAF, through its ability to reduce colour, algae and turbidity, has improved the operating performance of the membranes and efficiency of the WTP. The inclusion of the DAF is also reducing the propensity for nitrification and the formation of disinfection by products in the chloraminated supplies of Willaura and Lake Bolac.

2.3 Water Treatment Issues

Issues related to water quality that occurred in 2020/2021 include:

- Taste and odour compounds in the Horsham reticulation system.
- Raw water entering a treated water tank at Manangatang.
- Ongoing management of blue-green algae in the Murray River and receiving water storages.

These issues are discussed further in the section Emergency, Incident and Event Management.

3 Drinking Water Quality Results

For the 2020/2021 year, the sampling frequency and drinking water quality standards for *Escherichia coli*¸ trihalomethanes and turbidity were as specified in Schedule 2 under the Regulations (Table 3-1). The water quality standards are discussed below.

The water sampling program is based on ADWG recommendations, specific risks, historical data and operational changes, from catchment to tap. The water sampling points are located within a water sampling locality and are designed to ensure that the samples collected are representative of the supply system. The sampling program is reviewed as risk changes or every two years to align with changes in the risk profile of each locality. Samples are sent to a National Association of Testing Authorities (NATA) accredited laboratory for analysis.

Regulation 6 of the Regulations states that a water sampling locality is:

- An area supplied with drinking water.
- A discrete area of similar water quality – generally water entering the area is supplied from a common source.
- Inclusive of all consumers supplied with drinking water of similar water quality.
- Able to be described by its boundaries.

Table 3-1 – Summary of sampling and 2020/2021 results to meet Schedule 2 under the Regulations.

Parameter	Sampling frequency	Benchmark compliance standard	All Standards met	Comments
Escherichia coli (*E. coli*)	Weekly	No *Escherichia coli* per 100 mL of drinking water, with the exception of any false positive samples.	Yes	All localities were compliant for the period. Refer to Section 3.1 for details.
Trihalomethanes (THM)	Monthly	Must not exceed 0.25 mg/L.	Yes	All localities were compliant for the period. Refer to Section 3.2 for details.
Turbidity	Weekly	95th percentile of results for samples in any 12 months must be ≤ 5.0 NTU.	Yes	All localities were compliant for the period. Refer to Section 3.3 for details.

3.1 *Escherichia coli* (*E. coli*)

The health impacts and epidemiology of thermotolerant coliforms, and specifically *E. coli,* are described in detail in the ADWG fact sheet.

E. coli is used as a specific indicator of faecal contamination and hence is a measure used to determine the safety of water for drinking. *E. coli* should not be detected in a sample of drinking water. If detected, immediate action is taken.

As required by the Regulations, one sample of drinking water is collected each week per water sampling locality and two samples per week are collected for towns greater than 5000 people. All samples of drinking water collected in any 12 months period must contain no *E. coli* per 100 mL, with the exception of any false positive sample. In the case that E. coli is detected, an investigation is conducted in accordance with regulation 14 to determine whether the result was representative of the drinking water in the relevant locality. A false positive is considered to have occurred where the water supplier can demonstrate treatment and control systems were in place and the false positive is more than likely the result of an external factor such as laboratory or sampling error.

3.1.1 Results

E. coli sampling and analysis was undertaken at two sites weekly for the larger towns and weekly for all the smaller potable towns. There were no missed samples for *E. coli* in this reporting period.

Samples from Minyip (14 *E. coli*/100 mL) and Donald (2 *E. coli*/100 mL) recorded *E. coli* readings on the 16 December 2020 and 26 May 2021, respectively. The Department of Health (DH) were provided with a Section 22report. The investigation found that there were no contributing factors in accordance with (c)(i)(ii)(iii) or (iv) in Schedule 2 of the Regulations to cause the *E. coli* results. As such, the *E. coli* reading was deemed to be a false positive and no further action was required. Please refer to the Emergency, Incident and Event Management section for further information.

All other samples met the standard for the reporting period of 2020/2021 (Table 3-2).

Table 3-2 – Results for Escherichia coli in Drinking Water: 1 July 2020 – 30 June 2021. All samples of drinking water collected in any 12 months period must contain no E. coli/100 mL, with the exception of any false positive samples.

Sampling Locality	Sampling Frequency	No. of Samples	(*Escherichia coli*/100 mL)	No. of samples where standard was not met (S 18)
Ararat*	Twice-weekly	104	0	0
Beulah	Weekly	52	0	0
Birchip	Weekly	52	0	0
Brim	Weekly	52	0	0
Charlton	Weekly	52	0	0
Dimboola	Weekly	52	0	0
Donald	Weekly	52	2	0^

Sampling Locality	Sampling Frequency	No. of Samples	(*Escherichia coli*/100 mL)	No. of samples where standard was not met (S 18)
Edenhope	Weekly	52	0	0
Great Western	Weekly	52	0	0
Halls Gap	Weekly	52	0	0
Hopetoun	Weekly	52	0	0
Horsham*	Twice-weekly	104	0	0
Jeparit	Weekly	52	0	0
Lake Bolac	Weekly	52	0	0
Manangatang	Weekly	52	0	0
Minyip	Weekly	52	14	0^
Murtoa	Weekly	52	0	0
Natimuk	Weekly	52	0	0
Nhill	Weekly	52	0	0
Ouyen	Weekly	52	0	0
Pomonal	Weekly	52	0	0
Quambatook	Weekly	52	0	0
Rainbow	Weekly	52	0	0
Rupanyup	Weekly	52	0	0
Sea Lake	Weekly	52	0	0
St. Arnaud	Weekly	52	0	0
Stawell*	Twice-weekly	104	0	0
Underbool	Weekly	52	0	0
Warracknabeal	Weekly	52	0	0
Willaura	Weekly	52	0	0
Woomelang	Weekly	52	0	0
Wycheproof	Weekly	52	0	0

** Due to the population size of these towns two samples are taken.*
^ The E. coli readings were found to be a false positive.

3.2 Trihalomethanes (THMs)

Trihalomethanes (THMs) are present in drinking water, principally as the result of a reaction between organic and inorganic material in the water with chlorine, and to a lesser extent chloramine.

Based on health considerations, the concentration of THMs, either individually or in total, in drinking water should not exceed 0.25 mg/L.

3.2.1 Results

THM sampling and analysis was undertaken on a minimum monthly basis for all drinking water supplies. There were no missed samples for THMs and all sites met the standard for this reporting period (Table 3-3).

Table 3-3 – Results for Trihalomethanes in Drinking Water: 1 July 2020 – 30 June 2021. The concentration of THMs must not exceed 0.25 mg/L.

Sampling Locality	Sampling Frequency	No. of Samples	Max (mg/L)	Average (mg/L)	No. of samples where standard was not met (S 18)
Ararat*	Twice-monthly	24	0.077	0.060	0
Beulah	Monthly	12	0.068	0.055	0
Birchip	Monthly	12	0.089	0.040	0
Brim	Monthly	12	0.090	0.070	0
Charlton	Monthly	12	0.096	0.064	0
Dimboola	Monthly	12	0.082	0.053	0
Donald	Monthly	12	0.095	0.063	0
Edenhope	Monthly	12	0.120	0.090	0
Great Western	Monthly	12	0.132	0.100	0
Halls Gap	Monthly	12	0.081	0.044	0
Hopetoun	Monthly	12	0.069	0.035	0
Horsham*	Twice-monthly	24	0.146	0.084	0
Jeparit	Monthly	12	0.076	0.057	0
Lake Bolac	Monthly	12	0.048	0.020	0
Manangatang	Monthly	12	0.089	0.050	0
Minyip	Monthly	12	0.086	0.063	0
Murtoa	Monthly	12	0.075	0.061	0
Natimuk	Monthly	12	0.166	0.129	0
Nhill	Monthly	12	0.060	0.051	0
Ouyen	Monthly	12	0.126	0.097	0
Pomonal	Monthly	12	0.072	0.058	0
Quambatook	Monthly	12	0.190	0.137	0
Rainbow	Monthly	12	0.056	0.032	0
Rupanyup	Monthly	12	0.078	0.063	0
Sea Lake	Monthly	12	0.099	0.070	0
St. Arnaud	Monthly	12	0.060	0.042	0
Stawell*	Twice-monthly	24	0.076	0.061	0
Underbool	Monthly	12	0.086	0.057	0
Warracknabeal	Monthly	12	0.094	0.064	0
Willaura	Monthly	12	0.037	0.019	0
Woomelang	Monthly	12	0.079	0.063	0
Wycheproof	Monthly	12	0.100	0.058	0

** Due to the population size of these towns two samples are taken every month.*

3.3 Turbidity

Turbidity is caused by the presence of very fine suspended matter, such as clay, silt, colloidal particles, plankton and other microscopic organisms in water. High turbidity can result in a water sample having a 'muddy' or 'milky' appearance.

Turbidity is a measurement of the light scattering property of water, and the degree of scattering is dependent on the amount, size and composition of the suspended matter.

The ADWG fact sheet contains a detailed account of turbidity and its implications for water supply. The Regulations require that the 95th percentile of results for samples in any 12-month period must not exceed five Nephelometric Turbidity Units (NTU).

3.3.1 Results

Turbidity sampling and analysis is undertaken as a minimum, on a weekly basis for all drinking water supplies. There were no missed samples for turbidity for the reporting period of 2020/2021 and all sites met the standard (Table 3-4).

Table 3-4 – Results for turbidity in Drinking Water: 1 July 2020 – 30 June 2021. The 95th percentile of results for samples in any 12 month period must be less than or equal to 5.0 NTU.

Sampling Locality	Sampling Frequency	No. of Samples	Max (NTU)	Max 95th percentile in any 12 months (NTU)	No. of 95th percentile of results in any 12 months above standard (S 18)
Ararat*	Twice-weekly	104	0.30	0.20	0
Beulah	Weekly	52	0.30	0.24	0
Birchip	Weekly	52	0.30	0.25	0
Brim	Weekly	52	0.30	0.48	0
Charlton	Weekly	52	0.20	0.20	0
Dimboola	Weekly	52	0.10	0.10	0
Donald	Weekly	52	0.20	0.15	0
Edenhope	Weekly	52	0.52	0.21	0
Great Western	Weekly	52	0.30	0.20	0
Halls Gap	Weekly	52	0.80	0.53	0
Hopetoun	Weekly	52	2.70	0.51	0
Horsham*	Twice-weekly	104	0.30	0.20	0
Jeparit	Weekly	52	0.20	0.20	0
Lake Bolac	Weekly	52	0.20	0.24	0
Manangatang	Weekly	52	0.20	0.20	0
Minyip	Weekly	52	0.40	0.26	0
Murtoa	Weekly	52	0.40	0.35	0
Natimuk	Weekly	52	0.50	0.32	0
Nhill	Weekly	52	0.30	0.15	0
Ouyen	Weekly	52	0.10	0.10	0

Sampling Locality	Sampling Frequency	No. of Samples	Max (NTU)	Max 95th percentile in any 12 months (NTU)	No. of 95th percentile of results in any 12 months above standard (S 18)
Pomonal	Weekly	52	0.30	0.20	0
Quambatook	Weekly	52	0.20	0.20	0
Rainbow	Weekly	52	0.70	0.21	0
Rupanyup	Weekly	52	0.10	0.10	0
Sea Lake	Weekly	52	0.11	0.10	0
St. Arnaud	Weekly	52	0.20	0.10	0
Stawell*	Twice-weekly	104	0.30	0.20	0
Underbool	Weekly	52	0.70	0.25	0
Warracknabeal	Weekly	52	0.40	0.10	0
Willaura	Weekly	52	0.10	0.20	0
Woomelang	Weekly	52	2.10	1.27	0
Wycheproof	Weekly	52	0.30	0.20	0

** Due to the population size of these towns two samples are taken every week.*

3.4 Other chemicals, pathogens, algal toxins or substance that may pose a risk to human health

Regulation 12(b) requires the water supplier to ensure that the drinking water supplied to customers does not contain any chemical, toxin, pathogen or other substance at the levels that may pose a risk to human health. The ADWG fact sheets contain a detailed account of other water quality standards and their implications for water supply.

