



Annual Drinking Water Quality Report 2019/2020



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Cover image: Mildura 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 Wamba 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 Lower Murray Water.



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

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Robinvale Water Treatment Plant

From our Managing Director



**100% compliance with
water quality standards in
the Safe Drinking Water
Regulations in 2019/20**

I am pleased to present Lower Murray Urban and Rural Water Authority's (LMW) 2019/20 Annual Drinking Water Quality report (ADWQ), 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 2019/20.

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 Department of Health and Human Services (DHHS) and the Essential Services Commission (ESC), as they regulate and monitor 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 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 – updated August 2018 (the Guidelines).

An audit of our DWQMP was conducted by an approved external auditor for the reporting period with results indicating compliance with section 7(1) of the Act.

Throughout 2019/20, we continued to improve our operational activities to identify and manage risks, in our commitment to delivering safe and high-quality drinking water to our customers.

Ongoing improvements were identified to ensure our continued adherence to the water quality standards and requirements stipulated in the Act, Regulations and Guidelines. We implemented 15 water quality and safety improvement initiatives across our water treatment plants in 2019/20.

It is with pleasure that I report a 100% per cent compliance rate in 2019/20, for all water quality standards specified in Schedule 2 of the Regulations.

I commend our dedicated team of water quality specialists and recognise their commitment, innovation and collaboration with stakeholders to ensure the ongoing delivery of high-quality drinking water to our customers.

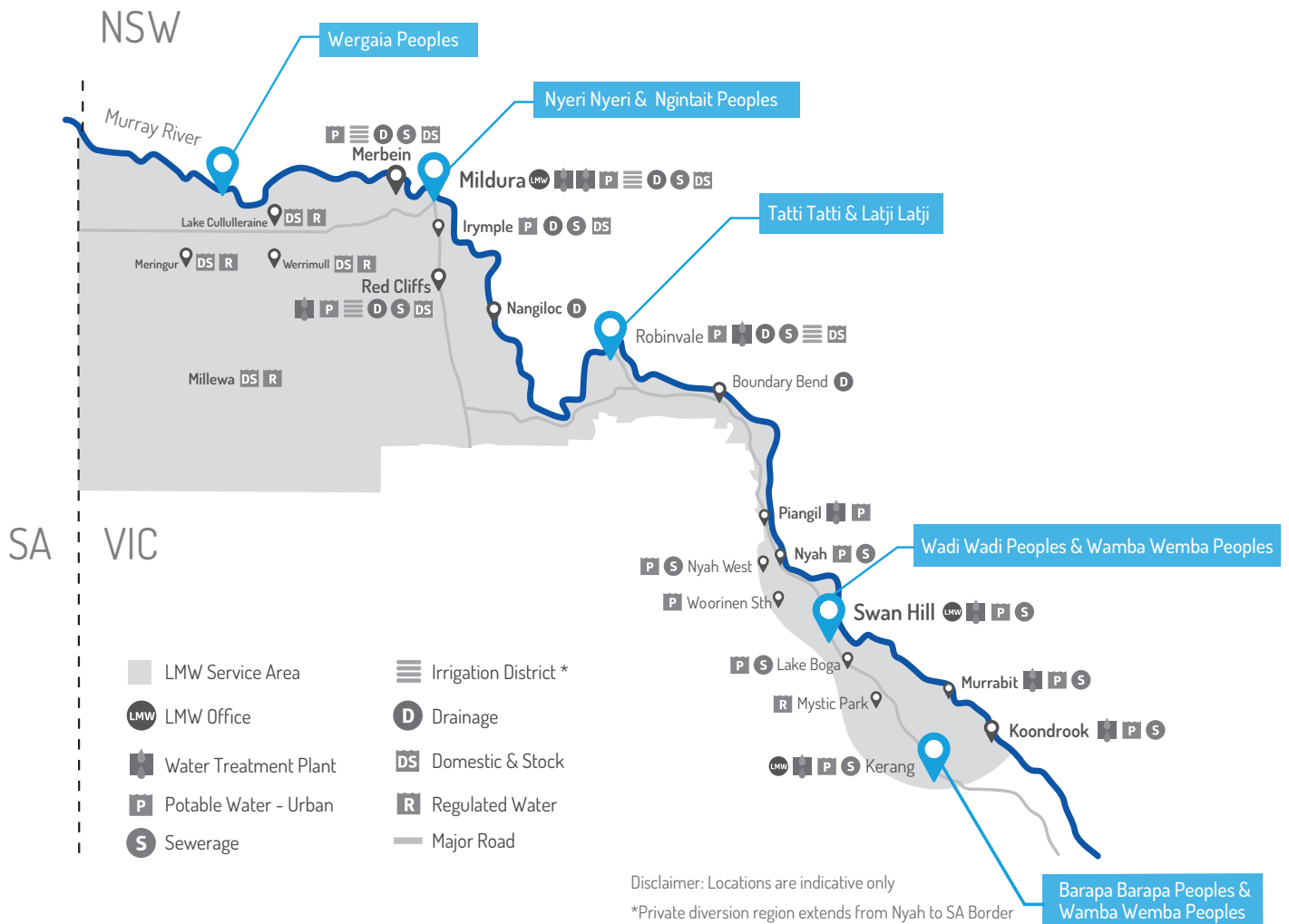
Managing Director



Anthony Couroupis
Managing Director



Our Service Region



Our area of operation extends from Kerang to the South Australian border taking in the municipalities of Mildura, Swan Hill and Gannawarra.

We recognise that our communities' overall wellbeing and livelihood 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.

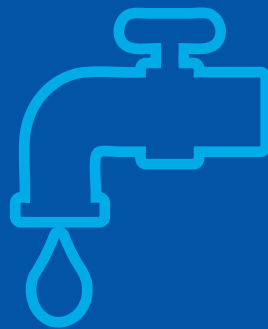
Lower Murray Water acknowledges the Traditional Owners of the land on which we work and reside. We recognise their continuing connection to land, waterways and community. We pay our respects to Elders past, present and future.

Nature and Range of Services provided

We provide:

- urban water services to 14 towns via nine water treatment plants (WTPs) to approximately 74,000 customers along the Murray River in Victoria from Koondrook to Merbein;
- wastewater collection, treatment and effluent re-use and disposal services to 11 towns via ten wastewater treatment plants;
- river quality water services to 2,616 irrigation and 1,856 stock and domestic customers in the four pumped irrigation districts of Merbein, Mildura, Red Cliffs, and Robinvale; and services to 290 Millewa rural district customers and some areas of the Yelta waterworks district;
- the collection and disposal of subsurface drainage water from the four pumped irrigation districts, as well as from private diverters in and around Boundary Bend, Nangiloc and Robinvale;
- oversight of irrigation and drainage design in new agricultural developments ensuring conformity with Irrigation Development Guidelines;
- management of the private diversion licenses of 1,165 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 services to important environmental and recreational sites; and
- management of the region's urban and bulk water entitlements

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.



PROVIDE WATER SERVICES TO 14 TOWNS VIA 9 TREATMENT PLANTS TO APPROX 74,000 CUSTOMERS

WASTEWATER COLLECTION, TREATMENT AND REUSE TO 11 TOWNS VIA 10 TREATMENT PLANTS



34,311 URBAN HOMES & BUSINESSES SERVED

MANAGEMENT OF THE REGION'S URBAN & RURAL BULK WATER ENTITLEMENTS



OVERSIGHT OF IRRIGATION & DRAINAGE DESIGN IN NEW AGRICULTURAL DEVELOPMENTS

Water Supply Systems

LMW manages eight drinking water supply systems, which provide drinking water to a population of approximately 74,000 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 within this report under Regulated Water.

Details of our drinking water and regulated water supply systems, including water sampling localities, population supplied, source water and water treatment plants 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 2020 (34,311) 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 2019/20.

TABLE 1 - LMW water supply systems

WATER SAMPLING LOCALITY	POPULATION	SOURCE WATER	TREATMENT PLANT
Irymple	8,321	Murray River	Mildura 7th street Mildura West
Kerang	4,214	- Murray River - Loddon River - 14/2 Irrigation Channel	Kerang
Koondrook	974	Murray River	Koondrook
Lake Boga	1,095	Murray River	Swan Hill
Merbein	3,674	Murray River	Mildura 7th street Mildura West
Mildura	35,918	Murray River	Mildura 7th street Mildura West
Murrabit	97	- Murray River - Storage Dam	Murrabit
Nyah	706	Murray River	Swan Hill
Nyah West	568	Murray River	Swan Hill
Piangil	231	Murray River	Piangil
Red Cliffs	3,918	Murray River	Red Cliffs
Robinvale	2,179	Murray River	Robinvale
Swan Hill	11,454	Murray River	Swan Hill
Woorinen South	437	Murray River	Swan Hill
Millewa*	169	Lake Cullulleraine	Millewa Water Quality Improvement Plant
Mystic park*	29	Kangaroo Lake	N/A
	Total: 73,983		

* Regulated Supplies

Source Water

The source of water for the majority of drinking water supplies in our service region is the Murray River. An exception to this is the Kerang drinking water supply, which sources water from the Loddon River and 14/2 Irrigation Channel in addition to the Murray River. Our two 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 water treatment plants' 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. We are responsible for supplying drinking water from Kerang through to Merbein as shown in Table 1.

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 water treatment plants, 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 water treatment plant 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.



Red Cliffs Water Treatment Plant and Irrigation Pump Station

Drinking Water Treatment Processes

During 2019/20, LMW treated over 20,361 megalitres (ML) of drinking water across nine water treatment plants. All of these water treatment plants use conventional water treatment systems, with one water treatment plant utilising dissolved air floatation as part of its treatment system. The water treatment systems involve the following process steps:

- Coagulation
- Flocculation
- Sedimentation/Clarification/Dissolved Air Floatation
- Filtration
- Disinfection
- Fluoridation

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.

Water treatment processes may slightly differ from one water treatment plant 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 below.

