DRINKING WATER QUALITY MANAGEMENT PLAN

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Drinking Water Quality Management Plan

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MOUNT ISA CITY COUNCIL

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1 INTRODUCTION

This Drinking Water Quality Management Plan (DWQMP) is for the potable water schemes managed by Mount Isa City Council (MICC): Mount Isa and Camooweal. This plan has been developed in accordance with the requirements of Section 93(3) of the *Water Supply (Safety and Reliability) Act 2008* (the Act). The DWQMP addresses the content requirement of the Queensland Drinking Water Quality Management Plan Guideline (the Guideline) (DERM 2010).

This plan contains or references all of the policies, procedures, and registers that are required to maintain drinking water quality for the MICC water supply schemes.

1.1 Scope of the DWQMP

This DWQMP applies to the drinking water distribution service provided by MICC for Mount Isa and the entire supply scheme for Camooweal. MICC is a customer of the Mount Isa Water Board (MIWB) who supplies bulk water to a number of customers in the Mount Isa area, including potable water to MICC.

1.2 Registered service details

MICC is registered as a medium service provider, with details as per Table 1.

Table 1 Registered service details

Service Description	Details	
Service Provider Identification Number (SPID)	91	
Service Provider Name and Contact Details	Mount Isa City Council PO Box 815 23 West Street Mount Isa QLD 4825 Tel: 07 4747 3200 Fax: 07 4747 3209 Email: city@mountisa.qld.gov.au	
Schemes that the plan refers to	**Mount Isa**	**Camooweal**
Current Connected Population	21,237	187
Future Connected Population (2027)	23,459	187
Current Connections (approx.)	7434	78
Current Demand (approx.) ML/a	4716	87.6
Future Demand (2025) ML/a	5209	87.6

Population estimates based on 1% annual growth for Mount Isa and zero growth for Camooweal. Demand forecasts based on current per capita consumption (projected to future population).

1.3 Mount Isa City Council

MICC operates the water supply and sewerage schemes in Mount Isa and Camooweal, in Queensland's north west (see Figure 1).

MICC is responsible for (only) the distribution of drinking water to the city of Mount Isa. The city itself covers an area of 43,310 km^2 and has a population of around 21,000. MICC is also responsible for the treatment and distribution of drinking water to Camooweal, a remote township with a population of about 200 people approximately 190km from Mount Isa.

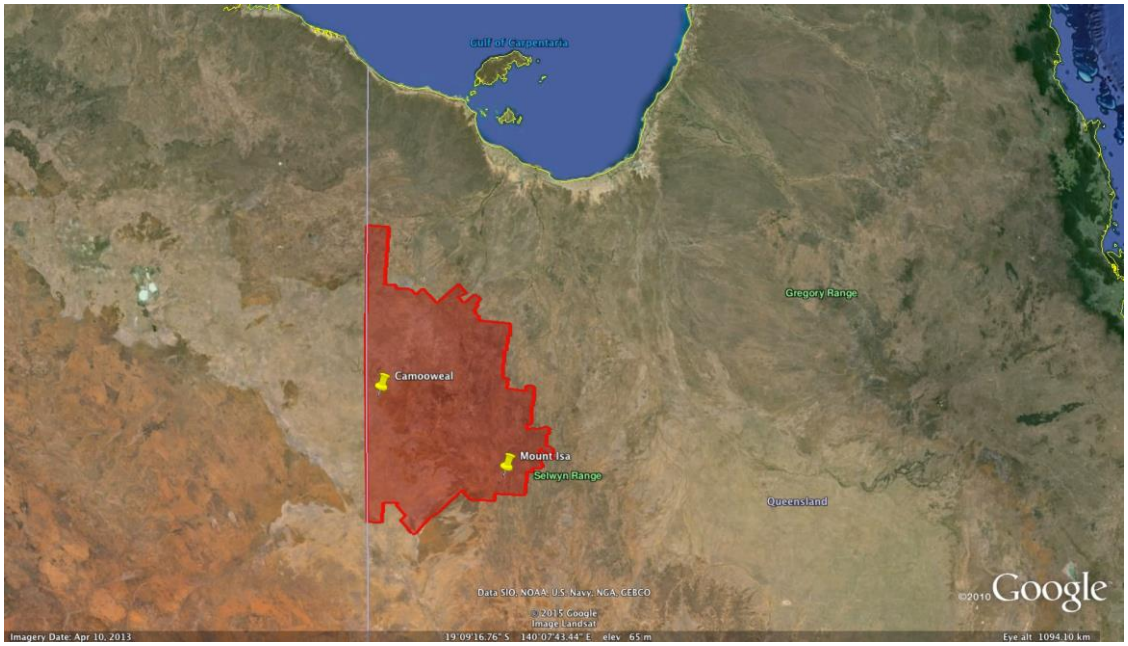


Figure 1 Mount Isa City Council Local Government Area

The Water and Sewerage Schemes are a part of MICC's long-term vision of adopting responsible environmental practice and developing a vibrant and healthy community.

2 COMMITMENT TO DRINKING WATER QUALITY MANAGEMENT

2.1 Drinking Water Quality Policy

MICC has a strong commitment to Drinking Water Quality Management. This is demonstrated by the Water Quality Policy, which is attached in Appendix A.

This policy has been communicated to all relevant staff and is available in hardcopy and digital format on MICC's intranet.

2.2 Regulatory and formal requirements

2.2.1 Regulatory scope

Details of relevant regulatory and other formal requirements relevant to MICC in addition to the Act are provided in the Legal and Other Requirements Register in Appendix B.

2.2.2 Employee responsibilities

The Team Leader Water & Sewerage is responsible for coordinating the implementation of the DWQMP.

Those employees within the water supply section with responsibilities directly related to water quality management have those requirements relevant to their position reflected in their Position Description (PD).

The Drinking Water Quality Policy provides a commitment to ensuring that managers, employees and contractors are aware of their responsibility to implement this plan. This DWQMP states where there are relevant responsibilities.

2.2.3 Identifying and communicating regulatory changes

It is the responsibility of the Team Leader Water & Sewerage to ensure regulatory compliance. Changes to legislation and formal requirements are identified by notification from the Department of Energy and Water Supply (DEWS) through a subscription with the Queensland Parliamentary Council. Changes to the Legal and Other Requirements Register are made accordingly. If a change in legislation requires a change in practice, the owner of the relevant procedure is notified and changes are made accordingly.

Any changes to this DWQMP due to regulatory and formal requirements are communicated to relevant managers, employees and contractors.

2.3 Engaging stakeholders

Stakeholders are any entity that could possibly increase/decrease water quality risks. Several aspects of drinking water quality management require involvement with other agencies and stakeholders. Similarly, consultation with relevant health and other regulatory authorities is necessary for establishing many elements of a DWQMP, such as monitoring and reporting requirements, emergency response plans and communication strategies. This means establishing two-way communication paths with State Government Departments, MICC's customers, contractors and providers.

A Stakeholder and Communication Register has been developed (Appendix C), which identifies all stakeholders who could affect, or be affected by decisions or activities of MICC. The register lists each stakeholder's contact details, their commitment and involvement with water quality, the

frequency of communication between parties and the method of communication. This register is maintained as required.

There are a number of stakeholders that would be classed as sensitive receptors. These include such customers as the hospital and schools. These customers and their contact details are listed in Table 24 of this document.

3 DETAILS OF INFRASTRUCTURE FOR PROVIDING THE SERVICE

3.1 Mount Isa

To supply the city of Mount Isa, MICC receives treated water from MIWB before distributing to its approximately 21,000 consumers. Water for the Mount Isa scheme is obtained from two dammed storages – Lake Julius and Lake Moondarra – on the Leichhardt River to the north of the city.

Water is pumped from the lakes by MIWB, treated (membrane filtration) and disinfected (chlorinated) before being supplied separately to Mount Isa City Council. From there, MICC is responsible for the distribution system (see Figure 2).

