2020/2021 Annual Report

Drinking Water Quality

LOWER MURRAY WATER

VICTORIA State Government

LOWER MURRAY WATER

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Cover image: Mildura Seventh Street Water Treatment Plant

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 People and Safety Trainee. 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.

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

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From our Managing Director

I am pleased to present Lower Murray Urban and Rural Water Authority's (LMW) 2020/21 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 (DoH) 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 achievements in 2020/21.

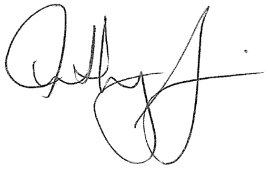
In addition to the above, the report includes the following information:

- 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 DoH 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 (the Guidelines).

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.

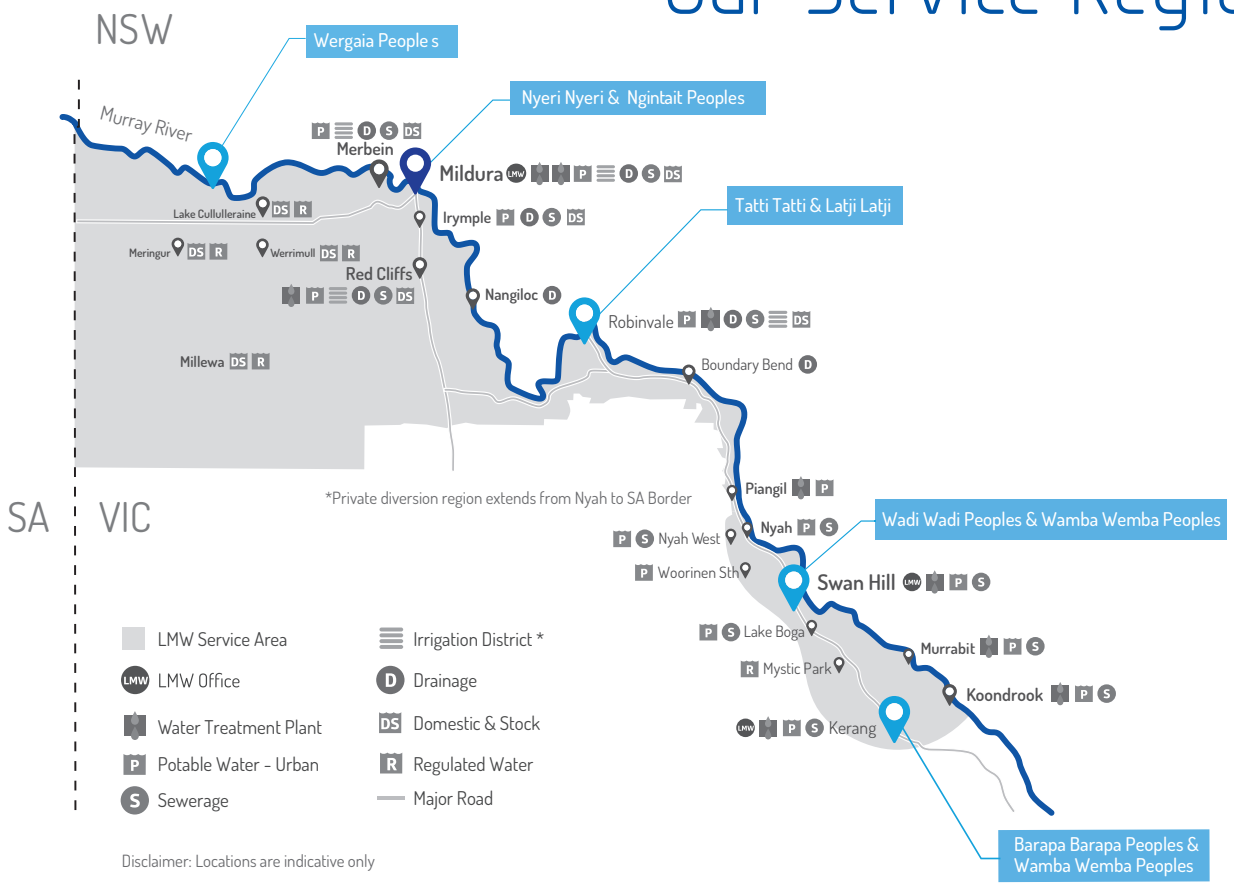
LMW is committed to continuing its record of reliably providing high quality, safe drinking water to our customers. I'm pleased to advise that we NOT ONLY achieved full compliance with the water quality standards and requirements of the Act and Regulations, but also, the Mildura drinking water was awarded the IXOM's 'Victoria's Best Tasting Tap Water' for the 2020/21 year at the Water Industry Operators Association of Australia (WIOA).



Anthony Couroupis
Managing Director

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 3.6, Updated March 2021.
DoH	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
orgs/100mL	Organisms per 100 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

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 services to both rural and urban customers including:

- urban water services to 14 townships via nine treatment plants to 34,311 households and businesses (approx. 74,000 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 2,666 irrigation and 2,240 stock and domestic customers in the four pumped irrigation districts of Mildura, Merbein, Red Cliffs and Robinvale, and to 297 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 licences of 1,313 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 74,000 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 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 at 30 June 2021 (34,784) multiplied by the 2016 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 2020/21.

TABLE 1 - LMW water supply systems

Water Sampling Locality	Source Water	Population	Treatment Plant
Irymple	Murray River	8,575	Mildura 7th Street Mildura West
Kerang	Murray River	4,057	Kerang
	Loddon River		
	14/2 Irrigation Channel		
Koondrook	Murray River	993	Koondrook
Lake Boga	Murray River	1,123	Swan Hill
Merbein	Murray River	3,700	Mildura 7th Street Mildura West
Mildura	Murray River	36,372	Mildura 7th Street Mildura West
Murrabit	Murray River	101	Murrabit
	Storage Dam		
Nyah	Murray River	708	Swan Hill
Nyah West	Murray River	572	Swan Hill
Piangil	Murray River	231	Piangil
Red Cliffs	Murray River	4,043	Red Cliffs
Robinvale	Murray River	2,198	Robinvale
Swan Hill	Murray River	11,601	Swan Hill
Woorinen South	Murray River	437	Swan Hill
Millewa*	Lake Cullulleraine	169	Millewa Water Quality Improvement Plant
Mystic park*	Kangaroo Lake	29	N/A
Total		**74,909**	

* Regulated Supplies

Source Water

The source of water for the majority of 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 Loddon River and 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 nearby 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 initial alert 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).

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. In addition, Phosphorus and Nitrogen are also monitored to provide an alert for potential blue-green algae (BGA) blooms.

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 produced 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.

Drinking Water Treatment Processes

During 2020/21, LMW treated more than 20,180 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 Floatation**
- **filtration**
- **chlorine Disinfection**
- **fluoridation**
- **UV disinfection**

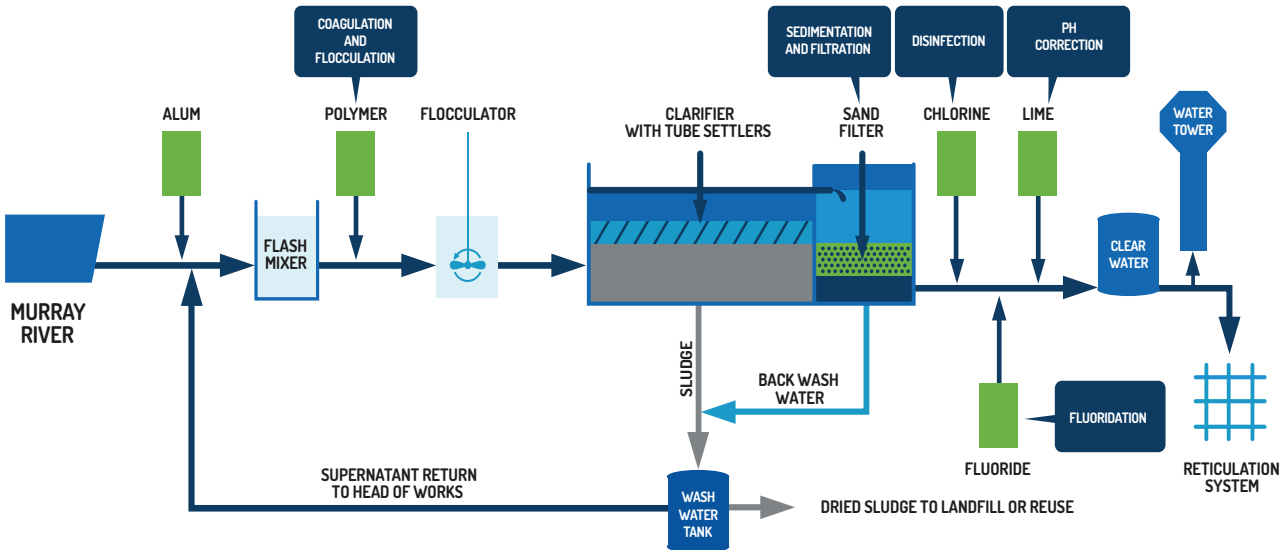
8,072
Olympic-sized swimming pools of drinking water treated in 2020/21

Our drinking water is disinfected using chlorine, the most widely used drinking water 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 have recently retrofitted Red Cliffs, Piangil, Koondrook, and Murrabit WTPs with UV disinfection systems, which provide additional barrier for Protozoa in line with the ADWG recommendations and industry best practice. The UV project is underway for Mildura 7th Street, Mildura West, Robinvale, Swan Hill, and Kerang WTPs.