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

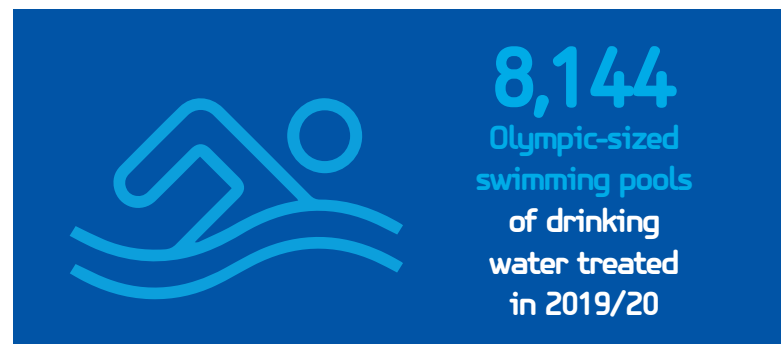
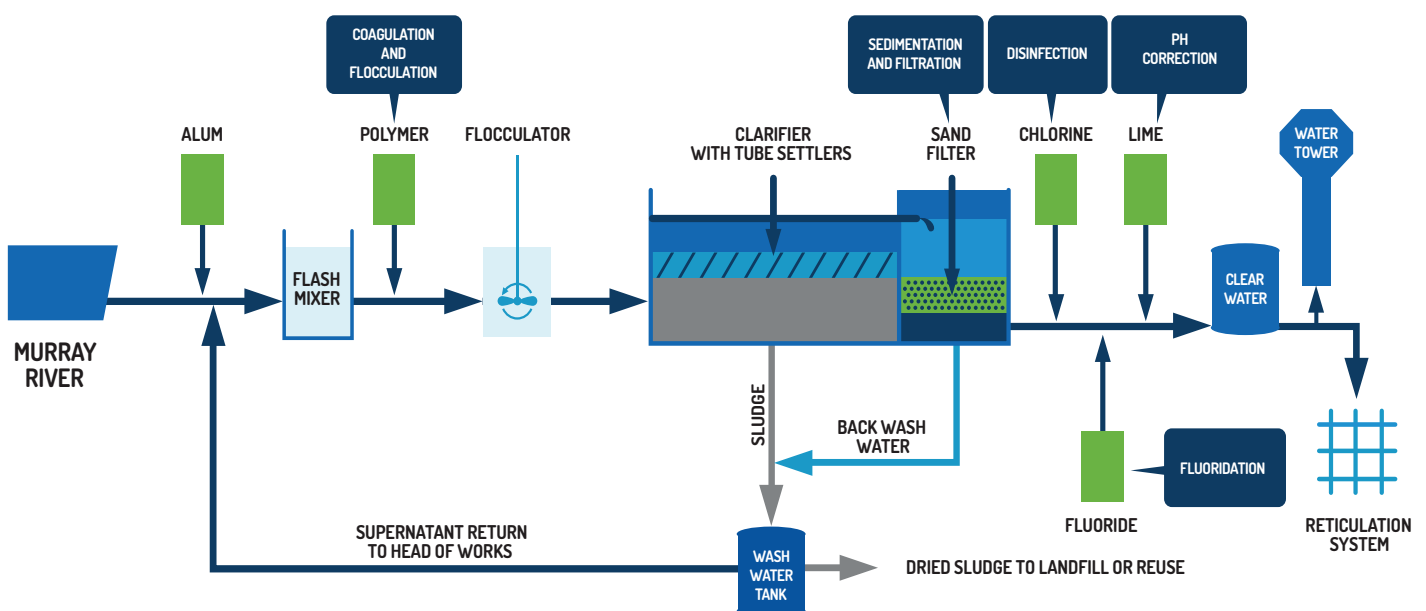


FIGURE 1. Drinking water treatment processes



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 and 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 by a mechanical 'sludge collection' device, 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.



Operations Team Leader inspecting clarity of treated water

Diffused 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 water treatment plants in the form of chlorine gas.

Ultraviolet (UV) Disinfection

UV disinfection is widely used in water treatment due to its ability to permanently de-activate bacteria, spores, moulds and viruses. It provides a secondary barrier to the conventional water treatment process, where filtration is the only barrier against protozoan 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 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 water treatment plants 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 Plant. 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.



Ultraviolet (UV) disinfection infrastructure

TABLE 2 - LMW drinking water treatment processes

WATER SAMPLING LOCALITY	WATER TREATMENT PLANT	TREATMENT PROCESS	ADDED SUBSTANCES
Kerang	Kerang	<ul style="list-style-type: none"> - Coagulation - Flocculation - Sedimentation; - Granular Media Filtration - Chlorine Disinfection - Fluoridation 	<ul style="list-style-type: none"> - Aluminium Sulphate - Hydrated Lime - Sodium Hydroxide - Chlorine Gas - Powdered Activated Carbon - Fluorosilicic Acid
Koondrook	Koondrook	<ul style="list-style-type: none"> - Coagulation - Flocculation - Sedimentation - Granular Media Filtration - Chlorination - UV Disinfection 	<ul style="list-style-type: none"> - Aluminium Sulphate - Sodium Hydroxide - Chlorine Gas - Powdered Activated Carbon
Mildura Merbein Irymple	Mildura 7th Street Mildura West	<ul style="list-style-type: none"> - Coagulation - Flocculation - Sedimentation - Clarification* - Slow Sand Filtration - Chlorination - Fluoridation 	<ul style="list-style-type: none"> - Aluminium Sulphate* - Aluminium Chlorohydrate** - Hydrated Lime* - Polymer - Chlorine Gas - Powdered Activated Carbon - Fluorosilicic Acid - Sodium Metabisulfite** - Sodium Hydroxide**
Murrabit	Murrabit	<ul style="list-style-type: none"> - Coagulation - Flocculation - Sedimentation - Granular Media Filtration - Chlorination - UV Disinfection 	<ul style="list-style-type: none"> - Aluminium Chlorohydrate - Sodium Hydroxide - Chlorine Gas - Powdered Activated Carbon
Piangil	Piangil	<ul style="list-style-type: none"> - Coagulation - Flocculation - Sedimentation - Granular Media Filtration - Chlorination - UV Disinfection 	<ul style="list-style-type: none"> - Aluminium Sulphate - Sodium Hydroxide - Chlorine Gas - Powdered Activated Carbon
Red Cliffs	Red Cliffs	<ul style="list-style-type: none"> - Coagulation - Flocculation - Pre-sedimentation - Dissolved Air Floatation - Granular Media Filtration - Chlorination - Fluoridation - UV Disinfection 	<ul style="list-style-type: none"> - Aluminium Sulphate - Sodium Hydroxide - Chlorine Gas - Powdered Activated Carbon - Fluorosilicic Acid
Robinvale	Robinvale	<ul style="list-style-type: none"> - Coagulation - Flocculation - Clarification - Granular Media Filtration - Chlorination - Fluoridation 	<ul style="list-style-type: none"> - Aluminium Sulphate - Soda Ash - Chlorine Gas - Powdered Activated Carbon - Sodium Fluoride
Swan Hill	Swan Hill	<ul style="list-style-type: none"> - Coagulation - Flocculation - Clarification - Slow Sand Filtration - Chlorination - Fluoridation 	<ul style="list-style-type: none"> - Aluminium Chlorohydrate - Sodium Hydroxide - Chlorine Gas - Powdered Activated Carbon - Fluorosilicic Acid

*Applies to Mildura 7th Street WTP

**Applies to Mildura West WTP

Drinking Water Quality Management

Quality Management Systems

An LMW Drinking Water Quality Risk 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 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's 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, etc.

To comply with the water quality monitoring requirements set out in the SDWA and SDWR, 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 2019/20 are available in Appendix A.

In 2019/20 we collected over 1,700 samples from our 16 water supply localities and analysed these for more than 40 parameters to assess water quality.

Sampling Points

The water quality sampling points have been carefully chosen based on the DHHS '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 point 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 of clear water storage tanks and service reservoirs, which was followed in 2019/20. 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, and seem to be efficient and reduce Occupational Health and Safety (OHS) risks.



Over 1,700
water samples analysed
for 40 water quality
parameters



Issues

The following issues relating to the water quality monitoring schedule occurred in 2019/20:

- The regulatory sample, collected on 7th October 2019 from the locality of Merbein, was delivered to the laboratory service provider as scheduled and tested for all water quality parameters except the turbidity test. The missing parameter is shown in Table 3 below:

TABLE 3 – Missing water quality parameter

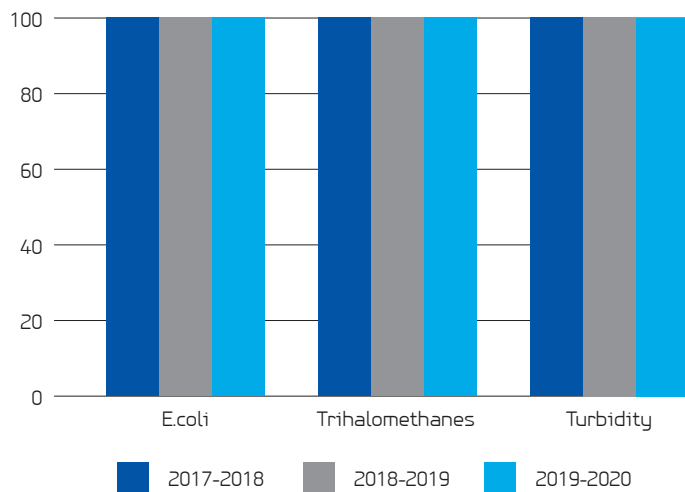
DATE SAMPLED	SOURCE OF SAMPLE	TESTING FREQUENCY	WATER QUALITY TEST PARAMETERS	LOCALITY
7th Oct 2019	Reticulation	Weekly	Turbidity	Merbein

An audit of the SCADA trends and laboratory records at the Mildura water treatment plants, which supply Merbein with drinking water, in the week leading up to and on the day of sampling (7th October 2019), revealed that the water quality was of a high quality standard and well under the critical control point (CCP) limits. Therefore, there is no evidence that poor water quality was supplied to Merbein customers on the week of the missed parameter.

The laboratory service provider conducted an investigation of this issue and found that an error occurred in the Lab Information Management Systems (LIMS), which generates the test list containing turbidity, resulting in the failure to schedule the turbidity for Merbein on that date.

FIGURE 2 - Compliance with water quality standards

Percentage of samples complying with schedule 2 water quality standard



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 2019/20, 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.



Inspection of clarifier No. 3 at Mildura Water Treatment Plant

Fluoride Treatment

During the reporting period, and based on live data using online fluoride analysers for fluoride monitoring sourced from the ClearSCADA systems at the water treatment plants, the average optimal fluoride concentration of 0.7 to 0.9mg/L, as recommended by DHHS 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 at Swan Hill and Kerang water supply systems, which may be attributed to the fluoride dosing systems intermittently offline to undertake reactive and scheduled maintenance and other factors related to accuracy of measurement.

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 4 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 DHHS of 11 Fluoride interruptions, where fluoride concentration in drinking water supplied was less than 0.6 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 4.

