Annual Drinking Water Quality Report

2022 - 2023

www.lmw.vic.gov.au

LOWER MURRAY WATER

VICTORIA State Government

This artwork has been provided by local artist Bella Sloane from the Ngiyampaa tribe. Her painting represents family titled, 'The Connection to Family'.

Acknowledgement of country

'Lower Murray Water acknowledges the Traditional Owners of the land on which we work and reside. We recognise their continuing connection to land, waterways and community. We pay our respects to Elders past, present and future. The Traditional Owner groups within Lower Murray Water's service region lie within the traditional lands of First Nations Peoples, from upstream at Koondrook moving downstream along the Murray River (Mil) through to the western edge of our region at the South Australian border. They are the Barapa Barapa Peoples, Wamba Wemba Peoples, Wadi Wadi Peoples, Tatti Tatti Peoples, Latji Latji Peoples, Nyeri Nyeri Peoples, Ngintait Peoples and the Wergaia Peoples. The First Nation Peoples' connection to land and water is the living cultural knowledge that is passed down from generation to generation. The stories that connected the ancestors to their culture still live through the First Nations Peoples of today.'

- Acknowledgement of Country written by Stephanie Sloane.

Stephanie works at Lower Murray Water as a Equality Diversity and Inclusion (EDI) Officer. She is a proud Ngiyampaa woman and has a strong connection to her culture, history, and the land. Stephanie has brought not only her experience and passion for people to this role but also a commitment to inspire and mentor others wishing to pursue a career at LMW.

Contents

Glossary of terms

The Act	Safe Drinking Water Act 2003 (Vic)
The Regulations	Victorian Safe Drinking Water Regulations 2015
ADWG	Australian Drinking Water Guidelines 6, 2011. Published by the National Health and Medical Research Council of Australia, version 3.8, Updated September 2022.
DH	Victorian Department of Health
EPA	Environment Protection Authority
ESC	Essential Services Commission
RMP	Risk Management Plan
DWQMP	Drinking Water Quality Management Plan
DWQMT	Drinking Water Quality Management Team
HACCP	Hazard Analysis and Critical Control Points
NATA	National Association of Testing Authorities
BGA	Blue Green Algae are Cyanobacteria that can range in colour from yellow to purple. Some types can be highly toxic to humans, livestock, and birds.
Coliforms Bacteria	Widely distributed throughout the environment, which provide a sensitive measure of microbiological quality
E. coli	*Escherichia coli*, a type of pathogenic bacteria that normally lives in human intestines, which indicate the presence of faecal contamination and therefore, is a health risk
THMs	Trihalomethanes
NTU	Nephelometric turbidity units
CFU/100mL	Colony forming Units per 100 millilitres
CFU/mL	Colony Forming Units per millilitres
mg/L	Milligrams per litre
RPZ	Reduced Pressure Zone
Water Sampling Locality	An area that has common water quality characteristics because the supply is provided through specific pipes, tanks, or pumps. It is more likely to follow geographic features than suburb boundaries
Water Hardness	Refers to the concentration of calcium and magnesium salts in water, which can attach to surfaces and cause a hard, flaky scale. These salts can also make it difficult to achieve lather when using soap.
UV Disinfection	Ultraviolet disinfection

From our Managing Director

I am pleased to present Lower Murray Urban and Rural Water Authority's (LMW) 2022/23 Annual Drinking Water Quality Report (ADWQ). It provides comprehensive information on the quality of drinking water we have provided to our customers and community throughout LMW's service area, which extends from Kerang to the South Australian border, in the municipalities of Gannawarra, Swan Hill and Mildura. The report highlights all the test results from our water quality monitoring program and outlines the processes we have in place to continue delivering safe, clean drinking water to all.

This report is provided to the Secretary to the Department of Health (DH) in accordance with section 26 of the Safe Drinking Water Act 2003 (the Act), and Regulations 16 and 17 of the Safe Drinking Water Regulations 2015 (the Regulations). This report includes a summary of the chemical, physical and bacteriological test results of drinking water supplied to our customers, as part of our water quality monitoring program for each water sampling locality.

The information presented in this report explains the sources of our drinking water and how it is treated to ensure it consistently meets regulatory requirement. It further demonstrates our commitment to delivering water of high-quality standards, and highlights water quality challenges experienced as well as our improvements in 2022/23.

In addition to the above, the report includes the following information:

- an overview of our water supply systems and sources of our water supply.
- a summary of water treatment and disinfection processes.
- an outline of how we arrange collection and testing of water samples.
- details of customer feedback regarding water quality and safety.
- a summary of the independent auditing processes used to verify our management of drinking water quality.

LMW is a statutory water authority created under the Water Act 1989 and governed by a board of non-executive directors appointed by the Minister for Water. We work closely with the Environment Protection Authority (EPA), the DH and the Essential Services Commission (ESC), as they regulate and monitor the service performance of our environmental, public health, and water pricing obligations.

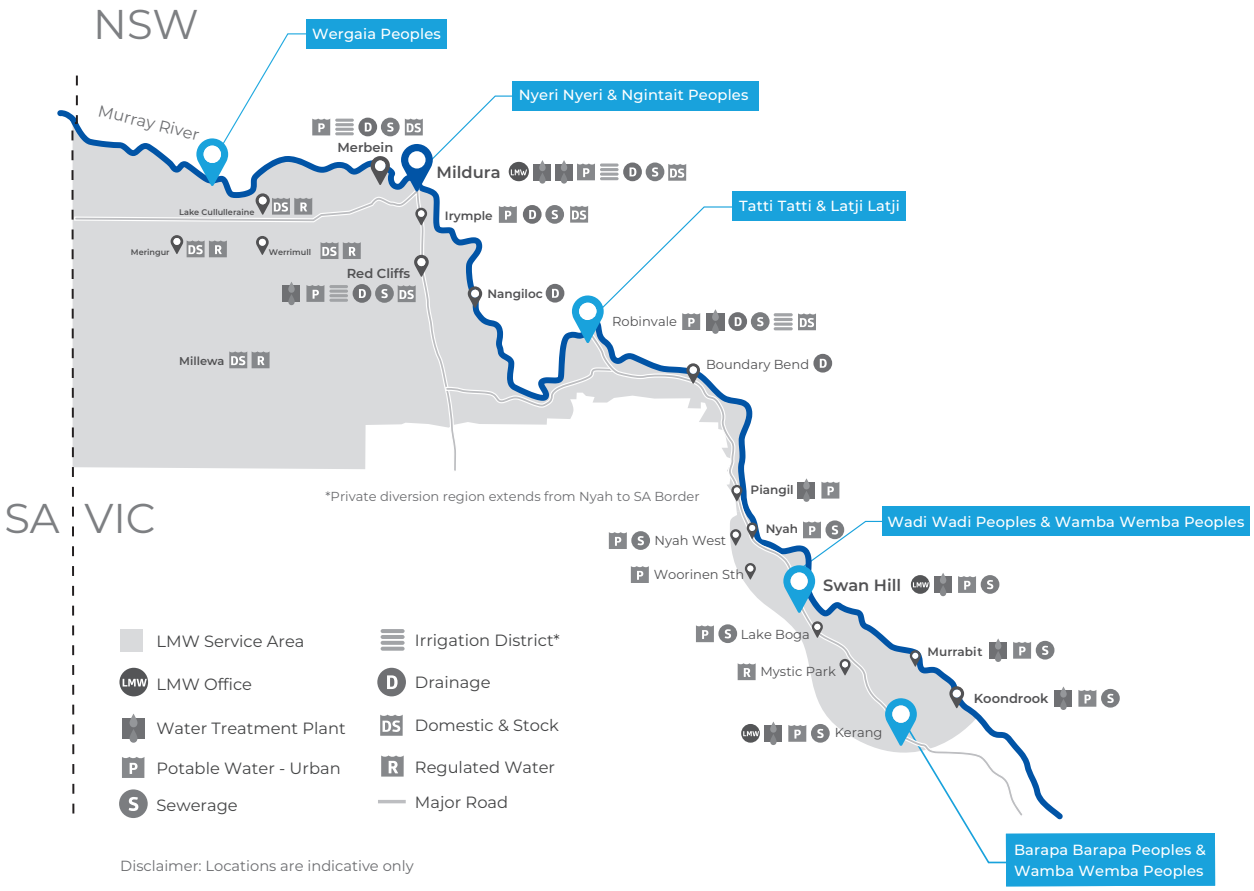
In accordance with the Act, we have adopted a multiple-barrier, catchment-to-tap approach to ensure safe, high-quality, drinking water is supplied to our customers. We are also required to prepare and implement a Drinking Water Quality Management Plan (DWQMP) to ensure the safety of our drinking water supply systems. Our DWQMP is based on Hazard Analysis and Critical Control Point (HACCP) principles and the Australian Drinking Water Guidelines 2011 (ADWG). The DWQMP was audited in this reporting period and LMW was compliant with 18 OFIs noted.

We verify the quality of the drinking water through a comprehensive monitoring program that also allows us to identify potential improvements to benefit our customers and the community. We also rely upon feedback from customers to advise of local issues that may arise, which are treated as water quality complaints.

LMW is committed to continuing its record of reliably providing high quality, safe drinking water to our customers. I'm pleased to advise that we achieved full compliance with the water quality standards and requirements of the Act and Regulations.

Paul Northey
Managing Director

Our service region



Our area of operation extends from Kerang to the South Australian border taking in the municipalities of Mildura, Swan Hill and Gannawarra. We recognise that the overall wellbeing and livelihood of our communities' is directly linked to the agricultural, tourism and support industries which form our economic backbone. How we manage our water resources recognises the intrinsic interrelationship between this resource and the social, environmental, and economic fabric of our region.

Nature and range of services provided

LMW provides the following services:

- urban water services to 14 townships via nine treatment plants to 31,346 households and businesses (approx. 76,100 customers) along the Murray River from Koondrook to Merbein.
- wastewater collection, treatment and effluent re-use and disposal services to 11 towns via 10 treatment plants.
- Raw (river quality) water services to 2,594 irrigation and 2,292 stock and domestic customers in the four pumped irrigation districts of Mildura, Merbein, Red Cliffs and Robinvale, and to 306 Millewa waterworks district customers and 12 Yelta waterworks district customers.
- management of the region's urban and rural bulk water entitlements.
- the collection and disposal of subsurface drainage water from the four pumped irrigation districts, as well as from private diverters in Nangiloc, Robinvale, and Boundary Bend.
- oversight of irrigation and drainage design in new agricultural developments ensuring conformity with salinity management plan development guidelines.
- management of the private diversion licenses of 1,410 water users along the Murray River in Victoria between Nyah and the South Australian border.
- the assessment and approval of licensing, water share and allocation trade applications.
- reclaimed water for third party use.
- water supply delivery to important environmental and recreational sites.

In addition to security of supply, public health, water quality and environmental responsibilities, LMW recognise the crucial economic role of water from a regional and state context.

Water supply systems

LMW manages eight drinking water supply systems, which provide drinking water to a population of approximately 76,000 customers along the Murray River in Victoria from Koondrook to Merbein. LMW also has two regulated water supplies, including a water quality improvement plant at Millewa intended to improve water quality for domestic and stock uses, but not for drinking.

Regulated water is not drinking water but could be mistaken for drinking water and is discussed in more detail in the Regulated Water section of this report.

Details of our drinking water and regulated water supply systems, including water sampling localities, population supplied, source water and Water Treatment Plants (WTP) are provided in Table 1. We do not manage raw water storages for drinking water supplies as we draw directly from the Murray River or other smaller waterbodies.

The population figures have been calculated based on the number of water connections as of 30 June 2023 (35,171) multiplied by the 2021 Census average household population for each region. Non-residential connections are not included. Locations of drinking water supply systems are shown on the map of our service region.

This report, in accordance with the Act, provides an overview of our drinking water supply systems, the quality systems in place for provision of safe drinking water and the drinking water test results for 2022/23.

Table 1 – LMW Water Supply Systems

Water Sampling Locality	Source Water	Population	Treatment Plant
Irymple	Murray River	8,440	Mildura 7th street and Mildura West
Kerang	Murray River	4,090	Kerang
	Loddon River		
	14/2 Irrigation Channel		
Koondrook	Murray River	1,063	Koondrook
Lake Boga	Murray River	1,148	Swan Hill
Merbein	Murray River	3,615	Mildura 7th street
			Mildura West
Mildura	Murray River	37,013	Mildura 7th street
			Mildura West
Murrabit	Murray River	104	Murrabit
	Storage Dam		
Nyah	Murray River	649	Swan Hill
Nyah West	Murray River	607	Swan Hill
Piangil	Murray River	265	Piangil
Red Cliffs	Murray River	4,110	Red Cliffs
Robinvale	Murray River	2,401	Robinvale
Swan Hill	Murray River	12,187	Swan Hill
Woorinen South	Murray River	424	Swan Hill
Millewa*	Lake Cullulleraine	248	Millewa Water Quality Improvement Plant
Mystic Park*	Kangaroo Lake	28	N/A
		Total: 76,114	

* Regulated Supplies

Source water

The source of water for most of the drinking water supplies in our service region is the Murray River. Two exceptions to this are the Kerang and Murrabit drinking water supplies. The Kerang supply system sources its water from the 14/2 Irrigation Channel in addition to the Murray River. The Murrabit drinking water supply source its water either from the Murray River or from a storage dam at the plant, which is supplied from the GMW channel, during times of BGA blooms along the Murray River.

LMW's regulated water supplies source water from Kangaroo Lake and Lake Cullulleraine (although this is directly connected to the Murray River) for the Mystic Park and Millewa areas respectively.