3.4.1 Algal toxins, pesticides and radiological parameters

The sampling of Algal toxins, pesticides and radiological parameters is risk-based. All tests of pesticides, algal toxins or radiological parameters in raw water storages and reservoirs for drinking water supplies were well within ADWG values.

3.4.2 Chlorine

Chlorine is used extensively as a disinfectant for drinking water supplies. Based on health considerations, the guideline value for total chlorine in drinking water is 5 mg/L. The fact sheets in ADWG provide a detailed account of the health impacts and other considerations relating to chlorine.

3.4.2.1 Results

Chlorine contact times are calculated for each drinking water town and the critical alarms are adjusted at the WTP to meet this chlorine contact time and customer aesthetic expectations. GWMWater meets contact times for water delivered from all WTPs to customers., except at a low-level backup storage in Horsham. This low level storage roof liner had some holes in it, which is thought to have been the cause of one pre chlorinated

operational *E.coli* detect over a two year period. The holes have now been repaired and the liner is earmarked for replacement which will ensure chlorine contact values are maintained. Free chlorine was measured in localities with chlorination system, and total chlorine was measured in chloramination systems. The ADWG gives general guidance that chlorine should be at least 0.2 mg/L at the end of the reticulation system and a maximum of 5.0 mg/L at any point. GWMWater aims to meet this guidance by providing adequate chlorine dose at the WTP and flushing when required.

Table 3-5 - Concentrations of chlorine in Drinking Water for 1 July 2020 – 30 June 2021.

Sampling Locality	Sampling Frequency	No. of Samples	Max (mg/L)	Average (mg/L)	No. of samples where standard was not met (S 18)
Ararat*	Twice-weekly	104	1.1	0.6	0
Beulah	Weekly	52	1.5	1.2	0
Birchip	Weekly	52	1.5	1.0	0
Brim	Weekly	52	1.2	0.7	0
Charlton	Weekly	52	0.9	0.5	0
Dimboola	Weekly	52	1.4	0.8	0
Donald	Weekly	52	1.6	1.0	0
Edenhope	Weekly	52	1.1	0.8	0
Great Western	Weekly	52	2.1	0.9	0
Halls Gap	Weekly	52	1.9	1.0	0
Hopetoun	Weekly	52	1.4	0.9	0
Horsham*	Twice-weekly	104	1.5	0.9	0
Jeparit	Weekly	52	1.0	0.7	0
Lake Bolac	Weekly	52	2.2	1.8	0
Manangatang	Weekly	52	1.4	1.0	0
Minyip	Weekly	52	1.2	0.8	0
Murtoa	Weekly	52	1.0	0.6	0
Natimuk	Weekly	52	1.8	1.0	0
Nhill	Weekly	52	1.5	0.8	0
Ouyen	Weekly	52	1.5	0.8	0
Pomonal	Weekly	52	1.2	0.7	0
Quambatook	Weekly	52	1.4	0.8	0
Rainbow	Weekly	52	1.4	1.2	0
Rupanyup	Weekly	52	1.3	0.8	0
Sea Lake	Weekly	52	1.5	1.0	0
St. Arnaud	Weekly	52	2.1	1.4	0
Stawell*	Twice-weekly	104	1.2	0.5	0
Underbool	Weekly	52	1.5	1.0	0
Warracknabeal	Weekly	52	1.4	0.7	0
Willaura	Weekly	52	2.3	1.8	0

Sampling Locality	Sampling Frequency	No. of Samples	Max (mg/L)	Average (mg/L)	No. of samples where standard was not met (S 18)
Woomelang	Weekly	52	1.3	0.7	0
Wycheproof	Weekly	52	1.5	1.0	0

** Due to the population size of these towns two samples are taken every week.*

3.4.3 Chloroacetic acids

Chloroacetic acids (monochloroacetic acid, dichloroacetic acid and trichloroacetic acid) are produced in drinking water as disinfection by-products (DBPs) of the reaction between chlorine and naturally occurring humic and fulvic acids. The fact sheets in ADWG provide a detailed account of the health impacts and other considerations relating to chloroacetic acids.

3.4.3.1 Results

The sampling of these parameters is based on ADWG recommendations, risks, historical data and any operational changes. There were no missed samples for chloroacetic acids during this reporting period and all samples met the standard.

Table 3-6 - Concentrations of Monochloroacetic Acid in Drinking Water for 1 July 2020 – 30 June 2021. The concentration of monochloroacetic acid should not exceed 0.15 mg/L.

Sampling Locality	Sampling Frequency	No. of Samples	Results (mg/L)		No. of samples where standard was not met (S 18)
			Max	Average	
Great Western	Monthly	12	0.005	0.005	0
Manangatang	Monthly	12	0.005	0.005	0
Ouyen	Monthly	12	0.005	0.005	0
Quambatook	Monthly	12	0.005	0.005	0

Table 3-7 - Concentrations of Dichloroacetic Acids in Drinking Water of 1 July 2020 – 30 June 2021. The concentration of dichloroacetic acid should not exceed 0.1 mg/L.

Sampling Locality	Sampling Frequency	No. of Samples	Results (mg/L)		No. of samples where standard was not met (S 18)
			Max	Average	
Great Western	Monthly	12	0.060	0.041	0
Manangatang	Monthly	12	0.033	0.020	0
Ouyen	Monthly	12	0.055	0.031	0
Quambatook	Monthly	12	0.029	0.014	0

Table 3-8 - Concentrations of Trichloroacetic Acids in Drinking Water for 1 July 2020 – 30 June 2021. The concentration of trichloroacetic acid should not exceed 0.1 mg/L.

Sampling Locality	Sampling Frequency	No. of Samples	Results (mg/L)		No. of samples where standard was not met (S 18)
			Max	Average	
Great Western	Monthly	12	0.061	0.044	0
Manangatang	Monthly	12	0.045	0.023	0
Ouyen	Monthly	12	0.083	0.050	0
Quambatook	Monthly	12	0.013	0.007	0

3.4.4 Lead

Lead can be present in drinking water as a result of dissolution from natural sources, or from household plumbing systems containing lead. Lead concentrations in drinking water can be reduced by conventional methods of water treatment using coagulants or lime softening.

Based on health considerations, the guideline value of lead in drinking water should not exceed 0.01 mg/L. The fact sheets in the ADWG provide a detailed account of the health impacts and other considerations relating to lead.

3.4.4.1 Results

The sampling of lead is based on ADWG recommendations, risks and historical data. All samples for lead met the standard for the 2020/2021 reporting period (Table 3-9).

Table 3-9 - Concentrations of Lead in Drinking Water for 1 July 2020 – 30 June 2021. The concentration of lead should not exceed 0.01 mg/L.

Sampling Locality	Sampling Frequency	No. of Samples	Max (mg/L)	Average (mg/L)	No. of samples where standard was not met (S 18)
Ararat	Biannual	2	0.001	0.001	0
Beulah	Biannual	2	0.003	0.003	0
Birchip	Biannual	2	0.001	0.001	0
Brim	Biannual	2	0.001	0.001	0
Charlton	Biannual	2	0.001	0.001	0
Dimboola	Biannual	2	0.001	0.001	0
Donald	Biannual	2	0.001	0.001	0
Edenhope	Biannual	2	0.001	0.001	0
Great Western	Biannual	2	0.001	0.001	0
Halls Gap	Biannual	2	0.006	0.004	0
Hopetoun	Biannual	2	0.001	0.001	0
Horsham	Biannual	2	0.001	0.001	0
Jeparit	Biannual	2	0.001	0.001	0

Sampling Locality	Sampling Frequency	No. of Samples	Max (mg/L)	Average (mg/L)	No. of samples where standard was not met (S 18)
Lake Bolac	Biannual	2	0.001	0.001	0
Manangatang	Biannual	2	0.002	0.002	0
Minyip	Biannual	2	0.001	0.001	0
Murtoa	Biannual	2	0.001	0.001	0
Natimuk	Biannual	2	0.001	0.001	0
Nhill	Biannual	2	0.001	0.001	0
Ouyen	Biannual	2	0.001	0.001	0
Pomonal	Biannual	2	0.001	0.001	0
Quambatook	Biannual	2	0.001	0.001	0
Rainbow	Biannual	2	0.002	0.002	0
Rupanyup	Biannual	2	0.001	0.001	0
Sea Lake	Biannual	2	0.001	0.001	0
St. Arnaud	Biannual	2	0.001	0.001	0
Stawell	Biannual	2	0.001	0.001	0
Underbool	Biannual	2	0.001	0.001	0
Warracknabeal	Biannual	2	0.001	0.001	0
Willaura	Biannual	2	0.001	0.001	0
Woomelang	Biannual	2	0.001	0.001	0
Wycheproof	Biannual	2	0.002	0.002	0

3.4.5 Nitrite and Nitrate

Nitrite: Based on health considerations, the concentration of nitrite in drinking water should not exceed 3 mg-NO_2/L, equivalent to 0.913 mg N/L.

Nitrate: Based on health considerations, the guideline value of 50 mg-NO_3/L, equivalent to 11.3 mg/L, has been set to protect bottle-fed infants under three months of age and up to 100 mg-NO_3/L, equivalent to 22.6 mg N/L can be safely consumed by adults.

A detailed description of nitrite and nitrate and its implications in a water supply can be found by reference to the ADWG.

3.4.5.1 Results

Nitrite and Nitrate were measured in the chloramination systems Willaura and Lake Bolac. All the results for nitrite (Table 3-10) and nitrate (Table 3-11) met the standard for this reporting period.