Aesthetic characteristics

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



All fluoridated water supply systems compliant with recommended fluoride levels

TABLE 4 – Summary of fluoride interruption

FLUORIDATION PLANT	FLUORIDE INTERRUPTION, DATE	FLUORIDE RESUMPTION, DATE	SUMMARY
Mildura 7th street	29-Jul-19	06-Aug-19	Faulty Fluoride analyser probe
Mildura 7th street	16-Aug-19	20-Aug-19	Pump faulted
Mildura 7th street	21-Aug-19	23-Aug-19	Fluoride leak
Kerang	09-Sep-19	13-Sep-19	Fluoride dosing pump faulted
Kerang	24-Oct-19	20-Dec-19	Online Fluoride analyser issues
Kerang	06-Dec-19	10-Dec-19	Faulty Fluoride analyser probe
Robinvale	03-Jan-20	08-Jan-20	Dosing pump damaged
Robinvale	25-Feb-20	30-Mar-20	Weather damaged pipework
Swan Hill	17-Apr-20	21-Apr-20	Dosing pump blockage
Swan Hill	21-Apr-20	07-May-20	Fluoride flow meter issues
Swan Hill	02-Jun-20	09-Jun-20	Repairs to WTP

Water Quality and Safety Improvement Initiatives

During the 2019/2020 financial year, LMW undertook a number of significant projects and invested heavily in improving the robustness of the water supply systems, ensuring that water quality and safety is not compromised.

Table 5 below lists the water quality and safety improvement projects that were initiated or completed in 2019/20.


Whilst all these projects were intended to improve water quality and safety, retrofitting the water treatment plants with UV disinfection system is considered a vital step up to the highest quality and safety standards.

We carried out a sanitary survey of the Murray River catchment, assessed the risks to water quality and safety, and found that its water quality can be compromised in the absence of a secondary barrier to remove pathogens. Consequently, a decision was made to retrofit all LMW's water treatment plants with Ultraviolet (UV) disinfection systems. This provides a secondary barrier for pathogenic bacteria, e.g. Cryptosporidium and Giardia, improves the robustness of the water supply systems, substantially and reduces risks to water safety especially during blackwater and blue-green algae events. While ensuring continuity of supply during such events, it also achieves compliance with the Act, Regulations and Guidelines.

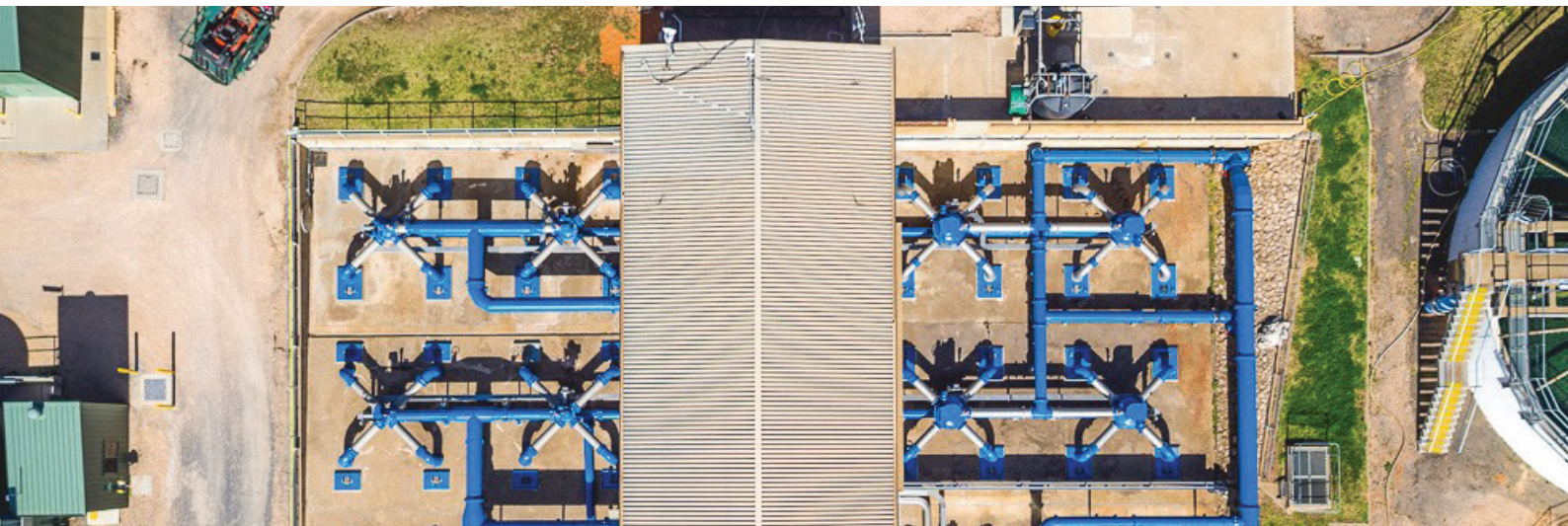
Other projects completed include installation of a Reduced Pressure Zone Valve (RPZ) at Mildura 7th Street WTP, upgrades to the ClearSCADA system at all WTPs, and providing generators to address emergency situations. These improvements ensure the continuity of water treatment and supply, which are of paramount importance to the quality and safety of drinking water.

Table 5 – Water quality and safety improvement projects

WATER TREATMENT PLANT (WTP)	PROJECT
All WTPs	General Laboratory Equipment
All WTPs	Instrument Replacement
Kerang	PLC Automation
Mildura West	Upgrade to ClearSCADA
Mildura West	Storage Tank Upgrade. Part D&C
Swan Hill	Clarifier Repairs
Red Cliffs	UV Treatment Upgrade
Piangil	UV Treatment Upgrade
Murrabit	UV Treatment Upgrade
Koondrook	UV Treatment Upgrade
Piangil	Control Systems Upgrade
Mildura	Install temporary dosing systems
Mildura	RPZ Works at 7th St WTP
Koondrook	Install Generator at Koondrook RWPS
Mildura	Install Generator at Koondrook RWPS



15
water quality and safety
improvement projects
implemented at water
treatment plants



Mildura Water Treatment Plant

Emergency Incident and Event Management

Section 22 Notifications

A Section 22 notification to DHHS is required under section 22 of the Act in instances where drinking water supplied to the public:

- may be the cause or a mean of an illness, does not comply, or is not likely to comply, with any relevant water quality standard, e.g. the Guidelines.
- may pose a risk to human health or cause widespread public complaint.

On 15 December 2019, LMW notified DHHS and submitted a Section 22 notification as a result of exceeding the Guidelines' filtered water turbidity guideline value of 0.2NTU, and breaching our filtered water turbidity Critical Control Point limit of 0.5NTU at Red Cliffs Water Treatment Plant. As filtration was impacted, a precautionary short-term boil water advisory was issued to Red Cliffs customers.

At this time, due to an unprecedented BGA bloom in the Murray, exacerbated by extreme and prolonged heat conditions in the region, the sludge collector in the pre-sedimentation tank at the Red Cliffs Water Treatment Plant failed. The sludge collection mechanism failure caused poor water quality through suboptimal performance of the filters. The failure of the sludge collection mechanism was due to an excessive amount of sludge accumulating at the bottom of the pre-sedimentation tank which was associated with the BGA present in the raw water.

The BGA bloom involved *Dolichospermum Coiled* species (Figure 3), which can generate Extracellular Polymeric Substances (EPS) (Figure 4) 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.

The presence of EPS in water affects the settling characteristics of flocs during the sedimentation stage by forming compact flocs that rapidly settle out leaving relatively large volume of micro flocs suspended in the settled water. Consequently, these micro flocs are carried over into the filters, in turn, impacting the performance of filters and resulting in turbidity breakthrough, i.e. producing non-compliant water (> 0.2 Normal Turbidity Units NTU).

The operations team immediately undertook vital measures to continue delivering safe drinking water to customers. This included isolating and securing the Clear Water Storage (CWS) at Red Cliffs, by diverting all water produced back into the river whilst trying to recover the treatment process to prevent non-compliant water entering the CWS. To recover the treatment process, we consulted with other water authorities who had experienced similar BGA events.

The above situation caused water supply limitations and a potential health risk to customers, which was a trigger to activate LMW's Emergency Management Team (EMT).

The EMT undertook additional measures to ensure the continuity of the safe drinking water supply. These included the introduction of emergency water restrictions (indoor use only) due to the limited availability of safe drinking water in storage, informing the Duty Officer at the Department of Environment, Land, Water and Planning (DELWP), and notifying DHHS about issuing a precautionary boil water advisory to Red Cliffs customers.

A risk-based decision to issue a precautionary boil water advisory was triggered at 17:30 on Sunday 15th December. Even though LMW regained control of the treatment process, the notice was given to address any potential deterioration of water quality. After meeting water quality specifications, the boil water advisory was lifted on Monday 16 December at 2:00pm.



Kerang Water Tower

FIGURE 3 – Dolichospermum coiled species

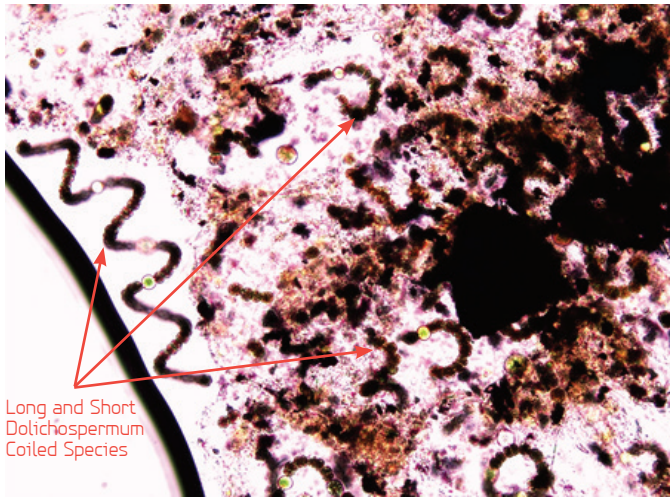
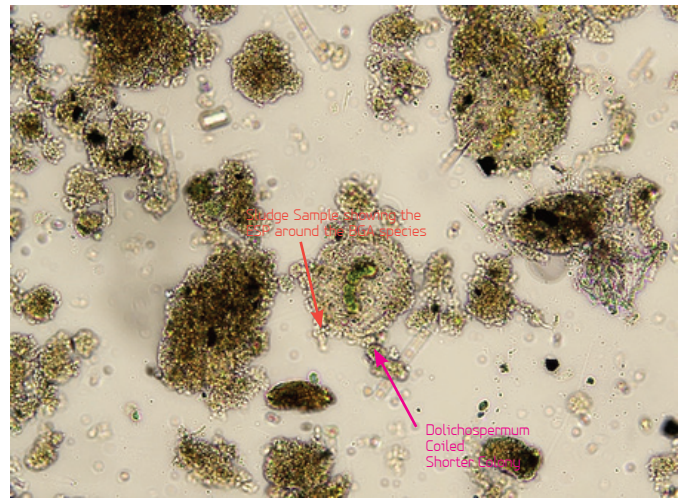


FIGURE 4 – ESP surrounding the Dolichospermum coiled species



Section 18 Notifications

A water supplier must notify DHHS under Section 18 of the Act if drinking water supplied to the public does not comply with any relevant water quality standard set out in Schedule 2 of the SDWR.