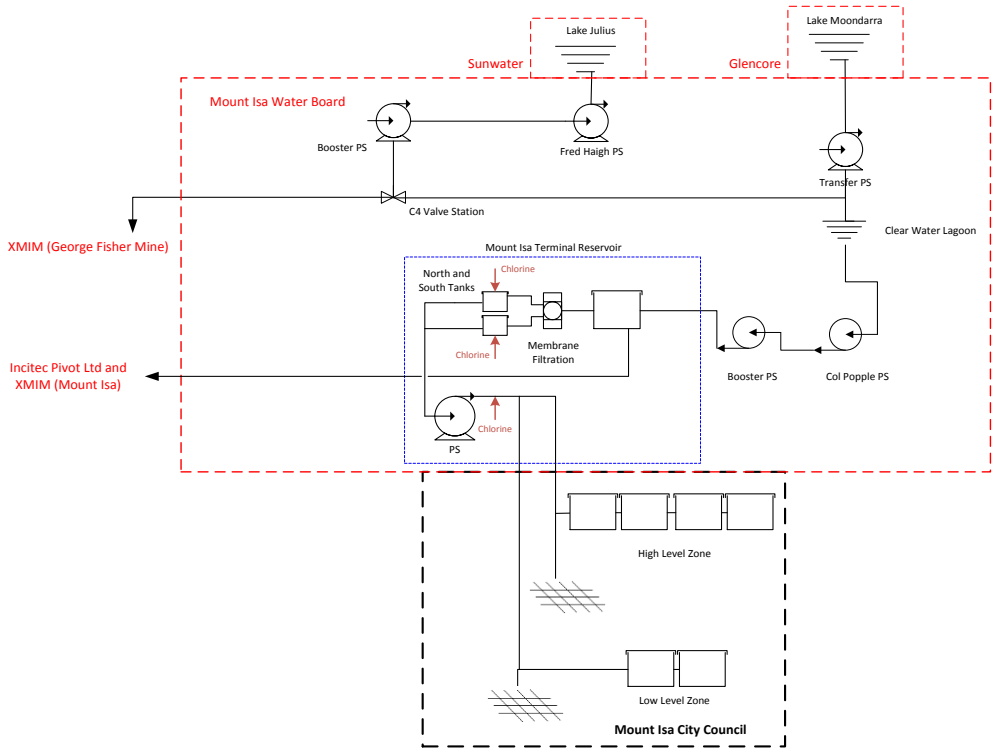


Figure 2 Mount Isa scheme overview

3.1.1 Catchment characteristics

MICC receives bulk treated water from MIWB hence details of the catchment are not described in this report. The catchment and treatment are managed by MIWB and not within the jurisdiction of MICC. Lake Julius is a remote lake that although unprotected has few water quality issues other than seasonal algal blooms. Lake Moondarra has direct cattle access to the Lake and some recreational activities. Lake Moondarra is also periodically impacted by algae. Water is sourced by MIWB from the higher quality source and transferred through Clear Water Lagoon, which is fully protected. Recent algal blooms within Clear Water Lagoon resulted in MIWB introducing membrane filtration which has dramatically improved the water delivered to MICC. Please refer to the MIWB DWQMP for a detailed overview of the catchments.

3.1.2 Process and schematic

The distribution system is divided into a high-level zone serving the development on the hills in the south and east, and a low-level zone serving development in the north and central parts of the city. The two zones have separate supply mains from Mount Isa Terminal Reservoir (MITR) and

reservoirs. The mains in each zone are interconnected at several locations but are normally isolated to prevent flow between zones.

Pumps at the interconnection points between the two zones were originally provided to boost flows from the low-level zone to the high-level zone. The subsequent construction of the separate supply from the MITR to the high-level service reservoirs has obviated the need for the booster pumps. The booster pumps have, however, been retained to provide a means of emergency supply to the high-level zone from the low-level supply. The reservoirs 2 and 4 have chlorine injection based on residual value, and PAX mixers in them. Figure 3 provides a schematic of the distribution system.

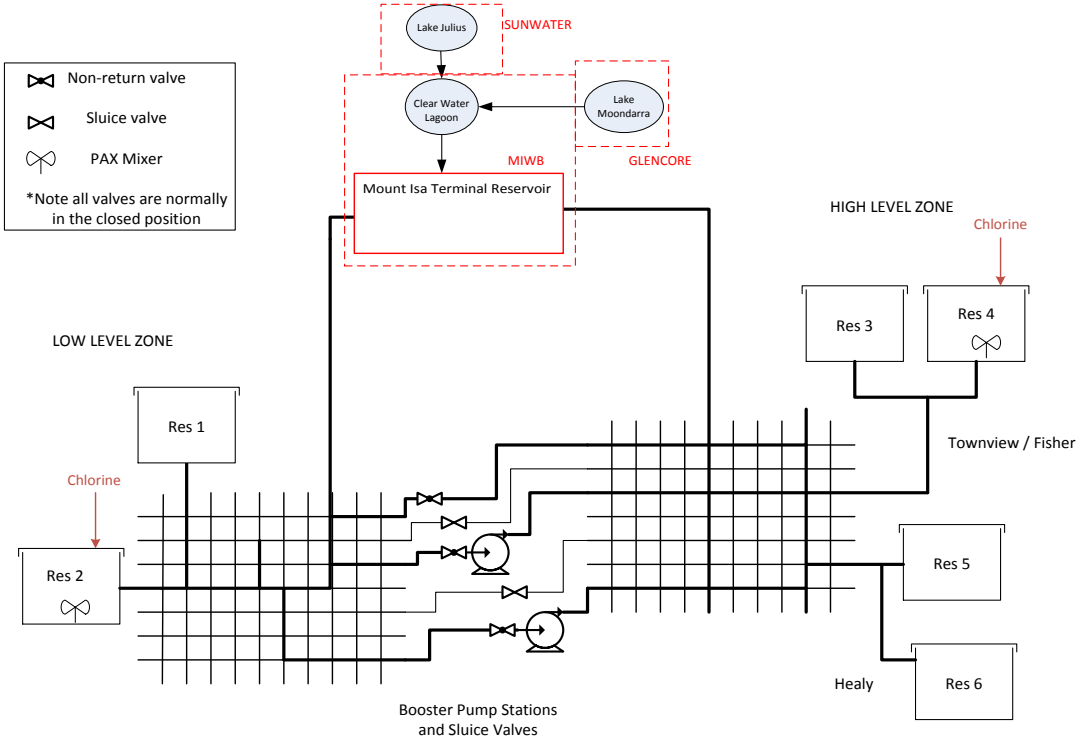


Figure 3 Mount Isa distribution system schematic

3.1.3 Asset details

3.1.3.1 Pipelines

There are 182.1 km of water mains in Mount Isa. Details of the pipe assets are shown in Table 2. A large portion of the reticulation was constructed in the 1960s at a time when asbestos cement pipes were used in this type of network. The performance of asbestos cement pressure pipes has proven to be variable, with significant failures occurring in some areas, while other areas are still performing adequately. It is expected that the failure rate in asbestos cement pipes will increase.

Pipe renewal is based on repair history. Repair history and records indicate “scattered” repairs, rather than a consistent failure of individual pipes. This has led to a targeted replacement program. Small diameter pipelines are replaced on failure.

Areas to the far south and far north of the city at the end of the trunk mains are dead ends and can have long detention times although there is some flushing by tankers collecting water.

Table 2 Infrastructure details

Distribution System	Mount Isa
Pipe material	Asbestos cement pipes being replaced by MDPE
Age range	1960-present (see also Table 2)
Approx. total length	182.1 km of mains
Areas with long detention times	Areas to the far south and the far north of the city at the end of the trunk mains are dead ends and can have long detention times. They get flushed out by tankers collecting water. Reservoirs 1, 2,3 & 4 have a common inlet and outlet pipe so water could potentially become aged within the reservoir.
Areas with low pressure	None

Condition assessment information is in Table 3 in the form of expected economic life. Some of the figures shown are indicative only, for example hydrants and valves are continually replaced as needed.

Table 3 Mount Isa assets: age and life expectancy

Asset Type	Est. age (years)	Expected life (years)	Remaining life (years)
Storage – Reservoir 1	62	100	38
Storage – Reservoirs (others)	40	100	60
Reticulation – Steel Pipes	52	100	48
Reticulation – MDPE	11	90	79
Reticulation – Asbestos Cement	52	70	18
Pump Stations	25	26	1
Fittings – Fire Hydrants	24	60	36
Fittings – Valves	30	60	30
Fittings – Flow meters	3	20	17

3.1.3.2 Storages

Water supplied from the MITR travels via two separate trunk mains. Water is distributed to reticulation before reaching the reservoirs. The reservoirs serve as storage and provide pressure. There are six reservoirs in total and it is estimated that there is just above a day's storage of water in the MICC reticulation system, as detailed in Table 4.

The Low Zone water supply contains Reservoirs 1 and 2 and is controlled by a low and high-level sensor in Reservoir 1. MIWB's control system operates the MITR pumps based on these settings. The top water level in Reservoir 2 is lower than Reservoir 1. A hydraulic valve controls the level of Reservoir 2 to prevent it overflowing. This inlet valve shuts when the reservoir reaches full level and opens again when water drops to the designated low level.

The High Zone has Reservoirs 3, 4, 5 and 6, which all have the same Top Water Level (TWL). Water is distributed evenly to each of the reservoirs and is controlled by the high and low levels of Reservoir 3. Reservoirs 3 and 4 have a common inlet/outlet, which is not ideal for mixing and may

increase water age. Reservoirs 5 and 6 have separate inlet and outlet pipes which provides for more even distribution of the stored water.

The reservoirs are fitted with metal sheeting roofs with box gutters to catch run-off. The box gutters are welded to the overflow pipe inside the reservoir, and roof water runs to a stormwater drain.

Table 4 Mount Isa reservoir details

Details	Res 1	Res 2	Res 3	Res 4	Res 5	Res 6
Capacity (ML)	7.7	8.5	6.8	9.1	1.1	1.25
Elevation (m)	382	375	400	405	405	406
Diameter (m)	37.8	32.1	32.1	36.4	13.8	14.5
Height (m)	7.5	11.2	9.4	9.4	8.1	8.1
TWL (m)	6.7	9.7	7.9	7.9	7.3	7.3
Roofed	Y	Y	Y	Y	Y	Y
Vermin-proof	Y	Y	Y	Y	Y	Y
Run-off directed off roof?	Y	Y	Y	Y	Y	Y

3.1.3.3 Disinfection and chemical dosing

Sodium hypochlorite (liquid) is dosed into reservoirs 2 and 4, with automatic injection based on residual chlorine levels in the reservoirs (the residual is set at 0.3mg/L). There are PAX mixers inside reservoirs 2 and 4 to promote chlorine mixing and prevent water stagnation. If necessary, sodium hypochlorite is dosed manually into the other reservoirs when chlorine becomes low.