Table 3-10 - Concentrations of Nitrite in Drinking Water for 1 July 2020 – 30 June 2021. The concentration of Nitrite should not exceed 3 mg-NO_2/L (0.913 mg N/L).

Sampling Locality	Sampling Frequency	No. of Samples	Max (mg N/L)	Average (mg N/L)	No of samples where standard was not met (S 18)

Lake Bolac	Weekly	52	0.36	0.017	0
Willaura	Monthly	12	0.002	0.002	0

Table 3-11 - Concentrations of Nitrate in Drinking Water for 1 July 2020 – 30 June 2021. The concentration of Nitrate should not exceed 50 mg-NO_3/L (11.3 mg N/L).

Sampling Locality	Sampling Frequency	No. of Samples	Max (mg N/L)	Average (mg N/L)	No of samples where standard was not met (S 18)
Lake Bolac	Weekly	52	0.15	0.07	0
Willaura	Monthly	12	0.12	0.06	0

3.4.6 Copper

The concentration of copper should not exceed 1 mg/L based on aesthetic considerations but would not be a health consideration unless the concentration exceeds 2 mg/L. Copper can occur naturally in catchments as it is widely distributed in rocks and soils as carbonate and sulphide minerals. A detailed description of copper and its implications in a water supply can be found by reference to the ADWG.

3.4.6.1 Results

The sampling of copper is based on ADWG recommendations, risks, historical data and any operational changes. All samples for copper met the standard for the reporting period (Table 3-12).

Table 3-12 - Concentrations of Copper in Drinking Water for 1 July 2020 – 30 June 2021. The concentration of Copper should not exceed 1 mg/L.

Sampling Locality	Sampling Frequency	No. of Samples	Max (mg/L)	Average (mg/L)	No. of samples where standard was not met (S 18)
Ararat	Biannual	2	0.067	0.025	0
Beulah	Biannual	2	0.281	0.180	0
Birchip	Biannual	2	0.010	0.006	0
Brim	Biannual	2	0.015	0.011	0
Charlton	Biannual	2	0.002	0.002	0
Dimboola	Biannual	2	0.002	0.002	0
Donald	Biannual	2	0.004	0.004	0
Edenhope	Biannual	2	0.006	0.005	0
Great Western	Biannual	2	0.027	0.025	0
Halls Gap	Biannual	2	0.064	0.037	0
Hopetoun	Biannual	2	0.015	0.008	0
Horsham	Biannual	2	0.010	0.005	0
Jeparit	Biannual	2	0.043	0.025	0
Lake Bolac	Biannual	2	0.019	0.017	0
Manangatang	Biannual	2	0.099	0.069	0
Minyip	Biannual	2	0.005	0.004	0

Sampling Locality	Sampling Frequency	No. of Samples	Max (mg/L)	Average (mg/L)	No. of samples where standard was not met (S 18)
Murtoa	Biannual	2	0.004	0.003	0
Natimuk	Biannual	2	0.042	0.042	0
Nhill	Biannual	2	0.012	0.007	0
Ouyen	Biannual	2	0.028	0.017	0
Pomonal	Biannual	2	0.107	0.087	0
Quambatook	Biannual	2	0.024	0.013	0
Rainbow	Biannual	2	0.095	0.048	0
Rupanyup	Biannual	2	0.014	0.011	0
Sea Lake	Biannual	2	0.079	0.045	0
St. Arnaud	Biannual	2	0.025	0.016	0
Stawell	Biannual	2	0.004	0.002	0
Underbool	Biannual	2	0.072	0.039	0
Warracknabeal	Biannual	2	0.004	0.003	0
Willaura	Biannual	2	0.041	0.036	0
Woomelang	Biannual	2	0.008	0.006	0
Wycheproof	Biannual	2	0.080	0.042	0

** Due to the population size of these towns two samples are taken every year.*

3.4.7 Arsenic

The concentration of arsenic should not exceed 0.01 mg/L in drinking water based on health consideration. Arsenic is naturally occurring element, which can be introduced into water through dissolution of minerals and ore from industrial effluent and atmospheric deposition.

A detailed description of arsenic and its implications in a water supply can be found by reference to the ADWG.

3.4.7.1 Results

The sampling of arsenic is based on ADWG recommendations, risks, historical data and any operational changes. All samples for arsenic met the standard for the reporting period (Table 3-13).

Table 3-13 - Concentrations of Arsenic in Drinking Water for 1 July 2020 – 30 June 2021. The concentration of Arsenic should not exceed 0.1 mg/L.

Sampling Locality	Sampling Frequency	No. of Samples	Max (mg/L)	Average (mg/L)	No. of samples where standard was not met (S 18)
Ararat	Biannual	2	0.001	0.001	0
Beulah	Biannual	2	0.001	0.001	0
Birchip	Biannual	2	0.001	0.001	0
Brim	Biannual	2	0.001	0.001	0

Sampling Locality	Sampling Frequency	No. of Samples	Max (mg/L)	Average (mg/L)	No. of samples where standard was not met (S 18)
Charlton	Biannual	2	0.001	0.001	0
Dimboola	Biannual	2	0.001	0.001	0
Donald	Biannual	2	0.001	0.001	0
Edenhope	Biannual	2	0.003	0.003	0
Great Western	Biannual	2	0.001	0.001	0
Halls Gap	Biannual	2	0.001	0.001	0
Hopetoun	Biannual	2	0.001	0.001	0
Horsham	Biannual	2	0.001	0.001	0
Jeparit	Biannual	2	0.001	0.001	0
Lake Bolac	Biannual	2	0.001	0.001	0
Manangatang	Biannual	2	0.001	0.001	0
Minyip	Biannual	2	0.001	0.001	0
Murtoa	Biannual	2	0.001	0.001	0
Natimuk	Biannual	2	0.001	0.001	0
Nhill	Biannual	2	0.001	0.001	0
Ouyen	Biannual	2	0.001	0.001	0
Pomonal	Biannual	2	0.001	0.001	0
Quambatook	Biannual	2	0.001	0.001	0
Rainbow	Biannual	2	0.001	0.001	0
Rupanyup	Biannual	2	0.001	0.001	0
Sea Lake	Biannual	2	0.001	0.001	0
St. Arnaud	Biannual	2	0.001	0.001	0
Stawell	Biannual	2	0.001	0.001	0
Underbool	Biannual	2	0.001	0.001	0
Warracknabeal	Biannual	2	0.001	0.001	0
Willaura	Biannual	2	0.001	0.001	0
Woomelang	Biannual	2	0.001	0.001	0
Wycheproof	Biannual	2	0.001	0.001	0

3.4.8 Fluoride

Fluoride is added to some water supplies to help protect teeth against dental decay. Based on health considerations, the concentration of fluoride in fluoridated drinking water supplies should not exceed 1.5 mg/L and Under s. 5 (3) of the *Health (Fluoridation) Act 1973*, fluoride added to drinking water must not result in an average optimum concentration of 1 mg/L. A detailed description of fluoride and its implications in a water supply can also be found by reference to the ADWG.

GWMWater has three fluoridated water supplies, including Ararat, Horsham and Natimuk. Fluoridation was installed at the Horsham WTP in November 2006 and Ararat WTP in

August 2016. Natimuk receives treated water from Horsham. The Horsham WTP had its fluoride plant offline for a PLC and dosing panel upgrade from 1 June to 15 July 2021. The fluoride plant was re-instated in accordance with a site-specific test and recommissioning plan. These works are the first stage of the fluoride plant upgrade to meet the new fluoride code of practice. The second stage will be a priority in Water Plan 2023-2028, with the delivery date to be confirmed.

3.4.8.1 Results

The sampling of fluoride is based on ADWG recommendations, the Code of practice for fluoridation of drinking water supplies, risks, historical data and any operational changes.

No water supplies exceeded the ADWG health-based guideline value for fluoride, and the average fluoride concentration delivered did not exceed the 1 mg/L (0.1 mg/L over the optimum range of 0.9 mg/L) designated by the *Health (Fluoridation) Act 1973* (Table 3-14).

Table 3-14 - Fluoride Results in Drinking Water for 1 July 2020 – 30 June 2021. The total concentration of fluoride should not exceed 1.5 mg/L.

Sampling Locality	Sampling Frequency	No. of Samples	Max (mg/L)	Average (mg/L)	Target Optimum operating concentration (mg/L)	No. of samples where standard was not met (S 18)
Ararat*	Twice-weekly	104	0.99	0.90	0.9	0
Horsham*	Twice-weekly	104	0.70	0.58	0.9	0
Natimuk	Weekly	52	0.67	0.60	0.9	0

** Due to the population size of these towns two samples are taken.*

3.4.9 Aluminium

Aluminium chlorohydrate (Megapac 23) is a coagulant used in water treatment to remove turbidity, natural organic matter (including colour), microorganisms and many inorganic chemicals. The coagulant is aluminium based, however, under normal operation, no aluminium is contained in the final drinking water.

As stated in the ADWG, based on aesthetic problems caused by post-flocculation, the concentration of acid-soluble aluminium in drinking water should not exceed 0.2 mg/L. Water authorities are strongly encouraged to keep acid-soluble aluminium concentrations as low as possible, preferably below 0.1 mg/L. There are no health-based guideline values set for aluminium at this time.

3.4.10 Results

Risk based sampling was conducted at localities that have coagulation as part of the treatment process. Samples were collected as a minimum of a monthly basis, and acid-soluble aluminium was analysed, with no missed samples (Table 3-15). One sample taken from Birchip on the 2 February 2021 had an Aluminium acid-soluble reading of 0.36 mg/L, exceeding the aesthetic guideline of 0.2 mg/L. This was result was an outlier with the average result for the year being 0.052 mg/L in the locality of Birchip.

Table 3-15 – Aluminium acid-soluble in Drinking Water for 1 July 2020 – 30 June 2021. The concentration of Aluminium acid-soluble should not exceed 0.2 mg/L.