LMW are pleased to report that during the reporting period, there were no incidents that required reporting under section 18 of the SDWA.

Lessons Learnt

Following are key learnings from the emergency incident:

- Raw water pH increased before showing impact on sludge, which is an early warning to increase the frequency of jar testing and make necessary adjustments to chemical dosing.
- Whilst PAC is used to mitigate the risks of Cyanobacteria toxins in the water due to being potentially toxic, additional testing of BGA confirmed the presence of the toxicity gene, which validates LMW's approach to risk assessment and treatment.
- Pre-season preparation for BGA including upgrading and providing new microscopes, cameras and screens to all water treatment plants, incorporating the use of smart phones to share pictures of BGA species and facilitate ongoing consultation and learning within the operations teams. Two facilitated BGA training sessions by a professional trainer were invaluable for the water treatment plant operators, improving

engagement in the identification of BGA species, undertaking the ongoing BGA monitoring program, facilitating discussion and better understanding of the various BGA species, their behaviour under certain circumstances and impact on the water treatment processes. This helped implement solutions to regain control of the treatment process and mitigate risks to water quality and safety.

- Engaging with other institutions and water agencies helped better understand the impact of BGA species on the treatment process, regain control and accelerate recovery of treatment processes.



1

precautionary
boil water advisory issued

Drinking Water Quality Standards

During 2019/20, LMW remained 100% compliant with the water quality standards specified for drinking water in Schedule 2 of the Regulations. These are outlined in Table 6. All drinking water quality results can be found in Appendix A of this report.

TABLE 6 - Schedule 2 Safer 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 7 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:

- $2,000 \leq \text{Cell Numbers} < 6,500 \text{ Cells/ml}$ Microcystis Aeruginosa, or
- $0.2 \leq \text{Total Biovolume} < 0.6 \text{ mm}^3/\text{L}$

DHHS 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 $\geq 1.3 \mu\text{g/l}$ (Microcystin-LR toxicity equivalents)
- Microcystis aeruginosa is present at $\geq 6,500 \text{ cells/ml}$
- Total combined biovolume of known toxic cyanobacterial species $\geq 0.6 \text{ mm}^3/\text{L}$
- Total combined biovolume of all cyanobacterial species $\geq 10 \text{ mm}^3/\text{L}$

OR

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



100% compliant
with water quality standards for drinking water



TABLE 7 – Other drinking water quality standards

PARAMETER	ADWG 2011 GUIDELINE, MG/L		FREQUENCY OF TESTING	MET THE GUIDELINE YES/NO
	HEALTH	AESTHETIC		
Arsenic	0.1		Quarterly	Yes
Cadmium	0.002		Quarterly	Yes
Chlorine	5	0.6	Weekly	Yes
Chromium	0.05		Quarterly	Yes
Copper	2	1	Quarterly	Yes
Cyanide	0.08		Quarterly	Yes
Fluoride	1.5		Weekly	Yes
Lead	0.01		Quarterly	Yes
Manganese	0.5	0.1	Quarterly	Yes
Mercury	0.001		Quarterly	Yes
Nitrate	50		Quarterly	Yes
Iron	c	0.3	Quarterly	Yes
Zinc	c	3	Quarterly	Yes
Selenium	0.01		Quarterly	Yes
Nickel	0.02		Quarterly	Yes
Sulphate	c	250	Quarterly	Yes
Atrazine	0.02		Yearly	Yes
Chlorpyrifos	0.01		Yearly	Yes
Chlorothalonil	0.05		Yearly	Yes
Glyphosate	1		Yearly	Yes
Maldison (Malathion)	0.07		Yearly	Yes
Simazine	0.02		Yearly	Yes
Gross Alpha			Every 5 years	Yes
Gross Beta			Every 5 years	Yes

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



Swan Hill Water Treatment Plant

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 the Corporation's customer management system 'Merit', which provides for workflow tracking of each complaint from registration to completion and produce 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, pH, turbidity and colour, and takes water samples for taste tasting. Mains 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.

2019/20 complaint data

A total of 35 water quality complaints from a customer base of 34,311 was recorded in 2019/20. This is a significant reduction from 2018/19 where 57 water quality complaints were recorded and equates to 0.102 water quality complaints per 100 customers.

Over the reporting period, the main water quality complaint was for taste and odour (15 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. In December 2019, a BGA bloom took place within LMW's operational area, its impact was noticeable in the Mildura and Red Cliffs area, which account for 67%, i.e. 10 out of 15 of the taste and odour complaints.

LMW systematically undertake mains cleaning programs that assist in maintaining and improving water quality, consequently reducing the number of water quality complaints. 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 water treatment plants to help absorb the taste and odour compounds.

Discoloured water was the other major water quality complaint for over the reporting period (12 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 or iron sediment, or potentially from a customer's internal plumbing.

We received five alleged illness complaints during the reporting period, which may be associated with the boil water advisory issued as a result of the BGA emergency event in mid-December 2019. Two water quality complaints were also received under the 'other' category, which after investigation were found to be unrelated to water quality.

Table 8A and Table 8B show a comparison between the number of water quality complaints received during 2019/20, to those of the previous year, and the types of complaints received by each of LMW's water sampling locality respectively.

Table 8C shows the types of water quality complaints, total water quality complaints received during 2019/20, and the number of complaints per 100 customers supplied.

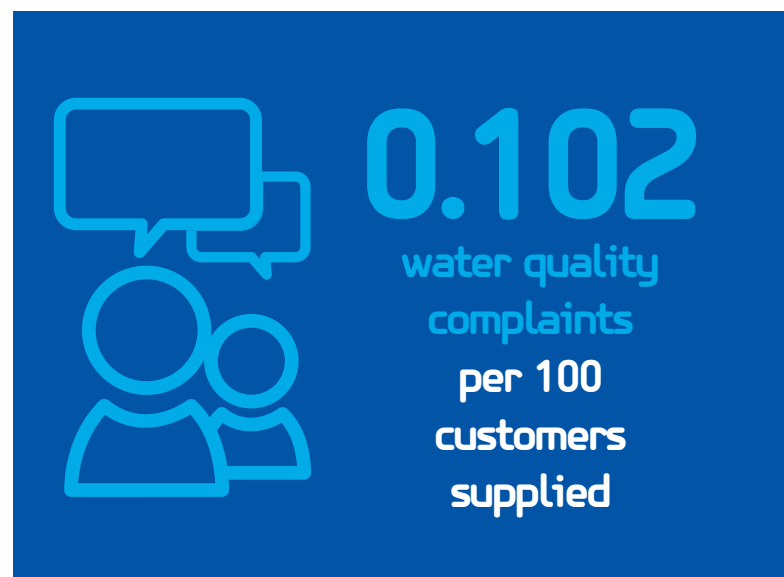


TABLE 8A - Types of complaints compared to previous reporting periods

TYPE OF COMPLAINTS	NUMBER OF COMPLAINTS			COMPARISON WITH PREVIOUS REPORTING PERIODS	COMMENTS
	19/20	18/19	17/18		
Colour	12	32	17	A decrease by 20 complaints	The significant decrease may be attributed to LMW's proactive water mains flushing program.
Taste & Odour	15	16	15	A decrease by one complaint	The decrease may be attributed to customers' individual ability to detect residual amount of MIB and Geosmin in water.
Blue Water	1	1	0	No change	One complaint received, which may be attributed to light reflection.
Alleged Illness	5	1	2	An increase by four complaints	The increase may be attributed to the boil water advisory issued mid-December 2019 associated with the BGA event.
Air in Water	0	1	0	A decrease by one complaint	This may be attributed to LMW's water mains flushing program.
Other	2	6	0	A decrease by four complaints	This category of complaints include various types of complaints that upon investigation were found to be not related to water quality.

TABLE 8B - Types of complaints by water sampling locality

WATER SAMPLING LOCALITY	TYPE OF COMPLAINTS							Total Complaints
	Colour	Taste and Odour	Blue Water	Alleged Illness	Air	Other		
Mildura	7	7	0	2	0	0	16	
Irymple	0	1	0	0	0	0	1	
Merbein	0	1	0	0	0	0	1	
Red Cliffs	0	3	0	3	0	0	7	
Robinvale	1	0	0	0	0	0	1	
Nyah	0	1	0	0	0	0	1	
Nyah West	0	0	0	0	0	0	0	
Woorinen	0	0	0	0	0	0	0	
Piangil	1	1	0	0	0	1	3	
Swan Hill	2	1	1	0	0	1	5	
Lake Boga	0	0	0	0	0	0	0	
Wakool	0	0	0	0	0	0	0	
Koondrook	0	0	0	0	0	0	0	
Murrabit	0	0	0	0	0	0	0	
Kerang	1	0	0	0	0	0	1	
Total	12	15	1	5	0	2	35	

TABLE 8C - Number of water quality complaints

TYPE OF COMPLAINT	NO. OF COMPLAINT	NO. OF COMPLAINTS PER 100 CUSTOMERS SUPPLIED
Colour	12	0.035
Taste and Odour	15	0.044
Blue Water	1	0.003
Alleged Illness	5	0.015
Air in Water	0	0.000
Other	2	0.006
TOTAL	35	0.102

Risk Management Plan Audit Results

Audit Process

Pursuant to the SDWA, LMW were required to undertake an independent audit of their risk management plan on behalf of DHHS. The audit took place under Auditor Approval Notice No. 167, dated 20 February 2020, with DHHS reference number HHSD/20/36635, in relation to the LMW's Risk Management Plan.

The purpose of the audit was to assess LMW's compliance with the Act and the Guidelines, as well as relevant aspects of the DHHS 'Risk Management Plan Regulatory Audit Guidance Information' issued in September 2017. The audit period was 29th May 2018 to 13th March 2020 inclusive.

Within the scope of the audit, LMW was found to be compliant with its obligations under the Act, Regulations and audit guidelines. Therefore, a compliant audit finding was made by the auditor under the Act and on behalf of DHHS. An audit certificate of compliance is attached in Appendix B.

The audit identified a total of 19 Opportunities for Improvement (OFI) in the Kerang, Swan Hill and Piangil water supply systems respectively, and five more broadly and applicable to multiple systems. A summary of the OFI's and our actions undertaken in response to each OFI is provided below. Audit recommendations are represented in italics.



