



Mount Isa Water Board

Drinking Water Quality Management Plan (DWQMP)
Annual Report 2019-2020

Drinking Water Quality Management Plan

Annual Report 2019-2020

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Table 1: Service provider details:

DETAIL	INFORMATION
SPID	199
Name	Mount Isa Water Board
Address	PO Box 1712 Mount Isa QLD 4825
Telephone	07 4740 1000
Email	info@mountisawater.qld.gov.au
Website	www.mountisawater.qld.gov.au
Water Supply Schemes covered by this plan	Mount Isa

Glossary of terms

ADWG	Australian Drinking Water Guidelines (2011) Published by the National Health and Medical Research Council of Australia
CCP	Critical control point is the process step to which control can be applied and is essential to prevent a safety hazard
CFU/100mL	Colony forming units per 100 millilitres
CWL	Clear Water Lagoon
DBP's	Disinfection by-products
DNRME	Department of Natural Resources, Mines and Energy, the agency administering the Water Supply (Safety and Reliability) Act 2008
<i>E coli</i>	<i>Escherichia coli</i> , a bacterium which is considered to indicate the presence of faecal contamination and therefore potential health risk
ELISA	Enzyme linked immunosorbent assay, used for cyanotoxin testing
HAA	Haloacetic acid, a disinfection by-product formed by the reaction of halogens and organic acids
HU	Hazen units
>	Greater than
<	Less than
mg/L	Milligrams per litre
NTU	Nephelometric Turbidity Units
MPN/100mL	Most probable number of microorganisms per 100 millilitres
PFAS	Per- and polyfluoroalkyl substances
SCADA	Supervisory Control And Data Acquisition
µg/l	Micrograms per litre
THMs	Trihalomethanes, a disinfection by-product formed by the reaction of halogens and organic compounds

1. Introduction

This annual report documents the performance of the Mount Isa Water Board (MIWB) water service provider with respect to its Drinking Water Quality Management Plan (DWQMP) as required under the *Water Supply (Safety and Reliability) Act 2008* (the Act) for the financial year 2019 – 2020.

Using the Australian Drinking Water Guidelines and a risk-based approach, the MIWB DWQMP has been developed with the goal of protecting public health through the identification and minimisation of any public health related risks associated with drinking water.

A number of physical and chemical parameters have been monitored throughout the year inclusive of *Escherichia coli*, Cryptosporidium, Giardia, soluble metals and disinfection by-products; and are summarised below. A more detailed review of verification monitoring results is given in [Appendix A](#)

Details of compliance with water quality criteria.

Overview of 2019 – 2020 Outcomes

Drinking water treated by MIWB for Mount Isa continued to be improved in quality over the reporting period. Chlorine dosing continues to be optimised throughout the process. Disinfection by-product concentrations are continuing to decrease within the drinking water supply. The moving average over the last 5 years is shown below.

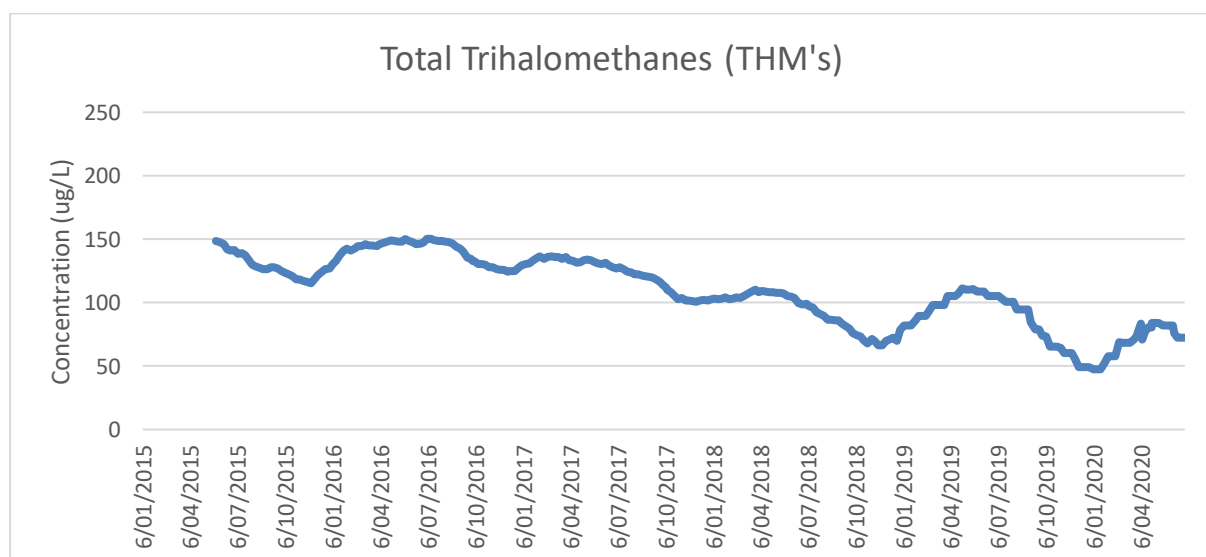


Figure 1 Total Trihalomethane (THM) concentrations drinking water supply

All drinking water test samples were free from *E.coli*, and despite the on-going blue-green algae bloom, cyanotoxins were controlled by oxidation with chlorine to below the limit of detection when using a NATA accredited method.

The four-yearly external audit of the DWQMP for MIWB was completed in June 2020; and submitted to the Water Supply Regulation group within the Department of Natural Resources, Mines and Energy (DNRME Water Supply Regulation) in June 2020. Fifteen requirements were audited of which ten were compliant, one was not required, and four minor non-conformances were noted.

Several additional physical and cyber-security measures were also implemented during the year.

2. Summary of scheme operated

MIWB provides bulk water treatment services to the local council and industrial customers. MIWB is a Category One Water Authority and Registered Service Provider (ID 199) established under the *Water Act 2000*. The Board operates as a commercialised statutory authority.

There are two sources of raw water that can be utilised: Lake Moondarra and Lake Julius. Water from either source is pumped via an aeration flume to oxygenate the water prior to entering a settling pond which utilises reed beds for natural filtration and sedimentation. Water follows from the Settling Pond into Clear Water Lagoon (CWL), a storage lagoon of approximately 2,300ML capacity. The CWL allows for residual suspended solids to be removed including any residual lead which has never been detected in product water. The Clear Water Lagoon is fenced along the access roads to minimise access by trespassers and cattle

Water is pumped to the Mount Isa Terminal Reservoir (MITR) from the Col Popple pump station located at Clear Water Lagoon, or additionally via a booster station.

The water at MITR undergoes a microfiltration treatment stage and chlorination before delivery to MIWB's sole drinking water customer - Mount Isa City Council (MICC). The daily demand of MIWB's three major customers is approximately 40-55 ML/day depending on seasonal changes and industrial customer's operational requirements.

A schematic for the water supply is presented in Figure 2:

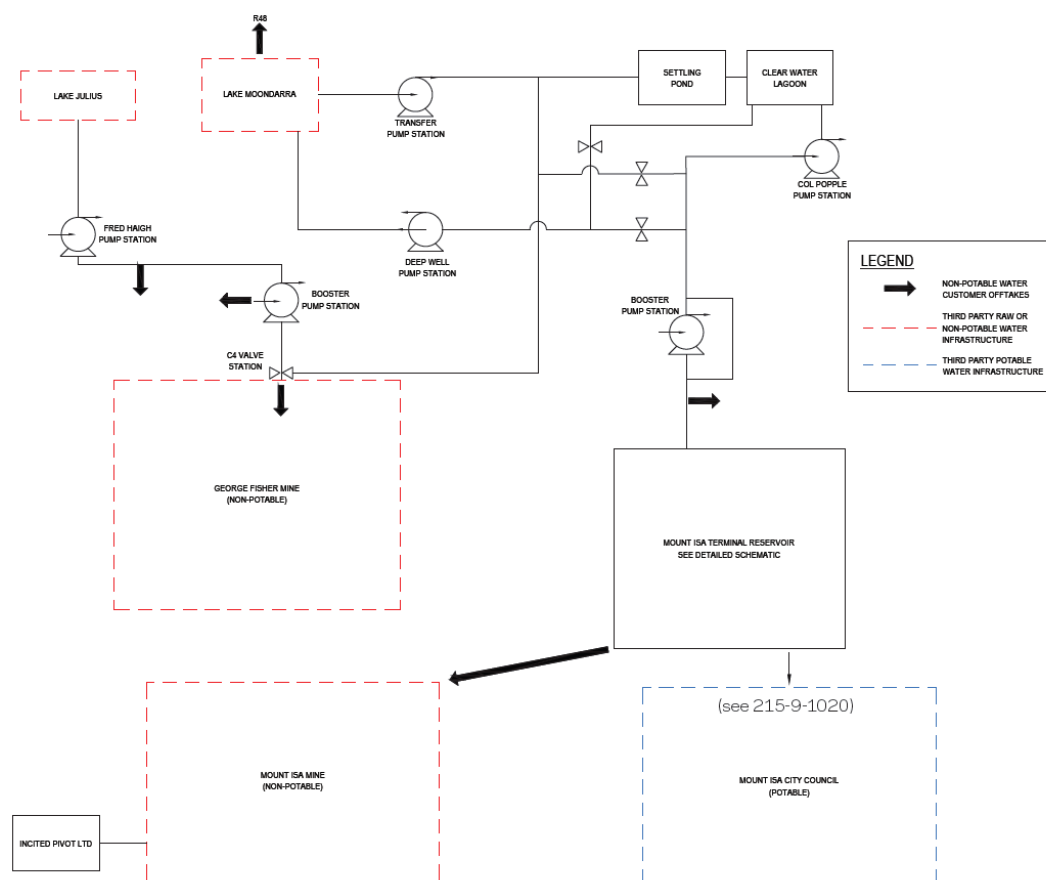


Figure 2: MIWB Drinking Water Supply Scheme

3. DWQMP Implementation

A number of critical control points (CCPs) have been identified within the system which are monitored. These CCPs can be actioned to prevent process excursions leading to non-compliant product.