3.1.3.4 Pump stations

There are two pumps – a large Thompson Lewis pump on Stanley Street and a smaller unit on East Street – each installed with non-return valves. The purpose of these pumps is to transfer water from the low-level zone to the high-level zone in the event of a loss of pressure in the high-level zone. No such incident has been reported in over ten years. There is also a reflux valve installed on the main at Buckley Street, which automatically allows water to flow from the low-level zone, if there is a loss of pressure in the high-level zone. The pumps have not been operated for at least 10 years and would require considerable effort to bring them back online.

In normal operation, the Stanley St Pump Station's 12-inch sluice valve is open and the reflux is closed by high level pressure. The sluice valve on the East Street Pump Station is closed under normal operation.

3.1.3.5 Fittings

Valves are installed to isolate sections of the reticulation network to minimise the impact of pipe failure and facilitate network repairs. A reflux valve is installed on the main at Buckley St. Under normal operation the sluice valve is open and the reflux valve is closed by high pressure.

Hydrants are used to draw off water from water mains for fire-fighting purposes, flow testing, scouring pipes to remove sediments and to flush dead ends in the network when required.

Water meters measure the water flow for the purpose of monitoring water usage, water losses and water charges (rates).

3.2 Camooweal

3.2.1 Overview

Camooweal currently has two reliable sub-artesian bores used as water sources. They were drilled in February 2012. The old Bore 1 was drilled in 1897, and is no longer in use. Despite its small population, there is a high per-capita water consumption in Camooweal, at more than 800 L/person/day.

3.2.2 Catchment characteristics

Camooweal is situated 188 km north-west of Mount Isa on the Barkly Tablelands in a geomorphological area known as the Camooweal karst area. Camooweal is located in a different catchment area to Mount Isa. It lies to the east of the Georgina River and is classed as arid to semi-arid, with some monsoonal influence. Camooweal receives, on average, 402.9 mm of rainfall across the year most of which occurs during summer. Evaporation exceeds mean rainfall in every month of the year. The vegetation is a mosaic of treeless grasslands and low open savannah woodlands.

Camooweal is situated on the edge of two bioregions. The town itself sits inside the same bioregion as Mount Isa – the Northwest Highlands with the same red soil. A couple of kilometres out of town on the western bank of the Georgina River, the country changes to the Mitchell Grass Downs bioregion. The geology on the western bank is a black soil flat plain of Cainozoic origin typical of the Barkly Tablelands.

The Georgina River groundwater area covers an area of 54,440 km^2. There is no data for water allocation or water use, nor has a sustainable yield for the Georgina groundwater been quantified. However, it is estimated that the present abstraction levels are much less than maximum abstraction possible without any regional depletion of the groundwater resources.

Groundwater resources in the Georgina are contained within four aquifers. These are alluvial, porous rock, fractured rock and carbonate rock aquifers. The carbonate aquifers are important for groundwater resources with the two main ones being the Thorntonia Limestone and the Camooweal Dolomite. The Camooweal Dolomite is extensive and the depth to the top of the aquifer varies from 64 m to 183 m. Bore yields of up to 7.5 L/s have been recorded however the average is 2 L/s. The three (3) Camooweal town bores tap into the same aquifer, Camooweal Dolomite at a depth of 76 m.

The majority of groundwater occurs in the fractures or in sandy beds within the dolomite. The fractures occur as joints, open bedding planes, and solution-widened cavities. It is possible that this could be a source of surface water contamination.

Groundwater recharge is highly localised and dependent on wet season rainfall events of sufficient intensity to cause surface runoff within the small cave catchment area. The general consensus is that the sub-artesian bore provides consistently good quality water.

The main land use in the area is cattle grazing. Bushfires are common in the areas surrounding Camooweal. A number of activities in the township have the potential, although small, to affect groundwater quality. There is an airstrip located to the north of town, a waste tip east of town, a diesel power station on the eastern side of town that contains three 55,000 L diesel tanks and a service station and council machinery depot in the town centre. The risks from these are related to spills and groundwater infiltration.

Residents have septic systems connected to a central effluent collection system. Evaporation ponds, located approximately a kilometre north of the town centre, are used to dispose of the effluent. Water evaporates quickly in the dry heat, however in the winter months, the ponds fill up more rapidly due to the increase in tourists. It is not likely any infiltration occurs that could affect

the water quality of the aquifer. There are no known leakages of septic tanks. Floods in the area have never encroached on the evaporation ponds.

3.2.3 Process and schematic

The bore pumps deliver water which gets injected with chlorine for disinfection before continuing on either to the header tanks or straight through to the town reticulation. Chlorination is undertaken using chlorine gas. The header tanks have a low level automatic switch which signals the bore pumps on, and a high level shut-off to stop the pumps when full. The bore pumps alternate on each cycle weekly so each bore supplies the same volume of water to the scheme based on the current pumping rates. The configuration enables the bores to supply the following proportion to the Camooweal scheme: Bore 1 – 50% and Bore 2 – 50%. There are alarms for pump faults.

If there is a high demand for water when the reservoir is low and the bore pumps are operating, water can travel directly to town without going via the reservoirs. Ground tanks are used only for irrigation. The schematic is shown in Figure 4.

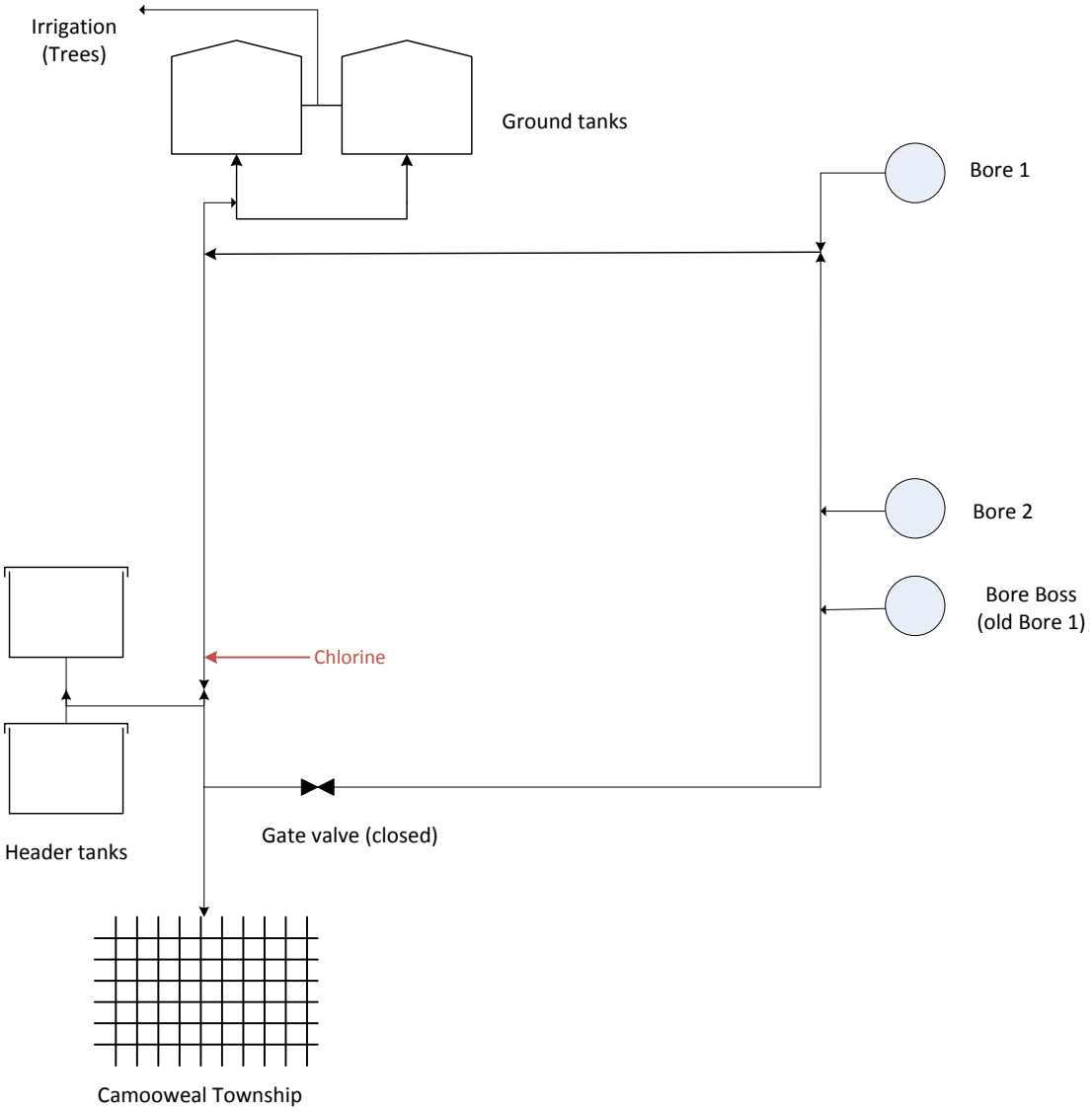


Figure 4 Camooweal schematic

3.2.4 Asset details

3.2.4.1 Infrastructure details

Condition assessment information is shown in Table 5 in the form of expected economic life. Some of the figures shown are indicative only, for example hydrants and valves are continually replaced as needed.