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) being 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.

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.

3. *For the Kerang WTP wet rack and lab area consideration could be given to including a maximum thermometer to check and, if required, installing temperature control stabilise temperature.*

The operation's team has discussed this OFI at the latest DWQM team meeting, which took place on 6th August 2020, and a decision was made to install a second air conditioner in the wet rack area.

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.

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, where the missing bolts were reinstated, vermin proofing was repaired and the frequency of the roof inspection and cleaning was reviewed.

- 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 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.

Swan Hill WTP and supply system

- 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.

- The Swan Hill treated water storage tank should be assessed to ensure risks from backflowing gutters are mitigated.

The Superintendent Civil Maintenance is reviewing the storage inspection frequency and cleaning requirements.

- 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 in the past two months, and now gives the Swan Hill team a good selection of contractors to use at their disposal.

- 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 her 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 few months ago, 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.

- Contamination risks at the 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 maintenance staff knowledge of assets conditions assessment, awareness of risks to water quality, timely communication to supervisors and/or managers, and that required actions are undertaken to mitigate risks and rectify any issues.



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.

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.

Those 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.

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 next DWQMT meeting.

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.

4. *For some parameters it would be useful to have a setpoint \pm 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.

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 always look at options to optimise the treatment process, however, consideration is given to the water source, as whilst the all water treatment plants use the Murray River as the only raw water supply source, Kerang WTP has multiple sources, this includes the Murray and Loddon rivers, and the 14/2 Channel. Therefore, and based on historical performance, Alum has been successfully used at the WTP, regardless of the mixing ratio and the final raw water quality. In addition, ACH use at Kerang WTP was successfully trialed and will be used, if required.

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, Manager Plant Operations and Maintenance, Water Quality Technologist, Team Leader Operations, two Engineering Officers, and Electrical/Instrumentation Technician.

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, 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, 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 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; provides clearer water for domestic uses such as washing, and farmers can benefit as well by reducing impact on their spraying equipment.

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.



Kerang Water Treatment Plant

Appendices



A. Water Quality Tables	27
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Appendix A - Water Quality Tables

All samples were taken in reticulations unless otherwise noted.

TABLES 1 TO 3

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	53	0	0	0
Kerang	Weekly	52	0	0	0
Koondrook	Weekly	52	0	0	0
Lake Boga	Weekly	53	0	0	0
Merbein	Weekly	53	0	0	0
Mildura	Weekly	118	0	0	0
Murrabit	Weekly	52	0	0	0
Nyah	Weekly	53	0	0	0
Nyah West	Weekly	53	0	0	0
Piangil	Weekly	53	0	0	0
Red Cliffs	Weekly	53	0	0	0
Robinvale	Weekly	53	0	0	0
Swan Hill	Weekly	77	0	0	0
Woorinen Sth	Weekly	53	0	0	0

**Additional number of samples were taken for Mildura & Swan Hill due to the larger populations serviced by these supplies. Koondrook, Murrabit and Kerang have 52 samples each due to the sampling schedule falling either side of the 19-20 end of financial year, mid-week.

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	0.033	0.018	0
Kerang	Monthly	12	0.25	0.032	0.025	0
Koondrook	Weekly	12	0.25	0.052	0.028	0
Lake Boga	Weekly	12	0.25	0.048	0.027	0
Merbein	Weekly	12	0.25	0.035	0.023	0
Mildura	Weekly	12	0.25	0.033	0.015	0
Murrabit	Weekly	12	0.25	0.04	0.023	0
Nyah	Weekly	12	0.25	0.051	0.035	0
Nyah West	Weekly	12	0.25	0.053	0.034	0
Piangil	Weekly	12	0.25	0.043	0.027	0
Red Cliffs	Weekly	12	0.25	0.044	0.027	0
Robinvale	Weekly	12	0.25	0.029	0.023	0
Swan Hill	Weekly	12	0.25	0.036	0.016	0
Woorinen Sth	Weekly	12	0.25	0.047	0.03	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	53	0.2	0.1	0
Kerang	Weekly	52	0.4	0.1	0
Koondrook	Weekly	52	0.5	0.1	0
Lake Boga	Weekly	53	0.6	0.1	0
Merbein	Weekly	52*	0.5	0.1	0
Mildura	Weekly	53	1.3	0.2	0
Murrabit	Weekly	52	0.6	0.1	0
Nyah	Weekly	53	<0.1	0.1	0
Nyah West	Weekly	53	0.2	0.1	0
Piangil	Weekly	53	0.2	0.1	0
Red Cliffs	Weekly	53	0.9	0.2	0
Robinvale	Weekly	53	2.4	0.2	0
Swan Hill	Weekly	53	0.2	0.1	0
Woorinen Sth	Weekly	53	0.2	0.1	0

* 52 Turbidity samples performed for Merbein instead of 53. A sample for 7/10/2019 was not undertaken due to laboratory scheduling error. Therefore, the weekly compliance was not met. An internal check of Water Treatment Plant performance was undertaken, to verify that no suspect or non-compliant water was supplied during the week leading up to, and on this date.

TABLES 4 TO 39

Tables 4 to 36 inclusive are results reporting against the Australian Drinking Water Guidelines 2011 (ADWG), health & aesthetic guidelines.

Tables 9 to 20 & 34 to 39, inclusive, are parameters from samples taken from LMW's nine water treatment plants entering the reticulation system, eight 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 nine water treatment plants.

Tables 17 to 20 & 33 to 39 inclusive, which have three-monthly scheduling, have five samples reported for Mildura supply as both the Mildura & Mildura West WTP's were operating simultaneously for six months of the quarterly sampling events. Tables 21 to 28, 31 & 32 Inclusive, which also have three-monthly scheduling, only had four samples reported for Mildura supply, as only Mildura WTP was operating at the times of sample scheduling. Mildura West WTP was online from mid November 2019 through to late April 2020 and was only sampled in February. Quarterly samples are taken the first week of Feb, May, Aug & Nov.

Tables 5, 9 to 16, 18 to 22, 25 to 27, 29, & 32, 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 0.6 – 1.0 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	Monthly	12	1.5	0.8	0.83	0.74	0
Kerang	Monthly	12	1.5	0.8	0.74	0.73	0
Lake Boga	Monthly	12	1.5	0.8	0.83	0.52	0
Merbein	Monthly	12	1.5	0.8	0.83	0.55	0
Mildura	Monthly	12	1.5	0.8	0.82	0.68	0
Nyah	Monthly	12	1.5	0.8	0.86	0.52	0
Nyah West	Monthly	12	1.5	0.8	0.84	0.52	0
Red Cliffs	Monthly	12	1.5	0.8	0.74	0.74	0
Robinvale	Monthly	12	1.5	0.8	0.73	0.71	0
Swan Hill	Monthly	12	1.5	0.8	0.84	0.57	0
Woorinen Sth	Monthly	12	1.5	0.8	0.86	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 (YES/NO)
Irymple	Monthly	12	<0.005	Yes
Kerang	Monthly	12	<0.005	Yes
Koondrook	Monthly	12	<0.005	Yes
Lake Boga	Monthly	12	<0.005	Yes
Merbein	Monthly	12	<0.005	Yes
Mildura	Monthly	12	<0.005	Yes
Murrabit	Monthly	12	<0.005	Yes
Nyah	Monthly	12	<0.005	Yes
Nyah West	Monthly	12	<0.005	Yes
Piangil	Monthly	12	<0.005	Yes
Red Cliffs	Monthly	12	<0.005	Yes
Robinvale	Monthly	12	<0.005	Yes
Swan Hill	Monthly	12	<0.005	Yes
Woorinen Sth	Monthly	12	<0.005	Yes

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

Table 6 Dichloroacetic Acid

Health Guideline Value (ADWG) 0.1 mg/L

WATER SAMPLING LOCALITY	FREQUENCY OF SAMPLING	NUMBER OF SAMPLES	MAXIMUM (MG/L)	AVERAGE (MG/L)	AVERAGE CHANGE *COMPARISON OF PAST 2 REPORTING PERIODS	MET ADWG GUIDELINE VALUE (YES/NO)
Irymple	Monthly	12	0.014	0.009	No Change	Yes
Kerang	Monthly	12	0.011	0.008	Increased	Yes
Koondrook	Monthly	12	0.026	0.011	Increased	Yes
Lake Boga	Monthly	12	0.025	0.011	Increased	Yes
Merbein	Monthly	12	0.012	0.007	No Change	Yes
Mildura	Monthly	12	0.008	0.007	No Change	Yes
Murrabit	Monthly	12	0.02	0.009	No Change	Yes
Nyah	Monthly	12	<0.02	0.011	Decreased	Yes
Nyah West	Monthly	12	0.014	0.010	No Change	Yes
Piangil	Monthly	12	0.018	0.010	Increased	Yes
Red Cliffs	Monthly	12	0.013	0.008	No Change	Yes
Robinvale	Monthly	12	0.011	0.007	No Change	Yes
Swan Hill	Monthly	12	0.013	0.008	No Change	Yes
Woorinen Sth	Monthly	12	0.013	0.009	No Change	Yes

Table 7 Trichloroacetic Acid

Health Guideline Value (ADWG) 0.1 mg/L

WATER SAMPLING LOCALITY	FREQUENCY OF SAMPLING	NUMBER OF SAMPLES	MAXIMUM (MG/L)	AVERAGE (MG/L)	AVERAGE CHANGE *COMPARISON OF PAST 2 REPORTING PERIODS	MET ADWG GUIDELINE VALUE (YES/NO)
Irymple	Monthly	12	0.006	0.006	No Change	Yes
Kerang	Monthly	12	0.011	0.009	No Change	Yes
Koondrook	Monthly	12	0.023	0.010	Increased	Yes
Lake Boga	Monthly	12	0.019	0.009	No Change	Yes
Merbein	Monthly	12	0.01	0.009	No Change	Yes
Mildura	Monthly	12	<0.005	<0.005	No Change	Yes
Murrabit	Monthly	12	0.021	0.009	No Change	Yes
Nyah	Monthly	12	0.02	0.011	Increased	Yes
Nyah West	Monthly	12	0.02	0.010	Increased	Yes
Piangil	Monthly	12	0.021	0.010	No Change	Yes
Red Cliffs	Monthly	12	0.012	0.008	No Change	Yes
Robinvale	Monthly	12	0.01	0.007	No Change	Yes
Swan Hill	Monthly	12	0.012	0.009	No Change	Yes
Woorinen Sth	Monthly	12	0.018	0.009	Increased	Yes

Table 8 Aluminium

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

LMW uses Aluminium Chlorohydrate or Aluminium Sulphate at our water treatment plants as a coagulant. This can result in the presence of acid soluble aluminium within drinking water. Should acid soluble aluminium exceed a concentration of 0.2 mg/L, a white gelatinous precipitate can form within the distribution network causing “milky coloured” water (depending on the pH of the water).