The Murray River catchment (part of the Murray-Darling Basin) covers a large area that spans Victoria, New South Wales, and Queensland. Water from Queensland catchments enters the Murray River downstream of Mildura so does not impact on our WTPs' raw water offtakes. Several other water agencies located upstream of our offtakes also utilise the Murray River to provide drinking water to major towns along the Murray River including Albury, Wodonga, Cobram, Echuca, and other smaller localities.

In 2015, we carried out a sanitary survey to identify the intensity and sources of contamination of water sources within the catchment area of our service region. The results indicated that the Murray River catchment is subject to various activities, which impact on water quality.

The Murray River lies within an open and unprotected catchment, where various activities such as stock grazing, human habitation, agriculture, and industry, take place. Dominant agricultural activities include extensive horticultural areas, the production of rice, dairy, wool, wheat, beef, lamb, and forestry. An abundance of recreational activities is undertaken along the Murray River and its tributaries including camping, swimming, fishing, water skiing, canoeing, sightseeing, and picnicking.

As a result, Murray River water is subject to a high microbial and chemical risk from humans, stock, and industry. To assess that LMW's water treatment processes can manage these risks, we have a source water quality monitoring program, which involves collecting and testing of source water samples for a range of parameters such as turbidity, colour, UV absorbance, pesticides, radioactivity, etc. to help assess risks from the catchment. In addition, the raw water turbidity is monitored online at all WTPs, which provides an early warning to treatment plant operators of potential changes to the raw water quality. This enables operators to undertake control measures to ensure adequate treatment is applied to the raw water and potential for process deviation is reduced.

To quantify the microbial risks in the catchment and realising the similarities in each catchment and the microbial hazards, we conducted a detailed microbial hazard quantification assessment on our drinking water supply systems. The assessment used the methodology outlined in the Water Services Association Australia (WSAA) Manual for the Application of Health Based Targets for Drinking Water (2015). We are undertaking a review of the QMRA done in 2015 to update the current state of knowledge and identify any potential gaps that might exist with the inclusion of the HBT targets in the ADWG released in 2022.

LMW has been intermittently monitoring Cryptosporidium and Giardia in the source water since January 1998. The monitoring frequency has changed to fortnightly and includes E. coli, to enable ongoing quantification and assessment of the source water risks.

Seasonal BGA monitoring is undertaken by our water quality team and WTP operators, to identify potential BGA presence in the source water, implement appropriate control measures when blooms are detected and ensure that treated water is safe to drink. BGA monitoring is undertaken on a weekly basis and the frequency can increase subject to the volume of BGA detected in the source water.

Catchment Management

LMW always endeavours to reduce potential risks to water quality in the Murray River being the main source of water supply for our water supply systems.

LMW is an active partner in the state-wide program that collects water and groundwater data, called the Regional Water Monitoring Partnership. LMW work closely with Mallee CMA to assess the risks of chemical contaminates in irrigation drainage water. We are a participating member of the Mallee CMA's Mallee floodplain management strategy implementation committee. This committee seeks to understand flooding risks for our region and coordinate a response to these risks with multiple agencies via development and implementation of mitigating actions.

Actions to date include mapping floodplains to help understand future flood risks and the building of strategically placed levees. LMW is a member of the Mallee CMA's Regional Catchment Steering committee which is in the process of renewing the Regional Catchment Strategy, a document which underpins the sustainable management of land and water resources and contributes to biodiversity management.

LMW regularly partners with Mallee CMA to flush Psyche bend lagoon on a high river, to reduce the salt load in the lagoon using LMW infrastructure. While this sounds counterproductive to water quality, this activity prevents highly saline waters to enter the river when a rain event occurs during a low river, which can trigger an electroconductivity exceedance in Morgan SA, and compromises water quality for LMW offtakes downstream. By doing this on a high river, the salinity is effectively diluted and poses no problems for water quality downstream of the lagoon.

Drinking Water Treatment Processes

During 2022/23, LMW treated more than 20,000 megalitres (ML) of drinking water across nine WTPs. All of these WTPs use conventional water treatment systems, with one WTP utilising dissolved air floatation as part of its treatment system. The water treatment systems involve the following process steps:

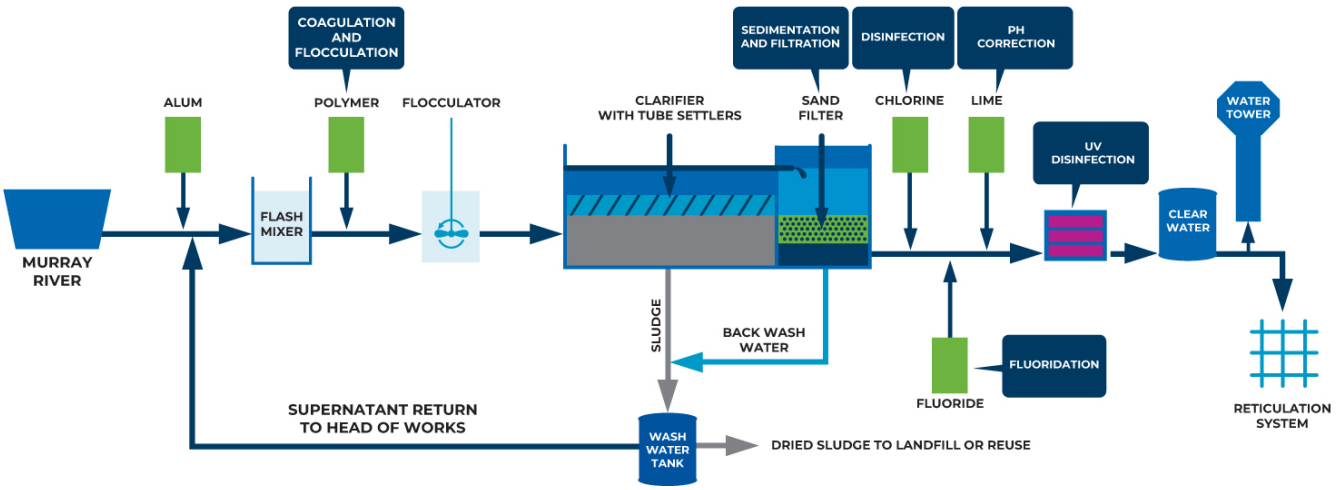
- coagulation
- Flocculation
- clarification/sedimentation/Dissolved Air Flotation
- filtration
- chlorine Disinfection
- fluoridation
- pH correction
- UV disinfection

Our drinking water is disinfected using chlorine, the most widely used disinfectant in the water industry. Chlorine dose rates are adjusted to provide adequate free chlorine residual throughout the distribution system. This helps provide some protection against potential contamination within the reticulation system and can limit biological regrowth. LMW has recently completed the UV project to retrofit all nine drinking WTPs with UV disinfection systems, which provides the additional barrier for Protozoa in line with the ADWG recommendations and industry best practice.

Water treatment processes may slightly differ from one WTP to another due to plant capacity, technology type or raw water quality characteristics of source water. Steps in the drinking water treatment process are outlined in Figure 1.

Table 2 shows water sampling localities, WTPs that supply water to those localities, treatment processes used to treat the water per locality, and chemicals used for water treatment.

Figure 1. Drinking Water Treatment Processes



Coagulation and flocculation

The first step of the conventional treatment process involves dosing a chemical coagulant to help gather suspended solids and organic material in the raw water. We use aluminium sulphate or aluminium chlorohydrate to bring about the coagulation process, which helps form larger particles called 'flocs' that can be more readily removed by subsequent treatment steps. During flocculation, the floc particles develop and agglomerate into larger particles. The larger size and weight of the agglomerated particles assists in the sedimentation or clarification process. Flocculant aids including polyelectrolytes are also commonly used to enhance the flocculation phase, which further assists in the sedimentation and clarification processes.

Sedimentation

Sedimentation is a step in the treatment process intended to enhance the filtration process, where suspended particles are removed from the water by means of gravity or separation. In the sedimentation process, the water passes through a relatively quiet and still basin. In these conditions, the floc particles settle to the bottom of the basin while 'clear' water passes out of the basin over an effluent baffle or weir. The solids collected on the bottom of the basin are removed through sludge bleeding pipework at the smaller "package" WTPs, or by a mechanical 'sludge collection' device at the larger plants, which scrapes the solids (sludge) to a collection point within the basin from which it is pumped to a storage for further treatment and disposal.

Solid contact clarification

The purpose of the solid contact clarification is the same as the sedimentation process, i.e., to enhance the filtration process by removing particles. It involves mixing the influent flow with previously settled solids within a cylinder located in the centre of the clarifier. Gentle mixing within the reaction well promotes agglomeration of floc particles and/or chemical precipitates. The aggregated solids settle out more rapidly in the clarification area. Even better clarity is achieved when particles become enmeshed in a sludge blanket layer. Rotating sludge scrapers transport settled solids to the centre of the basin for removal. Clarified overflow is removed through a circular launder system that draws water from the entire surface area to prevent solids carryover caused by uneven velocity currents.

Dissolved Air Flotation (DAF)

The process of flotation consists of three steps:

- bubble formation
- attachment of bubbles to the solids
- solids separation from the fluid

In DAF systems, air is pressurised under several atmospheres and then introduced into water, where it is mixed with pre-coagulated water just before it enters the flotation tank.

Upon attachment of air bubbles to the solid particles, the density of the solid becomes less than that of the surrounding fluid. In the process, the buoyant force lifts the solids to the surface to form a scum blanket, which is continuously swept to the periphery, automatically discharged into a scum trough by the skimming device.

Filtration

Filtration occurs as the water passes through filters that help remove particles that have not settled in the sedimentation process. Filters are commonly used in the water treatment process and may contain layers of gravels, sands and filter coal. The filtration process removes fine suspended solid matter as well as some other particles including larger micro-organisms, resulting in clear water passing through.

Disinfection using chlorine gas

Water is disinfected to kill any pathogens (disease-causing organisms) that remain in the treated water after filtration and provide protection within the distribution system. Without disinfection, the risk from waterborne disease is greatly increased. Disinfection is carried out by chlorination at all our WTPs in the form of chlorine gas.

Ultraviolet (UV) disinfection

UV disinfection is widely used in water treatment due to its ability to permanently de-activate bacteria, spores, moulds and viruses. It provides a secondary barrier to the conventional water treatment process, where filtration is the only barrier against protozoan pathogens, such as Cryptosporidium and Giardia. UV disinfection is highly effective against the Cryptosporidium oocysts and Giardia cysts that are resistant to the routinely applied doses of chlorine.

pH correction

Due to the addition of coagulants and chlorine, the pH of the water being treated is lowered, becoming more acidic. To inhibit corrosion and make the water safe to use, the pH is adjusted to a neutral pH, about pH 7.0, by adding lime or other alkaline chemicals such as soda ash or sodium hydroxide.

Fluoridation

Water fluoridation is the adjustment of fluoride in drinking water to a level that helps protect teeth against dental decay. We fluoridate five water supply systems that deliver fluoridated water to 12 localities within our service region. Fluoridation of the drinking water supplies is undertaken as per the requirements of the Health (Fluoridation) Act 1973.

Powdered Activated Carbon (PAC)

PAC is derived from a variety of sources such as coal, wood, and coconut. Due to its high adsorption capacity, i.e., ability to attract contaminants and bind them to its surface, PAC is used to assist in removing taste & odour compounds, blue-green algae toxins, and other impurities from water.

Manganese treatment

We use Calgon-T for manganese treatment, which is a sequestering agent that prevents the oxidation of manganese in the treated water and eliminates water discolouration.

Table 2 – LMW drinking water treatment processes

Water Treatment Plant	Water Supply Locality	Treatment Process	Added Substances
Kerang	Kerang	Coagulation	Aluminium Sulphate
		Flocculation	Hydrated Lime
		Sedimentation	Sodium Hydroxide
		Granular Media Filtration	Chlorine Gas
		Chlorine Disinfection	Powdered Activated Carbon
		Fluoridation	Fluorosilicic Acid
		UV Disinfection	
		pH Correction	
Koondrook	Koondrook	Coagulation	Aluminium Sulphate
		Flocculation	Sodium Hydroxide
		Sedimentation	Chlorine Gas
		Granular Media Filtration	Powdered Activated Carbon
		Chlorination	
		UV Disinfection	
		pH Correction	
Mildura 7th Street	Mildura	Coagulation	Aluminium Sulphate*, **
Mildura West	Merbein	Flocculation	Aluminium Chlorohydrate**
	Irymple	Sedimentation	Hydrated Lime*
		Clarification*	Polymer
		Slow Sand Filtration	Chlorine Gas
		Chlorination	Powdered Activated Carbon
		Fluoridation	Fluorosilicic Acid
		UV Disinfection	Sodium Metabisulfite**
		pH Correction	Sodium Hydroxide**
Murrabit	Murrabit	Coagulation	Aluminium Chlorohydrate
		Flocculation	Sodium Hydroxide
		Sedimentation	Chlorine Gas
		Granular Media Filtration	Powdered Activated Carbon
		Chlorination	
		UV Disinfection	
		pH Correction	
Piangil	Piangil	Coagulation	Aluminium Chlorohydrate
		Flocculation	Sodium Hydroxide
		Sedimentation	Chlorine Gas
		Granular Media Filtration	Powdered Activated Carbon
		Chlorination	
		UV Disinfection	
		pH Correction	

**Applies to Mildura 7th Street WTP only*
***Applies to Mildura West WTP*

Mildura West and Red Cliffs can utilize either Aluminium Sulphate or Aluminium Chlorohydrate. This flexibility is desired in periods of chemical supply shortages or also based on raw water quality.