In the reporting period of 2019 - 2020 there was one CCP event. The CCP event was supply of chlorinated potable water to a customer with chlorine below the CCP limit which occurred following the chlorine gas delivery system trip. The regulator was notified; and an investigation was conducted. Outcomes included training of Operators in the use of the SCADA system and new SCADA coding to shut down delivery pumps when chlorine delivery systems are not delivering chlorine.

The Operations Superintendent also meets fortnightly with the Chief Executive Officer and the Maintenance Superintendent, to discuss water quality and the implications for the DWQMP. The most recent analyses for disinfection by-products and other contaminants are trended in tabular or graphical form, and are discussed. Any operational changes that may affect water quality are also discussed at these meetings.

Progress against the risk management improvement program in the approved DWQMP is listed in this section and summarised in [Table 1 – Progress against the risk management improvement program](#)

Microbiological Contamination (HE-27 and HE-28)

MIWB has historically identified that protozoa such as cryptosporidium and giardia have been present at random times within the source water which has continued during the period with giardia detection in Lake Moondarra only. Giardia is removed by microfiltration.

Capital projects such as the replacement of the North, South and Header tanks have been identified. The construction of the Clean Water tanks were completed albeit significantly behind schedule. The piping tie-ins and commissioning have been completed post the end of the reporting period.

A trial configuration using a single pumping scenario was completed in 2018 which improved contact times (CT's) to and chlorine residuals with Mount Isa City Council system. The trial proved successful and a project to convert dual pump piping to a permanent single pumping configuration is underway. Design was completed in 2019 with initial works completed late 2019. Procurement delivery timeframes for crucial pipework have seen the pipework delayed until late 2020.

Installation of Backflow Prevention Devices from Customer Lines (WS-2)

The initial project for the installation of the backflow prevention devices has seen the installation of all scoped devices except one. The one device has been delayed as a result of supply pressure issues encountered at the site. All other devices have been calibrated and certified.

Disinfection By-products (HW-34)

Disinfection by-products are influenced by the organic load in the source water. Lake Julius water at times has a lower disinfection by-product forming potential. Current operation of the Lake Julius scheme does not allow for sufficient volumes to influence the overall organic loading in the water

and to date no extended trials have been negotiated with customers. This is on hold pending electrical reliability improvements.

Comprehensive Review of Operational Procedures (WS-5)

Sixteen operational procedures were identified for review with a target completion date of January 2019. The target date was not achieved, however as of June 2020 all procedures have been reviewed.

Security

In response to the Queensland Audit Report 19: security of critical water infrastructure: 2016-17, a number of security and cyber security measures were required to be implemented with reporting commencing for this 2019-20 period.

As at 30 June 2020, MIWB had:

- implemented a governance structure,
- conducted a vulnerability risk assessment of water assets,
- implemented multiple cyber security safeguards
- implemented a cyber security detection process; and
- developed a cyber security response and recovery plan.

MIWB has an active and on-going cyber security program.

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Table 1 – Progress against the risk management improvement program

Item No.	Scheme Component / Sub-component	Hazard	Target date/s	Status as at 30/06/20	(If implementing these actions will take longer than anticipated, please provide detail, as it may affect the approved DWQMP)
1	MITR – Storage Tanks	Ingress of foreign matter including vermin and stormwater; Poor turnover and mixing resulting in low chlorine.	June 2019	ONGOING A trial to reduce pump rates to MICC to improve CT's was completed and design of permanent pipework completed by June 2019. Delays in procurement of critical components delayed the completion of the project. A project for the procurement and installation of new fully enclosed tanks underway during 2019-20	Practical completion of permanent pipework now expected during 2020-21 Construction progressed behind schedule and the tanks were commissioned following the end of the period
2	Whole of System	Backflow of contaminated water from customer points of connection	October 2018	ONGOING The original project has been completed except one device where supply pressure issues are being resolved.	The single outstanding device is forecast to be installed during 2020-21.
3	MITR	Disinfection by-products (e.g. THMs & HAAs) above ADWG limits	June 2019	ONGOING An initial short trial was completed in early 2019, however the results were inconclusive.	A longer trial period for 2020 as been mooted however is on hold pending electrical system reliability improvements.
4	Whole of System	Procedures not implemented as required	January 2019	ONGOING The update of the procedures listed in the DWQMP was not completed by the end of the financial year	All procedures have been reviewed and consolidated as of June 2020

4. Verification monitoring

During the 2019 - 2020 financial year verification monitoring was undertaken for numerous parameters. In the monitoring program the following parameters are notable. All results for verification monitoring are shown in [Table 2A - Verification monitoring results Drinking Water Supply](#)

4.1 *Escherichia coli*

In all cases, the water quality results met the Australian Drinking Water Guidelines for *Escherichia coli*. Fifty-three samples were tested for *E. coli* in the product for reticulation, and no samples were observed to contain any colony forming units. A 100% compliance was observed for this parameter. Full details on monthly verification results are shown in Appendix A [Table 3B – Reticulation E. coli verification monitoring 2019-2020](#).

For Lake Moondarra source water, thirty-one samples were collected with a maximum *E. coli* count of 1918 CFU MPN/100mL. Lake Julius source water had forty-nine samples collected resulting in a maximum of 54 CFU MPN/100mL. The minima for both source waters equated to below the detection limit of 1MPN. Lake Moondarra results are given in [Table 5A - Raw Water monitoring results Lake Moondarra](#), and Lake Julius results are given in [Table 4A – Raw Water monitoring results Lake Julius](#).

4.2 *Cryptosporidium* and *Giardia*

During the financial year, the source water quality results showed little evidence of *Cryptosporidium* and *Giardia*. Twenty-seven samples each from Lake Moondarra and Lake Julius, were collected and tested by the NATA certified laboratory ALS. No Lake Moondarra or Lake Julius samples returned positive detections of a *Cryptosporidium* cyst. Full details for Lake Moondarra are provided in [Table 5A - Raw Water monitoring results Lake Moondarra](#), and Lake Julius results are provided in [Table 4A – Raw Water monitoring results Lake Julius](#).

4.3 Cyanobacteria Counts

A total of ninety-nine samples were collected during the year for cyanobacteria identification and counting. Of the eighty-nine samples, nineteen were from Lake Julius and eighty from Lake Moondarra. None of the samples showed evidence of *Nodularia spumigena* with all having levels below the detection limit which is 1cell/ml. All samples taken from Lake Julius and Lake Moondarra had varying amounts of *Raphidiopsis raciborskii* present. At Lake Julius, counts varied from 1200, to over 344,000,000 cells/ml. Lake Moondarra counts were less; between 30 and 12,300 cells/ml. *Microcystis aeruginosa* was not evident in any samples from Lake Julius or Lake Moondarra.

4.4 Cyanotoxins

A total of 243 samples were collected during the year for cyanotoxin testing; specifically, cylindrospermopsin. As scientific data is insufficient to establish a guideline value, the WHO health alert level of 1 µg/l has been adopted for reticulated samples.

Of the 243 samples, 62 were from Lake Moondarra, 12 from Lake Julius and 169 from MITR. 178 samples were analysed for cylindrospermopsin with an ELISA, whilst 65 were sent for verification analysis at a NATA accredited laboratory for cylindrospermopsin and de-

oxycylindrospermopsin. From the samples sent to the NATA laboratory 5 were for raw water and 60 were for treated and chlorinated samples. The five raw water samples tested positive, and a single sample from chlorinated water prior to the treatment plant returned a positive result, which was just above the limit of detection at 0.07µg/L (WHO limit 1.0 µg/L). These results indicate that the cyanotoxin continues to be successfully destroyed by oxidation with chlorine.

4.5 Disinfection By-products

As a secondary consequence of disinfection by chlorination, organic material can react with the chlorine and form disinfection by-products. Disinfection byproducts have been identified in drinking water including Trihalomethanes and Haloacetic acids for which regulations have been established. As part of the verification monitoring program, these groups of compounds are regularly monitored. For the 2019-2020 financial year, 13 samples for Trihalomethanes (THMs) and 53 samples for Haloacetic Acids (HAAs) were collected from MITR. All samples were tested at a NATA accredited laboratory. The THM results ranged from 24 to 126µg/l. No sample exceeded the ADWG health limit of 250µg/l for the year.

Of the samples collected for HAAs, none exceeded the ADWG for trichloroacetic acid of 100µg/l. The results ranged from 2 to 66µg/l.

In November 2017 Queensland Health published a new guideline limit for Total HAAs of 0.1mg/L, ADWG defines limits for specific species but does not define a limit for this group. Two samples exceeded the Queensland Health Total Guideline Limit at 0.2mg/L.