WATER SAMPLING LOCALITY	FREQUENCY OF SAMPLING	NUMBER OF SAMPLES	MAXIMUM (MG/L)	AVERAGE (MG/L)	AVERAGE CHANGE *COMPARISON OF PAST 2 REPORTING PERIODS	MET ADWG GUIDELINE VALUE (YES/NO)
Irymple	Monthly	12	0.03	0.02	Increased	Yes
Kerang	Monthly	12	<0.01	<0.01	No Change	Yes
Koondrook	Monthly	12	0.03	0.017	No Change	Yes
Lake Boga	Monthly	12	0.03	0.017	No Change	Yes
Merbein	Monthly	12	0.04	0.023	Increased	Yes
Mildura	Monthly	12	0.15	0.036	Increased	Yes
Murrabit	Monthly	12	0.02	0.013	No Change	Yes
Nyah	Monthly	12	0.03	0.021	Increased	Yes
Nyah West	Monthly	12	0.03	0.02	Increased	Yes
Piangil	Monthly	12	0.22	0.051	Increased	Yes
Red Cliffs	Monthly	12	0.08	0.025	Decreased	Yes
Robinvale	Monthly	12	0.02	0.014	No Change	Yes
Swan Hill	Monthly	12	0.03	0.020	No Change	Yes
Woorinen Sth	Monthly	12	0.03	0.023	No Change	Yes

Table 9 2,4 Dichlorophenoxy acetic acid

Health Guideline Value (ADWG) 0.03 mg/L

WATER SAMPLING LOCALITY	FREQUENCY OF SAMPLING	NUMBER OF SAMPLES	MAXIMUM MG/L	MET ADWG GUIDELINE VALUE (YES/NO)
Kerang	6 Monthly	2	<0.01	Yes
Koondrook	6 Monthly	2	<0.01	Yes
Mildura	6 Monthly	2	<0.01	Yes
Murrabit	6 Monthly	2	<0.01	Yes
Piangil	6 Monthly	2	<0.01	Yes
Red Cliffs	6 Monthly	2	<0.01	Yes
Robinvale	6 Monthly	2	<0.01	Yes
Swan Hill	6 Monthly	2	<0.01	Yes

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

Table 10 Benzene

Health Guideline Value (ADWG) 0.001 mg/L

WATER SAMPLING LOCALITY	FREQUENCY OF SAMPLING	NUMBER OF SAMPLES	MAXIMUM MG/L	MET ADWG GUIDELINE VALUE (YES/NO)
Kerang	6 Monthly	2	<0.001	Yes
Koondrook	6 Monthly	2	<0.001	Yes
Mildura	6 Monthly	2	<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

Health Guideline Value (ADWG) 0.003 mg/L

WATER SAMPLING LOCALITY	FREQUENCY OF SAMPLING	NUMBER OF SAMPLES	MAXIMUM MG/L	MET ADWG GUIDELINE VALUE (YES/NO)
Kerang	6 Monthly	2	<0.001	Yes
Koondrook	6 Monthly	2	<0.001	Yes
Mildura	6 Monthly	2	<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

Health Guideline Value (ADWG) 0.003 mg/L

WATER SAMPLING LOCALITY	FREQUENCY OF SAMPLING	NUMBER OF SAMPLES	MAXIMUM MG/L	MET ADWG GUIDELINE VALUE (YES/NO)
Kerang	6 Monthly	2	<0.001	Yes
Koondrook	6 Monthly	2	<0.001	Yes
Mildura	6 Monthly	2	<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

Health Guideline Value (ADWG) 0.03 mg/L

WATER SAMPLING LOCALITY	FREQUENCY OF SAMPLING	NUMBER OF SAMPLES	MAXIMUM MG/L	MET ADWG GUIDELINE VALUE (YES/NO)
Kerang	6 Monthly	2	<0.001	Yes
Koondrook	6 Monthly	2	<0.001	Yes
Mildura	6 Monthly	2	<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 14 Pentachlorophenol

Health Guideline Value (ADWG) 0.01 mg/L

WATER SAMPLING LOCALITY	FREQUENCY OF SAMPLING	NUMBER OF SAMPLES	MAXIMUM MG/L	MET ADWG GUIDELINE VALUE (YES/NO)
Kerang	6 Monthly	2	<0.001	Yes
Koondrook	6 Monthly	2	<0.001	Yes
Mildura	6 Monthly	2	<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 (YES/NO)
Kerang	6 Monthly	2	<0.001	Yes
Koondrook	6 Monthly	2	<0.001	Yes
Mildura	6 Monthly	2	<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

Health Guideline Value (ADWG) 0.02 mg/L

WATER SAMPLING LOCALITY	FREQUENCY OF SAMPLING	NUMBER OF SAMPLES	MAXIMUM MG/L	MET ADWG GUIDELINE VALUE (YES/NO)
Kerang	6 Monthly	2	<0.001	Yes
Koondrook	6 Monthly	2	<0.001	Yes
Mildura	6 Monthly	2	<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

Aesthetic Guideline Value (ADWG) 250 mg/L

WATER SAMPLING LOCALITY	FREQUENCY OF SAMPLING	NUMBER OF SAMPLES	MAXIMUM (MG/L)	AVERAGE (MG/L)	AVERAGE CHANGE *COMPARISON OF PAST 2 REPORTING PERIODS	MET ADWG GUIDELINE VALUE (YES/NO)
Kerang	3 Monthly	4	49	36.5	Increased	Yes
Koondrook	3 Monthly	4	17	15.25	Increased	Yes
Mildura	3 Monthly	5	31	25.4	Increased	Yes
Murrabit	3 Monthly	4	2	1.75	Increased	Yes
Piangil	3 Monthly	4	16	15.25	Decreased	Yes
Red Cliffs	3 Monthly	4	24	22.5	Decreased	Yes
Robinvale	3 Monthly	4	28	22.75	Decreased	Yes
Swan Hill	3 Monthly	4	3	2.67	No change	Yes

Table 18 Arsenic

Health Guideline Value (ADWG) 0.01 mg/L

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

WATER SAMPLING LOCALITY	FREQUENCY OF SAMPLING	NUMBER OF SAMPLES	MAXIMUM MG/L	MET ADWG GUIDELINE VALUE (YES/NO)
Kerang	3 Monthly	4	<0.001	Yes
Koondrook	3 Monthly	4	<0.001	Yes
Mildura	3 Monthly	5	<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 19 Selenium

Health Guideline Value (ADWG) 0.01 mg/L

WATER SAMPLING LOCALITY	FREQUENCY OF SAMPLING	NUMBER OF SAMPLES	MAXIMUM MG/L	MET ADWG GUIDELINE VALUE (YES/NO)
Kerang	3 Monthly	4	<0.001	Yes
Koondrook	3 Monthly	4	<0.001	Yes
Mildura	3 Monthly	5	<0.001	Yes
Murrabit	3 Monthly	4	<0.001	Yes
Piangil	3 Monthly	4	<0.001	Yes
Red Cliffs	3 Monthly	4	<0.001	Yes
Robinvale	3 Monthly	4	<0.001	Yes
Swan Hill	3 Monthly	4	<0.001	Yes

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

Table 20 Mercury

Health Guideline Value (ADWG) 0.001 mg/L

WATER SAMPLING LOCALITY	FREQUENCY OF SAMPLING	NUMBER OF SAMPLES	MAXIMUM MG/L	MET ADWG GUIDELINE VALUE (YES/NO)
Kerang	3 Monthly	4	<0.001	Yes
Koondrook	3 Monthly	4	<0.001	Yes
Mildura	3 Monthly	5	<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 previous 2 reporting periods.

Table 21 Lead

Health Guideline Value (ADWG) 0.01 mg/L

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

WATER SAMPLING LOCALITY	FREQUENCY OF SAMPLING	NUMBER OF SAMPLES	MAXIMUM MG/L	MET ADWG GUIDELINE VALUE (YES/NO)
Irymple	3 Monthly	4	<0.001	Yes
Kerang	3 Monthly	4	0.002	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	0.002	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.

Table 22 Nickel

Health Guideline Value (ADWG) 0.02 mg/L

WATER SAMPLING LOCALITY	FREQUENCY OF SAMPLING	NUMBER OF SAMPLES	MAXIMUM MG/L	MET ADWG GUIDELINE VALUE (YES/NO)
Irymple	3 Monthly	4	<0.001	Yes
Kerang	3 Monthly	4	<0.001	Yes
Koondrook	3 Monthly	4	<0.001	Yes
Lake Boga	3 Monthly	4	<0.001	Yes
Merbein	3 Monthly	4	<0.001	Yes
Mildura	3 Monthly	4	<0.001	Yes
Murrabit	3 Monthly	4	<0.001	Yes
Nyah	3 Monthly	4	<0.001	Yes
Nyah West	3 Monthly	4	<0.001	Yes
Piangil	3 Monthly	4	<0.001	Yes
Red Cliffs	3 Monthly	4	<0.001	Yes
Robinvale	3 Monthly	4	<0.001	Yes
Swan Hill	3 Monthly	4	<0.001	Yes
Woorinen Sth	3 Monthly	4	<0.001	Yes

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

Table 23 Zinc

Aesthetic Guideline Value (ADWG) 3 mg/L

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

WATER SAMPLING LOCALITY	FREQUENCY OF SAMPLING	NUMBER OF SAMPLES	MAXIMUM (MG/L)	AVERAGE (MG/L)	AVERAGE CHANGE *COMPARISON OF PAST 2 REPORTING PERIODS	MET ADWG GUIDELINE VALUE (YES/NO)
Irymple	3 Monthly	4	0.008	0.005	Increased	Yes
Kerang	3 Monthly	4	0.022	0.015	Increased	Yes
Koondrook	3 Monthly	4	0.011	0.007	Increased	Yes
Lake Boga	3 Monthly	4	0.014	0.007	Increased	Yes
Merbein	3 Monthly	4	0.005	0.004	Declined	Yes
Mildura	3 Monthly	4	0.018	0.008	Increased	Yes
Murrabit	3 Monthly	4	0.011	0.006	Increased	Yes
Nyah	3 Monthly	4	0.012	0.007	Increased	Yes
Nyah West	3 Monthly	4	0.007	0.005	Declined	Yes
Piangil	3 Monthly	4	0.025	0.013	Increased	Yes
Red Cliffs	3 Monthly	4	0.008	0.006	Declined	Yes
Robinvale	3 Monthly	4	0.007	0.005	No change	Yes
Swan Hill	3 Monthly	4	0.005	0.004	Increased	Yes
Woorinen Sth	3 Monthly	4	0.03	0.016	Increased	Yes