Table 2 – LMW drinking water treatment processes continued

Water Treatment Plant	Water Supply Locality	Treatment Process	Added Substances
Red Cliffs	Red Cliffs	Coagulation	Aluminium Chlorohydrate
		Flocculation	Aluminium Sulphate
		Pre-sedimentation	Sodium Hydroxide
		Dissolved Air Flotation	Chlorine Gas
		Granular Media Filtration	Powdered Activated Carbon
		Chlorination	Fluorosilicic Acid
		Fluoridation	
		UV Disinfection	
		pH Correction	
Robinvale	Robinvale	Coagulation	Aluminium Sulphate
		Flocculation	Soda Ash
		Clarification	Chlorine Gas
		Granular Media Filtration	Powdered Activated Carbon
		Chlorination	Sodium Fluoride
		Fluoridation	
		UV Disinfection	
		pH Correction	
Swan Hill	Swan Hill	Coagulation	Aluminium Chlorohydrate
		Flocculation	Sodium Hydroxide
		Clarification	Chlorine Gas
		Slow Sand Filtration	Powdered Activated Carbon
		Chlorination	Fluorosilicic Acid
		Fluoridation	
		pH Correction	

**Applies to Mildura 7th Street WTP only*
***Applies to Mildura West WTP*

Mildura West and Red Cliffs can utilize either Aluminium Sulphate or Aluminium Chlorohydrate. This flexibility is desired in periods of chemical supply shortages or also based on raw water quality.

Drinking water quality management

Quality management systems

LMW's DWQMP has been developed based on the 12 elements of the 'Framework for Management of Drinking Water Quality', described in the Guidelines and the requirements set out in the Act. The plan identifies key water quality risks in the water supply system using a catchment to tap approach. Each key risk is assessed, and critical control points are put in place to manage those risks to provide safe drinking water to our customers.

Verification of water quality monitoring

Water quality monitoring constitutes a significant part of our water supply activities. We have a water quality monitoring program that was designed based on the requirements of the Regulations, and the Guidelines, including consideration of locality population numbers for bacterial monitoring.

Using the outcomes of the sanitary survey to assist in identifying the source water quality hazards and risks, we reviewed the irrigation practices within our catchment area to identify raw water quality parameters that potentially constitute health risks, and therefore, require ongoing monitoring.

The Guidelines provide a basis for assessing the quality of drinking water. The microbiological assessment is based on *E. coli*, which is considered a definitive indicator for the presence of fecal contamination, and therefore, a health risk. In terms of the physical and chemical monitoring, it is based on a combination of parameters that indicate the physical and aesthetic characteristics of water such as pH,

colour and turbidity, as well as the chemical quality of the water, which include but not limited to free chlorine, iron and manganese, fluoride, dissolved salts, aluminium, copper, lead, chromium, nickel, and other parameters.

To comply with the water quality monitoring requirements set out in the Act and Regulations, we use an external National Association of Testing Authorities (NATA) registered laboratory to perform all regulatory drinking water testing, which was developed based on a rigorous risk assessment process. All drinking water quality test results for 2022/23 are available in Appendix A.

In 2022/23 we collected more than 1,700 samples from our 16 water supply localities and analysed these for more than 40 parameters to assess water quality and safety.

Sampling points

The water quality sampling points have been carefully chosen based on the DH 'Water Monitoring Program guidance', and risk assessment approach with the objective of identifying effective strategies for prevention and control of hazards within the distribution system.

This involved understanding the characteristics of the drinking water system, what hazards may arise, how these hazards create risks, and the processes and practices that affect drinking water quality.

While the sampling points are representative of the water quality within their subsequent supply systems, a regular review of the sampling points is undertaken to verify the locations of the current sampling points, ensure that they reflect the associated water quality risks within their distribution systems, and assess the need to add in additional sampling points to reflect the expansion of the water supply localities that results from population growth, i.e., new subdivisions.

Tank cleaning

A scheduled inspection and maintenance program is in place for cleaning clear water storage tanks and service reservoirs, which was followed in 2022/23. This involved general inspections of the interior and exterior of the storages for sediment build-up, asset condition, and the roof area to ensure that access hatches are properly sealed and prevent contamination that could result from rainwater ingress, and desludging of water storages as required.

In addition to physical inspections of clear water storages and service reservoirs, we recently undertook an extensive drone inspection for water tank condition inspections for all LMW storages.

Based on the drone and diver inspection reports a list was compiled and prioritisation of the works have been completed. Due to the floods in October, works have been delayed. High priority work that didn't require specialised contractor has been completed.

Emergency incident and event management

Section 18 and 22 notifications

Section 22 of the Act requires an officer of a water supplier to notify the DH where it's suspected that the drinking water supplied, or to be supplied to customers, may pose a risk to human health, or cause widespread public complaint.

Section 18 of the Act require water suppliers to notify the Secretary of DH if it becomes aware that the drinking water supplied, or to be supplied, to another person does not comply, or is not likely to comply, with any relevant water quality standard and must do so within 10 days after it becomes aware of that fact.

Reportable Incidents 2022-23

The following incidents have occurred during the reporting period:

LMW reported one instance of known or suspected contamination as required by Section 22 of the Act. A Section 22 report was submitted to DH on 27 June 2023 under the Code of Practice for Fluoridation of Drinking Water Supplies (Vic) for fluoride concentration in drinking water supplied, or to be supplied, exceeds 1.5 mg/L for the Swan Hill reticulation. The incident happened during a planned shutdown on 5 May 2023 to replace the switchboard. Upon resumption of fluoride dosing, DH was notified on 23 May 2023. The investigation into the event revealed that fluoride concentration after the treated water storage tank exceeded 1.5 mg/L. As the treated water fluoride analyser measures the concentration of fluoride in water to be supplied, LMW submitted a s22 report. The root cause for the high fluoride concentration was due to insufficient dilution during flushing of the dosing lines. In response to the incident a procedure was developed for manual startup of the fluoride dosing system. Lesson learned was shared among the operators in their toolbox meeting. A debrief was held between DH and LMW on 21 July 2023 where four action groups were identified and LMW is working towards implementing them.

Issues

Under the Regulations, LMW is required to provide a summary of any issues arising out of the application of the treatment processes that may have affected water quality and safety.

The floods caused significant operational challenges in maintaining supplies to the affected towns. The increase in dissolved organics and manganese lead to increase in chlorine demand. There were operational challenges from Blue Green Algae in the raw water at Kerang WTP. There were supply chain issues which caused maintaining of adequate chemical levels challenging.

LMW adapted and managed our operations to ensure essential services continued without interruption. LMW setup an Incident Management Team (IMT) in the days following the wet weather in early October. Sand bagging works and levees were built to ensure that our assets were protected. Communication plans

and regular situation reports were provided to the respective regulatory agencies including DH. Incident escalation worked well, with a strong focus on the management of fatigue and staff safety. There was overwhelming support from staff to contribute to the IMT and the broader flood response. A debrief session was organised in January 2023 and opportunities for improvement were identified.

Community sandbagging efforts at Kerang WTP to control a leak in the levee alongside the Loddon River.

Three-year percentage compliance

A comparison of test results of water samples collected in accordance with the sampling program set out in our DWQMP, and percentage of complying samples over the last three financial years, based on the regulated parameters stipulated in the Regulations, was undertaken.

The high quality of the drinking water we supplied continued for 2022/23, complying fully with all water quality standards.

Figure 2 demonstrates the continued outstanding performance and achievement of full compliance with the water quality standards detailed in Schedule 2 of the Regulations.

Further detailed comparisons of water quality parameters with the previous two financial years are provided in the drinking water quality test results in Appendix A.

Fluoride Treatment

Levels of fluoride have remained consistently below the maximums specified in the ADWG over the three-year period.

During the reporting period, the rolling annual fluoride concentration of drinking water was within the operating range of 0.7 to 0.9mg/l, as recommended by DH to provide a dental health benefit, was achieved within all water supply systems.

Fluoride levels sourced from the ClearSCADA systems at the WTPs.

LMW reviewed the design of all fluoride dosing systems, investigated, and identified upgrade requirements to increase reliability of the dosing systems. The upgrade works are underway and currently in being rolled out across all sites. Other changes included reviewing plant attendance procedures, training of staff and keeping stock of critical spares.

A LMW staff member checks river flood heights to compare against LMW infrastructure heights.

Sandbagging at Kerang WTP as part of the IMT planning phase to protect the community drinking water supply.

Fluoride outage notifications

LMW's water quality sampling program indicates that all localities that receive fluoridated water supply were compliant for fluoride for the reporting period. Comprehensive data is provided in Table 3 of Appendix A.

LMW notified the DH of a total of three fluoride interruptions, where fluoride concentration in drinking water supplied was less than 0.6 mg/L for a continuous period of > 72 hours, as required under the Code of Practice for Fluoridation of Drinking Water Supplies (Vic).

These occasions occurred when fluoridation was taken offline as a precautionary measure while LMW replaced the switch boards or undertook urgent maintenance. A summary of interruptions is provided in Table 3.

Aesthetic Characteristics

LMW's water quality sampling program included aesthetic drinking water parameters turbidity, salinity, hardness, pH and colour. These results are reported in detail in Appendix A.

Table 3 – Summary of Fluoride Interruption

Fluoridation Plant	Interruption, Date	Resumption, Date	Summary	Number of Days
Kerang	11/6/2023	07/07/2023	Switchboard replacement	26
Mildura 7th St	01/05/2023	25/05/2023	Replacement of dosing lines	24
Swan Hill	05/05/2023	13/05/2023	Switchboard replacement	8

Water quality and safety improvement initiatives

During the 2022/2023 financial year, LMW completed or continued several projects that contribute to maintaining and improving the robustness of the water treatment process and ensuring that water quality and safety is not compromised.

After a successful installation and commissioning of UV disinfection systems at Red Cliffs, Piangil, Koondrook, Kerang, Robinvale, Mildura West and Murrabit WTPs from 2019 onwards, LMW continues its endeavour to improve the robustness of the water supply systems. This includes completing our project to retrofit the Mildura 7th Street andSwan Hill WTPs with UV disinfection systems

UV disinfection systems provide a secondary barrier for pathogenic bacteria such as Cryptosporidium and Giardia, reduce risks to water safety especially during poor raw water quality events such as blackwater and blue-green algae blooms, and ensure the continuity of water supply during such events.

Table 4 below lists the water quality and safety improvement projects that were initiated or completed in 2022/23.

Table 4 – Water quality and safety improvement projects

Water Treatment Plant (WTP)	Project	Project Status (Completed, In Progress, Planning)	Expenditure, $
ALL SITES	Instrument Replacement	In Progress	$98,457.66
Mildura West WTP	Upgrade to ClearSCADA	Complete	$700,385.78
Kerang WTP	UV Treatment Upgrade	In Progress	$307,083.60
Swan Hill WTP	UV Treatment Upgrade	In Progress	$2,171,398.00
Robinvale WTP	UV Treatment Upgrade	In Progress	$383,084.00
Swan Hill WTP	Fluoride Upgrade - Fluoride Dosing Board Replacement	Complete	$1,652.00
Kerang WTP	Fluoride Upgrade - Fluoride Dosing Board Replacement	Complete	$TBD

Table 4 – Water quality and safety improvement projects continued

Water Treatment Plant (WTP)	Project	Project Status (Completed, In Progress, Planning)	Expenditure, $
Mildura West WTP	UV Treatment Upgrade	In Progress	$560,145.05
Mildura 7th St WTP	UV Treatment Upgrade	In Progress	$2,838,594.55
Red Clifs WTP	Replace PAC Mixing Tank with 5,000 Poly Tank	Complete	$18,191.98
Mildura 7th St WTP	Lime dosing hopper filter	Complete	$3,940.00
Red Cliffs WTP	Fluoride Upgrade	Complete	$434.00
Swan Hill WTP	Fluoride Upgrade	Complete	$1,652.00
Robinvale WTP	Fluoride Upgrade	In Progress	$491.00
Mildura 7th St WTP	Fluoride Upgrade	In Progress	$2,630.00
Kerang WTP	KER - WTP Filter Media Replacement	In Progress	$38,901.00
Mildura WTP	MDA - Replace Filter Valve actuators (1, 2, 5 ,6)	Complete	$23,993.00
Mildura	MDA - Reline 10th St Tower Drain Line	In Progress	$19,997.00
Swan Hill WTP	SH - PAC pump upgrade SH WTP	In Progress	$TBD
Mildura WTP	MDA - Replace Lime Dosing pumps MDA WTP	Complete	$15,869.00
Kerang	KER - RWP replacement KDK dry well	In Progress	$1,128.00
Kerang	KER – Main Replacement Victoria St Btw Scoresby & Wellington Install 250m of DN150	In Progress	$127,706.00
Kerang	KER - Tate Dr CWS Cathodic Protection Up	In progress	$TBD

Staff Training

LMW always endeavour to ensure that treatment plants' operators have achieved Certificate III qualifications in water industry operations. Whilst some operators have already completed this training, others are progressing towards achieving Certificate III, and new members who have recently joined the operational team have been enrolled in this training program.

In addition, LMW's treatment plant operators attend the Water Industry Operators Association conference in Bendigo on annual basis and visit other water authorities WTPs when the opportunity arises. We also engage instruments suppliers to conduct training on the operation and maintenance of the analysers.

Drinking water quality standards

During 2022/23 financial year, LMW remained 100% compliant with the water quality standards specified for drinking water in Schedule 2 of the Regulations. These are outlined in Table 5. All drinking water quality results can be found in Appendix A of this report.

Table 5 – Schedule 2 Safe Drinking Water Regulations 2015 Drinking Water Quality Standards

Parameter	Sampling Frequency	Quality Standards
Escherichia coli	One sample per week	No E. coli per 100 milliliters of drinking water, with the exception of any false positive sample.
Total Trihalomethanes	One sample per month	Less than or equal to 0.25 mg/l of drinking water.
Turbidity	One sample per week	The 95th percentile of results for samples in any 12-month period must be ≤ to 5.0 NTU.