4.6 Chlorine, physical parameters and Metals

Free and total chlorine was monitored throughout the financial year at the MITR. A total of 268 samples were tested, and none exceeded the ADWG limit of 5mg/l. Physical parameters such as pH and turbidity were also monitored as well as metals. There were no exceedances of any metals throughout the system. All results are shown in [Table 7D - Operational monitoring results Drinking Water Supply](#)

5. Notifications to the Regulator under sections 102 and 102A of the Act

There were three incident/events reported to the Regulator during the 2019-2020 year.

DWI-199-20-08131

On October 8, 2019 evidence of unauthorised access to Clear Water Lagoon was found. Investigation indicated there was no evidence of water quality changes or interference with equipment. The outcome was to increase security patrols, to daily, by operations personnel; and to implement electronic access locks at all infrastructure. The electronic access system at Clear Water Lagoon was installed and fully operational by June 30, 2020

DWI-199-20-08381

On March 23, 2020 routine monitoring found that potable water had been supplied to the customer below the DWQMP CCP limit. Investigations found that the chlorine delivery system had gone into fault, however no alarms were raised within the SCADA system. The chlorine system was immediately checked and reinstated to service. Actions from this event were to update the coding for the SCADA system to shutdown water delivery pumps if the free chlorine levels drop below the CCP; and for the Operators to undertake formal SCADA training. The SCADA coding was re-written and successfully tested during the period. Operator training was also completed in June 2020. No further low-level chlorine excursions have since occurred during pump operation since these actions were completed.

DWI-199-20-08402

On April 6, 2020 routine samples for total Haloacetic acid disinfection by-products exceeded the Queensland Health Department advisory of 0.1mg/L. The same week, chlorine dose rates had been reduced in response to conditions and follow-up samples were taken on April 9 to monitor the effectiveness of the change. The additional samples were found to be below the advisory limit of 0.1mg/L. No samples analysed were above the ADWG limits for chloroacetic acid, dichloroacetic acid, or trichloroacetic acid.

Incremental changes to chlorine dose rates continue; and no further exceedances have been observed. Construction of the covered clean water tanks has been completed, and once commissioned and in service will reduce the water temperature and ultraviolet fluctuations which can affect chlorine residuals, and DBP formation. A new chlorination system for the clean water tanks is also under development which will improve free chlorine control within the system. No samples exceeded the 5mg/L health limit for free chlorine.

The Mount Isa Water Board did not need to issue a boil or do not drink notice to our customers on any occasion.

6. Customer Complaints

MIWB did not receive any formal water quality complaints from its drinking water customer for the 2019 - 2020 financial year. However, MIWB took two complaints from Mount Isa residents regarding high chlorine levels which were referred to Mount Isa City Council, but also cross checked MIWB system status for the relevant period.

Table 1 - Complaints about water quality, (including per 1000 customers)

	Suspected Illness	Discoloured water	Taste and odour	Total
Scheme 1	0	1	0	1
Total	0	0	0	0

One raw water customer complained about the colour of the water to their site. No works were being undertaken at the time of the complaint, however samples were collected and analysed for physical parameters including colour. Investigations found that the colour of the water was inside

normal parameters for raw water at the time of the complaint. Feedback was given to the customer and no further complaints were received.

7. Findings and recommendations of the DWQMP auditor

The four yearly external audit was completed during the 2019-20 reporting period; and submitted to the Water Supply Regulation group within the Department of Natural Resources, Mines and Energy (DNRME Water Supply Regulation) in June 2020. Fifteen requirements were audited of which ten were compliant, one was not required, and four minor non-conformances were noted.

Recommendations are as follows:

1. Develop a work instruction or procedure on the process for collating all relevant data as identified in the approved DWQMP; including data validity checks, record on editing undertaken, calculation performed and the review of the report.
2. Ensure that the Mount Isa Terminal Reservoir (MITR) schematic and supply description details in the DWQMP reflect the current circumstances and ensure that the most recent version of the schematic is easily accessible in the system (ie update drawings to reflect the construction of the new tanks).
3. Review and update the risk assessment:
 - Include contingency process steps of flocculation and powdered activated carbon (PAC)
 - Include chemical quality assurance – wrong chemicals or incorrect specification of chemicals (as a whole of system hazardous event)
 - Include cyber security – new requirement post the last update of the DWQMP (as a whole of system hazardous event)
 - Assess protozoa as the limiting hazard for membranes failure in the filtration step, as filtration is currently the main barrier for protozoa control in the process
 - Review all preventive measures in the risk assessment table to ensure currency. Eg turbidity testing at Lake Moondarra is now continuous, integrity test of membranes is stated as an operations control point, OCP (but there is no related OCP procedure for it in the DWQMP, verify whether it is an OCP)
 - Identify and document action/s to improve uncertainty level where this has been assessed as “estimate” or “uncertain” in the risk assessment table
4. Review and update the CCP procedures:
 - Microfiltration turbidity CCP procedure – ensure there is no gap in between the numerical values for the target and adjustment limit
 - MITR chlorination CCP procedure – ensure that the lower target range is not below the lower adjustment or critical limit
 - Ensure that the CCP limits as documented are reflected in the SCADA set points.

8. Outcome of the review of the DWQMP and how issues raised have been addressed.

No revision of the DWQMP was undertaken during the 2019-20 reporting period.

Appendix A

Details of compliance with water quality criteria

The results from the verification monitoring program have been compared against the levels of the water quality criteria specified by the Regulator in the *Water Quality and Reporting Guideline for a Drinking Water Service*.

The reported statistics do not include results derived from repeat samples, or from emergency or investigative samples undertaken in response to an elevated result.

Verification monitoring has been carried out as per the monitoring program stated in the DWQMP. In some cases, increased frequencies for some parameters have been undertaken for seasonal variation and for data-gathering. The validation program is appropriate as both source waters and treated water is monitored routinely. Validation analyses are also carried out by a NATA accredited laboratory to ensure inter-laboratory correlations are maintained.

Table 2A - Verification monitoring results Drinking Water Supply

Scheme name	Scheme component	Parameter	Frequency of sampling	Total No. of samples collected	Water Quality Criteria	Number of Non-Compliant Samples	Comments
Microbiology and algal toxins							
Lake Julius and Lake Moondarra	Drinking Water Supply	<i>Escherichia coli</i>	Weekly	53	< 1 MPN/100mL	0	
	Drinking Water Supply	Total Coliforms	Weekly	53	N/A	0	
	Drinking Water Supply	Cyanotoxins	Weekly (if required)	6	<1 µg/L	0	

Table 2B - Verification monitoring results Drinking Water Supply

Scheme name	Scheme component	Parameter	Frequency of sampling	Total No. of samples collected	Water Quality Criteria	Number of Non-Compliant Samples	Comments
Nitrogen Species							
Lake Julius and Lake Moondarra	Drinking Water Supply	Ammonia	Quarterly	5	<0.5 mg/L*	0	
	Drinking Water Supply	Cyanide	Yearly	1	<0.08 mg/L	0	
	Drinking Water Supply	Nitrate	Quarterly	5	<50 mg/L	0	
	Drinking Water Supply	Nitrite	Quarterly	5	<3 mg/L	0	
Metals							
Lake Julius and Lake Moondarra	Drinking Water Supply	Aluminium	Weekly	53	<0.2 mg/L*	0	
	Drinking Water Supply	Antimony	Quarterly	5	<0.003 mg/L	0	
	Drinking Water Supply	Arsenic	Quarterly	5	<0.01 mg/L	0	
	Drinking Water Supply	Cadmium	Quarterly	5	<0.002 mg/L	0	
	Drinking Water Supply	Chromium	Quarterly	5	<0.05 mg/L	0	
	Drinking Water Supply	Copper	Monthly	13	<2 mg/L*	0	
	Drinking Water Supply	Iron	Weekly	53	<0.3 mg/L*	0	
	Drinking Water Supply	Lead	Weekly	53	<0.01 mg/L	0	
	Drinking Water Supply	Manganese	Weekly	53	<0.5 mg/L	0	
	Drinking Water Supply	Nickel	Quarterly	5	<0.02 mg/L	0	
	Drinking Water Supply	Zinc	Monthly	13	<3 mg/L*	0	

*Note: Aesthetic guideline values only

Table 2C - Verification monitoring results Drinking Water Supply

Scheme name	Scheme component	Parameter	Frequency of sampling	Total No. of samples collected	Water Quality Criteria	Number of Non-Compliant Samples	Comments
Non-Metal							
Lake Julius and Lake Moondarra	Drinking Water Supply	Chloride	Quarterly	5	<250 mg/L*	0	
	Drinking Water Supply	Fluoride	Quarterly	5	<1.5 mg/L	0	
	Drinking Water Supply	Hydrogen Sulphide	Quarterly	5	<0.05 mg/L*	0	
	Drinking Water Supply	Sodium	Quarterly	5	<180 mg/L*	0	
	Drinking Water Supply	Sulphate	Quarterly	5	<250 mg/L*	0	
Organic Disinfection By-Products							
Lake Julius and Lake Moondarra	Drinking Water Supply	Total Trihalomethanes	Monthly	13	<0.250 mg/L	0	
	Drinking Water Supply	Total Halo Acetic Acids	Monthly	53	<0.1 mg/L**	2	Sampling for HAA's was increased to weekly due to sensitivity to chlorine concentration. Two samples exceeded the Qld Health advisory guideline limit of 0.1mg/L
Physical							
Lake Julius and Lake Moondarra	Drinking Water Supply	Taste and Odour	Yearly	1	N/A	0	2-Methylisoborneol (MIB) and Geosmin analysis
	Drinking Water Supply	Total Dissolved Solids	Quarterly	5	<600 mg/L*	0	
	Drinking Water Supply	Conductivity	Weekly	53	N/A	0	
	Drinking Water Supply	Hardness	Quarterly	5	<200 mg/L*	0	