Sampling Locality	Sampling Frequency	No. of Samples	Max (mg/L)	Average (mg/L)	No. of samples where standard was not met (S 18)
Ararat*	Twice-monthly	24	0.07	0.037	0
Beulah	Monthly	12	0.06	0.021	0
Birchip	Monthly	12	0.36	0.052	0
Brim	Monthly	12	0.03	0.019	0
Charlton	Monthly	12	0.08	0.023	0
Dimboola	Monthly	12	0.04	0.023	0
Donald	Monthly	12	0.03	0.016	0
Edenhope	Monthly	12	0.07	0.017	0
Great Western	Monthly	12	0.03	0.018	0
Halls Gap	Monthly	12	0.03	0.014	0
Hopetoun	Monthly	12	0.03	0.017	0
Horsham*	Twice-monthly	24	0.04	0.033	0
Jeparit	Monthly	12	0.02	0.011	0
Lake Bolac	Monthly	12	0.07	0.039	0
Manangatang	Monthly	12	0.01	0.010	0
Minyip	Monthly	12	0.04	0.018	0
Murtoa	Monthly	12	0.03	0.016	0
Natimuk	Monthly	12	0.09	0.045	0
Nhill	Monthly	12	0.03	0.019	0
Ouyen	Monthly	12	0.01	0.010	0
Pomonal	Monthly	12	0.03	0.013	0
Quambatook	Monthly	12	0.04	0.017	0
Rainbow	Monthly	12	0.02	0.011	0
Rupanyup	Monthly	12	0.02	0.013	0
Sea Lake	Monthly	12	0.05	0.022	0
St. Arnaud	Monthly	12	0.02	0.013	0
Stawell*	Twice-monthly	24	0.06	0.032	0
Underbool	Monthly	12	0.05	0.020	0
Warracknabeal	Monthly	12	0.07	0.041	0
Willaura	Monthly	12	0.09	0.040	0
Woomelang	Monthly	12	0.05	0.028	0
Wycheproof	Monthly	12	0.02	0.013	0

** Due to the population size of these towns two samples are taken.*

4 Aesthetic Parameters

Individual monitoring results for 2020/2021 that exceed the aesthetic guideline value set out in ADWG are highlighted in the tables in this section.

4.1 pH

The aesthetic parameter, pH is a measure of the hydrogen ion concentration of water. It is measured on a logarithmic scale from 0 to 14. A pH of seven is neutral, while a pH greater than seven is alkaline, and a pH less than seven is acidic.

The ADWG suggests that, based on the need to reduce corrosion and encrustation in pipework, drinking water should have a pH value between pH 6.5 and pH 8.5.

4.1.1 Results

Sampling and laboratory analysis for pH during the reporting period was undertaken on a weekly basis for all drinking water towns (Table 4-1).

There were 5.3% of results which did not satisfy the aesthetic guideline values set out in the ADWG. It is understood cement lining of the pipe is causing variations in the pH in some parts of the reticulation in winter when usage is low. Flushing is undertaken if the pH variation persists. The average pH for each town was within the expected ADWG range, and continuous monitoring at the WTPs showed no deviations in critical control limits of pH.

Table 4-1 - pH of Drinking Water for 1 July 2020 – 30 June 2021. pH value should be between pH 6.5 and pH 8.5.

Sampling Locality	Sampling Frequency	No. of Samples	Max pH	Min pH	Average pH
Ararat*	Twice-weekly	104	7.7	6.6	7.1
Beulah	Weekly	52	9.4	6.9	7.8
Birchip	Weekly	52	9.1	6.7	7.7
Brim	Weekly	52	8.6	6.7	7.4
Charlton	Weekly	52	8.9	6.8	7.5
Dimboola	Weekly	52	8.0	6.4	7.2
Donald	Weekly	52	8.1	6.6	7.3
Edenhope	Weekly	52	8.0	6.8	7.3
Great Western	Weekly	52	7.7	6.7	7.1
Halls Gap	Weekly	52	8.5	6.6	7.1
Hopetoun	Weekly	52	10.6	6.9	8.0
Horsham*	Twice-weekly	104	7.6	6.6	7.2
Jeparit	Weekly	52	9.6	6.0	7.3
Lake Bolac	Weekly	52	9.3	6.9	7.8
Manangatang	Weekly	52	8.3	6.5	7.3
Minyip	Weekly	52	9.5	6.4	7.6
Murtoa	Weekly	52	7.8	6.8	7.3

Sampling Locality	Sampling Frequency	No. of Samples	Max pH	Min pH	Average pH
Natimuk	Weekly	52	7.6	6.5	7.1
Nhill	Weekly	52	8.2	6.7	7.3
Ouyen	Weekly	52	9.0	7.2	7.8
Pomonal	Weekly	52	7.5	6.6	7.0
Quambatook	Weekly	52	9.0	6.6	7.7
Rainbow	Weekly	52	9.5	6.5	7.7
Rupanyup	Weekly	52	7.6	6.4	7.0
Sea Lake	Weekly	52	9.8	0.6	7.5
St Arnaud	Weekly	52	7.8	6.6	7.1
Stawell*	Twice-weekly	104	7.8	6.6	7.1
Underbool	Weekly	52	9.6	7.3	8.1
Warracknabeal	Weekly	52	10.0	6.8	7.5
Willaura	Weekly	52	7.7	6.8	7.2
Woomelang	Weekly	52	11.7	7.0	8.0
Wycheproof	Weekly	52	9.8	6.6	7.5

** Due to the population size of these towns two samples are taken.*

4.2 Colour

In natural waters, colour is mainly due to the presence of Dissolved Organic Matter (DOM), which originates from soil and decaying vegetation.

The dissolution of metals in pipes and fittings can also discolour drinking water. In bore water, 'red water' is a frequent problem, caused by the oxidation of iron. In addition, a black discolouration in reservoirs and distribution systems can result from the action of bacteria on dissolved manganese to produce insoluble oxides. Some of these compounds form colloidal suspensions, or are only partially dissolved, and so contribute to apparent rather than true colour.

The fact sheet in the ADWG for colour states that, based on aesthetic considerations, true colour in drinking water should not exceed 15 Hazen Units (HU). GWMWater has an internal performance benchmark that the mean true colour will be less than 15 Hazen Units.

4.2.1 Results

The sampling of true colour was scheduled for Lake Bolac, Quambatook and Willaura based on ADWG recommendations, risks and historical data (Table 4-2).

One sample at Willaura had 18 HU on 7 September 2020 and two samples at Lake Bolac, which is supplied treated water from Willaura WTP, had 20 HU on the 7 September 2020 and 18 HU on 2 November 2020, exceeding the recommended aesthetic ADWG value of 15 HU. A Dissolved Air Flotation unit has been installed at the Willaura WTP in 2021 which

will reduce the likelihood of high colour occurring in the reticulation system for these townships.

Table 4-2 - True Colour of Drinking Water for 1 July 2020 – 30 June 2021. True colour in drinking water should not exceed 15 Hazen Units (HU).

Sampling Locality	Sampling Frequency	No. of Samples	Max (HU)	Average (HU)
Lake Bolac	Monthly	12	20	10
Quambatook	Monthly	12	4	2
Willaura	Monthly	12	18	8

4.3 Hardness

Hardness is caused primarily by the presence of calcium and magnesium ions.

The ADWG discuss ramifications of hardness and what constitutes hard and soft water. ADWG suggest that, to minimise build-up of scale in hot water systems, total hardness (as calcium carbonate) in drinking water should not exceed 200 mg/L.

High total hardness may be a problem for supplies reliant on groundwater. Surface waters can generally be expected to have acceptable values.

4.3.1 Results

Hardness sampling and analysis was either quarterly, biannual or annually for drinking water supplies (Table 4-3). There were no exceedances of hardness.

Table 4-3 - Hardness of Drinking Water for 1 July 2020 – 30 June 2021. GWMWater internal performance benchmark that the average hardness should be less than 200 mg/L.

Sampling Locality	Sampling Frequency	No. of Samples	Max (mg/L)	Average (mg/L)
Ararat*	Twice-biannually	4	44	41
Beulah	Quarterly	4	18	17
Birchip	Biannually	2	19	18
Brim	Quarterly	4	23	21
Charlton	Biannually	2	22	22
Dimboola	Biannually	2	19	18
Donald	Biannually	2	23	21
Edenhope	Quarterly	4	170	160
Great Western	Biannually	2	34	32
Halls Gap	Biannually	2	35	32
Hopetoun	Biannually	2	18	18
Horsham*	Twice-quarterly	8	31	25
Jeparit	Biannually	2	23	20
Lake Bolac	Quarterly	4	23	22
Manangatang	Biannually	2	24	22

Sampling Locality	Sampling Frequency	No. of Samples	Max (mg/L)	Average (mg/L)
Minyip	Quarterly	4	22	19
Murtoa	Biannually	2	17	17
Natimuk	Quarterly	4	27	26
Nhill	Biannually	2	18	17
Ouyen	Biannually	2	35	35
Pomonal	Biannually	2	34	31
Quambatook	Annually	1	150	150
Rainbow	Biannually	2	17	17
Rupanyup	Biannually	2	18	17
Sea Lake	Quarterly	4	23	21
St Arnaud	Biannually	2	21	20
Stawell*	Twice-biannually	4	33	32
Underbool	Quarterly	4	73	64
Warracknabeal	Biannually	2	21	21
Willaura	Annually	1	18	18
Woomelang	Quarterly	4	21	20
Wycheproof	Biannually	2	18	18

** Due to the population size of these towns two samples are taken.*

4.4 Electrical Conductivity

Electrical Conductivity (EC) is caused by inorganic salts and small amounts of organic matter that are dissolved in water. Electrical conductivity mostly comprises sodium, potassium, calcium, magnesium, chloride, sulphate, bicarbonate, carbonate, silica, organic matter, fluoride, iron, manganese, nitrate (and nitrite) and phosphate.

High EC values may be associated with excessive scaling in pipes, fittings and household appliances.

The ADWG sets a guideline values for Total Dissolved Solids (TDS) of 600 mg/L and approximates that the TDS is 0.64 times the electrical conductivity value. As it is more cost effective to monitor electrical conductivity than total dissolved solids, the analysis for compliance is based on electrical conductivity. The ADWG value for TDS is equivalent to an electrical conductivity of 1000 µS/cm.

4.4.1 Results

Sampling and field analysis for electrical conductivity was undertaken on a weekly basis. There were no exceedances for this reporting period (Table 4-4).

Table 4-4 - Electrical Conductivity (EC) of Drinking Water for 1 July 2020 – 30 June 2021. EC in drinking water should be less than 1000 µS/cm.

Sampling Locality	Sampling Frequency	No. of Samples	Max (µS/cm)	Average (µS/cm)
Ararat*	Twice-weekly	104	319	213
Beulah	Weekly	52	284	136
Birchip	Weekly	52	247	130
Brim	Weekly	52	297	120
Charlton	Weekly	52	154	117
Dimboola	Weekly	52	250	113
Donald	Weekly	52	157	126
Edenhope	Weekly	52	939	804
Great Western	Weekly	52	343	217
Halls Gap	Weekly	52	241	139
Hopetoun	Weekly	52	290	142
Horsham*	Twice-weekly	104	198	151
Jeparit	Weekly	52	212	121
Lake Bolac	Weekly	52	261	146
Manangatang	Weekly	52	362	132
Minyip	Weekly	52	170	119
Murtoa	Weekly	52	197	113
Natimuk	Weekly	52	210	155
Nhill	Weekly	52	233	114
Ouyen	Weekly	52	349	179
Pomonal	Weekly	52	179	137
Quambatook	Weekly	52	882	704
Rainbow	Weekly	52	246	134
Rupanyup	Weekly	52	183	115
Sea Lake	Weekly	52	278	133
St Arnaud	Weekly	52	162	121
Stawell*	Twice-weekly	104	291	185
Underbool	Weekly	52	401	242
Warracknabeal	Weekly	52	247	118
Willaura	Weekly	52	179	136
Woomelang	Weekly	52	267	131
Wycheproof	Weekly	52	332	138

** Due to the population size of these towns two samples are taken.*

4.5 Iron

At concentrations exceeding 0.3 mg/L, iron imparts an undesirable taste to water and stains plumbing fixtures and laundry. Some micro-organisms can concentrate iron and give rise to taste, odour and turbidity problems in distribution systems.