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.

Water Treatment Plant in-flow splitter box

Dissolved Air Floatation (DAF)

The process of floatation 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 floatation 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. Sand filters are commonly used in the water treatment process and may contain layers of gravels, sands and filter coal. The sand 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 PHOTO

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 pathogen, such as Cryptosporidium. UV disinfection is highly effective against the Cryptosporidium oocysts that are resistant to the routinely applied doses of chlorine.

pH correction

Due to the addition of coagulants and chlorine, the pH (acidity) 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.

Taste and odour treatment

Intermittent PAC dosing takes place at some WTPs during times where elevated blue-green algae counts are detected, or biovolume is above the trigger for PAC dosing for the control of potential algal toxins that may be present in water. PAC is also dosed occasionally to remove taste and odour compounds.

Manganese treatment

Historically, seasonal moderate manganese levels have been detected in the source water at Red Cliffs Water Treatment Plan. Over time, these have become more concentrated due to sludge handling and water recycling processes, where potassium permanganate was occasionally used as an oxidizing agent to remove soluble manganese from drinking water and maintain its levels below the limits stipulated in the Guidelines.

We have also used Calgon-T for manganese treatment, which is a sequestering agent that prevents the oxidation of manganese in the treated water and eliminates the water discolouration. Due to the recurrent nature of this problem, LMW liaised with the Environment Protection Authority (EPA) and obtained a permanent approval to discharge the recycled water with elevated manganese levels back into the Murray River.

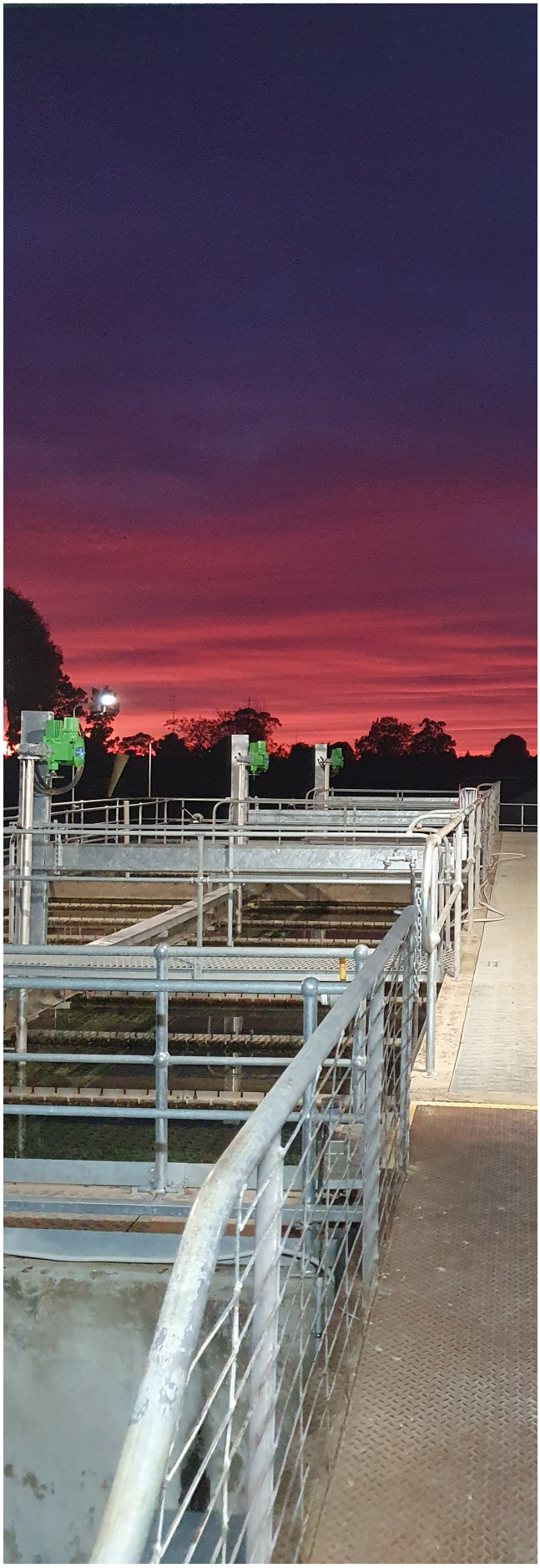


TABLE 2 - LMW drinking water treatment processes

WATER TREATMENT PLANT	WATER SUPPLY LOCALITY	TREATMENT PROCESS											ADDED SUBSTANCES										
		Coagulation	Flocculation	Pre-Sedimentation	Sedimentation	Dissolved Air Flotation	Granular Media Filtration	Clarification	Slow Sand Filtration	Chlorine Disinfection/Chlorination	Fluoridation	UV Disinfection	Aluminium Sulphate	Aluminium Chlorohydrate	Hydrated Lime	Soda Ash	Sodium Hydroxide	Polymer	Chlorine Gas	Powdered Activated Carbon	Fluorosilicic Acid	Sodium Metabisulfite	Sodium Fluoride
Kerang	Kerang	✓	✓		✓		✓			✓	✓		✓		✓		✓		✓	✓	✓		
Koondrook	Koondrook	✓	✓		✓		✓			✓		✓	✓				✓		✓	✓			
Mildura 7th Street	Mildura	✓	✓		✓			✓	✓	✓	✓		✓		✓			✓	✓	✓	✓			
Mildura West	Merbein	✓	✓		✓				✓	✓	✓			✓			✓	✓	✓	✓	✓	✓	
	Irymple	✓	✓		✓				✓	✓	✓			✓			✓	✓	✓	✓	✓	✓	
Murrabit	Murrabit	✓	✓		✓		✓			✓		✓	✓				✓		✓	✓			
Piangil	Piangil	✓	✓		✓		✓			✓		✓	✓				✓		✓	✓			
Red Cliffs	Red Cliffs	✓	✓	✓		✓	✓			✓	✓	✓		✓			✓		✓	✓	✓		
Robinvale	Robinvale	✓	✓				✓	✓		✓	✓		✓			✓			✓	✓			✓
Swan Hill	Swan Hill	✓	✓					✓	✓	✓	✓			✓			✓		✓	✓	✓		

Blue Green Algae, Murray River

Drinking Water Quality Management

Quality management systems

LMW's Drinking Water Quality Management Plan 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 processes 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 Escherichia coli (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 levels, 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 2020/21 are available in Appendix A.

In 2020/21 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 DoH 'Specification of Water Sampling Localities and Water Sampling Points guidelines', 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 2020/21. 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 are currently investigating the use of camera drones for water tank condition inspections. Whilst a scheduled inspection program has not yet been established for the drone's inspections, a few successful trials have been undertaken which seem to be efficient and reduce Occupational Health and Safety (OHS) risks.

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.

During the reporting period, GMW consulted with LMW throughout the planning and construction phase of two fishways on the Gunbower Creek in winter 2021. The purpose of the consultation was to minimise potential water quality impacts near town water offtakes, both upstream and downstream.

During the 2020/21 financial year, issues previously associated with BGA and bulking sludge at Mildura, Red Cliffs and Swan Hill WTPs did not impact water quality to the same extent/significantly. This was due to increased operational knowledge and a boost to monitoring systems. The sampling program was increased which helped manage water quality and provided insights and improvements to the treatment processes..The BGA bloom involved Dolichospermum Coiled species, which can generate Extracellular Polymeric Substances (EPS) as a result of physiological stress, such as lack of nutrients, exposure to elevated ultraviolet levels for long hours, or being at the end of its growth phase, for self-protection.

FIGURE 2 – JELLY SLUDGE

The presence of EPS in water affects the settling characteristics of flocs during the sedimentation stage by forming compact flocs (Figure 2) that rapidly settle out leaving relatively large volume of micro flocs suspended in the settled water.

Burst Water Main at Swan Hill

There was a large water burst, however, LMW's civil maintenance crews immediately flushed the main, removed any trapped air to prevent dirty water complaints, and monitored storage levels for continued supply.