*Note: Aesthetic guideline values only

**Note: No ADWG limit; Queensland Health Department advisory limit

Table 3A – Reticulation *E. coli* verification monitoring 2018-2019

Drinking water scheme:

Mount Isa Water Board - Lake Moondarra and Lake Julius

Year	2018 - 2019											
Month	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
No of samples collected	5	4	4	5	4	5	4	4	4	5	4	4
No of samples collected in which <i>E coli</i> is detected (ie a failure)	0	0	0	0	0	0	0	0	0	0	0	0
No of samples collected in previous 12-month period	55	55	55	55	55	56	55	54	52	53	52	52
No of failures for previous 12-month period	0	0	0	0	0	0	0	0	0	0	0	0
% of samples that comply	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Compliance with 98% annual value	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Table 3B – Reticulation *E. coli* verification monitoring 2019-2020

Drinking water scheme:

Mount Isa Water Board - Lake Moondarra and Lake Julius

Year	2019 - 2020											
Month	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
No of samples collected	5	4	5	4	4	5	4	4	5	4	5	4
No of samples collected in which <i>E coli</i> is detected (ie a failure)	0	0	0	0	0	0	0	0	0	0	0	0
No of samples collected in previous 12-month period	52	52	53	52	52	52	52	52	53	52	53	53
No of failures for previous 12-month period	0	0	0	0	0	0	0	0	0	0	0	0
% of samples that comply	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Compliance with 98% annual value	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Table 4A – Raw Water monitoring results Lake Julius

Scheme name	Scheme component	Parameter	Units	Frequency of sampling	Total No. of samples collected	No. of samples in which parameter was detected	No. of samples exceeding water quality criteria	Min	Max	Average (Mean)	Limit of Detection	Laboratory name
Microbiology												
Lake Julius and Lake Moondarra	Lake Julius	<i>Escherichia coli</i>	MPN/100mL	Fortnightly /Weekly	49	49	N/A	<1	54	4.4	1 MPN/100mL	MIWB
	Lake Julius	Cryptosporidium	Oocysts/L	Fortnightly	27	0	N/A	<0.2	<0.2	<0.1	0.1 oocyst/L	ALS
	Lake Julius	Giardia	Cysts/L	Fortnightly	27	0	N/A	<0.2	<0.2	<0.1	0.1 cyst/L	ALS
Metals												
Lake Julius and Lake Moondarra	Lake Julius	Aluminium	mg/L	Monthly	19	7	0	<0.005	0.015	<0.005	0.005 mg/L	ALS
	Lake Julius	Arsenic	mg/L	Quarterly	5	0	0	<0.001	<0.001	<0.001	0.001 mg/L	ALS
	Lake Julius	Barium	mg/L	Yearly	1	1	0	0.022	0.022	<0.001	0.001 mg/L	ALS
	Lake Julius	Beryllium	mg/L	Yearly	1	0	0	<0.001	<0.001	<0.001	0.001 mg/L	ALS
	Lake Julius	Boron	mg/L	Yearly	1	0	0	<0.05	<0.05	<0.05	0.05 mg/L	ALS
	Lake Julius	Iodide	mg/L	Yearly	1	0	0	<0.01	<0.01	<0.01	0.01 mg/L	ALS
	Lake Julius	Iron	mg/L	Monthly	19	19	0	0.06	0.60	0.19	0.05mg/L	ALS
	Lake Julius	Lead	mg/L	Monthly	19	0	0	<0.001	<0.001	<0.001	0.001 mg/L	ALS
	Lake Julius	Manganese	mg/L	Monthly	19	19	0	0.021	0.282	0.092	0.001 mg/L	ALS
	Lake Julius	Mercury	mg/L	Quarterly	5	0	0	<0.0001	<0.0001	<0.0001	0.0001 mg/L	ALS
	Lake Julius	Molybdenum	mg/L	Quarterly	5	0	0	<0.001	<0.001	<0.001	0.001 mg/L	ALS
	Lake Julius	Nickel	mg/L	Quarterly	5	0	0	<0.001	<0.001	<0.001	0.001 mg/L	ALS
	Lake Julius	Selenium	mg/L	Yearly	1	0	0	<0.01	<0.01	<0.01	0.01 mg/L	ALS
	Lake Julius	Silver	mg/L	Yearly	1	0	0	<0.01	<0.01	<0.01	0.01 mg/L	ALS
	Lake Julius	Tin	mg/L	Yearly	1	0	0	<0.01	<0.01	<0.01	0.01 mg/L	ALS
	Lake Julius	Zinc	mg/L	Quarterly	5	0	0	<0.005	<0.005	<0.005	0.005 mg/L	ALS

Table 4B - Raw Water monitoring results Lake Julius

Scheme name	Scheme component	Parameter	Units	Frequency of sampling	Total No. of samples collected	No. of samples in which parameter was detected	No. of samples exceeding water quality criteria	Min	Max	Average (Mean)	Limit of Detection	Laboratory name
Organics												
Lake Julius and Lake Moondarra	Lake Julius	Total Organic Carbon	mg/L	Monthly	12	12	0	5.43	9.06	7.28	0.01 ppm	MIWB
	Lake Julius	Organochlorides	mg/L	6 Monthly	2	0	0	<0.002	<0.002	<0.002	0.002 µg/L	ALS
	Lake Julius	Organophosphates	mg/L	6 Monthly	2	0	0	<0.002	<0.002	<0.002	0.002 µg/L	ALS
	Lake Julius	PFAS	mg/L	6 Monthly	2	0	0	<0.002	<0.002	<0.002	0.002 µg/L	ALS
Physicals												
	Lake Julius	Dissolved Oxygen	% Saturation	Weekly	48	48	34	26.1	110	72.9	0.10%	Field
	Lake Julius	pH	Standard	Weekly	48	48	6	6.30	8.38	7.42	0.1	Field
	Lake Julius	Conductivity	µS/cm	Weekly	48	48	1	89	274	190	1 µS/cm	Field
	Lake Julius	Temperature	°C	Weekly	48	48	N/A	18.25	32.07	25.19	0.1 °C	Field
	Lake Julius	Turbidity	NTU	Weekly	48	48	N/A	2	14	5.35	0.1 NTU	Field
	Lake Julius	Alkalinity	mg/L	Monthly	12	12	N/A	40	74	73	1 mg/L	ALS
	Lake Julius	Hardness	mg/L	Monthly	12	12	N/A	30	48	38	1 mg/L	ALS

Table 4C - Raw Water monitoring results Lake Julius

Scheme name	Scheme component	Parameter	Units	Frequency of sampling	Total No. of samples collected	No. of samples in which parameter was detected	No. of samples exceeding water quality criteria	Min	Max	Average (Mean)	Limit of Detection	Laboratory name
Algae Counts												
Lake Julius and Lake Moondarra	Lake Julius	<i>Anabaena circinalis/</i> <i>Anabaena</i> coiled or straight	cells/ml	Monthly/In use	19	0	N/A	0	0	0	1 Cell/mL	ALS
	Lake Julius	<i>Chrysochlorum</i>	cells/ml	Monthly/In use	19	0	N/A	0	0	0	1 Cell/mL	ALS
	Lake Julius	<i>Chrysochlorum c.f. bergii</i>	cells/ml	Monthly/In use	19	0	N/A	0	0	0	1 Cell/mL	ALS
	Lake Julius	<i>Chrysochlorum c.f. ovalisporum</i>	cells/ml	Monthly/In use	19	0	N/A	0	0	0	1 Cell/mL	ALS
	Lake Julius	<i>Cylindrocapsa</i>	cells/ml	Monthly/In use	19	0	N/A	0	0	0	1 Cell/mL	ALS
	Lake Julius	<i>Microcystis</i>	cells/ml	Monthly/In use	19	14	N/A	0	4291	1033	1 Cell/mL	ALS
	Lake Julius	<i>Microcystis c.f. aeruginosa</i>	cells/ml	Monthly/In use	19	0	N/A	0	0	0	1 Cell/mL	ALS
	Lake Julius	<i>Nodularia spumigena</i>	cells/ml	Monthly/In use	19	0	N/A	0	0	0	1 Cell/mL	ALS
	Lake Julius	<i>Raphidiopsis raciborskii</i>	cells/ml	Monthly/In use	19	19	N/A	1211	344961	115597	1 Cell/mL	ALS
	Lake Julius	Cyanotoxin	µg/L	In Use	12	12	N/A	0.09	4.08	1.29	0.05µg/L	MIWB/ALS