Other water quality standards

In addition to the water quality parameters stipulated in the Regulations, we also monitored a range of other parameters, such as substances that may pose a risk to human health, to compare against ADWG health-related guideline values and ensure the safety and quality of the drinking water.

Table 6 lists other parameters included in the water quality parameters list that are regularly monitored in drinking water samples collected from the reticulation system and water storages.

LMW has assessed the test results of these parameters against the Guidelines' health-related guideline values and found all results were fully compliant.

Blue-green algae

Blue-green algae (Cyanobacteria) are microscopic organisms that may thrive in warm, nutrient rich waters. They may impact water quality by releasing taste and odour compounds. In some extreme circumstances, these organisms may release concentrations of toxins.

As part of our water quality monitoring program, raw water samples are collected on a weekly basis from source water during the BGA season (November to May inclusive) and tested in-house for BGA cell count.

- The BGA monitoring frequency increases to twice weekly if:
- 2,000 ≤ Cell Numbers < 6,500 Cells/ml Microcystis Aeruginosa, or
- 0.2 ≤ Total Biovolume < 0.6 mm3/L

DH must be notified under Section 22 of the Act when treated water supplied for drinking may place public health at risk due to one or more of the following:

- total Microcystins are detected at ≥ 1.3 µg/l (Microcystin-LR toxicity equivalents)
- Microcystis aeruginosa is present at ≥ 6,500 cells/ml
- total combined biovolume of known toxic cyanobacterial species ≥ 0.6 mm3/L
- total combined biovolume of all cyanobacterial species ≥ 10 mm3/L

or

- BGA is present in drinking water at levels that may cause widespread public complaint, for example through taste and odour.

Table 6 – Other drinking water quality standards

Parameter	ADWG 2011 guideline, mg/L		Frequency of testing*	Met the guideline Yes/No
	Health	Aesthetic		
Arsenic	0.1		Quarterly	Yes
Cadmium	0.002		Quarterly	Yes
Chlorine	5	0.6	Weekly	Yes
Chromium	0.05		Quarterly	Yes
Copper	2	1	Quarterly	Yes
Cyanide	0.08		Quarterly	Yes
Fluoride	1.5		Weekly	Yes
Lead	0.01		Quarterly	Yes
Manganese	0.5	0.1	Quarterly	Yes

Table 6 – Other drinking water quality standards continued

Parameter	ADWG 2011 guideline, mg/L		Frequency of testing*	Met the guideline Yes/No
	Health	Aesthetic		
Mercury	0.001		Quarterly	Yes
Nitrate	50		Quarterly	Yes
Iron	c	0.3	Quarterly	Yes
Zinc	c	3	Quarterly	Yes
Selenium	0.01		Quarterly	Yes
Nickel	0.02		Quarterly	Yes
Sulphate	c	250	Quarterly	Yes
Atrazine	0.02		Yearly	Yes
Chlorpyrifos	0.01		Yearly	Yes
Chlorothalonil	0.05		Yearly	Yes
Glyphosate	1		Yearly	Yes
Maldison (Malathion)	0.07		Yearly	Yes
Simazine	0.02		Yearly	Yes
Gross Alpha			Every 5 years	Yes
Gross Beta			Every 5 years	Yes

c ADWG 2011 note that there is insufficient data to set a guideline value based on health conditions

Water quality complaints

LMW is committed to providing high quality, safe drinking water and continuously improving services and communications to all customers. To ensure water quality complaints are resolved in appropriate timeframes, complaints are captured in LMW's customer management system 'Merit', which provides workflow tracking of each complaint from registration to completion and produces reports as required. Merit directs the complaint to the relevant action officer to follow up with the customer. Complaints received after hours via our 1800 phone number are also directed to the relevant officer the next working day for follow up, if necessary.

If the issue cannot be resolved over the phone, an officer attends the property of concern to discuss the complaint with the customer, undertakes basic water quality testing such as pH, turbidity and colour, and takes water samples for taste tasting. Main's flushing will be undertaken, if necessary.

Monthly complaint summary reports for Board meetings, and quarterly reports for Essential Services Commission reporting are prepared from the Merit database.

2022/23 complaint data

A total of 79 water quality complaints from a customer base of 31,346 was recorded in 2022/23. This is a noticeable increase from 2021/22 where 26 water quality complaints were recorded, which equates to 0.104 water quality complaints per 100 customers.

Over the reporting period, the main water quality complaint was for discoloured water (52 complaints), Discoloured water can be attributed to one or a combination of several factors which could include a burst water main within the area, change in the direction of water flow that could result in scouring of the water mains, oxidise manganese, iron sediment or potentially from a customer's internal plumbing or hot water service. The colour complaints account for 65% of the total number of complaints received throughout the reporting period.

During the reporting period, increased chlorine dosing was required in all supply localities in response to high organics demand on the free chlorine residual. The organics were a result of black water event in the Murray River due to the floods.

LMW systematically undertake mains cleaning programs that assist in maintaining and improving water quality, consequently reducing the number of water quality complaints. Reactive mains flushing is conducted in response to customer requests to investigate water quality issues associated with colour, taste and/or odour complaints.

We monitor algae count/biovolume during the spring and summer season, where algae growth is accelerated due to the warm weather conditions. In general, we promote biological growth within the

filter media, as it helps break down the taste and odour compounds, which then can be removed during the disinfection process, due to being oxidized by chlorine. During algal blooms, we undertake additional treatment measures involving dosing of PAC at WTPs to help remove the taste and odour compounds.

The second highest number of complaints were for taste and odour (19 complaints), which can be generated by one or more factors including but not limited to the presence of BGA, soluble organics, elevated Chlorine residual, etc. Algal blooms can result in the presence of taste and odour compounds such as Geosmin and 2-methylisoborneol (MIB). Reduced water consumption and extended retention times during low flows in the reticulation system 'long age' and dead ends may also contribute to imparting taste and odour to the water.

LMW received three alleged illness complaints during the reporting period, two of which were linked to the same customer experiencing skin rashes. Five water quality complaints were also received under the 'other' category, which after investigation was found to be unrelated to water quality.

Tables 7A and 7B show a comparison between the number of water quality complaints received during 2022/23, to those of the previous year, and the types of complaints received by each of LMW's water sampling locality respectively.

Table 7C shows the types of water quality complaints, total water quality complaints received during 2022/23, and the number of complaints per 100 customers supplied.

Murrabit WTP raw water pumps surrounded by floodwater.

Table 7a – Types of complaints compared to previous reporting periods

Type of Complaints	Number of complaints	Comparison with previous reporting periods			Comments
	22/23	21/22	20/21		
Colour	52	14	11	An increase by forty complaints	The increase may be attributed to higher manganese levels from blackwater following the flooding event in 2022/23.
Taste and odour	19	9	13	An increase by ten complaints	The increase may be attributed to the flooding that occurred in the catchment in 2022/23.
Blue water	0	0	0	No change	No complaints received.
Alleged sickness	3	2	3	No Change	The alleged sickness complaints were investigated thoroughly and found not to be attributed to the water supplied.
Air in water	0	0	0	No change	No complaints received.
Other	5	1	1	An increase of four complaints	This category of complaints includes various types that upon investigation were found to be not related to water quality.
Total	**79**	**26**	**28**	**An increase of 53 complaints**	**All categories**

Table 7b – Types of complaints by water sampling locality

Water sampling locality	Type of complaints					
	Colour	Taste and odour	Blue water	Alleged sickness	Other	Total complaints
Mildura	26	7	0	1	1	35
Irymple	4	0	0	0	0	4
Merbein	0	0	0	0	1	1
Red Cliffs	1	0	0	0	0	1
Robinvale	7	1	0	0	0	8
Nyah	0	2	0	0	0	2
Nyah West	0	0	0	0	0	0
Woorinen	0	2	0	0	0	2
Piangil	0	0	0	0	0	0
Swan Hill	5	4	0	2	10	12
Lake Boga	1	1	0	0	0	2
Wakool	0	0	0	0	0	0
Koondrook	1	0	0	0	0	1
Murrabit	0	0	0	0	0	0
Kerang	7	2	0	0	20	11
Total	**52**	**19**	**0**	**3**	**5**	**79**

Table 7c – Water quality complaints

Type of complaints	No. of complaints	No. of complaints per 100 customers supplied	LMW's Corporate Target
Colour	52	0.068	-
Taste and odour	19	0.025	-
Alleged sickness	3	0.004	-
Blue water	0	0.000	-
Air in water	0	0.000	-
Other	5	0.007	-
Total	**79**	**0.104**	**< 25 Complaints**

Risk management plan audit results

Audit Process

For part of this reporting period, the 21/22 audit (Jan 1, 2021, to December 31, 2022) was held during March 2023. The following eighteen opportunities for improvements (OFI's) identified in the recent Safe Drinking Water Act audit conducted, LMW has undertaken all necessary actions to address the OFI as per table 8 below:

Status of OFI's

Since the March 2020 Safe Drinking Water Act audit, LMW has taken measures to bridge the gap and address all the OFI's identified during the audit except a single OFI which will be completed by December 2023.

Table 8 – Status of 2021-2022 Risk Management Plan OFIs

Opportunity for Improvement	Lower Murray Water Response	Status
Red Cliffs Water Supply System		
A printout of the instrument and calibration and operation manual was observed at the plant, dated September 2016 and may not be the latest version or relate to the current instruments at the plant. There may be a more up to date one available on the LMW Intranet. If so, it is recommended that it be printed out and saved in the folder in the lab at the plant. If not, it is recommended that the manual be reviewed and updated with the latest instruments if necessary.	A new copy was printed and displayed at site and outdated copy disposed of.	Complete
Koondrook WTP and supply system		
The current jar testing equipment at the plant is not fully functional. The team uses the jar testing equipment regularly, especially during rapid changes in water quality. It is recommended that the plant be provided with an operational jar tester.	A new jar tester arrived shortly after the audit.	Complete
At times the backwash water flowrate exceeds the capacity of the overflow pipework that allows these flows to be diverted to sewer. It is recommended that the system design be reviewed, and consideration given to installing a larger diameter overflow pipe from the backwash recovery tank	All viable options are being considered	Due by March 2024
Murrabit WTP and supply system		
It is recommended that LMW consider ways to enclose the sedimentation area, to prevent bird droppings from birds roosting in the roof above. Coagulation is one of the pathogen treatment barriers and compromising this barrier could pose a risk to water quality.	All viable options are being considered.	Due by March 2024
There are 4 treated water storages at this site, however only 3 are shown on the SCADA. It is recommended that the SCADA be updated to match the plant configuration.	Incorporating the 4th storage onto SCADA by installing a level sensor.	Due by March 2024
Millewa WQP and supply system		
Update required documentation to reflect actual practice once a final decision is made regarding the type of chlorine that will be dosed on an ongoing basis at the plant (that is continue with sodium hypochlorite after the current trial is evaluated, or resume chlorine gas dosing),. This could include updating procedures, process descriptions, plans, SCADA, pipework labelling, etc	The sodium Hypochlorite trial has not yet been undertaken	Due by December 2023
The procedure for adjusting coagulant dose rates that was available at the plant was 10 years old. There may be a more up to date one available on the LMW Intranet. If so, it is recommended that it be printed out and saved in the folder in the lab at the plant. If not, it is recommended that the procedure be reviewed and updated if necessary.	The procedure is potentially being merged with another related procedure	Due by December 2023
Consider undertaking annual audits rather than biennial. The face-to-face interactions with LMW are important to reinforce the messages that are in the pamphlets and signage.	The biannual audit frequency is being considered	Due by December 2023

Opportunity for Improvement	Lower Murray Water Response	Status
OFIs relevant more broadly and/or for one system		
Each system has a control limit summary table and then detailed CCP response tables. It is recommended that the following clarifications be made to the terminology used in the CCP tables. For example: a. In some cases, the limits relate to treated water and transfer water, however within the CCP limit table, these locations are sometimes referred to as "Corrected Water" and "Trim" (e.g. Murrabit CCP5-pH and CCP-FCR). These are likely understood by the operators familiar with these sites. However, it would be beneficial to have consistent terminology to avoid any confusion. b. For Murrabit CCP6 (Chlorination control) – the second line in the TARGET heading should be "treated" not "transfer" c. For Koondrook CCP 2 (filtration and UV disinfection) – last dot point in the target column should be "alum", not "caustic" d. Consider adding to CCP Control Limit summary page first column for PAC what is to be monitored (BGA potentially toxic species) and the units (mm3/L) and remove the units from column 2 to be consistent with the layout for other CCPs e. Consider including the CCP number in the first column of the Control Limits Summary sheet f. For Red Cliffs Control Limits Summary sheet add a footnote to the table with an explanation of note 1	The recommendations b)-f) are being included in the current CCP document revision. Recommendation a) will not be adopted due to the documents aligning with SCADA systems. The terminology is chosen by the contractor at the time of SCADA commissioning of the site and would cause even more confusion to change it.	Due by June 2024
It is recommended that LMW trial an on-line UVT instrument and if successful, implement SCADA calculations and alarms in line with the CCP limits and response protocols	UVT instruments are being procured for some sites with the intent to rollout across remaining sites	Due by June 2024
Some procedures were observed during the audit that had not been reviewed and updated for a number of years and in some cases greater than 5 years. It is understood that the Records team are in the process of developing reporting tools so that the team are made aware of what documents are due for review. It is recommended that once the Records team sets up this system, the documents that require review be prioritised and updated	Procedure revision is in progress	Due by June 2024
The team advised that there are sites that were not part of the audit scope where the chemical storage volumes could be increased (e.g. 7th Street) and this would be worthwhile to assess what would be required and the associated costs, land availability requirements, etc given there is less certainty in supply than previously	The quotation process has begun, with the view to increase chemical storage capacity at Mildura WTP	Due by March 2024
Murrabit and Koondrook WTPs include the provision of "filter to waste" in their design. The LMW team advised that this facility is not available at Mildura, Kerang and Red Cliffs WTPs. It would be beneficial to incorporate this functionality at these plants. It is recommended that LMW assess the options, costs and practicality of implementing "filter to waste" at these plants	Filter to Waste has been budgeted and scheduled for the current Water Plan Capital Works program for multiple sites.	This is a major project, possible timeframe will be June 2025
LMW is implementing a new system to visualise Health Based Target (HBT) compliance (KDX Vantage) that utilises data from SCADA. It is recommended that LMW investigate a data management solution for other operational information organise and collected by the team including external laboratory data, internal laboratory data, instrument calibration records, field inspection records, prepare regular reports. This system would reduce the likelihood of errors, be more efficient that the current process of manually managing data and preparing reports, have the ability to promptly identify non-compliances, etc	A data management system is being considered.	Due by March 2024
There would also be benefit in providing training to a broader team at LMW (e. g. staff who receive calls from the community, network operations and maintenance team members, etc) on the ADWG covering much of the content in the National Water Training Package Unit of Competency - GEN017 - - Apply the risk management principles of the water industry standards, guidelines and legislation and this is recommended for LMW consider.	Further planning is needed to facilitate a training package	Due by June 2024
Consider whether it would be worthwhile having a specific line item in the EMP – Table 3.3.4 Recognition Table – Determining the Level of Event/Response to cover water quality (e.g. what level of incident corresponds to issuing a boil water notice) to assist with determining the level of response required	This OFI is being incorporated into a larger EMP revision	Due by December 2023