On 9 and 10 January 2021 a longitudinal burst was identified in a 525mm diameter Glass Reinforced Plastic (GRP) rising main, which supplies water to a main storage facility within the Swan Hill water supply system.

The event saw two main storage facilities at Western site dropping dramatically in a peak demand period. The storages were bypassed to empty them and facilitate the repairs to the rising main. The operational team made necessary changes to keep the two towers in Swan hill at a consistent level to supply the township with reticulation pressure.

Once the repairs have been completed, the turbidity, pH and chlorine residual of the water was tested, and continued to be monitored before filling the storages, this also became a timely operation as the main was being flushed, to get the turbidity in the rising main to < 0.5 NTU using a 100mm scour point. Water demand was a bit less than the average due to cooler weather conditions and some rain, the storages were filled over a three-day period .

LOWER MURRAY WATER

Awarded

Best Tasting Tap Water in Victoria 2020

Achievements

Victoria's Best Tasting Tap Water 2020

LMW is proud to be the winners of IXOM's Best Tasting Tap Water in Victoria 2020.

The IXOM Victorian Water Taste Test, organised by the Water Industry Operators Association of Australia (WIOA), is an annual competition that selects the highest quality drinking water in Victoria as a way to celebrate the hard work that WTPs' operators do day-to-day in providing absolutely clean pristine water, recognise local water service providers, and their ability to supply safe water to the community.

Samples from water corporations across the state were blindly judged on appearance taste and odour at the annual water industry conference in Bendigo, where leading exhibitors display products, services, and innovations.

The Mildura WTP came in the top three finalists, including Gippsland Water's Traralgon WTP and Westernport Water's Ian Bartlett Water Purification Plant, and was named the winner of the 2020 best tasting water in Victoria. This award was a significant achievement by the operating teams who work tirelessly to supply safe drinking water to our customers.

Taste and Odour monitoring projects, advanced instrumentation for water quality monitoring programs and control systems, underpinned by knowledgeable and experienced operators, have led to better understanding of raw water quality conditions, overcome poor raw water quality, and produce high quality standard drinking water.

Three-year percentage compliance

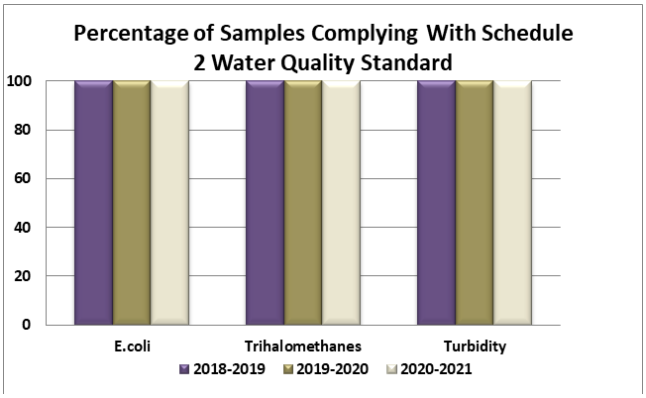
A comparison of test results of water samples collected in accordance with the sampling program set out in our DWQMP, and percentage of complying samples over the last three financial years, based on the regulated parameters stipulated in the Regulations, was undertaken.

The high quality of the drinking water we supplied continued for 2020/21, 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.

FIGURE 2 - COMPLIANCE WITH WATER QUALITY STANDARDS



Fluoride Treatment

Levels of fluoride have remained consistently below the maximums specified in the Australian Drinking Water Guidelines 2011 over the three-year period.

During the reporting period, the average optimal fluoride concentration of 0.7 to 0.9mg/l, as recommended by DoH to provide a dental health benefit, was achieved within the Mildura, Red Cliffs, and Robinvale water supply systems.

The average optimum fluoride levels were not achieved within the Swan Hill and Kerang water supply systems. This was due to the fluoride plant being offline at times for reactive and scheduled maintenance.

Fluoride levels sourced from the ClearSCADA systems at the WTPs.

LMW has 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 the planning stage.

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.

The variance in levels of fluoride in localities may be attributed to a fluoridation plant being offline for maintenance purposes. This can lead to periods of lower levels of fluoride during the interruption period.

LMW notified the DoH of a total of 14 temporary fluoride interruptions, where fluoride concentration in drinking water supplied was less than 0.7 mg/L for longer than 72 hours, as required under the Code of Practice for Fluoridation of Drinking Water Supplies.

These occasions occurred when fluoridation was taken offline as a precautionary measure while LMW confirmed potential irregularities with plant processes 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.

Water quality and safety improvement initiatives

During the 2020/2021 financial year, LMW undertook a number of projects that contribute to maintaining and improving the robustness of the water supply systems 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 and Murrabit WTPs in 2019/2020, LMW continues its endeavour to improve the robustness of the water supply systems. This includes a project to retrofit the Mildura 7th Street, Mildura West, Robinvale, Swan Hill, and Kerang 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 2020/21.

TABLE 3 – SUMMARY OF FLUORIDE INTERRUPTION

Fluoridation Plant	Interruption Date	Resumption Date	Number of days Fluoride is off-line	Summary
Mildura 7th St	07-Jul-20	04-Aug-20	28	A leak in the fluoride delivery pipe
	25-Sep-20	19-Oct-20	24	A leak in the fluoride dosing board
	07-Jan-21	05-Feb-21	29	Faulty fluoride flow meter
	12-Jun-21	15-Jun-21	3	Flow discrepancy during a backwash
Mildura West	20-Nov-20	04-Dec-20	15	Replacement of the transfer water fluoride analyser
	02-Mar-21	26-Mar-21	25	A blockage in the fluoride dosing line
	01-Apr-21	07-Apr-21	6	Faulty dosing pump and broken fitting on the dosing line
	13-Apr-21	29-Apr-21	16	Relocation of the fluoride dosing point to new pipework
Kerang	01-Oct-20	20-Oct-20	19	Faulty dosing pump
	19-Jan-21	08-Feb-21	21	Missing probes on new analyser
	17-Feb-21	23-Feb-21	6	Faulty probes on treated water analyser
Robinvale	16-Sep-20	13-Oct-20	28	Faulty transfer water fluoride analyser
Swan Hill	09-Jul-20	09-Sep-20	63	Maintenance works adjacent to the fluoride dosing line
	15-Jan-21	22-Jan-21	7	failure of the dosing pumps, and a blockage in the dosing lines

TABLE 4 – WATER QUALITY AND SAFETY IMPROVEMENT PROJECTS

Water Treatment Plant (WTP)	Project	Project Status	Expenditure, $ Actual 2021
ALL SITES	Instrument replacement	In Progress	55,192
Mildura West WTP	Upgrade to ClearSCADA	In Progress	1,264,287
Kerang WTP	Fluoride upgrade	On Hold	3,400
	Replace fluoride analyser	Complete	9,044
	UV treatment upgrade	In Progress	147,374
Koondrook WTP	Replace chlorine analysers	Complete	14,031
Mildura 7th St WTP	Power supply upgrade	In Progress	844,228
	Replace fluoride flow meter	Complete	8,472
	Replace fluoride analyser x 2	Complete	9,375 + 8,853
Mildura West WTP	Storage tank cathodic protection upgrade and coating repairs	In Progress	41,267
	UPS battery backup modules	Complete	4,581
	New installation of permanent Generator 780kVa	Complete	158,041
	UV treatment upgrade	In Progress	465,303
Red Cliffs CWS	Urban water Cliffside ground level storage bypass	In Progress	125,948
	Replace fluoride analyser RC WTP	Complete	9,853
	Fluoride Upgrade	In Progress	20,000
	Install generator at RC Cliffside Pump Station	In Progress	42,713
Robinvale WTP	RPZ works	Complete	2,056
	Replace pumps	Complete	50,094
	Replace fluoride analyser	Complete	7,991
	Replace VSD's	In Progress	236
Swan Hill WTP	Fluoride upgrade	On Hold	9,314
	Replace ACH chemical storage tanks x 2	Complete	45,674
	Replace fluoride analyser	Complete	8,501
	Replace PAC pumps x 2	Complete	17,750
	UV treatment upgrade	In Progress	17,351
Swan Hill Western Site	New 5 ML ground level storage	In Progress	143,390

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 DoH 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 DoH 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.

LMW are pleased to report that during the reporting period, there were no incidents that required reporting under sections 18 and 22 of the Act.

In addition, LMW has good established communication protocols with Goulburn Murray Water (GMW), being the water storage manager, to keep informed of potential incidents and events that could negatively impact the raw water quality in the Murray river upstream of LMW's offtakes.

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, other team members are progressing towards achieving certificate three, 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, visit other water authorities WTPs, attended Steve Hrudey training workshop or watched the workshop DVD and other workshops and seminar events when available. We also engage instruments suppliers to conduct training on the operation and maintenance of the analyzers.