Table 5A - Raw Water monitoring results Lake Moondarra

Scheme name	Scheme component	Parameter	Units	Frequency of sampling	Total No. of samples collected	No. of samples in which parameter was detected	No. of samples exceeding water quality criteria	Min	Max	Average (Mean)	Limit of Detection	Laboratory name
Microbiology												
Lake Julius and Lake Moondarra	Lake Moondarra	<i>Escherichia coli</i>	MPN/100mL	Fortnightly /Weekly	31	19	N/A	<1	1918	83	1 MPN/100m L	MIWB
	Lake Moondarra	Cryptosporidium	Oocysts/L	Fortnightly	27	0	N/A	<0.1	<0.2	<0.1	0.1 oocyst/L	ALS
	Lake Moondarra	Giardia	Cysts/L	Fortnightly	27	2	N/A	<0.1	0.2	<0.1	0.1 cyst/L	ALS
Metals												
	Lake Moondarra	Aluminium	mg/L	Weekly	53	43	0	<0.005	0.096	0.010	0.005 mg/L	ALS
	Lake Moondarra	Arsenic	mg/L	Quarterly	5	5	0	0.001	0.003	0.002	0.001 mg/L	ALS
	Lake Moondarra	Barium	mg/L	Yearly	1	1	0	0.033	0.033	0.033	0.001 mg/L	ALS
	Lake Moondarra	Beryllium	mg/L	Yearly	1	0	0	<0.001	<0.001	<0.001	0.001 mg/L	ALS
	Lake Moondarra	Boron	mg/L	Yearly	1	0	0	<0.05	<0.05	<0.05	0.05 mg/L	ALS
	Lake Moondarra	Iodide	mg/L	Yearly	1	0	0	<0.01	<0.01	<0.01	0.01 mg/L	ALS
	Lake Moondarra	Iron	mg/L	Weekly	53	52	0	<0.05	1.65	0.22	0.05mg/L	ALS
	Lake Moondarra	Lead	mg/L	Weekly	53	43	0	<0.001	0.01	0.002	0.001 mg/L	ALS
	Lake Moondarra	Manganese	mg/L	Weekly	53	53	0	0.018	0.19	0.057	0.001 mg/L	ALS
	Lake Moondarra	Mercury	mg/L	Quarterly	5	0	0	<0.0001	<0.0001	<0.0001	0.0001 mg/L	ALS
	Lake Moondarra	Molybdenum	mg/L	Quarterly	5	0	0	<0.001	<0.001	<0.001	0.001 mg/L	ALS
	Lake Moondarra	Nickel	mg/L	Quarterly	5	1	0	<0.001	0.002	<0.001	0.001 mg/L	ALS
	Lake Moondarra	Selenium	mg/L	Yearly	1	0	0	<0.01	<0.01	<0.01	0.01 mg/L	ALS
	Lake Moondarra	Silver	mg/L	Yearly	1	0	0	<0.01	<0.01	<0.01	0.01 mg/L	ALS
	Lake Moondarra	Tin	mg/L	Yearly	1	0	0	<0.01	<0.01	<0.01	0.01 mg/L	ALS
	Lake Moondarra	Zinc	mg/L	Quarterly	5	2	0	<0.005	0.013	<0.005	0.005 mg/L	ALS

Table 5B - Raw Water monitoring results Lake Moondarra

Scheme name	Scheme component	Parameter	Units	Frequency of sampling	Total No. of samples collected	No. of samples in which parameter was detected	No. of samples exceeding water quality criteria	Min	Max	Average (Mean)	Limit of Detection	Laboratory name
Organics												
Lake Julius and Lake Moondarra	Lake Moondarra	Total Organic Carbon	mg/L	Monthly	12	12	0	6.24	8.12	7.28	0.01 ppm	MIWB
	Lake Moondarra	Organochlorides	mg/L	6 Monthly	2	0	0	<0.002	<0.002	<0.002	0.002 µg/L	ALS
	Lake Moondarra	Organophosphates	mg/L	6 Monthly	2	0	0	<0.002	<0.002	<0.002	0.002 µg/L	ALS
	Lake Moondarra	PFAS	mg/L	6 Monthly	2	0	0	0.005	0.006	0.006	0.002 µg/L	ALS
Physicals												
	Lake Moondarra	Colour	HU	Weekly	52	52	N/A	5	306	54	1HU	MIWB
	Lake Moondarra	Dissolved Oxygen	% Saturation	Weekly	53	53	14	70.9	111.0	91.2	0.10%	Field
	Lake Moondarra	pH	Standard	Weekly	53	53	12	7.08	9.36	8.01	0.1	Field
	Lake Moondarra	Conductivity	µS/cm	Weekly	53	53	0	130	299	248	1 µS/cm	Field
	Lake Moondarra	Temperature	°C	Weekly	53	53	0	16.51	31.05	23.72	0.1 °C	Field
	Lake Moondarra	Turbidity	NTU	Daily	215	215	N/A	0.71	215	4.9	0.1 NTU	Field
	Lake Moondarra	Alkalinity	mg/L	Monthly	12	12	0	64	86	73	1 mg/L	ALS
	Lake Moondarra	Hardness	mg/L	Monthly	12	12	0	57	73	65	1 mg/L	ALS

Table 5C - Raw Water monitoring results Lake Moondarra

Scheme name	Scheme component	Parameter	Units	Frequency of sampling	Total No. of samples collected	No. of samples in which parameter was detected	No. of samples exceeding water quality criteria	Min	Max	Average (Mean)	Limit of Detection	Laboratory name
Algae Counts												
	Lake Moondarra	<i>Anabaena Circinalis/ Anabaena coiled or straight</i>	cells/ml	Fortnightly	27	0	N/A	0	0	0	1 Cell/mL	ALS
	Lake Moondarra	<i>Chrysosporum</i>	cells/ml	Fortnightly	27	0	N/A	0	0	0	1 Cell/mL	ALS
	Lake Moondarra	<i>Chrysosporum c.f. bergii</i>	cells/ml	Fortnightly	27	2	N/A	0	2337	185	1 Cell/mL	ALS
	Lake Moondarra	<i>Chrysosporum c.f. ovalisporum</i>	cells/ml	Fortnightly	27	1	N/A	0	990	40	1 Cell/mL	ALS
	Lake Moondarra	<i>Cylindrospermum</i>	cells/ml	Fortnightly	27	0	N/A	0	0	0	1 Cell/mL	ALS
	Lake Moondarra	<i>Microcystis</i>	cells/ml	Fortnightly	27	10	N/A	0	986	176	1 Cell/mL	ALS
	Lake Moondarra	<i>Microcystis c.f. aeruginosa</i>	cells/ml	Fortnightly	27	0	N/A	0	0	0	1 Cell/mL	ALS
	Lake Moondarra	<i>Nodularia spumigena</i>	cells/ml	Fortnightly	27	0	N/A	0	0	0	1 Cell/mL	ALS
	Lake Moondarra	<i>Raphidiopsis Raciborskii</i>	cells/ml	Fortnightly	27	26	N/A	0	11826	3938	1 Cell/mL	ALS
	Lake Moondarra	Cyanotoxin	µg/L	In Use	3	3	N/A	0.15	0.51	0.28	0.05µg/L	MIWB/ALS

Table 5D - Raw Water monitoring results Lake Moondarra

Scheme name	Scheme component	Parameter	Units	Frequency of sampling	Total No. of samples collected	No. of samples in which parameter was detected	No. of samples exceeding water quality criteria	Min	Max	Average (Mean)	Limit of Detection	Laboratory name
Microbiology												
Lake Julius and Lake Moondarra	Transport Bay	Faecal Coliform	MPN/100mL	Fortnightly	51	43	N/A	<1	326	18.4	1 MPN/100mL	MIWB
	Warrina Park	Faecal Coliform	MPN/100mL	Fortnightly	51	34	N/A	<1	201	10.1	1 MPN/100mL	MIWB
Physicals												
	Transport Bay	Dissolved Oxygen	% Saturation	Weekly	53	53	17	53.7	107.7	88.5	0.10%	Field
	Transport Bay	pH	Standard	Weekly	53	53	10	6.80	9.2	8.00	0.1	Field
	Transport Bay	Conductivity	µS/cm	Weekly	53	53	N/A	156	289	243	1 µS/cm	Field
	Transport Bay	Temperature	°C	Weekly	53	53	N/A	16.6	34.6	24.8	0.1 °C	Field
	Transport Bay	Turbidity	NTU	Weekly	53	53	N/A	0.7	30.7	3.1	0.1 NTU	Field
	Warrina Park	Colour	HU	Weekly	53	53	N/A	5	189	32.7	1HU	MIWB
	Warrina Park	Dissolved Oxygen	% Saturation	Weekly	53	53	N/A	59.9	105.4	87.7	0.10%	Field
	Warrina Park	pH	Standard	Weekly	53	53	N/A	6.50	9.3	7.80	0.1	Field
	Warrina Park	Conductivity	µS/cm	Weekly	53	53	N/A	136	291	245	1 µS/cm	Field
	Warrina Park	Temperature	°C	Weekly	53	53	N/A	15.0	34.8	23.9	0.1 °C	Field
	Warrina Park	Turbidity	NTU	Weekly	53	53	N/A	0.3	127	4.8	0.1 NTU	Field