Based on aesthetic considerations the ADWG suggests that the concentration of iron in drinking water should not exceed 0.3 mg/L. A detailed description of iron and its implications in a water supply can be found by reference to the ADWG.

4.5.1 Results

The sampling of iron is based on ADWG recommendations, risks, and historical data. There were no exceedances of iron this reporting period (Table 4-5).

Table 4-5 - Iron in Drinking Water for 1 July 2020 – 30 June 2021. The concentration of iron in drinking water should not exceed 0.3 mg/L.

Sampling Locality	Sampling Frequency	No. of Samples	Max (mg/L)	Average (mg/L)
Nhill	Quarterly	4	0.010	0.009
Quambatook	Monthly	12	0.030	0.012

4.6 Zinc

Based on aesthetic considerations the ADWG suggests that the concentration of zinc in drinking water should not exceed 3 mg/L as at higher concentrations zinc can impact the taste of water and cause visual impact at higher concentrations.

4.6.1 Results

The sampling of zinc is based on ADWG recommendations, risks, and historical data. There were no exceedances of zinc this reporting period (Table 4-6).

Table 4-6 - Zinc in Drinking Water for 1 July 2020 – 30 June 2021. The concentration of Zinc in drinking water should not exceed 3 mg/L.

Sampling Locality	Sampling Frequency	No. of Samples	Max (mg/L)	Average (mg/L)
Ararat	Biannual	2	0.014	0.007
Beulah	Biannual	2	0.050	0.048
Birchip	Biannual	2	0.013	0.010
Brim	Biannual	2	0.007	0.005
Charlton	Biannual	2	0.002	0.002
Dimboola	Biannual	2	0.003	0.003
Donald	Biannual	2	0.004	0.003
Edenhope	Biannual	2	0.007	0.006
Great Western	Biannual	2	0.002	0.002
Halls Gap	Biannual	2	0.014	0.010
Hopetoun	Biannual	2	0.008	0.004
Horsham	Biannual	2	0.007	0.004
Jeparit	Biannual	2	0.017	0.015
Lake Bolac	Biannual	2	0.002	0.002

Sampling Locality	Sampling Frequency	No. of Samples	Max (mg/L)	Average (mg/L)
Manangatang	Biannual	2	0.018	0.012
Minyip	Biannual	2	0.011	0.007
Murtoa	Biannual	2	0.017	0.011
Natimuk	Biannual	2	0.035	0.030
Nhill	Biannual	2	0.005	0.004
Ouyen	Biannual	2	0.005	0.005
Pomonal	Biannual	2	0.012	0.011
Quambatook	Biannual	2	0.027	0.017
Rainbow	Biannual	2	0.034	0.017
Rupanyup	Biannual	2	0.006	0.006
Sea Lake	Biannual	2	0.016	0.012
St. Arnaud	Biannual	2	0.011	0.007
Stawell	Biannual	2	0.002	0.002
Underbool	Biannual	2	0.009	0.008
Warracknabeal	Biannual	2	0.002	0.002
Willaura	Biannual	2	0.003	0.003
Woomelang	Biannual	2	0.031	0.017
Wycheproof	Biannual	2	0.012	0.009

5 Analysis of Results

5.1 Sampling Requirements

For 2020/2021 there were no missed samples according to regulation 13, and all were analysed according to regulation 14, of Safe Water Drinking Regulations 2015.

On the 23 June 2021, GWMWater sent DH a letter outlining some consecutive sampling that occurred at several sites. On the week commencing 28 December 2020 and 4 January 2021. This is contrary to regulation 8(1)(d)(v) of the Safe Water Drinking Regulations 2015. The localities with repeated samples were Ararat, Edenhope, Manangatang, Minyip and Quambatook. The repeated parameters within these samples were electrical conductivity, pH, free chlorine, *E. coli*, plate count, coliforms and turbidity. There were two corrective actions to reduce the probability of this occurring again, which included:

1. GWMWater has developed a checklist to manually check that sampling sites are not repeated in the sampling schedule.
2. In addition, engaging with the IT contractors to prevent sampling sites being repeated each time a new schedule is generated. These improvements work is booked in with the IT Contractor and is expected to be completed February 2022.

5.2 Water Quality

Regulation 16(h) requires analysis of all water quality sample information, data and results of drinking water supplied for this reporting period (2021/2022) with the last two reporting periods, 2019/2020 and 2018/2019.

The water quality performance has remained consistent compared with the previous reporting periods. All supplies met the standards for drinking water except for aesthetic parameters of pH and colour (Table 5-1).

In 2020/2021 5.3% of all pH samples exceeded the 6.5-8.5 range recommended in the ADWG. This was slightly less but comparable to the previous year, when 6.4% of samples exceeded the recommended aesthetic range. WTPs were producing water within ADWG and the average pH in the reticulation of all localities met the ADWG. Factors contributing to the number of pH exceedances is believed to be field instrument error and cement lining of the pipes leading to variation in pH. Scheduled inspection, calibration and verification checks of the instruments used to measure pH in the reticulation and the instruments themselves are being reviewed to identify opportunities to improve reliability. One sample taken from Birchip on the 2 February 2021 had an Aluminium acid-soluble reading of 0.36 mg/L, exceeding the aesthetic guideline of 0.2 mg/L. This was result was an outlier with the average result for the year being 0.052 mg/L in the locality of Birchip. Colour exceedance occurred at Willaura and Lake Bolac. Installation of DAF pre-treatment at Willaura WTP is expected to reduce the risk of this aesthetic exceedance occurring in these towns.

Table 5-1 - Comparison of analysis of water quality results of drinking water supplied from 2018/2019 to 2020/2021.

Parameters	2018/2019		2019/2020		2020/2021	
	Localities supplied drinking water that met standard (%)	Customers supplied drinking water that met standard (%)	Localities supplied drinking water that met standard (%)	Customers supplied drinking water that met standard (%)	Localities supplied drinking water that met standard (%)	Customers supplied drinking water that met standard (%)
Escherichia coli	100	100	100	100	100	100
Trihalomethanes	100	100	100	100	100	100
Turbidity	100	100	100	100	100	100
Aluminium acid-soluble	100	100	100	100	96.9	98.6
Monochloroacetic acid	100	100	100	100	100	100
Dichloroacetic acid	100	100	100	100	100	100
Trichloroacetic acid	100	100	100	100	100	100
Chlorine	100	100	100	100	100	100
Lead	100	100	100	100	100	100
Nitrite	100	100	100	100	100	100
Nitrate	100	100	100	100	100	100
Copper	100	100	100	100	100	100
Arsenic	100	100	100	100	100	100
Fluoride	100	100	100	100	100	100
pH*	31.0	45.1	37.5	41.4	53.1	79.8
Colour	100	100	100	100	93.8	98.8
Hardness	100	100	100	100	100	100
Electrical conductivity	100	100	100	100	100	100
Iron	100	100	100	100	100	100
Zinc#	N/A	N/A	100	100	100	100

* pH counted as not meeting targeted standard for the locality if multiple (≥2) exceedances occurred.
# Added to the sampling schedule at the beginning of 2020

6 Complaints

6.1 Complaints and Responses

GWMWater's Customer Complaints and Disputes Policy recognises the customer's rights, including the right to complain.

GWMWater systematically records all complaints in a register. Trends in water quality complaints are able to be tracked, monitored, and actioned appropriately.

All customer complaints are investigated to determine the cause and significance of the complaint. Operational changes or capital improvements which optimise treated water quality may be implemented in response to customer complaints. In response to a complaint, customers are contacted directly followed by appropriate action, which will vary depending on the nature of the complaint.

Table 6-1 and Table 6-2 summarises the complaints received during the reporting period for both drinking water and regulated water supplies, respectively.

Table 6-3 and Table 6-4 provide a detailed breakdown of the total number of complaints received from customers supplied with drinking and regulated water, respectively.

Table 6-1 – Drinking Water Quality Complaints comparison between 2018/2019 to 2020/2021.

Type of Complaint	Number of complaints			Comparison with previous reporting periods
	2018/2019	2019/2020	2020/2021	
Discoloured	63	74	59	Slight decrease within normal variation.
Taste/Odour	12	6	27	Significant increase, due to taste and odour event in Horsham and Natimuk.
Other	0	7	2	Typically, only scattered complaints categorised as other.
Total	75	89	88	No real change (1% decrease).

Table 6-2 – Regulated Water* Quality Complaints comparison between 2018/2019 to 2020/2021.

Type of Complaint	Number of complaints			Comparison with previous reporting periods
	2018/2019	2019/2020	2020/2021	
Discoloured	30	35	30	No significant change.
Odour	12	7	19	Significant increase, mostly odour complaints from the town of Berriwillock.
Other	0	3	5	Typically, only scattered complaints categorised as other.
Total	42	45	54	20% Increase.

** Regulated water is water that is not intended for drinking.*

6.2 Analysis of Issues

Over the 2020/2021 year the total number of customer complaints for drinking water and regulated supplies were within the expected range compared with the previous reporting periods.

For drinking water towns, the most notable increase in complaints was from 12 and 6 taste and odour complaints in the previous two financial years to 27 in the 2020/2021 year. This

was due to a taste and odour incident in Horsham (13 complaints) and the associated supply network, Natimuk (2 complaints) in February 2021. The taste and odour issue was due to the non-hazardous compound, geosmin, which was present at levels detectable to customers. Geosmin is a naturally occurring compound with a strong earthy taste and odour, and was present in the Horsham WTP raw water storage. To reduce the risk of this occurring in the future, the frequency of monitoring of taste and odour compounds in the raw water storage was increased and the monitoring program was updated to include testing for taste and odour compounds in the treated water tank at the Horsham WTP. If the taste and odour compounds are measured above levels detectable by customers this will trigger the use of Powder Activated Carbon (PAC) at the Mt Zero WTP, which can remove these compounds. Further details and corrective actions can be found in the section Emergency, Incident and Event Management.

A large portion of discoloured water complaints for 2020/2021 occurred in Ararat (19 complaints). Ararat also had a high proportion of discoloured water complaints (21 complaints) in the 2019/2020 year. The Ararat town has two distinct pressure zones. When changes in the reticulation system occur, such as from maintenance on the mains, flow directions change creating air bubbles and turbidity that can take several days to settle. This is addressed by conducting additional flushing to clear out more of the stirred-up water.