It would be more efficient and effective to have an internal process engineering resource to assist the operations and maintenance team, especially during and after flood/blackwater events. They would be able to implement actions raised and lessons learned from these events so that the team is better prepared with more robust processes to more effectively manage future events. Additionally, there is a significant number of equipment and other plant faults identified by the team, and the team could benefit from this additional process engineering resource. This resource could support with root cause analysis and continuous improvement work, resulting in reduced the risk of water quality incidents and make the water supply systems more robust.	A Process Engineer position is being considered	Due by December 2023
The water quality team is responsible for ensuring that the necessary systems and processes are in place to provide safe drinking water. It is recommended that LMW consider providing an additional resource in this team. The role would assist with progressing a number of the OFI's identified in this audit, provide water quality data review support and backup, help to keep documentation up to date, provide mentoring and refresher training for field teams, conduct internal audits, provide a backup for sampling, etc.	An extra resource in the Water Quality Team is being considered	Due by December 2023

Psyche Irrigation pump station surrounded by floodwater, with emergency pumps in situ following the disconnection of electricity to the pump station.

Audit certificate

The audit certificate for the period Jan 1 2021 to December 31 2022 issued by the auditor Lisa Procter is provided below.

Risk Management Plan Audit Certificate

Safe Drinking Water Regulations 2015 Regulation 10

Certificate Number: 192

Audit period: 1 January 2021 to 31 December 2022

To: Julienne Krake, Water Quality Technologist, 741-759 Fourteenth Street, Mildura VICTORIA 3500

Australian Business Number (ABN): 18 475 808 826

I, Lisa Procter, after conducting a risk management plan audit of the water supplied by Lower Murray Water, am of the opinion that Lower Murray Water has complied with the obligations imposed by section 7(1) of the *Safe Drinking Water Act 2003* during the audit period.

Signature of Approved Auditor: Lisa Procter

Date: 26 April 2023

beca hunterh2o
the future of water

Department of Health and Human Services

Regulated water

What is regulated water?

Section 6 of the Act allows the Minister for Health to declare any water that is not drinking water, but that may be supplied to the public in circumstances in which it may be mistaken as being drinking water, to be 'regulated water' for the purposes of the Act.

Following consultation between the DH and LMW, the Minister for Health declared the water supplied by LMW to the Millewa area and Mystic Park water supply systems as regulated water as per Section 6 of the Act.

The declaration for the Millewa system was gazetted in the Victoria Government Gazette Special Edition No. S28 on 15 February 2007 and the Mystic Park system was gazetted in the Victoria Government Gazette Special Edition No. S135 on 19 May 2009.

Declaration as regulated water meant that LMW had to prepare and implement risk management plans for the Millewa and Mystic Park water supply systems. This was to minimise the risk that the water as supplied could be mistaken for drinking water.

LMW take all reasonable steps to ensure that residents and visitors to Meringur, Werrimull, Cullulleraine in the Millewa Waterworks District and Mystic Park are aware that the mains water supply to these towns is untreated and not suitable for consumption. The following actions are undertaken:

- provide the 'Living with an Untreated Water Supply' brochure and reminder notices to LMW customers who are connected to an untreated water supply including private diverters, advising that untreated water is not suitable for drinking, teeth brushing or food preparation, and that due care should be taken when bathing and showering to avoid swallowing of untreated water.
- supply the 'Living with an Untreated Water Supply' brochure to accommodation facilities as requested to assist in informing guests that their supply is untreated and is not suitable for drinking, teeth brushing, or food preparation and that due care should be taken when bathing and showering to avoid swallowing of untreated water bathing.
- provide 'Do Not Drink' signs free of charge to the responsible managers of all publicly accessible taps connected to untreated water (e.g., parks, public toilets, schools, halls, caravan parks, etc.).
- provide notification via Information Statements of the property's untreated water supply to intending property purchasers.
- provide new irrigation or domestic and stock customers with an information kit including the 'Living with an Untreated Water Supply' brochure.
- make a copy of our customer charter available which details the respective rights and obligations of customers supplied with untreated water.
- Publish this information on our website.

LMW's Regulated Water Supplies

Millewa Water Supply System

A non-potable water system supplies an area which includes the towns of Meringur, Werrimull and Cullulleraine and also the surrounding rural properties in the Millewa district. The water is sourced from Lake Cullulleraine which is filled directly from the Murray River via an earthen channel. The population served by this supply is estimated to be less than 250.

The water supply system is primarily a domestic and stock water supply to dryland farmers in the Millewa area located to the west of Mildura. Previously, the water from Lake Cullulleraine had been chlorinated as it was pumped into the system to control the nuisance growth of the Plumatella species, which if allowed to become established within a pipeline system can cause severe ongoing operational challenges.

In 2013, LMW commissioned a Water Quality Plant at Lake Cullulleraine. The plant has improved water quality; providing clearer water for domestic uses such as washing, and farmers can benefit as the impact on their spraying equipment is reduced.

The treatment plant comprises two large lagoons that alternate as storages for removing turbidity. Aluminium sulphate is used to aid in the precipitation of the suspended matter. Clarified water is chlorinated whilst gravitating into a clear water storage tank from which it is pumped into the Bambill water storage dam or into the Cullulleraine reticulation system.

The 182 ML storage dam at Bambill is an earthen water storage within the Millewa system, located at Bambill South which supplies operating head for the system when the treated water pumps are not operating.

The dryland area serviced by the Millewa regulated water supply covers an area of approximately 243,500 hectares. The total number of connections for the supply to the dryland farming properties is 252.

Mystic Park Water Supply System

A non-potable water system supplies the small township of Mystic Park which is located to the south of Swan Hill. In May 2008, LMW assumed responsibility for the Mystic Park untreated water supply, previously the responsibility of the Gannawarra Shire Council.

The water is sourced from nearby Kangaroo Lake before being screened and pumped to an earthen dam located within the township. A small amount of coagulant is added as the water enters the dam. This dam provides some detention time assisting in the reduction of turbidity in the water, however no disinfection is provided.

The town population is currently 29 with 12 serviced properties, including a hotel, recreation reserve and cenotaph.

APPENDIX A – Water Quality Tables

All samples were taken in reticulations unless otherwise noted.

Tables 1 to 3 contain results reporting against the standards listed in Schedule 2 of the Safe Drinking Water Regulations 2015.

Table 1 E. coli

Water Quality Standard: All samples of drinking water collected are found to contain no Escherichia coli per 100 millilitres of drinking water, with the exception of any false positive sample.

E. coli is a microorganism that may cause illness in susceptible individuals. E. coli is associated with contamination of water supplies with faecal material and is therefore considered to be an important indicator of the safety of the water supply. Samples are taken at least weekly in each of the water sampling localities.

Water Sampling Locality	Frequency of Sampling	Number of Samples	Maximum detected (CFU/100mL)	Number of detections and investigations conducted (s.22)	Number of samples where standard was not met (s.18)
Irymple	Weekly	52	0	0	0
Kerang	Weekly	52	0	0	0
Koondrook	Weekly	52	0	0	0
Lake Boga	Weekly	52	0	0	0
Merbein	Weekly	52	0	0	0
Mildura*	Weekly	116	0	0	0
Murrabit	Weekly	52	0	0	0
Nyah	Weekly	52	0	0	0
Nyah West	Weekly	52	0	0	0
Piangil	Weekly	52	0	0	0
Red Cliffs	Weekly	52	0	0	0
Robinvale	Weekly	52	0	0	0
Swan Hill8	Weekly	78	0	0	0
Woorinen Sth	Weekly	52	0	0	0

**Additional number of samples were taken for Mildura & Swan Hill due to the larger populations serviced by these supplies.*

Table 2 Trihalomethanes

Water Quality Standard: Total Trihalomethanes less than or equal to 0.25 milligrams per litre of drinking water.

Trihalomethanes are compounds that may be produced when chlorine disinfectant reacts with organic material present in the water. These compounds may impact public health if they are present in drinking water in high concentrations over a long period of time.

Samples are usually taken monthly in each of the water sampling localities; however, this was increased to fortnightly to proactively monitor because of increased risk during the 2022/23 floods and blackwater event that lasted 6 months throughout LMW service regions.

Water Sampling Locality	Frequency of Sampling	Number of Samples	Drinking water quality standard (mg/L)	Maximum (mg/L)	Average (mg/L)	Number of samples where standard was not met (s.18)
Irymple	Monthly	22	0.25	0.13	0.08	0
Kerang	Monthly	21	0.25	0.13	0.07	0
Koondrook	Monthly	22	0.25	0.18	0.09	0
Lake Boga	Monthly	22	0.25	0.25	0.11	0
Merbein	Monthly	22	0.25	0.18	0.12	0
Mildura	Monthly	22	0.25	0.14	0.07	0
Murrabit	Monthly	22	0.25	0.18	0.09	0
Nyah	Monthly	22	0.25	0.25	0.13	0
Nyah West	Monthly	22	0.25	0.21	0.12	0
Piangil	Monthly	22	0.25	0.19	0.10	0
Red Cliffs	Monthly	22	0.25	0.20	0.11	0
Robinvale	Monthly	22	0.25	0.14	0.09	0
Swan Hill	Monthly	22	0.25	0.19	0.07	0
Woorinen Sth	Monthly	22	0.25	0.19	0.11	0

The high Trihalomethane concentration recorded in Lake Boga and Nyah Water Sampling Localities were due to increase in dissolved organic carbon concentration, high chlorine dosages and increased water age due to the flooding that occurred in October 2022.

Table 3 Turbidity

Water Quality Standard: The 95th percentile of results for samples in any 12-month period must be less than or equal to 5.0 Nephelometric Turbidity Units (NTU).

Turbidity measures the presence of fine suspended material present in the water and at elevated levels may result in a 'cloudy' appearance of water. Turbidity is an indirect indicator for the general quality of water and may represent fine particles such as clays, minerals or microscopic organisms. Samples are taken weekly in each of the water sampling localities.

Water Sampling Locality	Frequency of Sampling	Number of Samples	Maximum turbidity in a sample (NTU)	Maximum 95th percentile of turbidity results in any 12 months (NTU)	Number of 95th percentile of results in any 12 months above standard (s.18)
Irymple	Weekly	52	1.3	0.3	0
Kerang	Weekly	52	0.6	0.2	0
Koondrook	Weekly	52	0.4	0.2	0
Lake Boga	Weekly	52	0.5	0.2	0
Merbein	Weekly	52	3.4	0.3	0
Mildura	Weekly	53	5.9*	0.6	0
Murrabit	Weekly	53	3.7	0.3	0
Nyah	Weekly	52	1.2	0.2	0
Nyah West	Weekly	52	0.7	0.1	0
Piangil	Weekly	52	0.3	0.1	0
Red Cliffs	Weekly	52	0.6	0.2	0
Robinvale	Weekly	52	1.0	0.2	0
Swan Hill	Weekly	52	0.4	0.1	0
Woorinen Sth	Weekly	52	0.3	0.1	0

**A single sample in Mildura returned a result of 5.9 NTU on 24/10/22, attributed to a dual riser on the sample tap with suspected trapped sediment in the second tap. Both taps were flushed for a longer period before resampling with a result of 0.63 NTU. This locality is still within the 95th percentile of results 5 NTU or less in a 12-month period.*

Tables 4 to 38 inclusive, are results reporting against the Australian Drinking Water Guidelines 2011 (ADWG), health & aesthetic guidelines.

Tables 9 to 20 & 34 to 39, inclusive, are parameters from samples taken from LMW's 9 treatment plants entering the reticulation system, 8 localities in total (Mildura & Mildura West have a combined locality, Mildura). This differs from other parameters, which show 14 localities that are supplied from a total of 9 treatment plants.

Tables 17 to 20 & 37 to 41 inclusive, which have 3 monthly scheduling, have 8 samples reported for Mildura supply as both the Mildura & Mildura West WTP's were operating simultaneously.

Tables 5, 9 to 16, 18, 19, 23, 24, & 27 to 29 inclusive, do not have averages as the average cannot be calculated from 'less than' data.

Table 3 Fluoride

Water Quality Standard: The total concentration of fluoride in drinking water should not exceed 1.5 mg/L. Fluoride is added to the water sampling localities listed below to promote oral health under direction of DHHS. Fluoride samples are taken monthly in each of the fluoridated water sampling localities.