Table 5 Camooweal assets: age and life expectancy

Asset Type	Est. age (years)	Expected life (years)	Remaining life (years)
Headworks Bores 1 & 2	4	88	84
Chlorination Plant	5	25	20
Header Tanks	6	80	74
Reticulation – Steel Pipes	72	96	24
Reticulation – MDPE	0-12	93	81-93
Fittings – Fire hydrants	46	79	33
Fittings – Valves	55	85	30

3.2.4.2 Bores and pumps

Bore 1 was drilled by the State government while bore 2 was drilled by Norrie Drilling Services. The bore heads are raised above the ground level to provide protection from surface runoff. Local pooling or flooding is not considered an issue. The submersible bore pump for Bore 1 has a capacity of 300 L/min. The pressure pump system is subject to power outages and surges are common in the area. MICC has emergency generators and a mobile bore pump available in the case of power outages. Table 6 contains further details on the bores.

Table 6 Bore details

Detail	Bore Boss (old Bore 1)	Bore 1	Bore 2
Location	Water Storage Compound	Water Storage Compound (at 2 m distance from old bore)	Camooweal Sporting Ground
Drilled	1897	2012	2012
Depth	89.6 m	102 m	96 m
Capacity	Not used	6L/sec	6L/sec
Aquifer	Confined Sub-artesian	Confined Sub-artesian	Confined Sub-artesian
Response to events on surface	Unknown	Unknown	Unknown
Casing depth	89.6 m	102 m	96 m
Material	Steel	PVC casing	PVC casing
Age	77 years	5 years	5 years
Bore protection to prevent contamination	Iron collar approx.. 100mm above ground to prevent contaminants entering.	Boreheads are well raised above ground, with concrete slab around the borehead.	Boreheads are well raised above ground, with concrete slab around the borehead

3.2.4.3 Disinfection

A multistage Illawarra pump draws raw water from the main when the bore pump starts. This carrier water is chlorinated using a Siemens chlorinator and is injected back into the main prior to the elevated reservoir.

The chlorine cylinder stands on a set of scales and is manually weighed and manually changed over. There are two spare chlorine cylinders in the storage. Camooweal uses only two cylinders per year. If a complaint is received, then MICC adjusts the chlorine. The council is proposing to install a telemetry system with an online alarm.

The dosing arrangement is fixed, but the dose rate can be adjusted as required, to ensure a free chlorine concentration of at least 0.2 mg/L is maintained in the reticulation.

3.2.4.4 Pipelines

Camooweal has 4.2 km of mains varying in size from 75 to 150 mm servicing a population of 300 people (see Table 7). It is believed that there are no areas of long detention in the reticulation because some residents leave taps continuously running. This means that there is a continuous turn-over of freshly pumped water and a good turnover in the reservoirs. However, there are potential dead ends at Austral Street and Nowranie Street. Detention time for chlorination is an issue as the first customers to receive water are only a matter of metres away from the injection point.

Table 7 Distribution and reticulation details

Distribution System	Camooweal
Pipe material	MDPE, Steel
Age range	0-10, 70 years
Approx. total length	4.2 km of mains
Areas with long detention times	Austral Street and Nowranie Street
Areas with low pressure	None

3.2.4.5 Storages

The details of the storage reservoirs are shown in Table 8.

Table 8 Reservoir storage

Camooweal	Header Tanks	Ground Tanks
Capacity (L)	22,000 (x2)	45,400 (x2)
Elevation (m)	18	Ground
TWL (m)	1.6	3.2
Roofed	Y	Y
Vermin-proof	Y	Y
Run-off directed off roof?	Y	Y

4 HAZARD ANALYSIS AND RISK ASSESSMENT

4.1 Water quality assessment

4.1.1 Water quality data review

A comprehensive summary of the past 7 years' data is provided in Table 9-11 (2010-2017).

Table 12 summarises the most recent results for the source water monitoring (conducted in 2016). Note, for Mount Isa, source water refers to the bulk water delivered by MIWB. For raw water quality information please refer to the MIWB DWQMP, or MIWB's DWQMP Annual Report: http://www.mountisawater.qld.gov.au/wp-content/uploads/MIWB-DWQMP-2015-2016-Annual-Report-Final.pdf

Some notable pieces of information are highlighted in yellow in the tables, and expanded upon here:

Mount Isa

- The 5th percentile of free chlorine results measured at the Terminal Reservoir was 0.3mg/L; turbidity is frequently elevated; and HPC, total coliforms and iron have also been elevated but are usually low (however, there is a known issue with the sample point at this site);
- Free chlorine is frequently low in samples collected from reservoirs 1 to 6, however HPC is generally low (particularly since 2015);
- *E. coli* was detected at several reservoirs on a number of occasions up to 2011;
- Turbidity was historically elevated within the Mount Isa system, however since microfiltration was introduced into MIWB's treatment process, results have significantly dropped;
- Total coliforms have been detected at most sample sites, however the frequency of detection has significantly dropped since the MIWB treatment upgrade;
- THMs are often above 200ug/L but rarely above the health guideline of 250ug/L. One sample result from Reservoir 4 (1/12/2014) exceeded the guideline at 267ug/L. This is the only exceedance out of 85 results across all sample sites. This was prior to MIWB introducing microfiltration for the entire treated water supply and is not considered to reflect the current level of risk.

Camooweal

- Total coliforms have been detected on occasion in raw bore water, and *E. coli* was once detected in both bores on the same day (bore 1 at 2mpn/100mL and bore 2 at 94.5mpn/100mL on 19 June 2014). It is not known what caused these results. Rainfall totals for Camooweal in the preceding 6 weeks totalled 1.2mm so ingress of run-off is unlikely. Turbidity was 0.74NTU in the bore 2 sample, and 6.9NTU in bore 1.
- Turbidity has been elevated >1NTU in both bores, the header tanks, and the distribution system, exceeding the level recommended for chlorine disinfection efficacy; however *E. coli* results in all distribution system samples with turbidity >1NTU were <1mpn/100mL.
- 13 of 41 header tank samples failed the lower alert limit of <0.2mg/L for free chlorine, and HPC has been elevated on occasion (2 results >100cfu/mL);
- An elevated HPC result in the header tank sample coincided with a detection of *E. coli* in the water sample from the BP Station (samples collected 15/03/2017). This suggests possible contamination into the header tanks or bores (noting also that turbidity was high at 24NTU in the BP station sample the previous week). Chorine residuals were generally adequate before and/or after this event, indicating it was transitory. Based on Bureau of Meteorology data, 20mm of rain had fallen at Camooweal within the previous week. It is noted that the BP Station

tap is described as a poor sampling tap, with issues related to internal plumbing on-site (rusty/dirty water that requires flushing out before a sample is collected);

- 10 of 252 distribution system samples recorded turbidity results above 5NTU;
- Hardness and total dissolved solids exceed ADWG aesthetic guidelines;
- Gross alpha and beta (K40 corrected) activity was detectable, but below the screening level outlined in the ADWG; radioactivity is therefore not a concern;

Table 9 Mount Isa water quality assessment summary (1)

		Free Chlorine (mg/L)	pH	Turbidity (NTU)	HPC (cfu/mL)	*E. coli* (mpn/100mL)	Total coliforms (mpn/100mL)	Iron (mg/L)	THMs (ug/L)
Terminal Reservoir	Count	348	286	261	265	346	346	7	17
	Minimum	0.1	6.33	0.06	<1	<1	<1	0.02	56
	Maximum	3.5	8.14	20.3	738	<1	45.3	0.59	216
	Average	1.46	7.64	1.38	5.89	<1	<1	0.13	107
	Standard Dev.	0.59	0.23	2.19	50.66	<1	3.19	0.20	45
	95th percentile	2.5	7.915	3.59	9.86	<1	<1	0.437	179
	5th percentile	0.3	7.32	0.12	<1	<1	<1	0.0218	62
	# Exceeds high	0	0	7	N/A	0	N/A	1	0
	# Exceeds low	N/A	1	N/A	N/A	N/A	N/A	N/A	N/A
Reservoir 1	Count	323	267	241	243	218	219	N/A	6
	Minimum	<0.1	6.46	0.09	<1	<1	<1	N/A	167
	Maximum	1.2	8.05	3.14	738	2	>200	N/A	196
	Average	0.16	7.65	0.62	24.79	<1	12.55	N/A	179
	Standard Dev.	0.10	0.22	0.63	66.90	<1	32.98	N/A	12
	95th percentile	0.3	7.934	1.8	74	<1	66.28	N/A	195
	5th percentile	0.1	7.41	0.12	0	<1	<1	N/A	167
	# Exceeds high	0	0	0	N/A	1	N/A	N/A	0
	# Exceeds low	N/A	1	N/A	N/A	N/A	N/A	N/A	N/A
Reservoir 2	Count	360	280	256	256	256	255	N/A	6
	Minimum	<0.1	6.48	0.07	0	<1	<1	N/A	116
	Maximum	4	8.16	3.08	680	40	165.2	N/A	201
	Average	0.27	7.65	0.63	31.75	<1	7.85	N/A	159
	Standard Dev.	0.41	0.22	0.77	71.49	2.77	23.57	N/A	29
	95th percentile	0.9	7.92	2.4	167	<1	50.12	N/A	193
	5th percentile	<0.1	7.39	0.09	0	<1	0	N/A	121
	# Exceeds high	0	0	0	N/A	13	N/A	N/A	0
	# Exceeds low	N/A	1	N/A	N/A	N/A	N/A	N/A	N/A
Reservoir 3	Count	317	255	230	243	249	249	N/A	8
	Minimum	<0.1	6.39	0.06	<1	<1	<1	N/A	135
	Maximum	1.2	8.38	4.61	400	6	>200	N/A	197
	Average	0.25	7.64	0.82	10.6	<1	7.46	N/A	173
	Standard Dev.	0.20	0.25	0.79	35.9	<1	23.03	N/A	23
	95th percentile	0.7	7.98	2.3	43.5	<1	36.4	N/A	196
	5th percentile	0.1	7.33	0.12	<1	<1	<1	N/A	138
	# Exceeds high	0	0	0	N/A	2	N/A	N/A	0
	# Exceeds low	N/A	1	N/A	N/A	N/A	N/A	N/A	N/A