Table 5E - Raw Water monitoring results Lake Moondarra

Scheme name	Scheme component	Parameter	Units	Frequency of sampling	Total No. of samples collected	No. of samples in which parameter was detected	No. of samples exceeding water quality criteria	Min	Max	Average (Mean)	Limit of Detection	Laboratory name
Algae Counts												
	Transport Bay	<i>Anabaena circinalis/ Anabaena coiled or straight</i>	cells/ml	Fortnightly	27	0	N/A	0	0	0	1 Cell/mL	ALS
	Transport Bay	<i>Chrysochlorum</i>	cells/ml	Fortnightly	27	0	N/A	0	0	0	1 Cell/mL	ALS
	Transport Bay	<i>Chrysochlorum c.f. bergii</i>	cells/ml	Fortnightly	27	1	N/A	0	2897	107	1 Cell/mL	ALS
	Transport Bay	<i>Chrysochlorum c.f. ovalisporum</i>	cells/ml	Fortnightly	27	1	N/A	0	45	2	1 Cell/mL	ALS
	Transport Bay	<i>Cylindrocapsa</i>	cells/ml	Fortnightly	27	0	N/A	0	0	0	1 Cell/mL	ALS
	Transport Bay	<i>Microcystis</i>	cells/ml	Fortnightly	27	13	N/A	0	894	189	1 Cell/mL	ALS
	Transport Bay	<i>Microcystis c.f. aeruginosa</i>	cells/ml	Fortnightly	27	0	N/A	0	0	0	1 Cell/mL	ALS
	Transport Bay	<i>Nodularia spumigena</i>	cells/ml	Fortnightly	27	0	N/A	0	0	0	1 Cell/mL	ALS
	Transport Bay	<i>Raphidiopsis Raciborskii</i>	cells/ml	Fortnightly	27	27	N/A	44	12336	2572	1 Cell/mL	ALS
	Dam Wall	<i>Anabaena Circinalis/ Anabaena coiled or straight</i>	cells/ml	Fortnightly	26	0	N/A	0	0	0	1 Cell/mL	ALS
	Dam Wall	<i>Chrysochlorum</i>	cells/ml	Fortnightly	26	0	N/A	0	0	0	1 Cell/mL	ALS
	Dam Wall	<i>Chrysochlorum c.f. bergii</i>	cells/ml	Fortnightly	26	1	N/A	0	158	6	1 Cell/mL	ALS
	Dam Wall	<i>Chrysochlorum c.f. ovalisporum</i>	cells/ml	Fortnightly	26	3	N/A	0	3517	192	1 Cell/mL	ALS
	Dam Wall	<i>Cylindrocapsa</i>	cells/ml	Fortnightly	26	0	N/A	0	0	0	1 Cell/mL	ALS
	Dam Wall	<i>Microcystis</i>	cells/ml	Fortnightly	26	13	N/A	0	2277	420	1 Cell/mL	ALS
	Dam Wall	<i>Microcystis c.f. aeruginosa</i>	cells/ml	Fortnightly	26	0	N/A	0	0	0	1 Cell/mL	ALS
	Dam Wall	<i>Nodularia spumigena</i>	cells/ml	Fortnightly	26	0	N/A	0	0	0	1 Cell/mL	ALS
	Dam Wall	<i>Raphidiopsis raciborskii</i>	cells/ml	Fortnightly	26	26	N/A	41	12573	2620	1 Cell/mL	ALS

Table 6A - Raw Water monitoring results Clear Water Lagoon

Scheme name	Scheme component	Parameter	Units	Frequency of sampling	Total No. of samples collected	No. of samples in which parameter was detected	No. of samples exceeding water quality criteria	Min	Max	Average (Mean)	Limit of Detection	Laboratory name
Microbiology												
Lake Julius and Lake Moondarra	Clear Water Lagoon (In)	<i>Escherichia coli</i>	MPN/100mL	Fortnightly	53	10	N/A	<1	108	11.9	1 MPN/100mL	MIWB
	Clear Water Lagoon (In)	Cryptosporidium	Oocysts/L	Fortnightly	24	0	N/A	<0.1	<0.2	<0.1	0.1 oocyst/L	ALS
	Clear Water Lagoon (In)	Giardia	Cysts/L	Fortnightly	24	0	N/A	<0.1	<0.2	<0.1	0.1 cyst/L	ALS
Metals												
	Clear Water Lagoon (In)	Aluminium	mg/L	Weekly	53	22	0	<0.005	0.011	0.003	0.005 mg/L	ALS
	Clear Water Lagoon (In)	Iron	mg/L	Weekly	53	53	0	0.05	0.16	0.09	0.05mg/L	ALS
	Clear Water Lagoon (In)	Lead	mg/L	Weekly	53	5	0	<0.001	0.002	<0.001	0.001 mg/L	ALS
	Clear Water Lagoon (In)	Manganese	mg/L	Weekly	53	53	0	0.019	0.070	0.044	0.001 mg/L	ALS
Non-Metals and Organics												
	Clear Water Lagoon (In)	Total Nitrogen	mg/L	Monthly	13	13	0	0.48	0.77	0.65	0.05 mg/L	ALS
	Clear Water Lagoon (In)	Total Phosphorus	mg/L	Monthly	13	9	0	<0.005	0.020	0.011	0.005 mg/L	ALS
	Clear Water Lagoon (In)	Total Organic Carbon	mg/L	Weekly	53	53	0	7.06	9.04	8.08	0.01 ppm	MIWB

Table 6B - Raw Water monitoring results Clear Water Lagoon

Scheme name	Scheme component	Parameter	Units	Frequency of sampling	Total No. of samples collected	No. of samples in which parameter was detected	No. of samples exceeding water quality criteria	Min	Max	Average (Mean)	Limit of Detection	Laboratory name
Physicals												
Lake Julius and Lake Moondarra	Clear Water Lagoon (In)	Colour	HU	Weekly	52	52	N/A	12	104	61	1HU	MIWB
	Clear Water Lagoon (In)	Dissolved Oxygen	% Saturation	Weekly	53	53	4	83.8	104.8	95.6	0.10%	Field
	Clear Water Lagoon (In)	pH	Standard	Weekly	53	53	11	7.00	9	8.10	0.1	Field
	Clear Water Lagoon (In)	Conductivity	µS/cm	Weekly	53	53	N/A	142	291	252	1 µS/cm	Field
	Clear Water Lagoon (In)	Temperature	°C	Weekly	53	53	N/A	16.6	31.0	23.7	0.1 °C	Field
	Clear Water Lagoon (In)	Turbidity	NTU	Daily	366	366	N/A	0.8	5.3	2.5	0.1 NTU	Field
	Clear Water Lagoon (In)	Alkalinity	mg/L	Monthly	12	12	0	68	83	75	1 mg/L	ALS
	Clear Water Lagoon (In)	Hardness	mg/L	Monthly	12	12	0	62	75	68	1 mg/L	ALS

Table 6C - Raw Water monitoring results Clear Water Lagoon

Scheme name	Scheme component	Parameter	Units	Frequency of sampling	Total No. of samples collected	No. of samples in which parameter was detected	No. of samples exceeding water quality criteria	Min	Max	Average (Mean)	Limit of Detection	Laboratory name
Algae Counts												
Lake Julius and Lake Moondarra	Clear Water Lagoon (In)	<i>Anabaena circinalis/ Anabaena coiled or straight</i>	cells/ml	Weekly	52	0	N/A	0	0	0	1 Cell/mL	ALS
	Clear Water Lagoon (In)	<i>Chrysochlorum</i>	cells/ml	Weekly	52	0	N/A	0	0	0	1 Cell/mL	ALS
	Clear Water Lagoon (In)	<i>Chrysochlorum c.f. bergii</i>	cells/ml	Weekly	52	20	N/A	0	2378	244	1 Cell/mL	ALS
	Clear Water Lagoon (In)	<i>Chrysochlorum c.f. ovalisporum</i>	cells/ml	Weekly	52	3	N/A	0	106	4	1 Cell/mL	ALS
	Clear Water Lagoon (In)	<i>Cylindrospermum</i>	cells/ml	Weekly	52	0	N/A	0	0	0	1 Cell/mL	ALS
	Clear Water Lagoon (In)	<i>Microcystis</i>	cells/ml	Weekly	52	10	N/A	0	3958	1104	1 Cell/mL	ALS
	Clear Water Lagoon (In)	<i>Microcystis c.f. aeruginosa</i>	cells/ml	Weekly	52	1	N/A	0	735	14	1 Cell/mL	ALS
	Clear Water Lagoon (In)	<i>Nodularia spumigena</i>	cells/ml	Weekly	52	0	N/A	0	0	0	1 Cell/mL	ALS
	Clear Water Lagoon (In)	<i>Raphidiopsis raciborskii</i>	cells/ml	Weekly	52	50	N/A	0	127649	51900	1 Cell/mL	ALS
	Clear Water Lagoon (In)	Cyanotoxin	µg/L	Weekly	53	53	N/A	0.18	2.08	0.69	µg/L	MIWB/ALS