Discoloured water complaints occurred in Nhill (8 complaints) due to residual iron deposits in the mains from when the town was supplied untreated bore water. Flushing, air scouring and ice pigging of the reticulation has historically been completed to remove most of the iron prior to the introduction of treated water. Post the introduction of treated water, the remaining iron softens over time and dislodged. It is expected that the amount of residual iron will progressively decrease.

Berriwillock had the highest amount of complaints of regulated towns (13 complaints). This was due to automated switching of raw supply into town from Lake Bellfield to Murray River water during power outages and taste and odour compounds in the Berriwillock raw water storage. The Berriwillock pumps are being upgraded which will reduce the likelihood of Murray River water being supplied to the town.

The greatest number of complaints amongst other regulated towns were Ultima (6 complaints), Elmhurst (4 complaints), Kaniva (4 complaints), and Moyston (4 complaints). Drinking water is to be provided to these towns during the 2018-2013 water plan period. Wickliffe (3 complaints), Streatham (2 complaints) and Westmere (2 complaints) will also be supplied better quality water through the East Grampians Pipeline. Buangor (5 complaints), which receives water from McLeod Creek, also had a high proportion of complaints. Pipe cleaning will be investigated at Buangor to help alleviate seasonal odour complaints. GWMWater improves the water quality of regulated towns by swabbing/flushing some of the Mallee pipelines, flushing of water mains, a raw water storage cleaning program, and coagulant dosing.

Table 6-3 - Water Quality Complaints for Drinking Water Towns for 2020/2021.

Locality	Population	Number of Complaints			
		Colour	T&O^	Other	Total
Ararat	7790	19	1	1	21
Beulah	370				0
Birchip	790	1	1		2
Brim	190				0
Charlton	1180	1			1
Dimboola	1950	2			2
Donald	1690				0
Edenhope	1060		1	1	2
Great Western	450				0
Halls Gap	480	2			2
Hopetoun	610	1			1
Horsham	16360	4	13		17
Jeparit	380				0
Lake Bolac	370				0
Manangatang	270		2		2
Minyip	590	1	1		2
Murtoa	970	1			1
Natimuk	580		2		2
Nhill	2460	7	1		8
Ouyen	1340				0
Pomonal	360	1			1
Quambatook	280				0
Rainbow	770		1		1
Rupanyup	600	1			1
Sea Lake	720	5			5
St Arnaud	2290	1			1
Stawell	6210	8	1		9
Underbool	210		2		2
Warracknabeal	2610	3	1		4
Willaura	300				0
Woomelang	230	1			1
Wycheproof	660				0
Total	55110	**59**	**27**	**2**	**88**

^ *Taste and Odour (T & O).*

Table 6-4 - Water Quality Complaints for Regulated Supplies for 2020/2021.

Locality	Population	Number of Complaints			
		Colour	Odour	Other	Total
Antwerp	70				0
Apsley	300		1		1
Berriwillock	200	2	11		13
Buangor	110	4	1		5
Chillingollah	10	1			1
Chinkapook	40				0
Cowangie	40				0
Culgoa	110				0
Dooen	260				0
Elmhurst	200	3	1		4
Glenorchy	140	1			1
Goroke	320				0
Harrow	220				0
Jung	260			2	2
Kaniva	680	3		1	4
Kiata	70				0
Lalbert	160				0
Lascelles	100				0
Lillimur	120				0
Marnoo	130				0
Miram	40				0
Moyston	380	2			2
Murrayville	300				0
Nandaly	40				0
Nullawil	100				0
Patchewollock	120	1	1		2
Pimpinio	200	2		1	3
Serviceton	130				0
Speed	80	2			2
Streatham	170		2		2
Tarranyurk	30				0
Tempy	60				0
Ultima	190	5	1		6
Waitchie	50				0
Walpeup	170		1		1
Watchem	120				0
Westmere	40	2			2
Wickliffe	120	2		1	3
Yaapeet	90				0
Total	6230	**30**	**19**	**5**	54

7 Risk Management Plan Audit

A risk management plan audit was conducted by Viridis Consultants Pty Ltd in July 2020 in accordance with s. 11 of the *Safe Drinking Water Act 2003*. The period audited was from 28 March 2018 to 26 August 2020. The areas assessed included risk management activities, contents of risk management plans, risks to water supply, and documented procedures. Under s. 9 of the Act, the auditor determined that GWMWater:

- complied with the obligations imposed by section 7 (1) of the *Safe Drinking Water Act 2003*, and
- complied with the obligations imposed by section 8 (1) of the *Safe Drinking Water Act 2003*.

Opportunities for improvements provided as feedback from the audit are summarised in Table 7-1 with an update of actions required and status of their completion.

Table 7-1. Summary of audit actions and status.

OFI	**ACTIONS**	**STATUS (Estimated completion)**
Simplify the risk management plan documentation and risk register for easier maintenance and to improve ease of conveying information.	A summary chart was developed with digital links to assist in navigating the system.	Complete
Review the Catchment to Tap Risk Assessment and consider the risks posed by cybersecurity at tanker fill points and workforce management.	Risks of cybersecurity, tanker fill points and workforce management have been added to the catchment to tap risk assessment.	Complete
Finalise the procedure for mains repairs and installation.	The procedure is complete and has been presented to operational staff. Field training has been conducted.	Complete
Track all risk reduction measures through, from identification to completion, including status and date required for actions.	A tracking process is being implemented through TechnologyOne to track risk reduction measures.	Completed. Further Improvement (e.g. TechnologyOne integration identified)
Revise the risk management plan to document the need for a review of the risk assessment following an incident.	The GWMWater operational response procedure now includes a section to review the relevant water quality risks following an incident.	Complete

Consider increasing the review frequency in the document management system for drinking water risk management plans.	GWMWater has changed the water quality document review process to be completed every 2 years.	Complete
Make minor corrections to schematics in the risk management plans for Brim and Jung.	GWMWater has completed the nominated Audit Action to update the Brim and Jung Schematics. We have undertaken to update all schematics across all systems.	Completed. Scope extended to review all WTP schematics
Develop a stakeholder management plan for business as usual.	A stakeholder management plan is being developed in consultation with other water agencies.	In progress (December 2021)
Include details for events (e.g. black water) and response to these in the monitoring program.	This information has been updated in water quality management plans.	Complete
Review treatment processes against the WaterRA publication 'Good Practice Guide to the Operation of Drinking Water Supply systems for Management of Microbial Risk'.	GWMWater has reviewed the WaterRA Health based targets against our current treatment processes.	Complete

Risk Management Plan Audit Certificate
Safe Drinking Water Regulations 2015

Certificate Number: REC-20-221
Audit period: 28 March 2018 to 26 August 2020

To:
Anne Rudge
Manager Regulation, Safety & Assurance
GWMWater
PO Box 481
Horsham VIC 3402

Australian Business Number (ABN): 35 584 588 263

I, James Howey, after conducting a risk management plan audit of the water supplied by GWMWater, am of the opinion that—

GWMWater *has* complied with the obligations imposed by section 8(1) of the *Safe Drinking Water Act 2003* during the audit period.

26 August 2020

VIRIDIS CONSULTANTS

PO Box 131 Bulimba Qld 4171
Telephone: 1300 799 320
Email: info@viridis.net.au
Web: www.viridis.net.au

REC-20-266

22 October 2020

Suzie Sarkis
Manager Water
DHHS
suzie.sarkis@dhhs.vic.gov.au

cc: Anne Rudge
Manager Regulation, Safety & Assurance
GWMWater
anne.rudge@gwmwater.org.au

Dear Suzie

Amendment to Submitted Audit Certificate - GWMWater

In reference to the submitted Risk Management Plan Audit Certificate for GWMWater dated 26 August 2020, issued by me (James Howey, auditor approval No. 166), certificate number REC-20-221, please be advised:

a) I confirm that the audit was done correctly both as a water storage manager and water supplier.
b) I confirm that the absence of reference to section 7(1) in the certificate dated 26 August 2020 was an oversight and GWMWater has complied with the obligations imposed by section 7(1) of the Safe Drinking Water Act 2003 during the audit period.
c) I request that the certificate be treated as having been amended.

Thank you for your consideration in this matter.

Regards

James Howey
Director
Viridis Consultants Pty Ltd

REC-20-266

Figure 7-1 Risk Management Plan Audit Certificate.

8 Undertakings under Section 30 of the Act

There were no undertakings during the reporting period.

9 Regulated Water

Regulated water is water that is not intended for drinking, but which could reasonably be mistaken as drinking water. This could be the case when such water is, for example, delivered to households through a piped reticulation system.

Section 6 of the *Safe Drinking Water Act 2003* allows the Minister for Health to declare certain water as regulated. The Minister for Health declared all rural water pipelines, other than the WMP, as regulated supplies in the Victorian Government Gazette No. S 36 on Monday 23 February 2009.

GWMWater must manage risks in relation to water that is not intended for drinking, as part of its normal business practices. GWMWater is required to:

- Prepare a Risk Management Plan for the regulated water.
- Ensure the Risk Management Plan contains the matters specified in Regulation 8 of the Safe Drinking Water Regulations.
- Have the Plan audited by an approved auditor.
- Take all reasonable steps to minimise the likelihood of the water being mistaken as drinking water.
- Include a summary of the management activities for regulated water supply in the Annual Report.

GWMWater had a total of 39 towns supplied with water classified as 'regulated water' under Section 6 of the Act during the reporting period. The regulated water supplies are listed in Table 1-2.

Under Section 25 of the *Safe Drinking Water Act 2003*, water suppliers are required to report on the steps taken to make the public aware of regulated water (non-drinking water). GWMWater informs their customers in towns with a regulated water supply are advised of the water quality through:

a) 'Do not drink the water' symbol notices on their water bills, - four bills per annum.
b) Issue 'Untreated Water Supply' newsletters annually.
c) Provide 'Do not drink the water' signage/stickers to Local Government to place on publicly accessible taps in each town.
d) Provide information on GWMWater's website.

10 Emergency, Incident and Event Management

GWMWater has developed an Emergency Management Plan, and specific procedures for the management of water quality incidents.

Water quality incidents are notifiable to DH under Section 18s and 22s of the *Safe Drinking Water Act 2003*. Section 22s reports give DH an early warning notification of any known or suspected problem, whereas section 18s notifications are given when the water quality standard has not been met. For the 2020/2021 year, GWMWater:

- complied with the obligations imposed by section 18 of the *Safe Drinking Water Act 2003*, and
- provided DH with four reportsfor section 22 of the *Safe Drinking Water Act 2003*.

10.1 Detection of E*scherichia. coli* – section 22 reports

A reading of 14 *E. coli*/100 mL was recorded in a sample at Minyip on the 16 December 2020 and 2 *E. coli*/100 mL at Donald on the 26 May 2021. In response, the reticulation system was flushed, multiple sites were re-sampled (before and after flushing), and an investigation was carried out to determine if the sample taken was representative of the drinking water supplied in accordance with Schedule 2 of the Safe Drinking Water Regulations 2015.