Table 10 Mount Isa water quality assessment summary (2)

		Free Chlorine (mg/L)	pH	Turbidity (NTU)	HPC (cfu/mL)	*E. coli* (mpn/100mL)	Total coliforms (mpn/100mL)	Iron (mg/L)	THMs (ug/L)
Reservoir 4	Count	300	267	242	212	196	196	N/A	9
	Minimum	<0.1	6.42	0.06	<1	<1	<1	N/A	103
	Maximum	3	8.18	11.6	520	<1	>200	N/A	267
	Average	0.20	7.65	0.76	15.65	<1	33.31	N/A	182
	Standard Dev.	0.22	0.23	1.20	43.16	<1	63.43	N/A	49
	95th percentile	0.5	7.94	2.2	71.71	<1	201	N/A	243
	5th percentile	<0.1	7.38	0.09	<1	<1	<1	N/A	113
	# Exceeds high	0	0	2	N/A	0	N/A	N/A	0
	# Exceeds low	N/A	1	N/A	N/A	N/A	N/A	N/A	N/A
Reservoir 5	Count	346	283	257	265	249	249	N/A	7
	Minimum	<0.1	6.37	0.06	<1	<1	<1	N/A	127
	Maximum	0.8	8.14	2.96	500	5	>200	N/A	210
	Average	0.21	7.65	0.71	25.77	<1	21.51	N/A	177
	Standard Dev.	0.12	0.24	0.75	66.40	<1	47.41	N/A	34
	95th percentile	0.44	7.95	2.3	89.2	<1	144.5	N/A	210
	5th percentile	0.1	7.32	0.1	<1	<1	<1	N/A	129
	# Exceeds high	0	0	0	N/A	1	N/A	N/A	0
	# Exceeds low	N/A	2	N/A	N/A	N/A	N/A	N/A	N/A
Reservoir 6	Count	352	289	263	266	249	249	N/A	7
	Minimum	<0.1	6.38	0.05	<1	<1	<1	N/A	140
	Maximum	1	8.09	3.86	738	2	>200	N/A	236
	Average	0.23	7.64	0.71	16.96	<1	23.82	N/A	194
	Standard Dev.	0.14	0.23	0.75	64.02	<1	52.43	N/A	33
	95th percentile	0.5	7.94	2.3	73.95	<1	186.38	N/A	228
	5th percentile	0.1	7.31	0.1	<1	<1	<1	N/A	146
	# Exceeds high	0	0	0	N/A	1	N/A	N/A	0
	# Exceeds low	N/A	1	N/A	N/A	N/A	N/A	N/A	N/A
Distribution System	Count	1192	876	783	793	1184	1186	21	25
	Minimum	<0.1	6.36	0.06	<1	<1	<1	0.005	102
	Maximum	4	8.55	9.65	764	<1	>200	0.032	220
	Average	0.45	7.66	0.81	25.44	<1	7.23	0.02	144
	Standard Dev.	0.47	0.23	0.98	73.84	<1	31.51	0.01	28
	95th percentile	1.4	7.95	2.6	75.8	<1	25.05	0.03	201
	5th percentile	0.1	7.36	0.09	<1	<1	<1	0.005	111
	# Exceeds high	0	1	2	N/A	<1	N/A	0	25
	# Exceeds low	N/A	2	N/A	N/A	N/A	N/A	N/A	N/A

Table 11 Camooweal water quality assessment summary

		Free Chlorine (mg/L)	pH	Turbidity (NTU)	Total coliforms *(mpn/100mL)*	*E. coli* *(mpn/100mL)*	HPC (cfu/mL)
Bore 1	Count	N/A	74	59	76	69	N/A
	Minimum	N/A	6.62	0.06	<1	<1	N/A
	Maximum	N/A	8.04	6.9	>200	2	N/A
	Average	N/A	7.44	0.43	9.2	<1	N/A
	Standard Dev.	N/A	0.27	0.93	32.3	0.24	N/A
	95th percentile	N/A	7.82	1.02	34.9	<1	N/A
	5th percentile	N/A	6.95	0.09	<1	<1	N/A
	# Exceeds high	N/A	0	1	N/A	1	N/A
	# Exceeds low	N/A	0	N/A	N/A	N/A	N/A
Bore 2	Count	N/A	54	52	56	55	N/A
	Minimum	N/A	7.28	0.08	<1	<1	N/A
	Maximum	N/A	8.08	3.84	200	94.5	N/A
	Average	N/A	7.59	0.57	13.2	1.7	N/A
	Standard Dev.	N/A	0.19	0.75	40.1	12.7	N/A
	95th percentile	N/A	7.93	2.09	108.4	<1	N/A
	5th percentile	N/A	7.33	0.11	<1	<1	N/A
	# Exceeds high	N/A	0	0	N/A	1	N/A
	# Exceeds low	N/A	0	N/A	N/A	N/A	N/A
Header Tank	Count	41	41	41	8	8	40
	Minimum	<0.1	6.66	0.07	<1	<1	<1
	Maximum	3.5	7.98	3.44	7.5	<1	738
	Average	0.89	7.52	0.38	1	<1	30
	Standard Dev.	0.92	0.21	0.53	3	<1	118
	95th percentile	3	7.85	0.80	6	<1	82.2
	5th percentile	<0.1	7.32	0.15	<1	<1	0
	# Exceeds high	0	0	0	N/A	0	N/A
	# Exceeds low	41	0	N/A	N/A	N/A	N/A
Distribution System	Count	259	262	252	269	269	126
	Minimum	<0.1	6.59	0.06	<1	<1	0
	Maximum	4	8.06	67.5	165.2	30.6	208
	Average	0.57	7.51	1.44	3.03	<1	14.6
	Standard Dev.	0.74	0.22	5.56	14.0	1.9	28.3
	95th percentile	1.82	7.78	4.03	11.9	<1	60.6
	5th percentile	<0.1	7.20	0.09	<1	<1	0
	# Exceeds high	0	0	10	N/A	1	N/A
	# Exceeds low	N/A	0	N/A	N/A	N/A	N/A

Table 12 Source water quality monitoring – Mount Isa (Terminal Reservoir)

Parameter	Units	Count	Min	Max	Average	Stdev	# Exceeds
Nitrate	mg/L	2	0.02	0.02	0.02	<0.02	0
Nitrite	mg/L	2	<0.01	<0.01	<0.01	<0.01	0
Aluminium	mg/L	2	0.008	0.011	0.0095	0.002	0
Arsenic	mg/L	2	0.001	0.002	0.0015	0.001	0
Barium	mg/L	2	0.029	0.043	0.036	0.010	0
Beryllium	mg/L	2	<0.001	<0.001	<0.001	<0.001	0
Boron	mg/L	2	<0.05	<0.05	<0.05	<0.05	0
Cadmium	mg/L	2	<0.0001	0.0001	<0.0001	<0.0001	0
Chromium	mg/L	2	<0.001	0.005	0.00275	0.003	0
Copper	mg/L	2	0.002	0.005	0.0035	0.002	0
Iodide	mg/L	2	<0.01	0.048	0.0265	0.030	0
Iron	mg/L	7	0.011	0.18	0.049	0.060	0
Lead	mg/L	2	<0.001	<0.001	<0.001	<0.001	0
Manganese	mg/L	6	0.001	0.094	0.018	0.037	0
Mercury	mg/L	2	<0.0001	<0.0001	<0.0001	<0.0001	0
Molybdenum	mg/L	2	<0.005	<0.005	<0.005	<0.005	0
Nickel	mg/L	2	0.001	0.002	0.0015	0.001	0
Selenium	mg/L	2	<0.005	<0.005	<0.005	<0.005	0
Silver	mg/L	2	0.0005	0.0025	0.0015	0.001	0
Zinc	mg/L	2	0.015	0.019	0.017	0.003	0
Fluoride	mg/L	2	0.24	0.31	0.275	0.049	0
Hardness	mg/L as $CaCO_3$	4	75	100	85.5	11	0
TDS	mg/L	2	160	250	205	64	0
OC & OP Pesticides	µg/L	1	Not detected				
Gross Alpha Activity	Bq/L	1	Not detected				
Gross Beta Activity	Bq/L	1	Not detected				