Table 6D - Raw Water monitoring results Clear Water Lagoon

Scheme name	Scheme component	Parameter	Units	Frequency of sampling	Total No. of samples collected	No. of samples in which parameter was detected	No. of samples exceeding water quality criteria	Min	Max	Average (Mean)	Limit of Detection	Laboratory name
Metals												
Lake Julius and Lake Moondarra	Clear Water Lagoon (Out)	Aluminium	mg/L	Weekly	53	21	0	<0.005	0.009	0.003	0.005 mg/L	ALS
	Clear Water Lagoon (Out)	Iron	mg/L	Weekly	53	53	0	0.05	0.14	0.09	0.05mg/L	ALS
	Clear Water Lagoon (Out)	Lead	mg/L	Weekly	53	0	0	<0.001	<0.001	<0.001	0.001 mg/L	ALS
	Clear Water Lagoon (Out)	Manganese	mg/L	Weekly	53	53	0	0.020	0.091	0.042	0.001 mg/L	ALS
Non-Metals and Organics												
	Clear Water Lagoon (Out)	Total Organic Carbon	mg/L	Monthly	53	53	0	7.11	9.18	8.10	0.01 ppm	MIWB
Physicals												
	Clear Water Lagoon (Out)	Colour	HU	Weekly	52	52	N/A	14	111	62	1HU	MIWB
	Clear Water Lagoon (Out)	Dissolved Oxygen	% Saturation	Weekly	53	53	3	54	108.5	94.6	0.10%	Field
	Clear Water Lagoon (Out)	pH	Standard	Weekly	53	53	11	6.60	9.1	8.00	0.1	Field
	Clear Water Lagoon (Out)	Conductivity	µS/cm	Weekly	53	53	N/A	148	291	252	1 µS/cm	Field
	Clear Water Lagoon (Out)	Temperature	°C	Weekly	53	53	N/A	17.1	31.5	24.3	0.1 °C	Field
	Clear Water Lagoon (Out)	Turbidity	NTU	Weekly	53	53	N/A	1.5	6.3	3.5	0.1 NTU	Field
	Clear Water Lagoon (Out)	Alkalinity	mg/L	Monthly	12	12	0	72	83	75	1 mg/L	ALS

Table 6E - Raw Water monitoring results Clear Water Lagoon

Scheme name	Scheme component	Parameter	Units	Frequency of sampling	Total No. of samples collected	No. of samples in which parameter was detected	No. of samples exceeding water quality criteria	Min	Max	Average (Mean)	Limit of Detection	Laboratory name
Microbiology												
Lake Julius and Lake Moondarra	End of Flume	<i>Escherichia coli</i>	MPN/100mL	Fortnightly	26	26	N/A	2	2795	269	1 MPN/100mL	MIWB
	Bridge Settling Pond	<i>Escherichia coli</i>	MPN/100mL	Fortnightly	26	25	N/A	<1	498		1 MPN/100mL	MIWB
Metals												
	End of Flume	Aluminium	mg/L	Weekly	53	40	N/A	<0.005	0.402	0.019	0.005 mg/L	ALS
	End of Flume	Iron	mg/L	Weekly	53	52	N/A	<0.05	0.7	0.19	0.05mg/L	ALS
	End of Flume	Lead	mg/L	Weekly	53	29	N/A	<0.001	0.003	0.001	0.001 mg/L	ALS
	End of Flume	Manganese	mg/L	Weekly	53	53	N/A	0.017	1.010	0.097	0.001 mg/L	ALS
	Bridge Settling Pond	Aluminium	mg/L	Weekly	53	21	N/A	<0.005	0.283	0.010	0.005 mg/L	ALS
	Bridge Settling Pond	Iron	mg/L	Weekly	53	50	N/A	<0.05	0.35	0.12	0.05mg/L	ALS
	Bridge Settling Pond	Lead	mg/L	Weekly	53	8	N/A	<0.001	0.005	<0.001	0.001 mg/L	ALS
	Bridge Settling Pond	Manganese	mg/L	Weekly	53	53	N/A	0.014	0.585	0.070	0.001 mg/L	ALS

Table 6F - Raw Water monitoring results Clear Water Lagoon

Scheme name	Scheme component	Parameter	Units	Frequency of sampling	Total No. of samples collected	No. of samples in which parameter was detected	No. of samples exceeding water quality criteria	Min	Max	Average (Mean)	Limit of Detection	Laboratory name
Physicals												
Lake Julius and Lake Moondarra	End of Flume	Colour	HU	Weekly	52	52	N/A	10	211	49	1HU	MIWB
	End of Flume	Dissolved Oxygen	% Saturation	Weekly	53	53	N/A	38.5	106.4	90.5	0.10%	Field
	End of Flume	pH	Standard	Weekly	53	53	N/A	7.1	9.4	8.0	0.1	Field
	End of Flume	Conductivity	µS/cm	Weekly	53	53	N/A	122	300	233	1 µS/cm	Field
	End of Flume	Temperature	°C	Weekly	53	53	N/A	16.5	32.7	24.3	0.1 °C	Field
	End of Flume	Turbidity	NTU	Weekly	53	53	N/A	1.0	8.1	2.9	0.1 NTU	Field
	Bridge Settling Pond	Colour	HU	Weekly	52	52	N/A	11	111	40	1HU	MIWB
	Bridge Settling Pond	Dissolved Oxygen	% Saturation	Weekly	53	53	N/A	52.5	107.3	88.9	0.10%	Field
	Bridge Settling Pond	pH	Standard	Weekly	53	53	N/A	6.60	9.2	7.90	0.1	Field
	Bridge Settling Pond	Conductivity	µS/cm	Weekly	53	53	N/A	110	292	232	1 µS/cm	Field
	Bridge Settling Pond	Temperature	°C	Weekly	53	53	N/A	15.7	30.0	23.6	0.1 °C	Field
	Bridge Settling Pond	Turbidity	NTU	Weekly	53	53	N/A	0.9	6.5	2.4	0.1 NTU	Field

Table 7A - Operational monitoring results Drinking Water Supply

Scheme name	Scheme component	Parameter	Units	Frequency of sampling	Total No. of samples collected	No. of samples in which parameter was detected	No. of samples exceeding water quality criteria	Min	Max	Average (Mean)	Limit of Detection	Laboratory name
Microbiology												
Lake Julius and Lake Moondarra	Semi-Treated Water Supply	<i>Escherichia coli</i>	MPN/100mL	Weekly	53	0	0	<1	<1	<1	1 MPN/100mL	MIWB
	Semi-Treated Water Supply	Thermotolerant Coliforms	MPN/100mL	Weekly	53	15	0	<1	49	1	1 MPN/100mL	MIWB
	50ML Tank	Thermotolerant Coliforms	MPN/100mL	Weekly	53	50	N/A	<1	2335	95	1 MPN/100mL	MIWB
	North Tank	Thermotolerant Coliforms	MPN/100mL	Weekly	53	48	N/A	<1	23	2	1 MPN/100mL	MIWB
	50ML Tank	Heterotrophic Plate Count	MPN/100mL	Weekly	53	53	N/A	1203	>2419.6	2302	1 MPN/100mL	MIWB
	North Tank	Heterotrophic Plate Count	MPN/100mL	Weekly	50	50	N/A	122	>2419.6	1630	1 MPN/100mL	MIWB
	Drinking Water Supply	Heterotrophic Plate Count	MPN/100mL	Weekly	52	50	N/A	<1	479	78	1 MPN/100mL	MIWB
Disinfection Residual												
Lake Julius and Lake Moondarra	Semi-Treated Water Supply	Free Chlorine	mg/L	Daily	262	262	0	0.05	2.69	1.98	0.01 mg/L	Field
	50ML Tank	Free Chlorine	mg/L	Daily	275	272	0	<0.01	0.70	0.07	0.01 mg/L	Field
	North Tank	Free Chlorine	mg/L	Daily	266	257	0	<0.01	2.11	0.11	0.01 mg/L	Field
	Drinking Water Supply	Free Chlorine	mg/L	Daily	541	541	0	0.07	2.99	1.48	0.01 mg/L	Field

Table 7B - Operational monitoring results Drinking Water Supply

Scheme name	Scheme component	Parameter	Units	Frequency of sampling	Total No. of samples collected	No. of samples in which parameter was detected	No. of samples exceeding water quality criteria	Min	Max	Average (Mean)	Limit of Detection	Laboratory name
Nitrogen Species												
Lake Julius and Lake Moondarra	Semi-Treated Water Supply	Ammonia	mg/L	Monthly	13	9	0	<0.01	0.03	0.01	0.01 mg/L	ALS
	Semi-Treated Water Supply	Cyanide	mg/L	Yearly	1	0	0	<0.004	<0.004	<0.004	0.004 mg/L	ALS
	Semi-Treated Water Supply	Nitrate	mg/L	Quarterly	5	2	0	<0.01	0.04	0.01	0.01 mg/L	ALS
	Semi-Treated Water Supply	Nitrite	mg/L	Quarterly	5	0	0	<0.01	<0.01	<0.01	0.01 mg/L	ALS
Metals												
Lake Julius and Lake Moondarra	North Tank	Lead	mg/L	Weekly	52	28	0	<0.001	0.008	0.002	0.001 mg/L	ALS
	Semi-Treated Water Supply	Aluminium	mg/L	Weekly	53	19	0	<0.005	<0.005	0.020	0.003 mg/L	ALS
	Semi-Treated Water Supply	Antimony	mg/L	Quarterly	5	0	0	<0.001	<0.001	<0.001	0.001 mg/L	ALS
	Semi-Treated Water Supply	Arsenic	mg/L	Quarterly	5	5	0	0.001	0.003	0.002	0.001 mg/L	ALS
	Semi-Treated Water Supply	Cadmium	mg/L	Quarterly	5	0	0	<0.001	<0.001	<0.001	0.0001 mg/L	ALS
	Semi-Treated Water Supply	Chromium	mg/L	Quarterly	5	0	0	<0.001	<0.001	<0.001	0.001 mg/L	ALS
	Semi-Treated Water Supply	Copper	mg/L	Monthly	13	13	0	0.001	0.006	0.002	0.001 mg/L	ALS
	Semi-Treated Water Supply	Iron	mg/L	Weekly	53	48	0	<0.05	0.20	0.07	0.05 mg/L	ALS
	Semi-Treated Water Supply	Lead	mg/L	Weekly	53	0	0	<0.001	<0.001	<0.001	0.001 mg/L	ALS
	Semi-Treated Water Supply	Manganese	mg/L	Weekly	53	53	0	0.019	0.090	0.042	0.001 mg/L	ALS
	Semi-Treated Water Supply	Nickel	mg/L	Quarterly	5	0	0	<0.001	<0.001	<0.001	0.001 mg/L	ALS
	Semi-Treated Water Supply	Zinc	mg/L	Monthly	13	0	0	<0.005	<0.005	<0.005	0.005 mg/L	ALS