Drinking water quality standards

During 2020/21 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 millilitres 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 the Guidelines' 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

DR6000 Benchtop Spectrophotometer

DoH 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
	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
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

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.

2020/21 complaint data

A total of 28 water quality complaints from a customer base of 34,784 was recorded in 2020/21. This is a noticeable reduction from 2019/20 where 35 water quality complaints were recorded, which equates to 0.805 water quality complaints per 100 customers.

Over the reporting period, the main water quality complaint was for taste and odour (13 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.

Whilst the Geosmin and MIB are not harmful at levels detected in drinking water, they do have a very low detection threshold, which aesthetically affect the quality of the water. During the reporting period, BGA blooms continued to occur within LMW's operational area, resulting in dosing powdered activated carbon for most of the BGA season to efficiently remove those compounds. The taste and odour complaints account for 46% of the total number of complaints received throughout the reporting period.

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.

Microscope for Water Quality testing

We monitor algae count/biovolume during the spring and summer season, where algae growth is accelerated due to optimal 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 activated carbon at WTPs to help absorb the taste and odour compounds.

Discoloured water was the second highest category of water quality complaints for the reporting period (11 complaints). It 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 disturbing the sediment in the interior of mains, oxidized manganese, iron sediment or potentially from a customer's internal plumbing.

LMW received three alleged illness complaints during the reporting period, which may be associated with the BGA blooms. One water quality complaint was also received under the 'other' category, which after investigation were found to be unrelated to water quality.

Tables 7A and 7B show a comparison between the number of water quality complaints received during 2020/21, 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 2020/21, and the number of complaints per 100 customers supplied.

TABLE 7A - TYPES OF COMPLAINTS COMPARED TO PREVIOUS REPORTING PERIODS

Type of Complaints	Number of complaints 20/21	19/20	18/19	Comparison with previous reporting periods 19/20	Comments
Colour	11	12	32	A decrease by one complaint	The decrease may be attributed to LMW's proactive water mains flushing program.
Taste and odour	13	15	16	A decrease by two complaints	The decrease may be attributed to customers' individual ability to detect residual amount of MIB and Geosmin in water.
Blue water	0	1	1	A decrease by one complaint	No complaints received.
Alleged sickness	3	5	1	A decrease by two complaints	The decrease may be attributed to customers have restored their confidence in LMW's drinking water after the boil water advisory issued mid-December 2019, and the Mildura water supply system winning the Victoria's Best Tasting Tap Water.
Air in water	0	0	1	No change	No complaints received.
Other	1	2	6	A decrease by one complaint	This category of complaints include various types that upon investigation were found to be not related to water quality.
TOTAL	28	35	57	A decrease by 7 complaints	All categories

TABLE 7B - TYPES OF COMPLAINTS BY WATER SAMPLING LOCALITY

		Water sampling locality															
		Irymple	Kerang	Koondrook	Lake Boga	Merbein	Mildura	Murrabit	Nyah	Nyah West	Piangil	Red Cliffs	Robinvale	Swan Hill	Wakool	Woorinen	Total
Type of complaints	**Colour**	3	1	0	1	1	4	0	0	0	0	1	0	0	0	0	**11**
	Taste and odour	2	6	0	1	0	2	0	0	1	0	1	0	0	0	0	**13**
	Blue Water	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Alleged sickness	1	0	0	0	0	2	0	0	0	0	0	0	0	0	0	**3**
	Other	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	**1**
Total complaints		**6**	**7**	**0**	**2**	**1**	**9**	**0**	**0**	**1**	**0**	**2**	**0**	**0**	**0**	**0**	**28**

TABLE 7C - WATER QUALITY COMPLAINTS

TYPE of complaints	NO. of complaints	Complaints per 100 customers	LMW's Corporate Target
Colour	11	0.316	-
Taste and odour	13	0.374	-
Alleged sickness	0	0.086	-
Blue water	0	0.000	-
Air in water	3	0.000	-
Other	1	0.029	-
Total	**28**	**0.805**	**< 25 Complaints**

Risk management plan audit results

Audit Process

During the reporting period, LMW were not required to undertake an external audit of its risk management plan pursuant to the Act. In response to the following 19 opportunities for improvements (OFI's) identified in the previous Safe Drinking Water Act audit conducted for the period 29 May 2018 to 13 March 2020 inclusive, LMW has undertaken all necessary actions to address the OFI as per below:

Status of OFI's

Since the March 2020 Safe Drinking Water Act audit, LMW has undertaken few measures to bridge the gap and address all the OFI's identified during the audit.

The status of addressing 2019 – 2020 Risk Management Plan the OFIs are shown in table 8 below.

TABLE 8 – Status of 2019-2020 Risk Management Plan OFIs

Opportunity for Improvement	Lower Murray Water Response	Status
Swan Hill WTP and supply system		
1. The outdated sticker posted at the Swan Hill WTP showing outdated alert values needs to be removed and/or corrected and, if present, similar changes made at other sites.	This OFI has been taken on board, and the stickers were removed.	Complete
2. The Swan Hill treated water storage tank should be assessed to ensure risks from backflowing gutters are mitigated.	The Team Leader Operations (Swan Hill and Kerang) is reviewing the storage inspection frequency and cleaning requirements.	An inspection and maintenance schedule is in place.
3. For the Swan Hill area, means of completing minor works rapidly, without going via Mildura-based contractors under the RapidGlobal system, could be investigated, to help deliver works.	This OFI is being addressed as a high priority item. The Swan Hill's contractor list on Rapid Global has grown significantly, and now gives the Swan Hill team a good selection of contractors to use at their disposal.	Complete
4. Improved water quality management system support and resourcing based in the Swan Hill area would provide technical support for water quality management in general, including awareness, SCADA, monitoring, and reporting, to help compensate for the remoteness from Mildura. This would raise the standard of quality management since this is the area where compliance is least robust at present.	Two new operators have been appointed to provide additional resources to the Swan Hill and Kerang WTPs. In addition, LMW's Water Quality Technologist has increased visits to the Swan Hill and Kerang areas, including the number of days stayed there to provide guidance and technical support as required. The Senior Manager Operations, who was appointed in 2020, is currently residing near Lake Charm, and therefore, will provide additional support via frequent inspections and communication with the water quality team in the main office.	Complete
5. Contamination risks at the Lake Boga treated water storages should be assessed and consideration given to improving security against vermin and runoff entry via holes in the roof from missing bolts and/or to having the residual chlorine be continually monitored to ensure control of potential bacterial ingress from the large bird population roosting on the tank roof.	The missing bolts were reinstated immediately after the audit. A bird scarer was also placed on top of the tank. In addition, training options are being considered (inhouse and external) to improve the knowledge of maintenance staff across asset condition assessment, awareness of risks to water quality, timely communication to supervisors/managers, and required actions are undertaken to mitigate risks and rectify any issues.	Complete

Opportunity for Improvement	Lower Murray Water Response	Status
Kerang Water Supply System		
1. Black water events have been created by environmental flows flooding upstream forests and by releases of water from upstream lakes. LMW should lobby to have such activities undertaken in ways that don't adversely impact raw water quality. Those same source water protection lobbying efforts should consider factors such as pesticide application and council stormwater management.	Pesticides risks have been considered in LMW's DWQMP and were rated as a medium risk to water quality and safety. LMW has included Pesticides in its drinking water quality monitoring program and are being reviewed regularly to ensure changes to their use is reflected in the DWQMP. In addition, LMW has established communication protocols with the Goulburn-Murray Water (GMW) as the Water Storage Manager, and Mallee Catchment Management Authority (MCMA), and the Environment Protection Authority (EPA) to ensure timely notification of incidents, events and emergency situations that may adversely impact on the raw water quality.	Ongoing
2. It is worth considering locking chemical fill points at WTPs as an extra mitigation against accidental loading of the chemicals into the wrong place (this is based on observations at both Kerang and Swan Hill WTP so the OFI not repeated in the summary of Swan Hill WTP).	This OFI was immediately addressed after the audit.	Complete
3. For the Kerang WTP wet rack and lab area consideration could be given to including a max-min thermometer to check and, if required, installing temperature control stabilise temperature.	The operation's team discussed this OFI at the DWQM team meeting on 6 August 2020, and a decision was made to install a second air conditioner in the wet rack area.	Blinds have been fitted to the wet rack area, the holes in the windows have been repaired and the air con in the adjacent room is being used
4. The Kerang WTP Control Limits Summary should have the use of the terms 'combined' and 'individual' checked and corrected.	The water quality team has reviewed and amended the summary sheet to reflect the OFI recommendations.	Complete
5. The Kerang treated water storage tank should be assessed to improve its security against vermin and runoff entry via holes in the roof from missing bolts and blocked backflowing gutters.	A physical inspection of the tank was undertaken by the maintenance team. The missing bolts were reinstated, vermin proofing was repaired, and the frequency of the roof inspection and cleaning was reviewed.	Complete. A physical barrier is in place to prevent runoff entry into the storage tank.
6. At the Kerang WTP it was noted that some of the alert and critical limits in the SCADA system were tighter than those in RMP by a small margin, e.g., 0.1 mg/L more conservative, or with more conservative, shorter delay times. These changes had been made with the 'CCP Set Point Change Request' form having been used. It was accepted that operators should be able to tighten the limits, but not loosen them. However, this needs to be formalized in some way to ensure that operators understand that whilst tightening up alarms is acceptable, loosening them beyond the RMP limits is not.	The water quality and the WTPs' operation teams have jointly reviewed the CCP access levels, based on a risk assessment approach, and identified key officers that should be provided with the required access level to making changes to the limits. This is currently being finalised and will be implemented as part of ClearSCADA system upgrade projects.	Complete