Compliance is measured as: annual average fluoride level must not exceed 1 milligram per litre and all individual samples must be less than 1.5 milligrams per litre under s.5 (3) of the Health (Fluoridation) Act 1973.

Water Sampling Locality	Frequency of Sampling	Number of Samples	Drinking water quality standard (mg/L)	Target optimum operating fluoride concentration (mg/L)	Maximum (mg/L)	Average *(mg/L)	Number of samples where standard was not met (s.18)
Irymple	Weekly	52	1.5	0.8	0.89	0.71	0
Kerang	Weekly	52	1.5	0.8	0.99	0.73	0
Lake Boga	Weekly	52	1.5	0.8	0.97	0.72	0
Merbein	Weekly	52	1.5	0.8	0.79	0.66	0
Mildura	Weekly	52	1.5	0.8	0.89	0.69	0
Nyah	Weekly	53	1.5	0.8	0.94	0.71	0
Nyah West	Weekly	53	1.5	0.8	0.90	0.77	0
Red Cliffs	Weekly	52	1.5	0.8	0.87	0.72	0
Robinvale	Weekly	52	1.5	0.8	0.92	0.70	0
Swan Hill	Weekly	52	1.5	0.8	0.94	0.71	0
Woorinen Sth	Weekly	52	1.5	0.8	0.89	0.71	0

Meeting Obligation *is measured as: annual average fluoride level between 0.7 – 1.0 milligrams per litre in fluoridated systems.*

**No data for Koondrook, Murrabit and Piangil systems as these systems do not have fluoridation.*

Table 5 Chloroacetic Acid

Health Guideline Value (ADWG) 0.15 mg/L

Water Sampling Locality	Frequency of Sampling	Number of Samples	Maximum mg/L	Met ADWG guideline value (Yes/No)
Irymple	Monthly	12	<0.005	Yes
Kerang	Monthly	12	<0.005	Yes
Koondrook	Monthly	12	<0.005	Yes
Lake Boga	Monthly	12	<0.005	Yes
Merbein	Monthly	12	<0.005	Yes
Mildura	Monthly	12	<0.005	Yes
Murrabit	Monthly	12	<0.005	Yes
Nyah	Monthly	12	<0.005	Yes
Nyah West	Monthly	12	<0.005	Yes
Piangil	Monthly	12	0.005	Yes
Red Cliffs	Monthly	12	<0.005	Yes
Robinvale	Monthly	12	<0.005	Yes
Swan Hill	Monthly	12	<0.005	Yes
Woorinen Sth	Monthly	12	<0.005	Yes

**Note: The min/max values of this parameter have Remained the same in comparison to the previous 2 reporting periods*

Table 6 Dichloroacetic Acid

Health Guideline Value (ADWG) 0.1 mg/L

Water Sampling Locality	Frequency of Sampling	Number of Samples	Maximum (mg/L)	Average (mg/L)	Average change *Comparison of past 2 reporting periods	Met ADWG guideline value (Yes/No)
Irymple	Monthly	12	0.026	0.010	No Change	Yes
Kerang	Monthly	12	0.046	0.014	No Change	Yes
Koondrook	Monthly	12	0.034	0.022	Increased	Yes
Lake Boga	Monthly	12	0.035	0.018	Decreased	Yes
Merbein	Monthly	12	0.033	0.017	Decreased	Yes
Mildura	Monthly	12	0.045	0.016	No Change	Yes
Murrabit	Monthly	12	0.019	0.024	Increased	Yes
Nyah	Monthly	12	0.016	0.010	No Change	Yes
Nyah West	Monthly	12	0.057	0.009	No Change	Yes
Piangil	Monthly	12	0.053	0.027	Increased	Yes
Red Cliffs	Monthly	12	0.045	0.022	No Change	Yes
Robinvale	Monthly	12	0.044	0.020	No Change	Yes
Swan Hill	Monthly	12	0.028	0.018	No Change	Yes
Woorinen Sth	Monthly	12	0.017	0.011	No Change	Yes

Table 7 Trichloroacetic Acid

Health Guideline Value (ADWG) 0.1 mg/L

Water Sampling Locality	Frequency of Sampling	Number of Samples	Maximum mg/L	Average (mg/L)	Average change *Comparison of past 2 reporting periods	Met ADWG guideline value (Yes/No)
Irymple	Monthly	12	0.041	0.021	No Change	Yes
Kerang	Monthly	12	0.031	0.016	No Change	Yes
Koondrook	Monthly	12	0.062	0.029	Increased	Yes
Lake Boga	Monthly	12	0.100	0.026	Decreased	Yes
Merbein	Monthly	12	0.053	0.025	Decreased	Yes
Mildura	Monthly	12	0.032	0.017	No Change	Yes
Murrabit	Monthly	12	0.065	0.031	Increased	Yes
Nyah	Monthly	12	0.032	0.018	Decreased	Yes
Nyah West	Monthly	12	0.028	0.015	Decreased	Yes
Piangil	Monthly	12	0.065	0.030	Increased	Yes
Red Cliffs	Monthly	12	0.067	0.029	No Change	Yes
Robinvale	Monthly	12	0.058	0.024	No Change	Yes
Swan Hill	Monthly	12	0.070	0.027	No Change	Yes
Woorinen Sth	Monthly	12	0.032	0.013	Decreased	Yes

Table 8 Aluminium

Aesthetic Guideline Value (ADWG) 0.2 mg/L (acid soluble)

LMW uses Aluminium Chlorohydrate or Aluminium Sulphate at our water treatment plants as a coagulant. This can result in the presence of acid soluble aluminium within drinking water.

Should acid soluble aluminium exceed a concentration of 0.2 mg/L, a white gelatinous precipitate can form within the distribution network causing "milky coloured" water (depending on the pH of the water).

Water Sampling Locality	Frequency of Sampling	Number of Samples	Maximum mg/L	Average (mg/L)	Average change *Comparison of past 2 reporting periods	Met ADWG guideline value (Yes/No)
Irymple	Monthly	12	0.08	0.04	Increased	Yes
Kerang	Monthly	12	0.06	0.03	No Change	Yes
Koondrook	Monthly	12	0.05	0.03	Increased	Yes
Lake Boga	Monthly	12	0.04	0.02	No Change	Yes
Merbein	Monthly	12	0.06	0.03	Decreased	Yes
Mildura	Monthly	12	0.17	0.06	Increased	Yes
Murrabit	Monthly	12	0.07	0.02	No Change	Yes
Nyah	Monthly	12	0.03	0.01	No Change	Yes
Nyah West	Monthly	12	0.02	0.01	No Change	Yes
Piangil	Monthly	12	0.05	0.03	Decreased	Yes
Red Cliffs	Monthly	12	0.04	0.02	No Change	Yes
Robinvale	Monthly	12	0.03	0.02	No Change	Yes
Swan Hill	Monthly	12	0.02	0.01	No Change	Yes
Woorinen Sth	Monthly	12	0.02	0.02	No Change	Yes

Table 9 2,4 Dichlorophenoxy acetic acid

Health Guideline Value (ADWG) 0.03 mg/L

Water Sampling Locality	Frequency of Sampling	Number of Samples	Maximum mg/L	Met ADWG guideline value (Yes/No)
Kerang	6 Monthly	2	<0.01	Yes
Koondrook	6 Monthly	2	<0.01	Yes
Mildura	6 Monthly	4	<0.01	Yes
Murrabit	6 Monthly	2	<0.01	Yes
Piangil	6 Monthly	2	<0.01	Yes
Red Cliffs	6 Monthly	2	<0.01	Yes
Robinvale	6 Monthly	2	<0.01	Yes
Swan Hill	6 Monthly	2	<0.01	Yes

**Note: The min/max values of this parameter have Remained the same in comparison to the previous 2 reporting periods*

Table 10 Benzene

Health Guideline Value (ADWG) 0.001 mg/L

Water Sampling Locality	Frequency of Sampling	Number of Samples	Maximum mg/L	Met ADWG guideline value (Yes/No)
Kerang	6 Monthly	2	<0.01	Yes
Koondrook	6 Monthly	2	<0.01	Yes
Mildura	6 Monthly	4	<0.01	Yes
Murrabit	6 Monthly	2	<0.01	Yes
Piangil	6 Monthly	2	<0.01	Yes
Red Cliffs	6 Monthly	2	<0.01	Yes
Robinvale	6 Monthly	2	<0.01	Yes
Swan Hill	6 Monthly	2	<0.01	Yes

**Note: The min/max values of this parameter have Remained the same in comparison to the previous 2 reporting periods*

Table 11 Carbon Tetrachloride

Health Guideline Value (ADWG) 0.003 mg/L

Water Sampling Locality	Frequency of Sampling	Number of Samples	Maximum mg/L	Met ADWG guideline value (Yes/No)
Kerang	6 Monthly	2	<0.01	Yes
Koondrook	6 Monthly	2	<0.01	Yes
Mildura	6 Monthly	4	<0.01	Yes
Murrabit	6 Monthly	2	<0.01	Yes
Piangil	6 Monthly	2	<0.01	Yes
Red Cliffs	6 Monthly	2	<0.01	Yes
Robinvale	6 Monthly	2	<0.01	Yes
Swan Hill	6 Monthly	2	<0.01	Yes

**Note: The min/max values of this parameter have Remained the same in comparison to the previous 2 reporting periods*

Table 12 1,2 Dichloroethane

Health Guideline Value (ADWG) 0.003 mg/L

Water Sampling Locality	Frequency of Sampling	Number of Samples	Maximum mg/L	Met ADWG guideline value (Yes/No)
Kerang	6 Monthly	2	<0.01	Yes
Koondrook	6 Monthly	2	<0.01	Yes
Mildura	6 Monthly	4	<0.01	Yes
Murrabit	6 Monthly	2	<0.01	Yes
Piangil	6 Monthly	2	<0.01	Yes
Red Cliffs	6 Monthly	2	<0.01	Yes
Robinvale	6 Monthly	2	<0.01	Yes
Swan Hill	6 Monthly	2	<0.01	Yes

**Note: The min/max values of this parameter have Remained the same in comparison to the previous 2 reporting periods*

Table 13 1,1 Dichloroethene

Health Guideline Value (ADWG) 0.03 mg/L

Water Sampling Locality	Frequency of Sampling	Number of Samples	Maximum mg/L	Met ADWG guideline value (Yes/No)
Kerang	6 Monthly	2	<0.01	Yes
Koondrook	6 Monthly	2	<0.01	Yes
Mildura	6 Monthly	4	<0.01	Yes
Murrabit	6 Monthly	2	<0.01	Yes
Piangil	6 Monthly	2	<0.01	Yes
Red Cliffs	6 Monthly	2	<0.01	Yes
Robinvale	6 Monthly	2	<0.01	Yes
Swan Hill	6 Monthly	2	<0.01	Yes

**Note: The min/max values of this parameter have Remained the same in comparison to the previous 2 reporting periods*

Table 14 Pentachlorophenol

Health Guideline Value (ADWG) 0.01 mg/L

Water Sampling Locality	Frequency of Sampling	Number of Samples	Maximum mg/L	Met ADWG guideline value (Yes/No)
Kerang	6 Monthly	2	<0.01	Yes
Koondrook	6 Monthly	2	<0.01	Yes
Mildura	6 Monthly	4	<0.01	Yes
Murrabit	6 Monthly	2	<0.01	Yes
Piangil	6 Monthly	2	<0.01	Yes
Red Cliffs	6 Monthly	2	<0.01	Yes
Robinvale	6 Monthly	2	<0.01	Yes
Swan Hill	6 Monthly	2	<0.01	Yes

**Note: The min/max values of this parameter have Remained the same in comparison to the previous 2 reporting periods*

Table 15 Tetrachloroethene

Health Guideline Value (ADWG) 0.05 mg/L

Water Sampling Locality	Frequency of Sampling	Number of Samples	Maximum mg/L	Met ADWG guideline value (Yes/No)
Kerang	6 Monthly	2	<0.01	Yes
Koondrook	6 Monthly	2	<0.01	Yes
Mildura	6 Monthly	4	<0.01	Yes
Murrabit	6 Monthly	2	<0.01	Yes
Piangil	6 Monthly	2	<0.01	Yes
Red Cliffs	6 Monthly	2	<0.01	Yes
Robinvale	6 Monthly	2	<0.01	Yes
Swan Hill	6 Monthly	2	<0.01	Yes

**Note: The min/max values of this parameter have Remained the same in comparison to the previous 2 reporting periods*

Table 16 2,4,6 Trichlorophenol

Health Guideline Value (ADWG) 0.02 mg/L

Water Sampling Locality	Frequency of Sampling	Number of Samples	Maximum mg/L	Met ADWG guideline value (Yes/No)
Kerang	6 Monthly	2	<0.01	Yes
Koondrook	6 Monthly	2	<0.01	Yes
Mildura	6 Monthly	4	<0.01	Yes
Murrabit	6 Monthly	2	<0.01	Yes
Piangil	6 Monthly	2	<0.01	Yes
Red Cliffs	6 Monthly	2	<0.01	Yes
Robinvale	6 Monthly	2	<0.01	Yes
Swan Hill	6 Monthly	2	<0.01	Yes

**Note: The min/max values of this parameter have Remained the same in comparison to the previous 2 reporting periods*

Table 17 Sulphate

Aesthetic Guideline Value (ADWG) 250 mg/L

Samples taken exiting treatment plants.