Table 13 Source water quality monitoring – Camooweal (Bores 1 and 2)

Parameter	Units	Count	Min	Max	Average	Stdev	# Exceeds
Nitrate	mg/L	4	0.17	0.54	0.39	0.17	0
Nitrite	mg/L	4	<0.01	<0.01	<0.01	<0.01	0
Aluminium	mg/L	4	0.0025	0.022	0.007	0.01	0
Arsenic	mg/L	4	<0.001	<0.001	<0.001	<0.001	0
Barium	mg/L	4	0.117	0.129	0.122	0.006	0
Beryllium	mg/L	4	<0.001	<0.001	<0.001	<0.001	0
Boron	mg/L	4	0.096	0.102	0.099	0.003	0
Cadmium	mg/L	4	<0.0001	<0.0001	<0.0001	<0.0001	0
Chromium	mg/L	4	<0.001	0.001	<0.001	<0.001	0
Copper	mg/L	4	0.001	0.002	0.00125	<0.001	0
Iodide	mg/L	4	<0.01	0.01	0.0075	<0.01	0
Iron	mg/L	4	<0.01	0.063	0.03	0.03	0
Lead	mg/L	4	<0.001	0.001	<0.001	<0.001	0
Manganese	mg/L	4	<0.001	<0.001	<0.001	<0.001	0
Mercury	mg/L	4	<0.0001	<0.0001	<0.0001	<0.0001	0
Molybdenum	mg/L	4	<0.005	<0.005	<0.005	<0.005	0
Nickel	mg/L	4	0.001	0.003	0.002	0.001	0
Selenium	mg/L	4	0.0025	0.0025	0.0025	0	0
Silver	mg/L	4	0.0005	0.0005	0.0005	0	0
Zinc	mg/L	4	<0.005	0.005	<0.005	<0.005	0
Fluoride	mg/L	4	0.36	0.48	0.41	0.05	0
Hardness	mg/L as $CaCO_3$	4	360	400	385	19	4
TDS	mg/L	4	550	660	595	47	1
OC & OP Pesticides	µg/L	2	Not detected				
Gross Alpha Activity	Bq/L	2	0.07	0.07	0.07	0	0
Gross Beta Activity	Bq/L	2	0.06	0.1	0.08	0.028	0

4.1.2 Customer complaints

Two years of customer water quality complaint data were reviewed, with the nature of the complaints as follows:

- Dirty water – 16 complaints in Mount Isa
- Taste/odour – 2 complaints in Mount Isa

No complaints were received from the Camooweal scheme.

The rate of customer complaints (less than 1 per 1000 customers per year) is considered to be low. The cause of the dirty water complaints is likely to be accumulated sediment in the distribution system.

4.2 Risk assessment team

As with the previous risk assessments, MICC's risk assessment team:

- Is multi-disciplinary, including staff with knowledge of the day to day operations of the schemes;
- included at least one member with formal risk assessment training or equivalent experience or skills, the remaining members of the team received an introduction to the risk assessment process, prior to commencing the risk assessment.

Table 14 Risk assessment team

Name	Organisation	Position title	Role & Experience
Stephen Wagner	MICC	Team Leader Water and Sewerage	Overall management responsibility for DWQMP implementation. Significant experience in water & sewage operations & plumbing. 3 years at Mount Isa City Council and has been involved with numerous water quality, safety and environmental risk assessments and audits.
Andrea O'Hara	MICC	Administration Officer Water & Sewerage	Administrative support for DWQMP implementation and reporting. 2 years' experience coordinating DWQMP tasks and monitoring Water & Sewerage team activities.
Isaac Ryan	MICC	Leading Hand Water and Sewerage	Leads operational tasks in accordance with DWQMP. 6 years as a qualified plumber, 5 years' experience in water and wastewater operations at MICC.
Sean Hinton	Bligh Tanner	Senior Scientist	Risk review facilitator. Facilitated numerous water quality risk assessments and developed several drinking water quality management plans. Background in water chemistry, and qualified Water Quality Management Systems Lead Auditor.

The team were advised that there had been no change in the incoming risk levels from MIWB since the 2015 risk review.

4.3 Risk methodology

Previously, MICC has utilised a methodology that involved the assessment of inherent risk (that present in the source water); maximum risk (the inherent risk plus any additional sources of risk due to MICC's infrastructure or activities); and residual risk (maximum risk reassessed with application of controls). For the 2017 risk review, this process has been refined to simply assess maximum risk and residual risk.

Any risk that was assessed as high or above was deemed to be significant or unacceptable. Significant maximum risks require adequate risk mitigation to be in place and robust operational procedures. Unacceptable residual risks identify a gap in risk mitigation and require further risk treatments to bring the risk level down to acceptable. It should be noted that all unacceptable residual risks were assigned additional risk treatments, and form part of the Improvement Plan of the DWQMP.

Risk scores are assessed using a likelihood and consequence risk matrix (Table 15). The risk score is the intercept of likelihood and consequence.

Table 15 Risk matrix

Likelihood	Consequence				
	Insignificant	Minor	Moderate	Major	Catastrophic
Almost certain	Medium (E1)	High (E2)	Very High (E3)	Extreme (E4)	Extreme (E5)
Likely	Medium (D1)	High (D2)	Very High (D3)	Extreme (D4)	Extreme (D5)
Possible	Low (C1)	Medium (C2)	High (C3)	Very High (C4)	Extreme (C5)
Unlikely	Low (B1)	Low (B2)	Medium (B3)	High (B4)	Very High (B5)
Rare	Low (A1)	Low (A2)	Low (A3)	Medium (A4)	Medium (A5)

In assessing the risk score, the first step is to determine the consequence of the hazardous event. The consequence categories used are defined in Table 16.

Table 16 Consequence descriptors

Descriptor	Definition	Example
Insignificant	Insignificant impact, little disruption to normal operation, low increase in normal operation costs	Isolated exceedance of aesthetic parameter with little or no disruption to normal operation
Minor	Minor impact for small population, some manageable operation disruption, some increase in operating costs	Local aesthetic impact or isolated exceedance of chronic health parameter
Moderate	Minor impact for large population, significant modification to normal operation but manageable, operation costs increase, increased monitoring	Widespread aesthetic impact or repeated breach of chronic health parameter
Major	Major impact for small population, systems significantly compromised and abnormal operation if at all, high level of monitoring required	Potential acute health impact, single barrier failure and increased localised risk of pathogen contamination
Catastrophic	Major impact for large population, complete failure of systems	Potential acute health impact, loss of system control and the safety of a widespread area of the supply is compromised

Following the identification of the consequence, the likelihood of that consequence materialising was determined using the likelihood categories defined in Table 17. To assist in the categorisation of hazardous events, a unit was considered to be a day, e.g. a seasonal event that lasted a week was considered to happen seven times per year, hence would have been defined as possible.

The advantage of using the "likelihood of the consequence" approach is that it does not overstate risk. Calculation of the likelihood of the hazard occurring would not be a realistic representation.

Table 17 Likelihood descriptors

Descriptor	Definition	Example
Rare	May occur only in exceptional circumstances	May occur less than or equal to once every 10 years
Unlikely	Could occur at some time	May occur more often than once every 10 years and up to once every 5 years
Possible	Might occur or should occur at some time	May occur more often than once every 5 years and up to once a year
Likely	Will probably occur in most circumstances	May occur more often than once per year and up to once per month
Almost Certain	Is expected to occur in most circumstances	May occur more often than once per month

Assessing uncertainty provides an indication of the need to undertake further work or gather more data to ensure that the risk assessment is accurate and reliable. This is addressed in risk treatment (improvements), and is included in the Improvement Plan, where relevant.

For each hazard and hazardous event assessment, the level of uncertainty in the assessment was identified using the definitions in Table 18.

Table 18 Uncertainty descriptors

Descriptor	Definition
Certain	There is 5 years of continuous monitoring data, which has been trended and assessed, with at least daily monitoring; or the processes involved are thoroughly understood
Confident	There is 5 years of continuous monitoring data, which has been collated and assessed, with at least weekly monitoring or for the duration of seasonal events; or there is a considerable understanding of the processes involved
Reliable	There is at least a year of continuous monitoring data available, which has been assessed; or there is a good understanding of the processes involved
Estimate	There is limited monitoring data available; or there is a reasonable understanding of the processes involved
Uncertain	There is limited or no monitoring data available; or the processes are not well understood

4.4 Risk assessment

To review the pre-existing risk assessment, the following process was undertaken:

- The team discussed the system schematics, risk methodology, recent water quality performance, and the findings from the 2017 external DWQMP audit;
- Water quality hazards were reviewed, and consideration was given to whether any new hazards could be identified;

- Recent communications with MIWB on water quality issues were discussed, as to their relevance on transferred risk;
- Maximum risk level was reviewed, and risk scoring re-evaluated (including uncertainty);
- Hazardous events were reviewed, and consideration was given to whether any new hazardous events could be identified;
- Preventive measures were reviewed, to determine whether they were still relevant and/or if any new preventive measures existed;
- Residual risk was reassessed, and risk scoring (including uncertainty) updated where relevant;
- Risk management improvement items were identified to address unacceptable risks (see section 8).