Opportunity for Improvement	Lower Murray Water Response	Status
Piangil WTP and supply system		
1. The completion and logging of routine tasks at the Piangil WTP needs to be aligned better with the information given in the RMP. This may mean that more resources are required and/or the system needs to be adapted to match what is achievable at the site within constraints of resources.	The Swan Hill and Piangil WTP's are operated by one operator. An additional resource has been appointed to assist with the operation of both plants. Please see comments of Swan Hill OFI number four.	Complete
2. The Piangil treated water storage tank should be assessed to improve its security against vermin and runoff entry via holes in the roof from missing bolts and loose vermin-mesh.	This OFI has been attended to and completed in timely manner.	Complete

Opportunity for Improvement	Lower Murray Water Response	Status
OFIs relevant more broadly and/or for one system		
1. More operator and/or contractor training and awareness is worth considering to clarify what is expected in terms of treated water storage reservoir integrity, particularly in the southern area. There were a number of potential ingress points noted during the audit despite LMW having procedures and processes to help identify and capture those. The importance of reservoir integrity, and clarification and communication to operators and/or contractors of LMW's expectations in this regard, is worth emphasising.	This is being considered as per comments on Swan Hill OFI number five.	Complete
2. LMW needs to continue to push ahead to improve backflow prevention compliance. Given that this is a regulatory compliance obligation it may be worth reporting this to the Board in a dashboard, traffic light, or similar report.	This OFI will be raised at the DWQMT meetings.	A team, including managers and a general manager, has been developed to drive improvement initiatives and keep the board updated.
3. It is recommended that the Water Quality and Environment team's log of monthly instrument checks be updated to include a section for recording checks on individual filter effluent turbidity since this is a most critical monitoring point.	The OFI recommended action is being investigated, and options are being considered.	Checks are being done. Development of a monthly report on the status of all instrumentation calibration is in progress.
4. For some parameters it would be useful to have a setpoint ± a range rather than an upper and lower limit, to help avoid nuisance alarms at sites that have potentially variable setpoints, e.g., for chlorine residuals.	This OFI has been noted.	All set points have a range to enable optimising processes and cater for changes in raw water quality.
5. At some sites (e.g., Kerang) alum was still being dosed whereas some operators advised that in many cases ACH is preferred for River Murray water, and this could be reviewed where it may simplify coagulation and improve performance.	LMW's water quality and operations teams constantly look at ways to optimise the treatment process. However, consideration is given to the water source, as whilst all WTPs use the Murray River as the only raw water supply source, Kerang WTP has multiple sources (including the Murray and Loddon rivers, and the 14/2 Channel. Based on historical performance, Alum has been successfully used at the WTP, regardless of the mixing ratio and the final raw water quality.	Complete
6. Changes to CCP limits should be limited to a supervisor or a team leader level and higher to help reduce the risk of them being changed without due process.	This OFI has been discussed with the operational team, where the risks associated with uncontrolled access to CCP changes was explained, and a decision was made to limit the access to the Manager Water Quality and Environment, Water Quality Technologist, Manager Plant Operations and Maintenance, Team Leaders Operations, two Engineering Officers, and Electrical/Instrumentation Technician.	Complete

Audit certificate

The audit certificate for the period 29 May 2018 to 13 March 2020 issued by the auditor, Dan Deere, contained an error, in that it says LMW was compliant under section 8(1), however, this section refers to water storage manager conditions, not water suppliers, and therefore, a letter was sent to LMW to clarify and correct this error.

A copy of the letter is provided below.

Water Futures

Water Futures Pty Ltd
ABN: 97 109 956 961
66 Merrivale Rd, Pymble, NSW 2073
0409 283 737
dan@waterfutures.net.au

Ms Suzie Sarkis
Manager Water
Department of Health and Human Services
50 Lonsdale Street
Melbourne
Victoria 3000

Dear Ms Sarkis,

Re: incorrect section reference in *Safe Drinking Water Act 2003* risk management plan audit certificate number 167 for Lower Murray Water dated 29 May 2020.

The risk management plan audit certificate, number 167, dated 29 May 2020, submitted by me for Lower Murray Water, referred to an incorrect section of the *Safe Drinking Water Act 2003* (the Act).

Specifically, the audit certificate as issued incorrectly referred to section 8(1) of the Act. The audit certificate should have referred to section 7(1) of the Act.

I hereby request that the certificate be treated as having been amended accordingly.

Please accept my apologies for the inconvenience caused by this error and pass on my thanks to your team for noticing it.

Yours Sincerely,

DADeere

Dan Deere

Risk Management Plan Auditor

30 November 2020

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 DHSS 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.
- make this information is available 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 182ml 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 34 with 16 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 (orgs/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	53	0	0	0
Koondrook*	Weekly	53	0	0	0
Lake Boga	Weekly	52	0	0	0
Merbein	Weekly	52	0	0	0
Mildura**	Weekly	116	0	0	0
Murrabit*	Weekly	53	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 Hill**	Weekly	77	0	0	0
Woorinen Sth	Weekly	52	0	0	0

*Koondrook, Murrabit, and Kerang have 53 samples each due to the sampling schedule falling either side of the 20-21 end of financial year, mid-week.
**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 taken monthly in each of the water sampling localities.

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	12	0.25	0.04	0.02	0
Kerang	Monthly	12	0.25	0.04	0.03	0
Koondrook	Weekly	12	0.25	0.07	0.04	0
Lake Boga	Weekly	12	0.25	0.06	0.04	0
Merbein	Weekly	12	0.25	0.05	0.04	0
Mildura	Weekly	12	0.25	0.03	0.02	0
Murrabit	Weekly	12	0.25	0.06	0.03	0
Nyah	Weekly	12	0.25	0.07	0.05	0
Nyah West	Weekly	12	0.25	0.08	0.05	0
Piangil	Weekly	12	0.25	0.05	0.04	0
Red Cliffs	Weekly	12	0.25	0.07	0.04	0
Robinvale	Weekly	12	0.25	0.05	0.03	0
Swan Hill	Weekly	12	0.25	0.03	0.02	0
Woorinen Sth	Weekly	12	0.25	0.06	0.04	0

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	0.4	0.1	0
Kerang	Weekly	53	0.8	0.2	0
Koondrook	Weekly	53	<0.1	0.1	0
Lake Boga	Weekly	52	<0.1	0.1	0
Merbein	Weekly	52	0.8	0.2	0
Mildura	Weekly	53	0.6	0.2	0
Murrabit	Weekly	53	0.2	0.1	0
Nyah	Weekly	52	<0.1	0.1	0
Nyah West	Weekly	52	0.1	0.1	0
Piangil	Weekly	52	<0.1	0.1	0
Red Cliffs	Weekly	52	1.2	0.2	0
Robinvale	Weekly	52	1.3	0.2	0
Swan Hill	Weekly	52	<0.1	0.1	0
Woorinen Sth	Weekly	52	0.4	0.1	0

Tables 4 to 38 inclusive, are results reporting against the Australian Drinking Water Guidelines 2011 (ADWG), health & aesthetic guidelines.
Table 3, 4 & 32 Mildura reported 53 samples, as an extra set was taken from this locality on 17/05/2021.
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 6 samples reported for Mildura supply as both the Mildura & Mildura West WTP's were operating simultaneously.
Tables 9-16 Inclusive, which have 6 monthly scheduling, only had 3 samples reported for Mildura supply rather than 4, as Mildura West WTP was offline for one of the scheduled samples in May 2021. Mildura West WTP was online from mid-November 2020. Samples are taken the first week of Feb, May, Aug & Nov.
Tables 5, 9 to 16, 18, 19, 23, 24, 27 to 29 & 34, inclusive, do not have averages as the average cannot be calculated from 'less than' data.