The investigation concluded that the results of the analysis conducted in accordance with regulation 14 were not representative of the water in the relevant water sampling locality because:

- all other factors that would indicate the presence of *E. coli* were not present in the water in the water sampling locality at the time of the investigation; and
- the drinking water treatment process applied were such as would be reasonably expected to have eliminated the presence of *E. coli* in the water sampling locality at the time; and
- all plant and infrastructure associated with the water treatment process were operating to specification at all relevant times; and
- there were no issues arising from degradation of plant or infrastructure in or around the relevant water sampling locality that could reasonably be suspected to have contributed to the presence of *E. coli* in the drinking water in that water sampling locality.

Accordingly, the result was deemed to be a false positive, escalation via a Section 18 notification was not needed, and no further action was required.

10.2 Manangatang raw water contamination – section 22 report

Raw water entered the clear water storage (CWS) at Manangatang on the 23 November 2020 when a raw water bypass valve was inadvertently opened. Improvement works were being conducted at the time to connect the inlet of the WTP to the raw water storage.

The CWS contained filtered water that gets chlorinated as it leaves the CWS and is pumped to a large elevated tank for supply to the town. The chlorine residual in the elevated tank remained above critical levels for effective virus and bacteria disinfection.

The contamination was identified by staff attending the site. A rapid risk assessment was conducted, and after discussions with the DH a 'Do Not Drink' advisorywas issued for the town. Corrective actions undertaken included taking multiple samples throughout the distribution system to assess for health risk, cleaning of the CWS and the elevated tank, flushing to achieve multiple turnover of the water in the town reticulation system and re-sampling for verification that there was no health risk. Following corrective actions, on 29 November 2020 the 'Do Not Drink' advisory was lifted.

A number of actions were identified to reduce the likelihood of a recurrence. In summary the key actions were the removal of the raw water bypass that was incorrectly operated, increased water quality monitoring and control and improvements to the process for managing minor capital works.

At no point did the contamination event cause water in the reticulation system to not comply with any relevant water quality standard so a Section 18 notification was not required.

10.3 Horsham and Natimuk Taste and Odour – section 22 report

A taste and odour incident occurred in Horsham (13 complaints) and the same water is supplied to Natimuk (2 complaints). GWMWater first become aware of the issue on 12 February 2021 due to calls from customers complaining of poor tasting water. Sampling established the cause to be the presence of non-hazardous geosmin, a naturally occurring compound with a strong earthy taste and odour. Powder Activated Carbon (PAC) dosing was initiated at the Horsham WTP to remove the compound from the water and samples were taken which confirmed that the cause of the complaints was from geosmin. Flushing was conducted at Natimuk to help draw fresh water sooner.

The occurrence of geosmin was a result of the water level in the raw water storage at Horsham WTP drawing down to a level that exposed microorganisms in the storage to sunlight, which in turn stimulated production of geosmin.

Raw water is supplied to the raw water storage at the WTP from Lake Wartook via the Mt. Zero channel. This transfer takes several days and consequently the level in the raw water storage is susceptible to fluctuation with extended period of high demand. A level sensor will be installed on the raw water storage to provide early warning of level decrease. In addition, the concentrations of geosmin and 2-Methylisoborneol (MIB, another taste and odour compound), will be regularly monitored in the raw water storage and treated water tank at Horsham WTP, and used to trigger the operation of PAC if detected.

Geosmin is a compound with aesthetic consequences only, it poses no health risk, and does not breach the water quality standards, hence escalation via a Section 18 notification was not needed.

10.4 Blue-Green Algae (BGA) in the Murray River

BGA in the Murray River was at levels that indicated increased vigilance and monitoring between December 2019 and April 2021. The predominant species were all in the *Aphanizomenonaceae* family, varying between species in the genus *Dolichospermum* and *Chrysosporum*. GWMWater has a management plan that outlines various strategies to be utilised during algal events, including operational changes to supply networks, communications, carting water and optimising plant performance.

During this bloom the sampling frequency increased, customers in the affected areas were notified and GWMWater maintained an incident management team. For several days, at the beginning of April 2021, the Manangatang township was supplied water by carting drinking water from another town to the treated water storage at Manangatang WTP. At Ouyen WTP, raw water storage capacity and treatment of Ouyen raw water storages allows their continued use during BGA events.

GWMWater water is continuing to improve treatment options to help manage future blooms, which are anticipated to increase in severity, and will be piloting pre-treatment using a Dissolved Air Flotation unit for water supplies to the Ouyen WTP, Underbool WTP and rural customers supplied from the Wemen pumping station.

11 Water Storage Manager

In addition to being a water supplier for the purposes of the *Safe Drinking Water Regulations,* GWMWater is also a water storage manager. This arises when a water corporation owns reservoirs or major headworks assets that supply water to multiple users, including other water corporations. Other water corporations may in turn use the water to supply drinking water to various localities.

GWMWater is a Water Storage Manager for some of the water used by Wannon Water and Coliban Water. To address GWMWater's obligations as a water storage manager a Memorandum of Understanding (MoU) between GWMWater and both these corporations is in place.

GWMWater has developed a risk management framework for the headworks storages under its control and meet with Coliban Water and Wannon Water on an annual basis. The management role includes water quality monitoring for a suite of predetermined parameters with all analysis being conducted by a NATA accredited laboratory. These results are made available to the other water corporations as needed, who have access to monitoring data conducted by GWMWater in its role of water storage manager.

In management of reservoirs in the Wimmera catchment, GWMWater liaise with the Wimmera CMA, and liaise with the Glenelg Hopkins CMA for management of Rocklands and Moora Moora Reservoirs.

Table 11-1 – Summary of water supply systems.

Catchments	Source Water	Raw water storage area	Treatment*	Treatment Plant	Water Receivers
Lake Bellfield	Supply System 4, Wimmera Mallee Pipeline	N/A	N/A	N/A	Coliban Water
Waranga Western Channel	Waranga Basin	N/A	N/A	N/A	Coliban Water
Willaura Headwork – Mt William and Stoney Creek	Glenthompson Pipeline	N/A	N/A	N/A	Wannon Water
Rocklands Reservoir	Pipeline	N/A	N/A	N/A	Wannon Water

* The water storage manager does not apply any drinking water treatment processes before supplying its water.

11.1 Coliban Water

GWMWater provides raw water to Coliban Water, which subsequently treats the water and supplies it to the localities of Wedderburn, Bridgewater, Inglewood, Borung, Korong Vale and Wychitella (Figure 11-1). In winter this water is sourced predominately from Supply System 4 of the WMP, which is fed from the Grampians Headworks, primarily Lake Bellfield. Taylors Lake provides an emergency back-up source of supply to the WMP if Lake Bellfield water is unsuitable. Between November and April, the raw water supply to Coliban Water is usually switched to the Waranga Basin via the Waranga Western Channel.

The catchment of Lake Bellfield is in the Grampians National Park, and is a moderately protected surface water (category 3). The catchment of Taylors Lake includes inflow from the Grampians National Park and land utilised for farming. Taylors Lake can also receive water transfers from other reservoirs within the Grampians Headworks. Taylors Lake and the Waranga Basin are considered to be a poorly protected catchment (category 4).

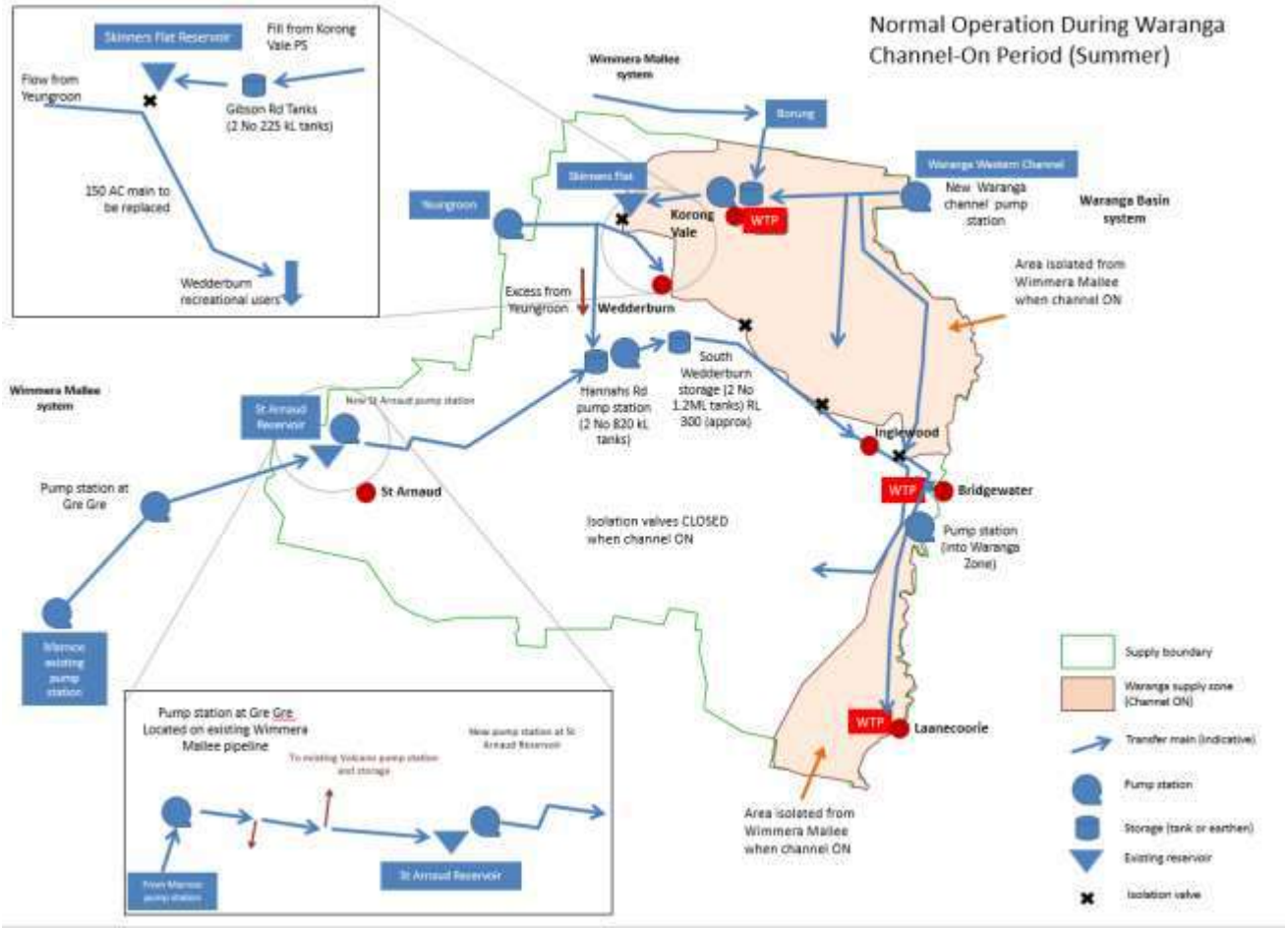

Figure 11-1 Schematic showing supplies to Coliban Water from Bellfield and Waranga Western Channel (during summer).