Table 24 Nitrate Nitrogen

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

WATER SAMPLING LOCALITY	FREQUENCY OF SAMPLING	NUMBER OF SAMPLES	MAXIMUM (MG/L)	AVERAGE (MG/L)	AVERAGE CHANGE *COMPARISON OF PAST 2 REPORTING PERIODS	MET ADWG GUIDELINE VALUE (YES/NO)
Irymple	3 Monthly	4	0.04	0.030	No change	Yes
Kerang	3 Monthly	4	0.12	0.100	Increased	Yes
Koondrook	3 Monthly	4	0.1	0.067	No change	Yes
Lake Boga	3 Monthly	4	0.08	0.037	No change	Yes
Merbein	3 Monthly	4	0.07	0.070	No change	Yes
Mildura	3 Monthly	4	0.08	0.043	No change	Yes
Murrabit	3 Monthly	4	0.12	0.095	Increased	Yes
Nyah	3 Monthly	4	0.03	0.027	No change	Yes
Nyah West	3 Monthly	4	0.06	0.040	No change	Yes
Piangil	3 Monthly	4	0.08	0.053	No change	Yes
Red Cliffs	3 Monthly	4	0.05	0.038	Increased	Yes
Robinvale	3 Monthly	4	0.1	0.046	Increased	Yes
Swan Hill	3 Monthly	4	0.08	0.040	No change	Yes
Woorinen Sth	3 Monthly	4	0.06	0.040	No change	Yes

Table 25 Cyanide

Health Guideline Value (ADWG) 0.08 mg/L

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

WATER SAMPLING LOCALITY	FREQUENCY OF SAMPLING	NUMBER OF SAMPLES	MAXIMUM MG/L	MET ADWG GUIDELINE VALUE (YES/NO)
Irymple	3 Monthly	4	<0.005	Yes
Kerang	3 Monthly	4	<0.005	Yes
Koondrook	3 Monthly	4	0.005	Yes
Lake Boga	3 Monthly	4	<0.005	Yes
Merbein	3 Monthly	4	<0.005	Yes
Mildura	3 Monthly	4	<0.005	Yes
Murrabit	3 Monthly	4	<0.005	Yes
Nyah	3 Monthly	4	<0.005	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.

Table 26 Chromium

Health Guideline Value (ADWG) 0.05 mg/L

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

WATER SAMPLING LOCALITY	FREQUENCY OF SAMPLING	NUMBER OF SAMPLES	MAXIMUM MG/L	MET ADWG GUIDELINE VALUE (YES/NO)
Irymple	3 Monthly	4	<0.001	Yes
Kerang	3 Monthly	4	<0.001	Yes
Koondrook	3 Monthly	4	<0.001	Yes
Lake Boga	3 Monthly	4	<0.001	Yes
Merbein	3 Monthly	4	<0.001	Yes
Mildura	3 Monthly	4	<0.001	Yes
Murrabit	3 Monthly	4	<0.001	Yes
Nyah	3 Monthly	4	<0.001	Yes
Nyah West	3 Monthly	4	<0.001	Yes
Piangil	3 Monthly	4	<0.001	Yes
Red Cliffs	3 Monthly	4	<0.001	Yes
Robinvale	3 Monthly	4	<0.001	Yes
Swan Hill	3 Monthly	4	<0.001	Yes
Woorinen Sth	3 Monthly	4	<0.001	Yes

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

Table 27 Cadmium

Health Guideline Value (ADWG) 0.002 mg/L

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

WATER SAMPLING LOCALITY	FREQUENCY OF SAMPLING	NUMBER OF SAMPLES	MAXIMUM MG/L	MET ADWG GUIDELINE VALUE (YES/NO)
Irymple	3 Monthly	4	<0.0002	Yes
Kerang	3 Monthly	4	<0.0002	Yes
Koondrook	3 Monthly	4	<0.0002	Yes
Lake Boga	3 Monthly	4	<0.0002	Yes
Merbein	3 Monthly	4	<0.0002	Yes
Mildura	3 Monthly	4	<0.0002	Yes
Murrabit	3 Monthly	4	<0.0002	Yes
Nyah	3 Monthly	4	<0.0002	Yes
Nyah West	3 Monthly	4	<0.0002	Yes
Piangil	3 Monthly	4	<0.0002	Yes
Red Cliffs	3 Monthly	4	<0.0002	Yes
Robinvale	3 Monthly	4	<0.0002	Yes
Swan Hill	3 Monthly	4	<0.0002	Yes
Woorinen Sth	3 Monthly	4	<0.0002	Yes

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

Table 28 Copper

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

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

WATER SAMPLING LOCALITY	FREQUENCY OF SAMPLING	NUMBER OF SAMPLES	DRINKING WATER QUALITY STANDARD (MG/L)	MAXIMUM MG/L	AVERAGE (MG/L)	AVERAGE CHANGE *COMPARISON OF PAST 2 REPORTING PERIODS	Number of samples where standard was not met (s. 18)
Irymple	3 Monthly	4	2	0.005	0.003	Declined	0
Kerang	3 Monthly	4	2	0.009	0.008	Declined	0
Koondrook	3 Monthly	4	2	0.027	0.018	Increased	0
Lake Boga	3 Monthly	4	2	0.048	0.021	Increased	0
Merbein	3 Monthly	4	2	0.008	0.006	No Change	0
Mildura	3 Monthly	4	2	0.004	0.003	Declined	0
Murrabit	3 Monthly	4	2	0.014	0.010	Increased	0
Nyah	3 Monthly	4	2	0.024	0.010	Increased	0
Nyah West	3 Monthly	4	2	0.016	0.016	Declined	0
Piangil	3 Monthly	4	2	0.046	0.028	Increased	0
Red Cliffs	3 Monthly	4	2	0.007	0.005	Increased	0
Robinvale	3 Monthly	4	2	0.017	0.012	Increased	0
Swan Hill	3 Monthly	4	2	0.016	0.011	Declined	0
Woorinen Sth	3 Monthly	4	2	0.009	0.006	Declined	0

Table 29 Manganese

Health Guideline Value (ADWG) 0.5 mg/L

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

WATER SAMPLING LOCALITY	FREQUENCY OF SAMPLING	NUMBER OF SAMPLES	MAXIMUM MG/L	AVERAGE CHANGE *COMPARISON OF PAST 2 REPORTING PERIODS	MET ADWG GUIDELINE VALUE (YES/NO)
Irymple	3 Monthly	4	0.002	No Change	Yes
Kerang	3 Monthly	4	0.008	Increased	Yes
Koondrook	3 Monthly	4	0.012	Increased	Yes
Lake Boga	3 Monthly	4	<0.001	Increased	Yes
Merbein	3 Monthly	4	0.005	No Change	Yes
Mildura	3 Monthly	4	0.005	No Change	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	0.012	No Change	Yes
Red Cliffs	3 Monthly	4	<0.001	Decreased	Yes
Robinvale	3 Monthly	4	0.004	Decreased	Yes
Swan Hill	3 Monthly	4	<0.001	No Change	Yes
Woorinen Sth	3 Monthly	4	<0.001	No Change	Yes

Table 30 pH

Aesthetic Guideline Range (ADWG) 6.5-8.5 pH Units

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

WATER SAMPLING LOCALITY	FREQUENCY OF SAMPLING	NUMBER OF SAMPLES	MINIMUM PH UNITS	MAXIMUM PH UNITS	AVERAGE PH UNITS	AVERAGE CHANGE *COMPARISON OF PAST 2 REPORTING PERIODS	Aesthetic operating range
Irymple	Weekly	53	7.7	7	7.3	Increased	6.5-8.5
Kerang	Weekly	52	7.5	7	7.3	Increased	6.5-8.5
Koondrook	Weekly	52	7.4	6.5	7.2	Increased	6.5-8.5
Lake Boga	Weekly	53	7.6	7.2	7.4	Increased	6.5-8.5
Merbein	Weekly	52	7.5	7.1	7.2	Increased	6.5-8.5
Mildura	Weekly	53	7.4	7	7.2	Increased	6.5-8.5
Murrabit	Weekly	52	7.4	6.9	7.2	Increased	6.5-8.5
Nyah	Weekly	53	7.4	6.9	7.2	Increased	6.5-8.5
Nyah West	Weekly	53	7.5	7	7.2	Increased	6.5-8.5
Piangil	Weekly	53	7.9	7	7.3	Increased	6.5-8.5
Red Cliffs	Weekly	53	7.8	7.2	7.5	Increased	6.5-8.5
Robinvale	Weekly	53	7.7	7	7.4	Increased	6.5-8.5
Swan Hill	Weekly	53	7.4	7	7.3	Increased	6.5-8.5
Woorinen Sth	Weekly	53	7.5	7	7.2	Increased	6.5-8.5

Table 31 Colour

Aesthetic Guideline Value (ADWG) 15 HU*

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

WATER SAMPLING LOCALITY	FREQUENCY OF SAMPLING	NUMBER OF SAMPLES	MAXIMUM PT/CO UNITS*	AVERAGE PT/CO UNITS*	AVERAGE CHANGE *COMPARISON OF PAST 2 REPORTING PERIODS	MET ADWG GUIDELINE VALUE (YES/NO)
Irymple	Monthly	12	4	2	No change	Yes
Kerang	Monthly	12	4	2	No change	Yes
Koondrook	Monthly	12	4	2	No change	Yes
Lake Boga	Monthly	12	4	2	No change	Yes
Merbein	Monthly	12	4	2	No change	Yes
Mildura	Monthly	12	4	2	No change	Yes
Murrabit	Monthly	12	4	2	No change	Yes
Nyah	Monthly	12	4	2	No change	Yes
Nyah West	Monthly	12	4	2	No change	Yes
Piangil	Monthly	12	4	2	No change	Yes
Red Cliffs	Monthly	12	4	2	No change	Yes
Robinvale	Monthly	12	4	2	No change	Yes
Swan Hill	Monthly	12	4	2	No change	Yes
Woorinen Sth	Monthly	12	4	2	No change	Yes

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

Table 32 Iron

Aesthetic Guideline Value (ADWG) 0.3 mg/L

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

WATER SAMPLING LOCALITY	FREQUENCY OF SAMPLING	NUMBER OF SAMPLES	MAXIMUM (MG/L)	AVERAGE CHANGE *COMPARISON OF PAST 2 REPORTING PERIODS	MET ADWG GUIDELINE VALUE (YES/NO)
Irymple	3 Monthly	4	0.03	No Change	Yes
Kerang	3 Monthly	4	<0.01	No Change	Yes
Koondrook	3 Monthly	4	0.02	No Change	Yes
Lake Boga	3 Monthly	4	<0.01	No Change	Yes
Merbein	3 Monthly	4	0.02	No Change	Yes
Mildura	3 Monthly	4	0.03	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.