Table 7C - Operational monitoring results Drinking Water Supply

Scheme name	Scheme component	Parameter	Units	Frequency of sampling	Total No. of samples collected	No. of samples in which parameter was detected	No. of samples exceeding water quality criteria	Min	Max	Average (Mean)	Limit of Detection	Laboratory name
Non-Metals and Organics												
Lake Julius and Lake Moondarra	Semi-Treated Water Supply	Total Chloride	mg/L	Quarterly	5	5	0	26	34	29	1 mg/L	ALS
	Semi-Treated Water Supply	Fluoride	mg/L	Quarterly	5	5	0	0.20	0.30	0.22	0.1 mg/L	ALS
	Semi-Treated Water Supply	Hydrogen Sulphide	mg/L	Quarterly	5	0	0	<0.05	<0.05	<0.05	0.05 mg/L	ALS
	Semi-Treated Water Supply	Sodium	mg/L	Quarterly	5	5	0	19	25	22	1 mg/L	ALS
	Semi-Treated Water Supply	Sulphate	mg/L	Quarterly	5	5	0	11	18	15	1 mg/L	ALS
Organic Disinfection By-Products												
Lake Julius and Lake Moondarra	Semi-Treated Water Supply	Total Trihalomethanes	mg/L	Monthly	13	13	0	<0.1	0.1	<0.1	0.1 mg/L	ALS
	Semi-Treated Water Supply	Total Halo Acetic Acids	mg/L	Monthly	13	13	0	<0.1	0.1	<0.1	0.1 mg/L	ALS

Table 7D - Operational monitoring results Drinking Water Supply

Scheme name	Scheme component	Parameter	Units	Frequency of sampling	Total No. of samples collected	No. of samples in which parameter was detected	No. of samples exceeding water quality criteria	Min	Max	Average (Mean)	Limit of Detection	Laboratory name
Physicals												
Lake Julius and Lake Moondarra	Semi-Treated Water Supply	Colour	HU	Weekly	52	52	N/A	3	82	42	1HU	MIWB
	Semi-Treated Water Supply	Dissolved Oxygen	% Saturation	Weekly	53	53	15	77.9	102.9	91.3	0.10%	Field
	Semi-Treated Water Supply	pH	Standard	Weekly	53	53	1	6.7	9.3	7.6	0.1	Field
	Semi-Treated Water Supply	2-Methylisoborneol (MIB)	ng/l	Annually	1	1	N/A	8.9	8.9	8.9	0.1 ng/L	ALS
	Semi-Treated Water Supply	Geosmin	ng/l	Annually	1	1	N/A	2.8	2.8	2.8	0.1 ng/L	ALS
	Semi-Treated Water Supply	Total Dissolved Solids	mg/L	Quarterly	5	5	N/A	137	173	155	1mg/L	ALS
	Semi-Treated Water Supply	Conductivity	µS/cm	Weekly	53	53	N/A	161	292	254	1 µS/cm	Field
	Semi-Treated Water Supply	Temperature	°C	Weekly	53	53	N/A	17.5	32.7	25.0	0.1 °C	Field
	Semi-Treated Water Supply	Turbidity	NTU	Weekly	52	52	N/A	1.5	4.4	2.7	0.1 NTU	Field
	Semi-Treated Water Supply	Hardness	Standard	Quarterly	5	5	N/A	62	74	69	1 mg/L	ALS
	50ML Tank	Cyanotoxin	µg/L	Weekly	53	1	0	<0.05	0.07	<0.05	0.05 µg/L	ALS

Table 7D - Operational monitoring results Drinking Water Supply continued...

Scheme name	Scheme component	Parameter	Units	Frequency of sampling	Total No. of samples collected	No. of samples in which parameter was detected	No. of samples exceeding water quality criteria	Min	Max	Average (Mean)	Limit of Detection	Laboratory name
Physicals												
Lake Julius and Lake Moondarra	50ML Tank	Colour	HU	Weekly	52	52	N/A	4	115	44	1HU	MIWB
	50ML Tank	Dissolved Oxygen	% Saturation	Weekly	53	53	10	71.1	111.3	92.5	0.10%	Field
	50ML Tank	pH	Standard	Weekly	53	53	0	6.9	8.4	7.7	0.1	Field
	50ML Tank	Conductivity	µS/cm	Weekly	53	53	N/A	133	294	252	1 µS/cm	Field
	50ML Tank	Temperature	°C	Weekly	53	53	N/A	17.2	34.6	24.7	0.1 °C	Field
	50ML Tank	Turbidity	NTU	Weekly	53	53	N/A	1.1	6.4	2.7	0.1 NTU	Field
	North Tank	Colour	HU	Weekly	52	52	N/A	<1	54	9.0	1HU	MIWB
	North Tank	Dissolved Oxygen	% Saturation	Weekly	53	53	0	87.8	106.7	98.1	0.10%	Field
	North Tank	pH	Standard	Weekly	53	53	1	6.39	8.38	7.75	0.1	Field
	North Tank	Conductivity	µS/cm	Weekly	53	53	N/A	153	298	255	1 µS/cm	Field
	North Tank	Temperature	°C	Weekly	53	53	N/A	15.1	32.5	24.8	0.1 °C	Field
	North Tank	Turbidity	NTU	Weekly	53	53	N/A	0.2	0.7	0.3	0.1 NTU	Field

Table 7D - Operational monitoring results Drinking Water Supply continued...

Scheme name	Scheme component	Parameter	Units	Frequency of sampling	Total No. of samples collected	No. of samples in which parameter was detected	No. of samples exceeding water quality criteria	Min	Max	Average (Mean)	Limit of Detection	Laboratory name
Physicals												
Lake Julius and Lake Moondarra	Drinking Water Supply	Colour	HU	Weekly	52	52	N/A	<1	16	5	1HU	MIWB
	Drinking Water Supply	Dissolved Oxygen	% Saturation	Weekly	53	53	0	90.0	106.1	97.9	0.10%	Field
	Drinking Water Supply	pH	Standard	Weekly	53	53	0	6.6	8.1	7.6	0.1	Field
	Drinking Water Supply	Conductivity	µS/cm	Weekly	53	53	N/A	215	295	258	1 µS/cm	Field
	Drinking Water Supply	Temperature	°C	Weekly	53	53	N/A	16.8	32.1	24.6	0.1 °C	Field
	Drinking Water Supply	Turbidity	NTU	Weekly	53	53	N/A	0.1	1.0	0.4	0.1 NTU	Field

Table 7E - Operational monitoring results Drinking Water Supply

Scheme name	Scheme component	Parameter	Units	Frequency of sampling	Total No. of samples collected	No. of samples in which parameter was detected	No. of samples exceeding water quality criteria	Min	Max	Average (Mean)	Limit of Detection	Laboratory name
Algae Counts												
Lake Julius and Lake Moondarra	50ML Tank	<i>Anabaena circinalis/ Anabaena coiled or straight</i>	cells/ml	Weekly	53	0	N/A	0	0	0	1 Cell/mL	ALS
	50ML Tank	<i>Chrysochlorum</i>	cells/ml	Weekly	53	0	N/A	0	0	0	1 Cell/mL	ALS
	50ML Tank	<i>Chrysochlorum c.f. bergii</i>	cells/ml	Weekly	53	25	N/A	0	2910	356	1 Cell/mL	ALS
	50ML Tank	<i>Chrysochlorum c.f. ovalisporum</i>	cells/ml	Weekly	53	6	N/A	0	2606	108	1 Cell/mL	ALS
	50ML Tank	<i>Cylindrocapsa</i>	cells/ml	Weekly	53	0	N/A	0	0	0	1 Cell/mL	ALS
	50ML Tank	<i>Microcystis</i>	cells/ml	Weekly	53	48	N/A	0	4653	887	1 Cell/mL	ALS
	50ML Tank	<i>Microcystis c.f. aeruginosa</i>	cells/ml	Weekly	53	0	N/A	0	0	0	1 Cell/mL	ALS
	50ML Tank	<i>Nodularia spumigena</i>	cells/ml	Weekly	53	0	N/A	0	0	0	1 Cell/mL	ALS
	50ML Tank	<i>Raphidiopsis raciborskii</i>	cells/ml	Weekly	53	53	N/A	5654	193545	55732	1 Cell/mL	ALS