Water Sampling Locality	Frequency of Sampling	Number of Samples	Maximum mg/L	Average (mg/L)	Average change *Comparison of past 2 reporting periods	Met ADWG guideline value (Yes/No)
Kerang	3 Monthly	4	81	51	Increased	Yes
Koondrook	3 Monthly	4	64	37	Decreased	Yes
Mildura	3 Monthly	8	77	38	Increased	Yes
Murrabit	3 Monthly	4	3	3	No Change	Yes
Piangil	3 Monthly	4	5	3	No Change	Yes
Red Cliffs	3 Monthly	4	61	25	Increased	Yes
Robinvale	3 Monthly	4	59	45	Increased	Yes
Swan Hill	3 Monthly	4	6	5	No Change	Yes

Table 18 Arsenic

Health Guideline Value (ADWG) 0.01 mg/L

Arsenic is a naturally occurring element, which can be introduced into water in the catchment through the presence of naturally occurring minerals and ores. Short and long-term exposure to arsenic may result in potential health impacts.

Water Sampling Locality	Frequency of Sampling	Number of Samples	Maximum mg/L	Met ADWG guideline value (Yes/No)
Kerang	6 Monthly	2	<0.01	Yes
Koondrook	6 Monthly	2	<0.01	Yes
Mildura	6 Monthly	4	<0.01	Yes
Murrabit	6 Monthly	2	<0.01	Yes
Piangil	6 Monthly	2	<0.01	Yes
Red Cliffs	6 Monthly	2	<0.01	Yes
Robinvale	6 Monthly	2	<0.01	Yes
Swan Hill	6 Monthly	2	<0.01	Yes

**Note: The min/max values of this parameter have remained the same in comparison to the past 2 years except Swan Hill, which saw a slight increase from 0.001 to 0.004.*

Table 19 Selenium

Health Guideline Value (ADWG) 0.01 mg/L

Water Sampling Locality	Frequency of Sampling	Number of Samples	Maximum mg/L	Met ADWG guideline value (Yes/No)
Kerang	3 Monthly	4	<0.001	Yes
Koondrook	3 Monthly	4	<0.001	Yes
Mildura	3 Monthly	8	<0.001	Yes
Murrabit	3 Monthly	4	<0.001	Yes
Piangil	3 Monthly	4	<0.001	Yes
Red Cliffs	3 Monthly	4	<0.001	Yes
Robinvale	3 Monthly	4	<0.001	Yes
Swan Hill	3 Monthly	4	<0.001	Yes

**Note: The min/max values of this parameter have Remained the same in comparison to the past 2 years*

Table 20 Mercury

Health Guideline Value (ADWG) 0.001 mg/L

Water Sampling Locality	Frequency of Sampling	Number of Samples	Maximum mg/L	Met ADWG guideline value (Yes/No)
Kerang	3 Monthly	4	<0.0001	Yes
Koondrook	3 Monthly	4	<0.0001	Yes
Mildura	3 Monthly	8	<0.0001	Yes
Murrabit	3 Monthly	4	<0.0001	Yes
Piangil	3 Monthly	4	<0.0001	Yes
Red Cliffs	3 Monthly	4	<0.0001	Yes
Robinvale	3 Monthly	4	<0.0001	Yes
Swan Hill	3 Monthly	4	<0.0001	Yes

**Note: The min/max values of this parameter have Remained the same in comparison to the past 2 years*

Table 21 Gross Alpha Activity

Health Guideline Value (ADWG) 0.5 Bq/L

Water Sampling Locality	Frequency of Sampling	Number of Samples	Maximum mg/L	Met ADWG guideline value (Yes/No)
Kerang	5 yearly	1	<0.05	Yes
Koondrook	5 yearly	1	<0.05	Yes
Mildura	5 yearly	2	<0.05	Yes
Murrabit	5 yearly	1	<0.05	Yes
Piangil	5 yearly	1	<0.05	Yes
Red Cliffs	5 yearly	1	<0.05	Yes
Robinvale	5 yearly	1	<0.05	Yes
Swan Hill	5 yearly	1	<0.05	Yes

**Note: 2020 results shown, samples are taken every 5 years from source water.*

Table 22 Gross Beta Activity

Health Guideline Value (ADWG) 0.5 Bq/L

Water Sampling Locality	Frequency of Sampling	Number of Samples	Maximum mg/L	Met ADWG guideline value (Yes/No)
Kerang	5 yearly	1	<0.1	Yes
Koondrook	5 yearly	1	<0.1	Yes
Mildura	5 yearly	2	<0.1	Yes
Murrabit	5 yearly	1	<0.1	Yes
Piangil	5 yearly	1	<0.1	Yes
Red Cliffs	5 yearly	1	<0.1	Yes
Robinvale	5 yearly	1	<0.1	Yes
Swan Hill	5 yearly	1	<0.1	Yes

**Note: 2020 results shown, samples are taken every 5 years from source water.*

Table 23 Lead

Health Guideline Value (ADWG) 0.01 mg/L

Lead may occur naturally in water or be introduced through contact with lead pipes and joint fittings. Human exposure to high levels of lead may result in toxic effects.

Water Sampling Locality	Frequency of Sampling	Number of Samples	Maximum mg/L	Met ADWG guideline value (Yes/No)
Irymple	3 Monthly	4	<0.001	Yes
Kerang	3 Monthly	4	<0.001	Yes
Koondrook	3 Monthly	4	<0.001	Yes
Lake Boga	3 Monthly	4	<0.001	Yes
Merbein	3 Monthly	4	0.001	Yes
Mildura	3 Monthly	4	0.002	Yes
Murrabit	3 Monthly	4	<0.001	Yes
Nyah	3 Monthly	4	<0.001	Yes
Nyah West	3 Monthly	4	0.001	Yes
Piangil	3 Monthly	4	<0.001	Yes
Red Cliffs	3 Monthly	4	<0.001	Yes
Robinvale	3 Monthly	4	0.002	Yes
Swan Hill	3 Monthly	4	<0.001	Yes
Woorinen Sth	3 Monthly	4	<0.001	Yes

**Note: The Max values of this parameter for Nyah West had a decrease, Merbein, Mildura and Robinvale increased very slightly, while other localities stayed the same in comparison to the previous 2 reporting periods.*

Table 24 Nickel

Health Guideline Value (ADWG) 0.02 mg/L

Water Sampling Locality	Frequency of Sampling	Number of Samples	Maximum mg/L	Met ADWG guideline value (Yes/No)
Irymple	3 Monthly	4	0.001	Yes
Kerang	3 Monthly	4	0.001	Yes
Koondrook	3 Monthly	4	0.001	Yes
Lake Boga	3 Monthly	4	0.001	Yes
Merbein	3 Monthly	4	0.001	Yes
Mildura	3 Monthly	4	0.001	Yes
Murrabit	3 Monthly	4	0.001	Yes
Nyah	3 Monthly	4	<0.001	Yes
Nyah West	3 Monthly	4	<0.001	Yes
Piangil	3 Monthly	4	0.001	Yes
Red Cliffs	3 Monthly	4	<0.001	Yes
Robinvale	3 Monthly	4	0.001	Yes
Swan Hill	3 Monthly	4	0.001	Yes
Woorinen Sth	3 Monthly	4	0.001	Yes

**Note: The min/max values of this parameter have decreased or Remained the same in comparison to the previous 2 reporting periods.*

Table 24 Nickel

Health Guideline Value (ADWG) 0.02 mg/L

Water Sampling Locality	Frequency of Sampling	Number of Samples	Maximum mg/L	Met ADWG guideline value (Yes/No)
Irymple	3 Monthly	4	0.001	Yes
Kerang	3 Monthly	4	0.001	Yes
Koondrook	3 Monthly	4	0.001	Yes
Lake Boga	3 Monthly	4	0.001	Yes
Merbein	3 Monthly	4	0.001	Yes
Mildura	3 Monthly	4	0.001	Yes
Murrabit	3 Monthly	4	0.001	Yes
Nyah	3 Monthly	4	<0.001	Yes
Nyah West	3 Monthly	4	<0.001	Yes
Piangil	3 Monthly	4	0.001	Yes
Red Cliffs	3 Monthly	4	<0.001	Yes
Robinvale	3 Monthly	4	0.001	Yes
Swan Hill	3 Monthly	4	0.001	Yes
Woorinen Sth	3 Monthly	4	0.001	Yes

**Note: The min/max values of this parameter have decreased or Remained the same in comparison to the previous 2 reporting periods.*

Table 25 Zinc

Aesthetic Guideline Value (ADWG) 3 mg/L

Zinc may occur naturally in the environment, or may be introduced through industrial activity, as well as through corrosion of customer service piping. High levels of zinc in the water can impart taste and appearance issues with drinking water.

Water Sampling Locality	Frequency of Sampling	Number of Samples	Maximum mg/L	Average (mg/L)	Average change *Comparison of past 2 reporting periods	Met ADWG guideline value (Yes/No)
Irymple	3 Monthly	4	0.010	0.006	No Change	Yes
Kerang	3 Monthly	4	0.014	0.006	Decreased	Yes
Koondrook	3 Monthly	4	0.010	0.008	Increased	Yes
Lake Boga	3 Monthly	4	0.007	0.004	No Change	Yes
Merbein	3 Monthly	4	0.014	0.007	Increased	Yes
Mildura	3 Monthly	4	0.007	0.004	No Change	Yes
Murrabit	3 Monthly	4	0.015	0.007	No Change	Yes
Nyah	3 Monthly	4	0.009	0.007	Increased	Yes
Nyah West	3 Monthly	4	0.031	0.015	Decreased	Yes
Piangil	3 Monthly	4	0.008	0.00	Decreased	Yes
Red Cliffs	3 Monthly	4	0.018	0.015	Increased	Yes
Robinvale	3 Monthly	4	0.008	0.01	Decreased	Yes
Swan Hill	3 Monthly	4	0.007	0.005	Increased	Yes
Woorinen Sth	3 Monthly	4	0.019	0.016	Increased	Yes

Table 26 Nitrate Nitrogen

Health Guideline Value (ADWG) 50 mg/L (as Nitrate)

Water Sampling Locality	Frequency of Sampling	Number of Samples	Maximum mg/L (as Nitrate)	Average (mg/L)	Average change *Comparison of past 2 reporting periods	Met ADWG guideline value (Yes/No)
Irymple	3 Monthly	4	0.17	0.06	Increased	Yes
Kerang	3 Monthly	4	0.39	0.20	Increased	Yes
Koondrook	3 Monthly	4	0.26	0.12	Increased	Yes
Lake Boga	3 Monthly	4	0.10	0.06	Decreased	Yes
Merbein	3 Monthly	4	0.13	0.07	Increased	Yes
Mildura	3 Monthly	4	0.11	0.05	Decreased	Yes
Murrabit	3 Monthly	4	0.11	0.07	Decreased	Yes
Nyah	3 Monthly	4	0.12	0.10	Increased	Yes
Nyah West	3 Monthly	4	0.12	0.09	Increased	Yes
Piangil	3 Monthly	4	0.08	0.06	Increased	Yes
Red Cliffs	3 Monthly	4	0.08	0.03	Decreased	Yes
Robinvale	3 Monthly	4	0.09	0.06	Increased	Yes
Swan Hill	3 Monthly	4	0.27	0.13	Decreased	Yes
Woorinen Sth	3 Monthly	4	0.10	0.07	Decreased	Yes

Table 27 Cyanide

Health Guideline Value (ADWG) 0.08 mg/L

Cyanide may occur naturally in the environment or be introduced through human activity.

Water Sampling Locality	Frequency of Sampling	Number of Samples	Maximum mg/L	Met ADWG guideline value (Yes/No)
Irymple	3 Monthly	4	<0.005	Yes
Kerang	3 Monthly	4	<0.005	Yes
Koondrook	3 Monthly	4	<0.005	Yes
Lake Boga	3 Monthly	4	<0.005	Yes
Merbein	3 Monthly	4	<0.005	Yes
Mildura	3 Monthly	4	<0.005	Yes
Murrabit	3 Monthly	4	<0.005	Yes
Nyah	3 Monthly	4	0.041	Yes
Nyah West	3 Monthly	4	0.010	Yes
Piangil	3 Monthly	4	0.077	Yes
Red Cliffs	3 Monthly	4	<0.005	Yes
Robinvale	3 Monthly	4	0.005	Yes
Swan Hill	3 Monthly	4	<0.005	Yes
Woorinen Sth	3 Monthly	4	<0.005	Yes

**Note: The min/max values of this parameter have remained the same in comparison to the previous 2 reporting periods, except for Nyah, Nyah West and Piangil which have increased.*

Table 28 Chromium

Health Guideline Value (ADWG) 0.05 mg/L

Chromium may occur naturally in the environment or be introduced through human activity.

Water Sampling Locality	Frequency of Sampling	Number of Samples	Maximum mg/L	Met ADWG guideline value (Yes/No)
Irymple	3 Monthly	4	<0.001	Yes
Kerang	3 Monthly	4	<0.001	Yes
Koondrook	3 Monthly	4	<0.001	Yes
Lake Boga	3 Monthly	4	<0.001	Yes
Merbein	3 Monthly	4	<0.001	Yes
Mildura	3 Monthly	4	<0.001	Yes
Murrabit	3 Monthly	4	<0.001	Yes
Nyah	3 Monthly	4	<0.001	Yes
Nyah West	3 Monthly	4	<0.001	Yes
Piangil	3 Monthly	4	<0.001	Yes
Red Cliffs	3 Monthly	4	<0.001	Yes
Robinvale	3 Monthly	4	<0.001	Yes
Swan Hill	3 Monthly	4	<0.001	Yes
Woorinen Sth	3 Monthly	4	<0.001	Yes

**Note: values of this parameter have Remained the same in comparison to the previous 2 reporting periods except for Murrabit which saw an increase.*

Table 29 Cadmium

Health Guideline Value (ADWG) 0.002 mg/L

Cadmium may be introduced into drinking water supplies through corrosion of pipes and fittings. Exposure to high concentrations of cadmium may result in potential health implications.