11.2 Wannon Water

GWMWater delivers untreated water from the Willaura Headworks (Mt William and Stoney Creek) to Wannon Water through the Glenthompson Pipeline (Figure 11-2). Between the months of June and December, water supplied to Glenthompson is primarily from surface water diversion from unregulated waterways in the Grampians National Park. Groundwater bores supply water between January to May.

The bore water is considered a protected catchment (category 1), while the creeks deliver water from a moderately protected catchment (category 2). The overall catchment classification is category 2.

The water for Hamilton and Balmoral is taken directly from Rocklands Reservoir. Rocklands Reservoir is located between the Grampians National Park and Black Range State Park. The majority of the catchment is native forest; however, the storage is poorly protected (category 4).

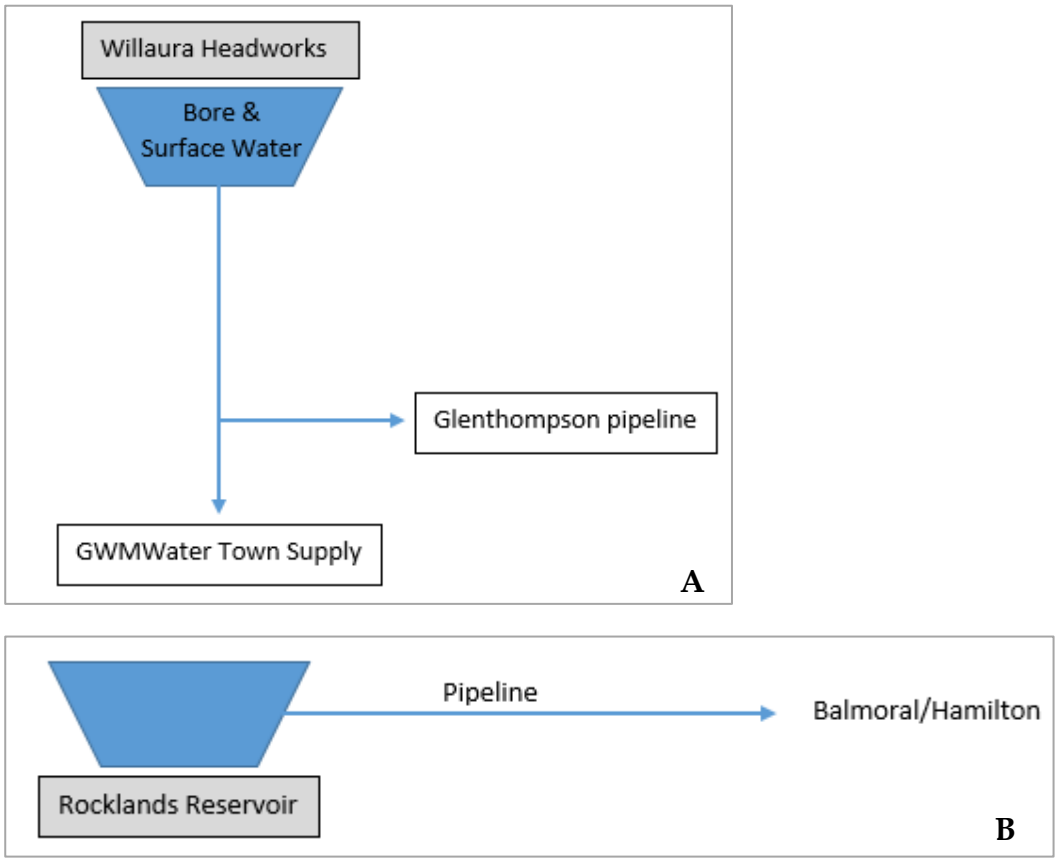

Figure 11-2 Simplified schematic diagram showing supplies to Wannon Water from Willaura Headworks (A), and Rocklands Reservoir (B).

11.3 Water Storage Manager: Emergency, Incident and Event Management

The West Waranga Channel undergoes weekly blue-green algae sampling during the normal supply period to Coliban Water of November to April. During this routine sampling BGA levels were regularly detected at varying levels, reaching a maximum total biovolume

of 6.7 mm^3/L and total toxic biovolume of 4.1 mm^3/L. Because of this risk, supply to Coliban Water was not taken from the West Waranga Channel at any point, instead Lake Bellfield water was supplied through the Wimmera Mallee Pipeline for the year.

Blue-green algal levels in Rocklands Reservoir were detected at toxic biovolumes in excess of the 0.6 mm^3/L guideline limit on Thursday 21 January 2021. Species present were Noularia spumigena and also of the *Aphanizomenonaceae* family (straight). Wannon Water carted water for several days to service affected towns and once consecutive sampling results for BGA below the guideline limit were detected by Friday 29 January 2021, normal raw water supply service could be returned. BGA biovolumes stayed below trigger levels for the remainder of the season.

12 Glossary of Terms

Terms and abbreviations used in this report have been collated into a Glossary to provide clarity.

Term/Abbreviation	Description
ADWG, 2011:	The Australian Drinking Water Guidelines provide a framework for the management of drinking water supplies designed to ensure safety at the point of use.
Alum:	Aluminium sulphate as used as a coagulant in the water treatment process.
BGA:	Blue Green Algae.
BOOT:	Build, Own, Operate and Transfer. A form of commercial contract associated with the provision of treated water at privately-owned water treatment plants.
Bore:	Conduit for extracting groundwater from an aquifer to the surface for use in a town water supply.
CCP:	Critical Control Point in the Risk Management Plan.
Chlorination:	Process of adding chlorine to water as a disinfectant.
Coagulation:	The clumping together of solids so they can more easily be settled out or filtered out of water. A chemical called aluminium sulphate (alum) or aluminium chlorohydrate (Megapac 23) is generally used to aid coagulation in water treatment.
Concentration:	A measure of how much of a given substance there is mixed with another substance (in this case water), usually expressed as a weight to volume, e.g. milligrams per litre (mg/L).
CWS:	Clear Water Storage.
DELWP:	Department of Environment, Land, Water and Planning
DH:	Department of Health.
DBP:	Disinfection by-product – a reaction of natural organic material with the disinfectant medium producing by-products via reaction.
Disinfection-only	Water supplies that have disinfection as their only form of treatment.
Dissolution:	A form of chemical weathering in which water molecules, sometimes in combination with acid or another compound in the environment, attract and remove oppositely charged ions or ion groups from a mineral or rock.
Distribution system:	The system of pipes delivering water from the water treatment plant to the reticulation system.
DOC:	Dissolved organic carbon – a measure of the concentration of humic and fulvic acids in the water.
DOM:	Dissolved organic matter – this term can be interrelated with the amount of 'colour' in the water (is similar to DOC).
Drinking water:	Legislatively defined as water intended for human consumption or associated with purposes for human consumption. Also known as a potable supply.
EC:	Electrical conductivity as measured in micro Siemens per centimetre (µS/cm).
Entry point:	The point at which the water supply enters the reticulation system.

Flocculation:	The water treatment process after coagulation that uses gentle stirring to cause suspended particles to form larger, aggregated masses (floc). The aggregates are removed from the water by a separation process (e.g. sedimentation, flotation, or filtration).
Fluoridation:	The act of adding fluoride to a water supply in accordance with the *Health (Fluoridation) Act 1973*.
Fully-treated water Supplies:	Water supplies that have coagulation and filtration processes in addition to disinfection.
GWMWater:	Grampians Wimmera Mallee Water Corporation (trading as GWMWater).
Hardness:	Caused by the presence of calcium and magnesium ions in water and can contribute to scale build up in pipes and appliances.
HU:	Scientific units for true colour measurements – Hazen Units.
Jar Testing:	A bench top test designed to optimise chemical dose rates based on known quality of raw water.
kL:	Kilolitre (1,000 L).
L:	Litre
Megapac 23:	Aluminium chlorohydrate as used as a coagulant in the water treatment process.
mg/L:	Scientific units for the concentration of a parameter given as milligrams per litre. Also known as parts per million (ppm).
ML:	Megalitre (1,000,000 L).
NATA:	National Association of Testing Authorities, Australia. National Accredited Testing Authority.
NMP:	Northern Mallee Pipeline drawing its water from the Murray River.
Notifications:	Pursuant to Sections 18 and 22 of the *Safe Drinking Water Act,* 2003.
NTU:	Scientific units for turbidity measurements – Nephelometric Turbidity Units.
Orgs/100 mL:	Organisms per 100 mL. A measure of the number of *E. coli*.
pH:	The measure of the concentration of hydrogen ions in a sample related to a logarithmic scale between 1 (acidic) and 14 (basic).
Regulated water:	Water not intended for human consumption, but that could easily be mistaken as such. Also known as non-potable supply. This term is defined in the *Safe Drinking Water Act,* 2003.
Reticulation system:	The system of pipes delivering water to the customers tap from the entry point of the system.
RMP:	Risk Management Plan pursuant to the *Safe Drinking Water Act 2003*.
Safe Drinking Water Act, 2003:	Legislative framework for assuring drinking water quality in Victoria.
Safe Drinking Water Regulations, 2015:	Regulations made subsequent to the *Safe Drinking Water Act 2003* that give effect to key aspects of the Act.
Sampling:	The process of collecting a representative amount of water from a reticulation system to analyse and compare against the ADWG Standards and subsequently report to DH.

SCADA:	Supervisory Control and Data Acquisition. A computer interface to acquire data remotely through a telemetered communications exchange network.
T&O:	Taste and odour.
THMs:	Trihalomethanes – disinfection by-products formed when using chlorine as a disinfectant. Take the form of trichloromethane, bromodichloromethane, dibromochloromethane and tribromomethane.
Undertakings:	Legally binding commitment made pursuant to Section 30 of the *Safe Drinking Water Act*, 2003.
WMP:	Wimmera Mallee Pipeline.
WPS:	Water pump station.
WTP:	Water treatment plant.
95th Percentile:	The value for which 95 percent of the time the data is below.

13 References

a) **Australian Drinking Water Guidelines 2011**, National Health and Medical Research Council, Canberra, 2011

b) ***Safe Drinking Water Act 2003*** (Act No. 46/2003), 11 June 2003, Parliament of Victoria.

c) **Safe Drinking Water Regulations 2015** (S/R No. 88/2015), 18 July 2015, Parliament of Victoria.

d) ***Health (Fluoridation) Act 1973***, (Act No. 8506/1973), 1 July 1973, Parliament of Victoria.

e) **Code of Practice for fluoridation of drinking water supplies**, Second edition, Department of Health and Human Services, Victoria, 2018.

f) **Victoria Government Gazette No. S 344,** 30 August 2019, Victorian Government.