Table 33 Hardness

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

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

WATER SAMPLING LOCALITY	FREQUENCY OF SAMPLING	NUMBER OF SAMPLES	MAXIMUM (MG/L)	AVERAGE (MG/L)	AVERAGE CHANGE *COMPARISON OF PAST 2 REPORTING PERIODS	MET ADWG GUIDELINE VALUE (YES/NO)
Kerang	3 Monthly	4	53	35.25	Increased	Yes
Koondrook	3 Monthly	4	17	14.75	Increased	Yes
Mildura	3 Monthly	5	41	32.8	Increased	Yes
Murrabit	3 Monthly	4	17	14.75	Increased	Yes
Piangil	3 Monthly	4	18	16.25	Decreased	Yes
Red Cliffs	3 Monthly	4	23	20.25	Decreased	Yes
Robinvale	3 Monthly	4	24	19.5	No change	Yes
Swan Hill	3 Monthly	4	19	16.5	Increased	Yes

Table 34 Chloride

Aesthetic Guideline Value (ADWG) 250 mg/L

WATER SAMPLING LOCALITY	FREQUENCY OF SAMPLING	NUMBER OF SAMPLES	MAXIMUM (MG/L)	AVERAGE (MG/L)	AVERAGE CHANGE *COMPARISON OF PAST 2 REPORTING PERIODS	MET ADWG GUIDELINE VALUE (YES/NO)
Kerang	3 Monthly	4	12	10	Increased	Yes
Koondrook	3 Monthly	4	10	6	Increased	Yes
Mildura	3 Monthly	5	17	11	Decreased	Yes
Murrabit	3 Monthly	4	12	7	Increased	Yes
Piangil	3 Monthly	4	13	7	Increased	Yes
Red Cliffs	3 Monthly	4	18	11	Decreased	Yes
Robinvale	3 Monthly	4	18	8	Decreased	Yes
Swan Hill	3 Monthly	4	20	8	Increased	Yes

Table 35 Sodium

Aesthetic Guideline Value (ADWG) 180 mg/L

WATER SAMPLING LOCALITY	FREQUENCY OF SAMPLING	NUMBER OF SAMPLES	MAXIMUM (MG/L)	AVERAGE (MG/L)	AVERAGE CHANGE *COMPARISON OF PAST 2 REPORTING PERIODS	MET ADWG GUIDELINE VALUE (YES/NO)
Kerang	3 Monthly	4	18	14.75	Increased	Yes
Koondrook	3 Monthly	4	9.5	9.025	Increased	Yes
Mildura	3 Monthly	5	9.1	7.48	Decreased	Yes
Murrabit	3 Monthly	4	6.6	5.65	Increased	Yes
Piangil	3 Monthly	4	10	9.4	Decreased	Yes
Red Cliffs	3 Monthly	4	21	16.25	Decreased	Yes
Robinvale	3 Monthly	4	24	21.25	Increased	Yes
Swan Hill	3 Monthly	4	11	7.875	Increased	Yes

Table 36 Conductivity

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

WATER SAMPLING LOCALITY	FREQUENCY OF SAMPLING	NUMBER OF SAMPLES	MAXIMUM (MG/L)	AVERAGE (MG/L)	AVERAGE CHANGE *COMPARISON OF PAST 2 REPORTING PERIODS	MET ADWG GUIDELINE VALUE (YES/NO)
Kerang	3 Monthly	4	190	97	Increased	Yes
Koondrook	3 Monthly	4	95	82	Increased	Yes
Mildura	3 Monthly	5	150	84	Decreased	Yes
Murrabit	3 Monthly	4	75	60	Increased	Yes
Piangil	3 Monthly	4	110	87	Decreased	Yes
Red Cliffs	3 Monthly	4	150	130	Decreased	Yes
Robinvale	3 Monthly	4	160	150	Increased	Yes
Swan Hill	3 Monthly	4	110	70	Increased	Yes

*Total dissolved solids 600 mg/L

Table 37 Calcium

No Guideline Value

WATER SAMPLING LOCALITY	FREQUENCY OF SAMPLING	NUMBER OF SAMPLES	MAXIMUM MG/L	AVERAGE (MG/L)
Kerang	3 Monthly	4	16	9.825
Koondrook	3 Monthly	4	3.1	2.6
Mildura	3 Monthly	5	13	9
Murrabit	3 Monthly	4	3	2.6
Piangil	3 Monthly	4	3.3	3
Red Cliffs	3 Monthly	4	4.4	3.775
Robinvale	3 Monthly	4	4.2	3.625
Swan Hill	3 Monthly	4	3.2	2.875

Table 38 Alkalinity (as CaCO3)

No Guideline Value

WATER SAMPLING LOCALITY	FREQUENCY OF SAMPLING	NUMBER OF SAMPLES	MAXIMUM MG/L	AVERAGE (MG/L)	AVERAGE CHANGE *COMPARISON OF PAST 2 REPORTING PERIODS
Kerang	3 Monthly	4	27	20.5	Decreased
Koondrook	3 Monthly	4	17	14	No Change
Mildura	3 Monthly	5	20	16.8	Decreased
Murrabit	3 Monthly	4	18	16.5	Decreased
Piangil	3 Monthly	4	18	15.75	Decreased
Red Cliffs	3 Monthly	4	19	17.5	No Change
Robinvale	3 Monthly	4	33	29.75	No Change
Swan Hill	3 Monthly	4	19	18.5	No Change

Table 39 Magnesium

No Guideline Value

WATER SAMPLING LOCALITY	FREQUENCY OF SAMPLING	NUMBER OF SAMPLES	MAXIMUM MG/L	AVERAGE (MG/L)	AVERAGE CHANGE *COMPARISON OF PAST 2 REPORTING PERIODS
Kerang	3 Monthly	4	3.3	2.7	No Change
Koondrook	3 Monthly	4	2.3	1.975	No Change
Mildura	3 Monthly	5	2.9	2.52	Decreased
Murrabit	3 Monthly	4	2.2	1.925	Decreased
Piangil	3 Monthly	4	2.3	2.075	Decreased
Red Cliffs	3 Monthly	4	2.9	2.625	Decreased
Robinvale	3 Monthly	4	3.2	2.55	Decreased
Swan Hill	3 Monthly	4	2.8	2.3	Decreased

Appendix B – Safe Drinking Water Act 2003 Audit Certificate

Risk management plan audit certificate

Safe Drinking Water Regulations 2015 - Regulation 10

Certificate Number:

167

Audit period:

29 May 2018 to 13 March 2020

To:

Muneeb Sunna, Manager Water Quality and Environment

Lower Murray Water, 741-759 Fourteenth St, Mildura, 3500

Australian Business Number (ABN):

18 475 808 826

I, Dr Daniel Deere, after conducting a risk management plan audit of

the water supplied by Lower Murray Water am of the opinion that -

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

Signature of approved auditor:

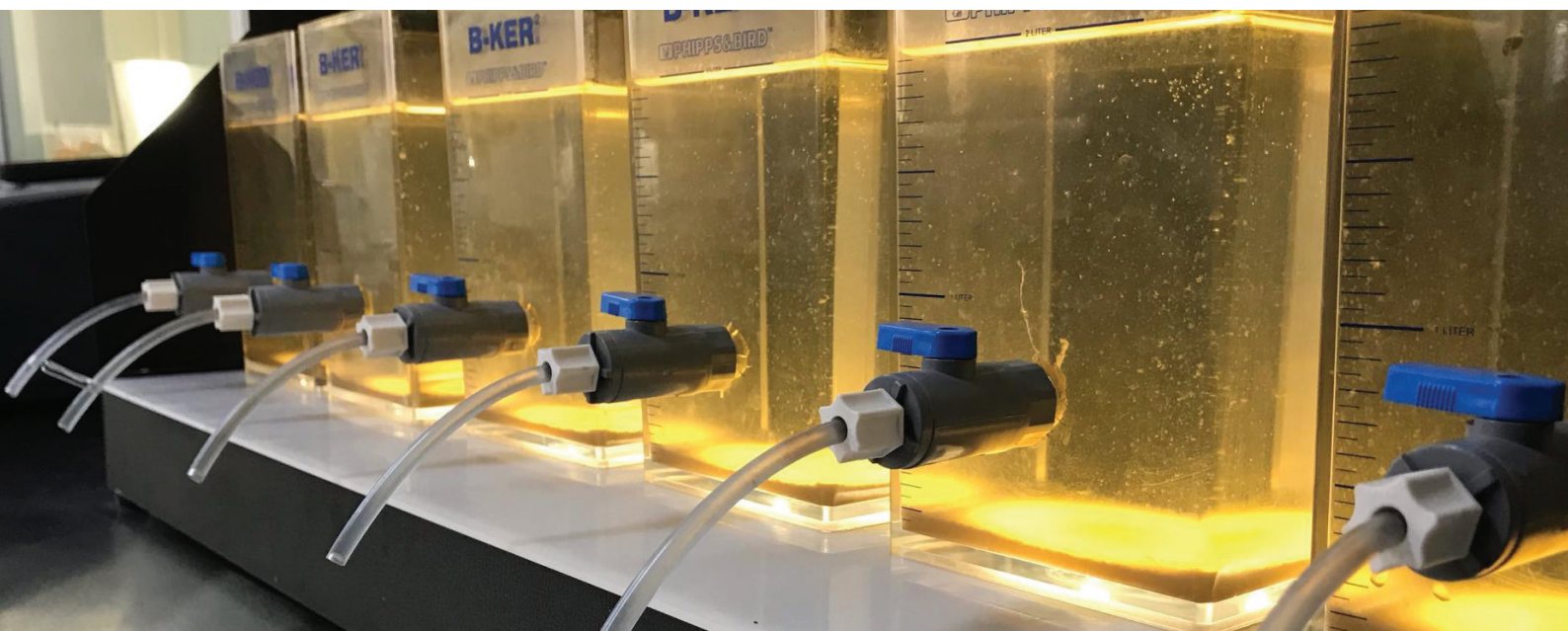
D Deere

Date:

29 May 2020



Mildura West Water Treatment Plant.



Jar testing at Mildura Water Treatment Plant