Water Sampling Locality	Frequency of Sampling	Number of Samples	Maximum mg/L	Met ADWG guideline value (Yes/No)
Irymple	3 Monthly	4	<0.0002	Yes
Kerang	3 Monthly	4	<0.0002	Yes
Koondrook	3 Monthly	4	<0.0002	Yes
Lake Boga	3 Monthly	4	<0.0002	Yes
Merbein	3 Monthly	4	<0.0002	Yes
Mildura	3 Monthly	4	<0.0002	Yes
Murrabit	3 Monthly	4	<0.0002	Yes
Nyah	3 Monthly	4	<0.0002	Yes
Nyah West	3 Monthly	4	<0.0002	Yes
Piangil	3 Monthly	4	<0.0002	Yes
Red Cliffs	3 Monthly	4	<0.0002	Yes
Robinvale	3 Monthly	4	<0.0002	Yes
Swan Hill	3 Monthly	4	<0.0002	Yes
Woorinen Sth	3 Monthly	4	<0.0002	Yes

**Note: The min/max values of this parameter have Remained the same in comparison to the previous 2 reporting periods.*

Table 30 Copper

Water Quality Standard: The total concentration of copper in drinking water should not exceed 2 mg/L.

Copper may occur naturally in the environment or be introduced into water through contact with corroding copper pipes and fittings.

Water Sampling Locality	Frequency of Sampling	Number of Samples	Drinking water quality standard (mg/L)	Maximum mg/L	Average (mg/L)	Average change *Comparison of past 2 reporting periods	Number of samples where standard was not met (s. 18)
Irymple	3 Monthly	4	2	0.014	0.007	Increased	0
Kerang	3 Monthly	4	2	0.006	0.005	Decreased	0
Koondrook	3 Monthly	4	2	0.023	0.017	Decreased	0
Lake Boga	3 Monthly	4	2	0.034	0.013	Decreased	0
Merbein	3 Monthly	4	2	0.031	0.015	Increased	0
Mildura	3 Monthly	4	2	0.011	0.005	Increased	0
Murrabit	3 Monthly	4	2	0.017	0.007	No Change	0
Nyah	3 Monthly	4	2	0.012	0.007	Decreased	0
Nyah West	3 Monthly	4	2	0.190	0.055	Decreased	0
Piangil	3 Monthly	4	2	0.035	0.022	Decreased	0
Red Cliffs	3 Monthly	4	2	0.009	0.006	Decreased	0
Robinvale	3 Monthly	4	2	0.015	0.010	Decreased	0
Swan Hill	3 Monthly	4	2	0.015	0.011	Decreased	0
Woorinen Sth	3 Monthly	4	2	0.013	0.009	Increased	0

Table 31 Manganese

Health Guideline Value (ADWG) 0.5 mg/L

Manganese may occur naturally in the environment or may be introduced through industrial activity. Manganese may cause aesthetic issues (such as taste or staining of laundry and appliances) as well as health issues at high concentrations.

Water Sampling Locality	Frequency of Sampling	Number of Samples	Maximum mg/L	Met ADWG guideline value (Yes/No)
Irymple	3 Monthly	4	0.018	Yes
Kerang	3 Monthly	4	0.048	Yes
Koondrook	3 Monthly	4	0.120	Yes
Lake Boga	3 Monthly	4	0.120	Yes
Merbein	3 Monthly	4	0.063	Yes
Mildura	3 Monthly	4	0.053	Yes
Murrabit	3 Monthly	4	0.100	Yes
Nyah	3 Monthly	4	0.009	Yes
Nyah West	3 Monthly	4	0.017	Yes
Piangil	3 Monthly	4	0.190	Yes
Red Cliffs	3 Monthly	4	0.003	Yes
Robinvale	3 Monthly	4	0.031	Yes
Swan Hill	3 Monthly	4	0.200	Yes
Woorinen Sth	3 Monthly	4	0.076	Yes

Table 32 pH

Aesthetic Guideline Range (ADWG) 6.5-8.5 pH Units.

pH is the measure of the acidity (pH <7.0) or alkalinity (pH >7.0) of the water. Extreme pH values may cause corrosion or scaling in certain circumstances. High pH may also reduce the effectiveness of chlorine disinfection.

Water Sampling Locality	Frequency of Sampling	Number of Samples	Minimum pH Units	Maximum pH Units	Average pH Units	Average change *Comparison of past 2 reporting periods	Aesthetic operating range
Irymple	Weekly	53	7.0	7.8	7.3	Increased	6.5-8.5
Kerang	Weekly	52	6.8	7.8	7.2	Increased	6.5-8.5
Koondrook	Weekly	52	6.9	7.7	7.4	Decreased	6.5-8.5
Lake Boga	Weekly	52	7.3	7.8	7.5	Decreased	6.5-8.5
Merbein	Weekly	52	7.0	7.7	7.2	Decreased	6.5-8.5
Mildura	Weekly	53	6.9	7.7	7.2	Decreased	6.5-8.5
Murrabit	Weekly	52	6.9	8.0	7.3	Increased	6.5-8.5
Nyah	Weekly	52	7.0	7.5	7.2	Decreased	6.5-8.5
Nyah West	Weekly	52	6.9	7.6	7.2	Decreased	6.5-8.5
Piangil	Weekly	52	7.2	7.8	7.4	Decreased	6.5-8.5
Red Cliffs	Weekly	52	7.0	7.7	7.3	Increased	6.5-8.5
Robinvale	Weekly	52	7.1	7.8	7.4	Increased	6.5-8.5
Swan Hill	Weekly	52	7.0	7.7	7.3	Decreased	6.5-8.5
Woorinen Sth	Weekly	52	7.0	7.7	7.3	Decreased	6.5-8.5

Table 33 Colour

Aesthetic Guideline Value (ADWG) 15 HU*.

Colour generally occurs in water as a result of dissolved organic material. Although not a health consideration, elevated colour can be an aesthetic issue.

Water Sampling Locality	Frequency of Sampling	Number of Samples	Maximum Pt/Co Units*	Average Pt/Co Units*	Average change *Comparison of past 2 reporting periods	Met ADWG guideline value (Yes/No)
Irymple	Monthly	12	2	2	No change	Yes
Kerang	Monthly	12	6	3	No change	Yes
Koondrook	Monthly	12	6	5	No change	Yes
Lake Boga	Monthly	12	6	5	No change	Yes
Merbein	Monthly	12	2	2	No change	Yes
Mildura	Monthly	12	2	2	No change	Yes
Murrabit	Monthly	12	6	5	No change	Yes
Nyah	Monthly	12	2	2	No change	Yes
Nyah West	Monthly	12	4	3	No change	Yes
Piangil	Monthly	12	4	4	No change	Yes
Red Cliffs	Monthly	12	2	2	No change	Yes
Robinvale	Monthly	12	4	4	No change	Yes
Swan Hill	Monthly	12	4	4	No change	Yes
Woorinen Sth	Monthly	12	4	3	No change	Yes

**Pt-Co Units = Hazen Units (HU) = PCU = Platinum Cobalt Colour*

Table 34 Iron

Aesthetic Guideline Value (ADWG) 0.3 mg/L

Iron may occur naturally in the environment, or may be introduced through industrial activity, as well as through customer service piping. High levels of iron in the water can impart taste and may stain laundry or fittings. There is no health-based guideline for iron in drinking water.

Water Sampling Locality	Frequency of Sampling	Number of Samples	Maximum mg/L	Average change *Comparison of past 2 reporting periods	Met ADWG guideline value (Yes/No)
Irymple	3 Monthly	4	0.07	No change	Yes
Kerang	3 Monthly	4	0.04	No change	Yes
Koondrook	3 Monthly	4	<0.01	No change	Yes
Lake Boga	3 Monthly	4	0.07	Increased	Yes
Merbein	3 Monthly	4	0.05	Increased	Yes
Mildura	3 Monthly	4	0.11	No change	Yes
Murrabit	3 Monthly	4	<0.01	No change	Yes
Nyah	3 Monthly	4	<0.01	No change	Yes
Nyah West	3 Monthly	4	0.01	No change	Yes
Piangil	3 Monthly	4	<0.01	No change	Yes
Red Cliffs	3 Monthly	4	<0.01	No change	Yes
Robinvale	3 Monthly	4	<0.01	No change	Yes
Swan Hill	3 Monthly	4	0.05	No change	Yes
Woorinen Sth	3 Monthly	4	0.02	No change	Yes

Table 35 Hardness

Aesthetic Guideline Value (ADWG) 200 mg/L (as CaCO3)

Hardness is caused by the presence of dissolved calcium compounds in water. Hard water may result in scaling issues.

Water Sampling Locality	Frequency of Sampling	Number of Samples	Maximum mg/L	Average (mg/L)	Average change *Comparison of past 2 reporting periods	Met ADWG guideline value (Yes/No)
Kerang	3 Monthly	4	61	44	Increased	Yes
Koondrook	3 Monthly	4	34	23	Increased	Yes
Mildura	3 Monthly	8	92	62	Increased	Yes
Murrabit	3 Monthly	4	67	34	Increased	Yes
Piangil	3 Monthly	4	46	31	Increased	Yes
Red Cliffs	3 Monthly	4	62	45	Increased	Yes
Robinvale	3 Monthly	4	52	40	Increased	Yes
Swan Hill	3 Monthly	4	63	36	Increased	Yes

Table 36 Chloride

Aesthetic Guideline Value (ADWG) 250 mg/L

Water Sampling Locality	Frequency of Sampling	Number of Samples	Maximum mg/L	Average (mg/L)	Average change *Comparison of past 2 reporting periods	Met ADWG guideline value (Yes/No)
Kerang	3 Monthly	4	29	19	Increased	Yes
Koondrook	3 Monthly	4	23	14	Increased	Yes
Mildura	3 Monthly	8	50	36	Increased	Yes
Murrabit	3 Monthly	4	40	24	Increased	Yes
Piangil	3 Monthly	4	48	28	Increased	Yes
Red Cliffs	3 Monthly	4	47	37	Increased	Yes
Robinvale	3 Monthly	4	31	24	Increased	Yes
Swan Hill	3 Monthly	4	72	39	Increased	Yes

Table 37 Sodium

Aesthetic Guideline Value (ADWG) 180 mg/L

Water Sampling Locality	Frequency of Sampling	Number of Samples	Maximum mg/L	Average (mg/L)	Average change *Comparison of past 2 reporting periods	Met ADWG guideline value (Yes/No)
Kerang	3 Monthly	4	34	24	Increased	Yes
Koondrook	3 Monthly	4	33	22	Increased	Yes
Mildura	3 Monthly	8	39	22	Increased	Yes
Murrabit	3 Monthly	4	23	13	Increased	Yes
Piangil	3 Monthly	4	20	14	Increased	Yes
Red Cliffs	3 Monthly	4	36	24	Increased	Yes
Robinvale	3 Monthly	4	56	40	Increased	Yes
Swan Hill	3 Monthly	4	35	20	Increased	Yes

Table 38 Conductivity

Aesthetic Guideline Value (ADWG) <830 µS/cm*

Water Sampling Locality	Frequency of Sampling	Number of Samples	Maximum mg/L	Average (mg/L)	Average change *Comparison of past 2 reporting periods	Met ADWG guideline value (Yes/No)
Kerang	3 Monthly	4	350	245	Increased	Yes
Koondrook	3 Monthly	4	270	178	Increased	Yes
Mildura	3 Monthly	8	400	275	Increased	Yes
Murrabit	3 Monthly	4	300	161	Increased	Yes
Piangil	3 Monthly	4	250	164	Increased	Yes
Red Cliffs	3 Monthly	4	350	243	Increased	Yes
Robinvale	3 Monthly	4	390	300	Increased	Yes
Swan Hill	3 Monthly	4	380	210	Increased	Yes

Total dissolved solids 600 mg/L

Table 39 Calcium

No Guideline Value

Water Sampling Locality	Frequency of Sampling	Number of Samples	Maximum mg/L	Average (mg/L)
Kerang	3 Monthly	4	17	10.7
Koondrook	3 Monthly	4	6	4.2
Mildura	3 Monthly	8	28	15
Murrabit	3 Monthly	4	12	6.2
Piangil	3 Monthly	4	8.9	5.8
Red Cliffs	3 Monthly	4	12	8.8
Robinvale	3 Monthly	4	11	8.1
Swan Hill	3 Monthly	4	11	6.2

Table 40 Alkalinity (as CaCO3)

No Guideline Value

Water Sampling Locality	Frequency of Sampling	Number of Samples	Maximum mg/L	Average (mg/L)	Average change *Comparison of past 2 reporting periods
Kerang	3 Monthly	4	44	30.3	Increased
Koondrook	3 Monthly	4	30	19.8	Increased
Mildura	3 Monthly	8	48	36	Increased
Murrabit	3 Monthly	4	77	35.5	Increased
Piangil	3 Monthly	4	42	29	Increased
Red Cliffs	3 Monthly	4	44	34.3	Increased
Robinvale	3 Monthly	4	87	58.8	Increased
Swan Hill	3 Monthly	4	70	35.5	Increased

Table 41 Magnesium

No Guideline Value

Water Sampling Locality	Frequency of Sampling	Number of Samples	Maximum mg/L	Average (mg/L)	Average change *Comparison of past 2 reporting periods
Kerang	3 Monthly	4	6.0	4.1	Increased
Koondrook	3 Monthly	4	4.3	3.1	Increased
Mildura	3 Monthly	8	9.1	6.1	Increased
Murrabit	3 Monthly	4	9.0	4.5	Increased
Piangil	3 Monthly	4	5.9	3.9	No change
Red Cliffs	3 Monthly	4	7.6	5.6	Increased
Robinvale	3 Monthly	4	6.3	4.9	Increased
Swan Hill	3 Monthly	4	8.9	5.0	No change

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