Table 4
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.
Meeting Obligation is measured as: annual average fluoride level between 0.7 – 0.9 milligrams per litre in fluoridated systems.

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	0.9	0.61	0
Kerang	Weekly	53	1.5	0.8	0.8	0.62	0
Lake Boga	Weekly	52	1.5	0.8	1.2	0.55	0
Merbein	Weekly	52	1.5	0.8	0.9	0.52	0
Mildura	Weekly	53	1.5	0.8	0.9	0.55	0
Nyah	Weekly	52	1.5	0.8	0.8	0.56	0
Nyah West	Weekly	52	1.5	0.8	0.8	0.57	0
Red Cliffs	Weekly	52	1.5	0.8	0.9	0.76	0
Robinvale	Weekly	52	1.5	0.8	0.9	0.69	0
Swan Hill	Weekly	52	1.5	0.8	1.4	0.53	0
Woorinen Sth	Weekly	52	1.5	0.8	1.3	0.56	0

*No data for Koondrook, Murrabit, and Piangil systems as they 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
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

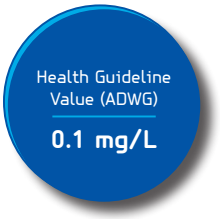
*Note: The min/max values of this parameter have remained the same in comparison to the previous 2 reporting periods

Table 6
Dichloroacetic Acid

Health Guideline Value (ADWG)
0.10 mg/L

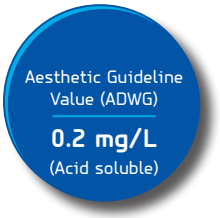
Water Sampling Locality	Frequency of Sampling	Number of Samples	Maximum (mg/L)	Average (mg/L)	Average change *Comparison of past 2 reporting periods	Met ADWG guideline value
Irymple	Monthly	12	0.010	0.006	No Change	Yes
Kerang	Monthly	12	0.017	0.01	No Change	Yes
Koondrook	Monthly	12	0.028	0.016	Increased	Yes
Lake Boga	Monthly	12	0.026	0.014	Increased	Yes
Merbein	Monthly	12	0.016	0.009	No Change	Yes
Mildura	Monthly	12	0.009	0.007	No Change	Yes
Murrabit	Monthly	12	0.030	0.014	Increased	Yes
Nyah	Monthly	12	0.008	0.007	Increased	Yes
Nyah West	Monthly	12	0.009	0.007	Increased	Yes
Piangil	Monthly	12	0.023	0.014	Increased	Yes
Red Cliffs	Monthly	12	0.014	0.008	No Change	Yes
Robinvale	Monthly	12	0.019	0.011	No Change	Yes
Swan Hill	Monthly	12	0.014	0.008	No Change	Yes
Woorinen Sth	Monthly	12	0.011	0.008	Declined	Yes

Table 7
Trichloroacetic Acid



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
Irymple	Monthly	12	0.007	0.006	No Change	Yes
Kerang	Monthly	12	0.011	0.009	No Change	Yes
Koondrook	Monthly	12	0.022	0.014	Increased	Yes
Lake Boga	Monthly	12	0.020	0.011	Increased	Yes
Merbein	Monthly	12	0.017	0.009	No Change	Yes
Mildura	Monthly	12	0.006	0.006	No Change	Yes
Murrabit	Monthly	12	0.031	0.014	Increased	Yes
Nyah	Monthly	12	0.024	0.015	Increased	Yes
Nyah West	Monthly	12	0.023	0.014	Increased	Yes
Piangil	Monthly	12	0.018	0.012	Increased	Yes
Red Cliffs	Monthly	12	0.012	0.009	No Change	Yes
Robinvale	Monthly	12	0.014	0.009	No Change	Yes
Swan Hill	Monthly	12	0.012	0.008	No Change	Yes
Woorinen Sth	Monthly	12	0.021	0.014	Declined	Yes

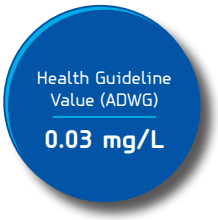
Table 8
Aluminium



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
Irymple	Monthly	12	0.14	0.037	Increased	Yes
Kerang	Monthly	12	0.04	0.018	No Change	Yes
Koondrook	Monthly	12	0.03	0.014	Increased	Yes
Lake Boga	Monthly	12	0.03	0.017	No Change	Yes
Merbein	Monthly	12	0.11	0.033	Increased	Yes
Mildura	Monthly	12	0.07	0.036	No Change	Yes
Murrabit	Monthly	12	0.03	0.019	No Change	Yes
Nyah	Monthly	12	0.03	0.018	Declined	Yes
Nyah West	Monthly	12	0.03	0.018	Declined	Yes
Piangil	Monthly	12	0.06	0.03	Declined	Yes
Red Cliffs	Monthly	12	0.04	0.024	No Change	Yes
Robinvale	Monthly	12	0.06	0.025	Increased	Yes
Swan Hill	Monthly	12	0.03	0.02	No Change	Yes
Woorinen Sth	Monthly	12	0.03	0.019	No Change	Yes

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).

Table 9
2,4 Dichlorophenoxy acetic acid [MS1]



Water Sampling Locality	Frequency of Sampling	Number of Samples	Maximum mg/L	Met ADWG guideline value
Kerang	6 Monthly	2	<0.01	Yes
Koondrook	6 Monthly	2	<0.01	Yes
Mildura	6 Monthly	3	<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

Water Sampling Locality	Frequency of Sampling	Number of Samples	Maximum mg/L	Met ADWG guideline value
Kerang	6 Monthly	2	<0.001	Yes
Koondrook	6 Monthly	2	<0.001	Yes
Mildura	6 Monthly	3	<0.001	Yes
Murrabit	6 Monthly	2	<0.001	Yes
Piangil	6 Monthly	2	<0.001	Yes
Red Cliffs	6 Monthly	2	<0.001	Yes
Robinvale	6 Monthly	2	<0.001	Yes
Swan Hill	6 Monthly	2	<0.001	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

Water Sampling Locality	Frequency of Sampling	Number of Samples	Maximum mg/L	Met ADWG guideline value
Kerang	6 Monthly	2	<0.001	Yes
Koondrook	6 Monthly	2	<0.001	Yes
Mildura	6 Monthly	3	<0.001	Yes
Murrabit	6 Monthly	2	<0.001	Yes
Piangil	6 Monthly	2	<0.001	Yes
Red Cliffs	6 Monthly	2	<0.001	Yes
Robinvale	6 Monthly	2	<0.001	Yes
Swan Hill	6 Monthly	2	<0.001	Yes

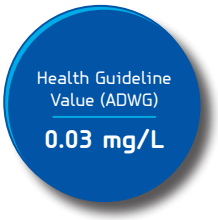
*Note: The min/max values of this parameter have remained the same in comparison to the previous 2 reporting periods.

Table 12
1,2 Dichloroethane [MS2]

Water Sampling Locality	Frequency of Sampling	Number of Samples	Maximum mg/L	Met ADWG guideline value
Kerang	6 Monthly	2	<0.001	Yes
Koondrook	6 Monthly	2	<0.001	Yes
Mildura	6 Monthly	3	<0.001	Yes
Murrabit	6 Monthly	2	<0.001	Yes
Piangil	6 Monthly	2	<0.001	Yes
Red Cliffs	6 Monthly	2	<0.001	Yes
Robinvale	6 Monthly	2	<0.001	Yes
Swan Hill	6 Monthly	2	<0.001	Yes

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

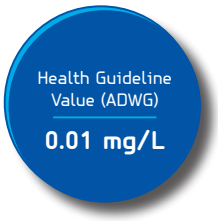
Table 13
1,1 Dichloroethene



Water Sampling Locality	Frequency of Sampling	Number of Samples	Maximum mg/L	Met ADWG guideline value
Kerang	6 Monthly	2	<0.0001	Yes
Koondrook	6 Monthly	2	<0.0001	Yes
Mildura	6 Monthly	3	<0.0001	Yes
Murrabit	6 Monthly	2	<0.0001	Yes
Piangil	6 Monthly	2	<0.0001	Yes
Red Cliffs	6 Monthly	2	<0.0001	Yes
Robinvale	6 Monthly	2	<0.0001	Yes
Swan Hill	6 Monthly	2	<0.0001	Yes