The resulting risk registers for Mount Isa and Camooweal are provided in Appendix D. A summary of the unacceptable mitigated risks is provided in Table 19 below. The 'limiting' hazard for each hazardous event is shown in bold text.

Table 19 Significant unacceptable risks

Scheme	Hazard(s)	Hazardous Event	Residual risk level
Mount Isa	**Bacteria**, turbidity & taste/odour	Deterioration of water quality in reservoirs as a result of variable residence times; stagnation	Very high
	Bacteria, opportunistic pathogens, turbidity, DBPs	Poor mixing within reservoir	Very high
	Bacteria, opportunistic pathogens, protozoa, viruses, hydrocarbons, taste/odour, pesticides, fertilisers, toxins	Backflow	High
	Disinfection by-products (e.g. THMs & HAAs)	Formation of Disinfection By-products	High
Camooweal	Viruses, **Bacteria**, Protozoa, Hydrocarbons, Turbidity, Colour	Stormwater runoff ingress through bore casing and insecure bore head.	High
	Viruses, **Bacteria**, **Protozoa,** Hydrocarbons, Turbidity, Colour	Contaminated surface water may negatively impact water in the aquifer. Dumping of rubbish in surrounding caves could lead to groundwater contamination after rainfall event (see Eberhard 2003).	High (*for both limiting hazards; bacteria and protozoa assessed separately*)

5 RISK MANAGEMENT

5.1 Operational control

5.1.1 Existing preventive measures

A Critical Control Point (CCP) is defined as an activity, procedure or process at which control can be applied and which is essential to prevent a hazard or reduce it to an acceptable level. Not all activities are amenable to selection as critical control points. A CCP has several operational requirements, including:

- operational parameters that can be measured and for which critical limits can be set to define the operational effectiveness of the activity (e.g. chlorine residuals for disinfection)
- operational parameters that can be monitored frequently enough to reveal any failures in a timely manner (online and continuous monitoring is preferable)
- procedures for corrective action that can be implemented in response to deviation from critical limits.

The determination of CCPs was made using the decision tree in Figure 5.

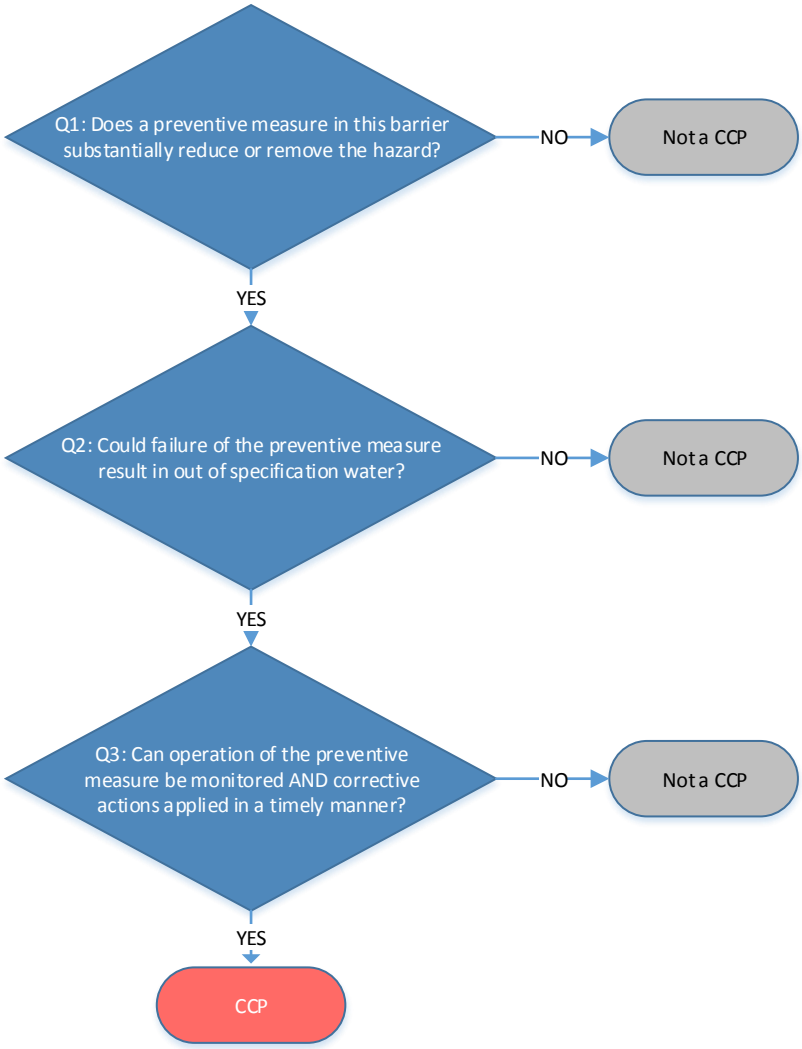


Figure 5 CCP decision tree

Preventive measures that manage a hazard with a significant maximum risk were assessed to determine if they were a CCP for that hazard. There could be more than one CCP for a particular hazard. The identified CCPs are recorded in Table 6 overleaf.

CCPs are to be reassessed on the following triggers:

- if there is a significant change to the process
- if the risk assessment is changed
- if the review of CCP identifies the need.

For each identified CCP critical and alert limits were set. The critical limit is the point where, once exceeded, the treatment process is taken to be out of control. This may result in a non-compliant product being supplied, so action must be taken to bring the process back under control. Alert limits are set to raise the alarm before the critical limit is exceeded.

Existing preventive measures including CCPs are described in Table 20.

5.1.2 Proposed preventive measures

Proposed preventive measures are included in the risk management improvement plan (see Section 8) along with timeframes and responsibilities for their implementation.

5.1.3 Operation and maintenance procedures

Operational procedures formalise the activities that are essential to ensure the provision of consistently good quality water. Detailed procedures are required for the operation of all processes and activities (both on-going and periodic), including preventive measures, operational monitoring and verification procedures, and maintenance requirements.

MICC has developed several significant standard operating procedures which were identified during the development of the original DWQMP. Water staff have also undergone training on use and implementation of the developed procedures.

The Team Leader Water & Sewerage is responsible for the revision of procedures and documents, if procedures are changed or need to be upgraded.

If there is a change in the operating practice then the relevant staff (e.g. Leading Hand) informs the Team Leader Water & Sewerage to undertake the revision. All staff concerned have input into the revision/upgrade of documents/procedures. The version control of documents is maintained by the Team Leader Water & Sewerage.

All operations and maintenance procedures and documents are accessible by operational staff as hard copies available on-site.

It the responsibility of the Team Leader Water and Sewerage to ensure that the procedures are understood and implemented by operational staff. The Team Leader ensures that procedures are followed and identifies any emerging issues. Staff members are trained in procedures relevant to their role through induction and on the job training.

Table 21 lists the set of procedures which are in place to reduce significant risks.

Table 20 Existing preventive measures

Measure	What	How	Where	When	Who	Target	CCP?	Critical Limit	Corrective Action Procedure
Chlorine residual	Free chlorine	Grab samples	Reservoirs	Weekly (Mt Isa)	Laboratory Assistant	0.3-0.5 mg/L	Yes	>4.5mg/L or <0.1mg/L (alert >3.5mg/L or <0.2mg/L)	CCP Procedure
Reservoir inspection (incl. security fences, locks on hatches)	Reservoir integrity	Visual inspection	Reservoirs	6-monthly	Operators	No issues	No	N/A	Reservoir inspection
Management of reservoir levels (Mt Isa)	Free chlorine	Grab samples	Reservoirs	Weekly	Laboratory Assistant	0.3-0.5 mg/L	No	N/A	Reservoir management
	HPC	Grab samples	Reservoirs	Weekly	Laboratory Assistant	<200 cfu/mL	No	N/A	
Flushing	Odour	Sensory	Mains	Following flushing, pipe repairs	Operators	No foul smell	No	N/A	Mains Flushing, Mains Repairs
	Chlorine	Grab samples	Mains			0.3-0.5 mg/L	No	N/A	
	Colour	Visual	Mains			Not dirty	No	N/A	
Plumbing code for backflow connections	Annual tests of backflow devices	Test report	At each individual device	Annually	Trade Waste Officer (role vacant)	Compliance	No	N/A	Improvement Plan
AS/NZS 4020	Assurance that the product meets Australian Standard.	Specified in contract	N/A	On purchase or receipt	Team Leader	Compliance Australian Standard Watermark	No	N/A	Council policies
On the job training	Competency	Training register through HR, inspection of work	Onsite; human resources	Ongoing	Team Leader	Competency to undertake delegated tasks	No	N/A	Stated in DWQMP
Collar and casing on the bore	Integrity	Visual inspection	Bores	6-monthly	Operators	No issues	No	N/A	Bore inspection

Table 21 Procedure list

Title	Status	Date active/revised
Mains Hygiene	Existing	2017
Mains Flushing	Existing	2017
Reservoir and Bore Inspections	Existing	2017
Reservoir Cleaning	Existing	2017
Management of Reservoirs	Existing	2017
CCP for Chlorination	Existing	2017
Response to water quality complaints	Existing	2004
Response to customer complaints	Existing	2004
Water quality monitoring and testing	Existing (hard copies in lab)	To be rewritten (see RMIP)

5.1.4 Materials and chemicals

The selection of materials and chemicals used in water systems is an important consideration as they have the potential to adversely affect drinking water quality.