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

Table 14
Pentachlorophenol



Water Sampling Locality	Frequency of Sampling	Number of Samples	Maximum mg/L	Met ADWG guideline value
Kerang	6 Monthly	2	<0.001	Yes
Koondrook	6 Monthly	2	<0.001	Yes
Mildura	6 Monthly	3	<0.001	Yes
Murrabit	6 Monthly	2	<0.001	Yes
Piangil	6 Monthly	2	<0.001	Yes
Red Cliffs	6 Monthly	2	<0.001	Yes
Robinvale	6 Monthly	2	<0.001	Yes
Swan Hill	6 Monthly	2	<0.001	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
Kerang	6 Monthly	2	<0.001	Yes
Koondrook	6 Monthly	2	<0.001	Yes
Mildura	6 Monthly	3	<0.001	Yes
Murrabit	6 Monthly	2	<0.001	Yes
Piangil	6 Monthly	2	<0.001	Yes
Red Cliffs	6 Monthly	2	<0.001	Yes
Robinvale	6 Monthly	2	<0.001	Yes
Swan Hill	6 Monthly	2	<0.001	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 [MS3]

Health Guideline Value (ADWG)
0.02 mg/L

Water Sampling Locality	Frequency of Sampling	Number of Samples	Maximum mg/L	Met ADWG guideline value
Kerang	6 Monthly	2	<0.001	Yes
Koondrook	6 Monthly	2	<0.001	Yes
Mildura	6 Monthly	3	<0.001	Yes
Murrabit	6 Monthly	2	<0.001	Yes
Piangil	6 Monthly	2	<0.001	Yes
Red Cliffs	6 Monthly	2	<0.001	Yes
Robinvale	6 Monthly	2	<0.001	Yes
Swan Hill	6 Monthly	2	<0.001	Yes

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

Table 17
Sulphate

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
Kerang	3 Monthly	4	41	34	Declined	Yes
Koondrook	3 Monthly	4	40	34.25	Increased	Yes
Mildura	3 Monthly	6	39	22.6	Declined	Yes
Murrabit	3 Monthly	4	3	2	Declined	Yes
Piangil	3 Monthly	4	22	19	Increased	Yes
Red Cliffs	3 Monthly	4	37	31.25	Increased	Yes
Robinvale	3 Monthly	4	37	32.25	Increased	Yes
Swan Hill	3 Monthly	4	5	2.75	Increased	Yes

Table 18
Arsenic

Water Sampling Locality	Frequency of Sampling	Number of Samples	Maximum mg/L	Met ADWG guideline value
Kerang	3 Monthly	4	<0.001	Yes
Koondrook	3 Monthly	4	<0.001	Yes
Mildura	3 Monthly	6	<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

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.

Table 19
Selenium

Water Sampling Locality	Frequency of Sampling	Number of Samples	Maximum mg/L	Met ADWG guideline value
Kerang	3 Monthly	4	<0.001	Yes
Koondrook	3 Monthly	4	<0.001	Yes
Mildura	3 Monthly	6	<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

Water Sampling Locality	Frequency of Sampling	Number of Samples	Maximum mg/L	Met ADWG guideline value
Kerang	3 Monthly	4	<0.0001	Yes
Koondrook	3 Monthly	4	<0.0001	Yes
Mildura	3 Monthly	6	<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 previous 2 reporting periods.

Table 21
Gross Alpha Activity

Health Guideline Value (ADWG)
0.5 Bq/L

Water Sampling Locality	Frequency of Sampling	Number of Samples	Maximum Bq/L	Met ADWG guideline value
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

Table 22
Gross Beta Activity

Health Guideline Value (ADWG)
0.5 Bq/L

Water Sampling Locality	Frequency of Sampling	Number of Samples	Maximum Bq/L	Met ADWG guideline value
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

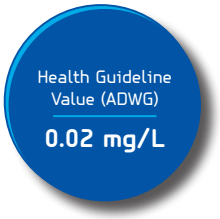
Table 23
Lead

Water Sampling Locality	Frequency of Sampling	Number of Samples	Maximum mg/L	Met ADWG guideline value
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	0.002	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 Max values of this parameter for Kerang and Piangil have increased while the other localities stayed the same in comparison to the previous 2 reporting periods.

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.

Table 24
Nickel



Water Sampling Locality	Frequency of Sampling	Number of Samples	Maximum mg/L	Met ADWG guideline value
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

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
Irymple	3 Monthly	4	0.009	0.005	No Change	Yes
Kerang	3 Monthly	4	0.017	0.013	Declined	Yes
Koondrook	3 Monthly	4	0.008	0.006	Declined	Yes
Lake Boga	3 Monthly	4	0.005	0.005	Declined	Yes
Merbein	3 Monthly	4	0.005	0.004	No Change	Yes
Mildura	3 Monthly	4	0.006	0.004	Declined	Yes
Murrabit	3 Monthly	4	0.008	0.005	Declined	Yes
Nyah	3 Monthly	4	0.007	0.005	Declined	Yes
Nyah West	3 Monthly	4	0.013	0.006	Increased	Yes
Piangil	3 Monthly	4	0.006	0.005	Declined	Yes
Red Cliffs	3 Monthly	4	0.018	0.011	Increased	Yes
Robinvale	3 Monthly	4	0.006	0.005	No Change	Yes
Swan Hill	3 Monthly	4	0.005	0.003	Declined	Yes
Woorinen Sth	3 Monthly	4	0.015	0.012	Declined	Yes

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.

Table 26
Nitrate Nitrogen

Water Sampling Locality	Frequency of Sampling	Number of Samples	Maximum mg/L (as Nitrate)	Average (mg/L as Nitrate)	Average change *Comparison of past 2 reporting periods	Met ADWG guideline value
Irymple	3 Monthly	4	0.05	0.033	Increased	Yes
Kerang	3 Monthly	4	0.16	0.115	Increased	Yes
Koondrook	3 Monthly	4	0.12	0.078	Increased	Yes
Lake Boga	3 Monthly	4	0.12	0.060	Increased	Yes
Merbein	3 Monthly	4	0.19	0.083	Increased	Yes
Mildura	3 Monthly	4	0.1	0.073	No Change	Yes
Murrabit	3 Monthly	4	0.88	0.295	Increased	Yes
Nyah	3 Monthly	4	0.11	0.070	Increased	Yes
Nyah West	3 Monthly	4	0.1	0.043	Increased	Yes
Piangil	3 Monthly	4	0.19	0.095	Increased	Yes
Red Cliffs	3 Monthly	4	0.08	0.055	Increased	Yes
Robinvale	3 Monthly	4	0.14	0.067	Declined	Yes
Swan Hill	3 Monthly	4	0.03	0.023	No Change	Yes
Woorinen Sth	3 Monthly	4	0.1	0.060	No Change	Yes

Health Guideline Value (ADWG)
0.08 mg/L

Table 27
Cyanide

Water Sampling Locality	Frequency of Sampling	Number of Samples	Maximum mg/L	Met ADWG guideline value
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	<0.005	Yes
Nyah West	3 Monthly	4	<0.005	Yes
Piangil	3 Monthly	4	<0.005	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.

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

Table 28
Chromium

Water Sampling Locality	Frequency of Sampling	Number of Samples	Maximum mg/L	Met ADWG guideline value
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 remained the same in comparison to the previous 2 reporting periods.

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

Table 29
Cadmium

Water Sampling Locality	Frequency of Sampling	Number of Samples	Maximum mg/L	Met ADWG guideline value
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.

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.

Table 30
Copper

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	0.002	0.002	Increased	0
Kerang	3 Monthly	4	2	0.008	0.007	Declined	0
Koondrook	3 Monthly	4	2	0.027	0.022	Increased	0
Lake Boga	3 Monthly	4	2	0.053	0.028	Increased	0
Merbein	3 Monthly	4	2	0.006	0.005	Declined	0
Mildura	3 Monthly	4	2	0.003	0.003	No Change	0
Murrabit	3 Monthly	4	2	0.018	0.012	Increased	0
Nyah	3 Monthly	4	2	0.017	0.008	Declined	0
Nyah West	3 Monthly	4	2	0.046	0.012	Increased	0
Piangil	3 Monthly	4	2	0.062	0.042	Increased	0
Red Cliffs	3 Monthly	4	2	0.013	0.006	Increased	0
Robinvale	3 Monthly	4	2	0.017	0.009	Declined	0
Swan Hill	3 Monthly	4	2	0.02	0.011	No Change	0
Woorinen Sth	3 Monthly	4	2	0.012	0.007	Increased	0

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.

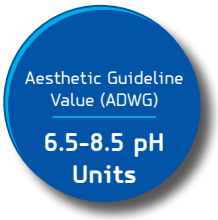
Health Guideline Value (ADWG)
0.05 mg/L

Table 31
Manganese

Water Sampling Locality	Frequency of Sampling	Number of Samples	Maximum mg/L	Average change *Comparison of past 2 reporting periods	Met ADWG guideline value
Irymple	3 Monthly	4	0.003	Increased	Yes
Kerang	3 Monthly	4	0.002	Declined	Yes
Koondrook	3 Monthly	4	0.004	Declined	Yes
Lake Boga	3 Monthly	4	<0.001	No Change	Yes
Merbein	3 Monthly	4	0.005	Declined	Yes
Mildura	3 Monthly	4	0.003	Declined	Yes
Murrabit	3 Monthly	4	<0.001	No Change	Yes
Nyah	3 Monthly	4	<0.001	No Change	Yes
Nyah West	3 Monthly	4	<0.001	No Change	Yes
Piangil	3 Monthly	4	0.005	Declined	Yes
Red Cliffs	3 Monthly	4	0.005	Increased	Yes
Robinvale	3 Monthly	4	0.007	Increased	Yes
Swan Hill	3 Monthly	4	<0.001	No Change	Yes
Woorinen Sth	3 Monthly	4	<0.001	No Change	Yes

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.

Table 32
pH



Water Sampling Locality	Frequency of Sampling	Number of Samples	pH Units			Average change *Comparison of past 2 reporting periods	Aesthetic operating range
			Minimum	Maximum	Average		
Irymple	Weekly	52	7	7.8	7.3	Increased	6.5-8.5
Kerang	Weekly	53	7	7.6	7.3	Increased	6.5-8.5
Koondrook	Weekly	53	7	7.5	7.3	Increased	6.5-8.5
Lake Boga	Weekly	52	7.3	9.1*	7.5	Increased	6.5-8.5
Merbein	Weekly	52	7.1	7.6	7.3	Increased	6.5-8.5
Mildura	Weekly	53	7	7.5	7.2	Increased	6.5-8.5
Murrabit	Weekly	53	6.9	7.5	7.2	Increased	6.5-8.5
Nyah	Weekly	52	6.9	7.5	7.2	Increased	6.5-8.5
Nyah West	Weekly	52	7	7.5	7.3	Increased	6.5-8.5
Piangil	Weekly	52	7	7.8	7.4	Increased	6.5-8.5
Red Cliffs	Weekly	52	7	7.7	7.5	Declined	6.5-8.5
Robinvale	Weekly	52	7.2	7.8	7.4	Increased	6.5-8.5
Swan Hill	Weekly	52	7.1	7.6	7.3	Increased	6.5-8.5
Woorinen Sth	Weekly	52	7	7.6	7.3	Increased	6.5-8.5

*Note: The maximum of 9.1 in Lake Boga occurring on 11/8/20 was a singular event possibly caused by water stagnation in a court dead end main. Immediate corrective actions undertaken in response to the elevated pH included flushing of the main, free chlorine checks and resampling on the 17/8/20 confirmed ideal pH levels of 7.4 and 0.56mg/L free chlorine residual.

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.

Table 33
Colour

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
Irymple	Monthly	12	2	2	No change	Yes
Kerang	Monthly	12	4	3	No change	Yes
Koondrook	Monthly	12	4	2	No change	Yes
Lake Boga	Monthly	12	4	3	No change	Yes
Merbein	Monthly	12	2	2	No change	Yes
Mildura	Monthly	12	4	3	No change	Yes
Murrabit	Monthly	12	4	3	No change	Yes
Nyah	Monthly	12	2	2	No change	Yes
Nyah West	Monthly	12	2	2	No change	Yes
Piangil	Monthly	12	2	2	No change	Yes
Red Cliffs	Monthly	12	4	3	No change	Yes
Robinvale	Monthly	12	4	2	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

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

Table 34
Iron

Water Sampling Locality	Frequency of Sampling	Number of Samples	Maximum (mg/L)	Average change *Comparison of past 2 reporting periods	Met ADWG guideline value
Irymple	3 Monthly	4	0.02	No Change	Yes
Kerang	3 Monthly	4	<0.01	No Change	Yes
Koondrook	3 Monthly	4	<0.01	No Change	Yes
Lake Boga	3 Monthly	4	0.02	No Change	Yes
Merbein	3 Monthly	4	0.04	No Change	Yes
Mildura	3 Monthly	4	0.02	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	<0.01	No Change	Yes
Woorinen Sth	3 Monthly	4	<0.01	No Change	Yes

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

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.

Table 35
Hardness

Aesthetic Guideline Value (ADWG)
200 mg/L
(as CaC03)

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
Kerang	3 Monthly	4	33	20	Declined	Yes
Koondrook	3 Monthly	4	20	14	Increased	Yes
Mildura	3 Monthly	6	41	25	Increased	Yes
Murrabit	3 Monthly	4	19	15	Increased	Yes
Piangil	3 Monthly	4	22	15	Increased	Yes
Red Cliffs	3 Monthly	4	27	24	Increased	Yes
Robinvale	3 Monthly	4	26	21	Increased	Yes
Swan Hill	3 Monthly	4	22	16	Increased	Yes

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

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
Kerang	3 Monthly	4	21	15	Increased	Yes
Koondrook	3 Monthly	4	17	10.75	Increased	Yes
Mildura	3 Monthly	6	19	16.5	Increased	Yes
Murrabit	3 Monthly	4	22	14	Increased	Yes
Piangil	3 Monthly	4	21	13.75	Increased	Yes
Red Cliffs	3 Monthly	4	22	17.75	Increased	Yes
Robinvale	3 Monthly	4	23	15.75	Increased	Yes
Swan Hill	3 Monthly	4	26	17.25	Increased	Yes

Table 37
Sodium

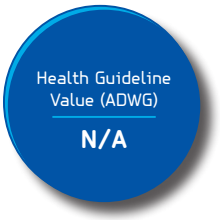
Water Sampling Locality	Frequency of Sampling	Number of Samples	Maximum (mg/L)	Average (mg/L)	Average change *Comparison of past 2 reporting periods	Met ADWG guideline value
Kerang	3 Monthly	4	25	18.75	Increased	Yes
Koondrook	3 Monthly	4	23	18.25	Increased	Yes
Mildura	3 Monthly	6	12	9.683	Increased	Yes
Murrabit	3 Monthly	4	11	7.6	Increased	Yes
Piangil	3 Monthly	4	18	13.75	Increased	Yes
Red Cliffs	3 Monthly	4	24	20.5	Increased	Yes
Robinvale	3 Monthly	4	32	27.5	Increased	Yes
Swan Hill	3 Monthly	4	13	10.3	Increased	Yes

Table 38
Conductivity

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
Kerang	3 Monthly	4	200	170	Increased	Yes
Koondrook	3 Monthly	4	180	150	Increased	Yes
Mildura	3 Monthly	6	170	145	Increased	Yes
Murrabit	3 Monthly	4	110	85.25	Increased	Yes
Piangil	3 Monthly	4	150	124.75	Increased	Yes
Red Cliffs	3 Monthly	4	180	172.5	Increased	Yes
Robinvale	3 Monthly	4	210	192.5	Increased	Yes
Swan Hill	3 Monthly	4	120	104.25	Increased	Yes

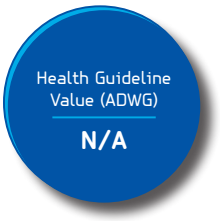
*Total dissolved solids 600 mg/L

Table 39
Calcium



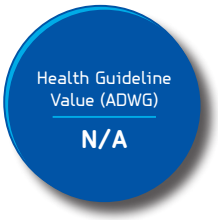
Water Sampling Locality	Frequency of Sampling	Number of Samples	Maximum mg/L	Average (mg/L)
Kerang	3 Monthly	4	7.8	5.5
Koondrook	3 Monthly	4	3.3	2.9
Mildura	3 Monthly	6	11	8.333
Murrabit	3 Monthly	4	3.1	2.85
Piangil	3 Monthly	4	3.9	3.475
Red Cliffs	3 Monthly	4	5.3	4.875
Robinvale	3 Monthly	4	4.5	4.225
Swan Hill	3 Monthly	4	3.9	3.425

Table 40
Alkalinity (as CaCO3)



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	24	20.5	No Change
Koondrook	3 Monthly	4	18	15.5	Increased
Mildura	3 Monthly	6	25	20.667	Increased
Murrabit	3 Monthly	4	21	18.25	Increased
Piangil	3 Monthly	4	21	18.25	Increased
Red Cliffs	3 Monthly	4	21	19.5	Increased
Robinvale	3 Monthly	4	41	35	Increased
Swan Hill	3 Monthly	4	25	19.75	Increased

Table 41
Magnesium



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	3.3	2.9	Increased
Koondrook	3 Monthly	4	2.9	2.25	Increased
Mildura	3 Monthly	6	3.7	3.25	Increased
Murrabit	3 Monthly	4	2.8	2.25	Increased
Piangil	3 Monthly	4	3	2.675	Increased
Red Cliffs	3 Monthly	4	3.5	3.35	Increased
Robinvale	3 Monthly	4	3.5	3.05	Increased
Swan Hill	3 Monthly	4	3.1	2.775	Increased