MICC procures sodium hypochlorite and gaseous chlorine from reputable drinking water chemical providers (e.g. IXOM or Elite Chemicals).

5.2 Information management

This DWQMP contains and identifies all documents and records that are required for the management of drinking water quality. All employees receive on-the-job training to ensure that they understand operating procedures, document management and record keeping requirements in accordance with this DWQMP.

The management of the records for water quality information is explained in the Monitoring Plan (supporting document). The Team Leader Water & Sewerage is responsible for revision of procedures. Revisions are prompted when procedures are changed or need to be upgraded. The Team Leader is responsible for ensuring all staff are aware of and implement revised procedures.

MICC's documents and records are stored on Dataworks electronic filing system. Incoming documents are scanned and filed electronically and hard copies are filed in the relevant departments. Monitoring data is recorded in a digital format on an Excel spreadsheet every three to four days at the laboratory and emailed to the Team Leader for review before being saved to Dataworks in chronological folders. All staff have access to Dataworks. Documents go through the Senior Records Officer, the Senior Environmental Health Officer, the Executive and the Chief Executive Officer.

The Senior Records Officer is responsible for record retention and currency on Dataworks. Only current documents, including procedures are accessible by staff through Dataworks. This ensures that obsolete procedures are not used. The currency of any printed hard copy procedure on-site is the responsibility of the Team Leader. Five-year-old data are archived through the council system.

6 INCIDENTS AND EMERGENCIES

Considered and controlled responses to incidents and emergencies that can compromise the safety of water quality are essential for protecting public health, as well as maintaining consumer confidence and the organisation's reputation.

6.1 Incident levels

Incidents and emergencies within MICC's drinking water schemes are grouped in four levels, with Level 1 being the least severe and complex in relation to response coordination. Figure 6 shows the levels and escalations of drinking water incidents and emergency, and linkages between the levels.

Table 22 describes the situations that would lead to classification against the various incident levels, and Table 23 describes the typical actions that would be undertaken.

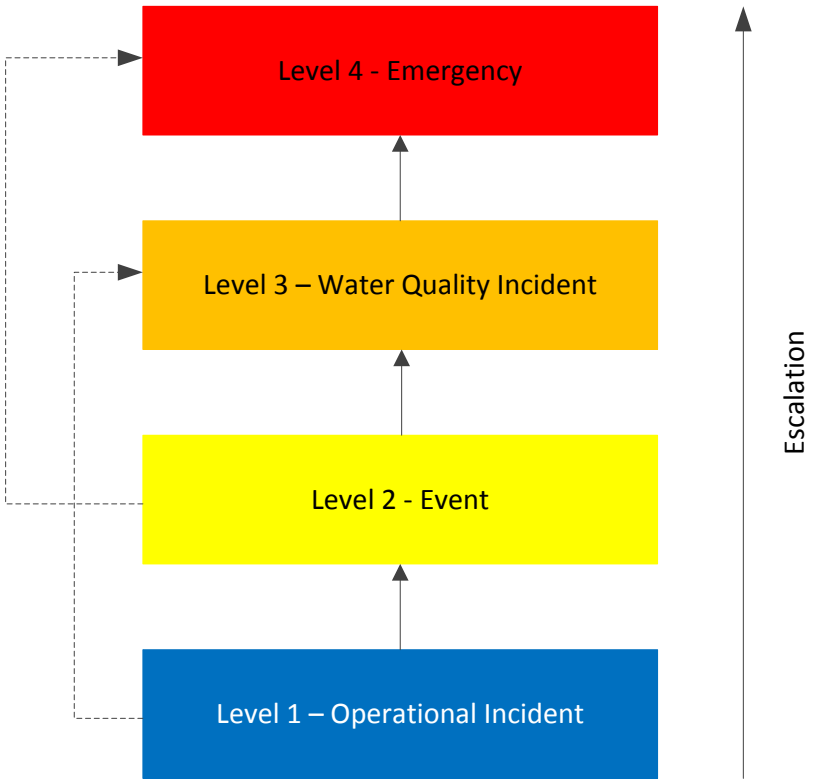


Figure 6 Incident and emergency levels

Table 22 Incident and emergency levels and descriptors

Incident/ Emergency Level	Description of Level
Level 1 (Operational incident)	Exceedance of operational limits as per the DWQMP. Includes customer complaints. There is no non-compliance against the water quality criteria to impact public health. Incident is managed within the operations team. The incident is managed in line with the DWQMP without any additional assistance.
Level 2 (Event)	Anything that has happened or is likely to happen, in relation to a drinking water service that may have an adverse effect on public health. Examples include flood, bushfire, contamination of source water, contamination of treated water, major mains breaks, terrorism, natural disaster, and treatment failure, including lower critical limit breach for chlorination CCP. Incident may require coordination across the Council departments and external resources and support, such as from DEWS or Queensland Health. It has the potential to create secondary issues more damaging than the actual incident.
Level 3 (Water quality incident)	There is a non-compliance against the water quality criteria (ADWG health guideline values). Includes upper critical limit exceedance for chlorination CCP. May result from escalation of a Level 1 or Level 2 event. Incident is managed within the team responsible for drinking water operations and management in line with the DWQMP. In some cases, it may require coordination across the Council departments and external resources and support, such as from the DEWS or Queensland Health.
Level 4 (Emergency)	There is an outbreak of waterborne disease or declared disaster situation by the Council or state/national government. May result from escalation of Level 2 or Level 3. Requires coordination across the Council departments and is likely to require external resourcing and support from agencies, such as the DEWS, Queensland Health, local disaster management groups, emergency responders QFRS and Police.

Table 23 Incident and emergency actions

Incident/ Emergency Level	Actions to be taken	Person responsible
Level 1 (Operational incident)	▪ Implement relevant standard operating procedure or the CCP procedure ▪ Undertake follow up sampling, as required ▪ Review operations and maintenance records for anomalies ▪ Commence investigation to determine cause and instigate immediate remediation actions ▪ In case of customer complaints, coordinate investigation and resolution, including obtaining water samples where required ▪ Ensure all preventive measures identified in the DWQMP are functioning effectively ▪ Increase operational monitoring frequency where required ▪ Fill in the appropriate form or the CCP reporting form, as required ▪ If necessary, conduct de-brief meeting for CCP alert exceedance ▪ If turbidity is measured >2.5NTU in Mount Isa and there is concern it is a bulk water quality issue, contact MIWB. Depending on the outcome of discussions, this may become a Level 2 Event.	Team Leader Water and Sewerage

Incident/ Emergency Level	Actions to be taken	Person responsible
Level 2 (Event)	▪ Report incident to DEWS within the required timeframe (Senior EHO to report) if MICC believes there may be a risk to public health (as required by DWQMP approval notice). ▪ For Mount Isa scheme - contact MIWB to inform them of the event ▪ Ensure all control measures identified in the DWQMP are functioning effectively ▪ Commence investigation to determine cause and instigate immediate remediation actions, including isolation of affected area where possible (e.g. if high turbidity in one of the Camooweal bores, isolate bore from service) ▪ Consider need to revise water restriction level, as necessary ▪ Follow any directives from DEWS or Queensland Health ▪ Drought Management Plan / Significant Service Failure Plan and Disaster Management Plan are on standby if the need arises	Team Leader Water and Sewerage
Level 3 (Water quality incident)	▪ Report incident to DEWS within the required timeframe (Senior EHO to report) ▪ Mount Isa - contact MIWB to investigate possible problem with bulk supply. If chlorine overdose – refer to CCP procedure. ▪ For non-compliance of bulk water supplied by MIWB at point of receipt, immediately notify MIWB and isolate supply if required ▪ Initiate follow up sampling ▪ Review associated laboratory reports and operational records ▪ Ensure all control measures identified in the DWQMP are functioning effectively ▪ Commence investigation to determine cause and instigate immediate remediation actions, including isolation of affected area where possible ▪ Follow any directives from DEWS or Queensland Health regarding risk to public health, need for public warning and corrective actions ▪ Consider what community notification or messaging is needed (e.g. do not drink alert, boil water alert or water distribution) in consultation with DEWS & Q Health. Boil Water & Do Not Drink templates are attached in Appendix E. ▪ Disaster Management Plan is on standby if the need arises	Team Leader Water and Sewerage
Level 4 (Emergency)	▪ Activate Council's Disaster Management Plan as required and undertake actions as per direction from the Disaster Management Group. Guidance may be taken from the above actions and this DWQMP as necessary.	Chief Executive Officer

6.2 Incident communications

Effective communication is vital in managing incidents and emergencies. For water quality incidents of all levels, it will typically be the Team Leader Water & Sewerage responsible for the initial incident classification and coordination of response actions (with the exception of Level 4 Emergencies). Higher MICC management are informed as necessary, along the reporting line shown in Figure 7. Other Council staff will be engaged at the appropriate level (for example Communications & Marketing Officer if public notification is required).

The Team Leader Water & Sewerage will ensure regulatory reporting occurs, and external agencies are involved where necessary (e.g. MIWB, QLD Health).

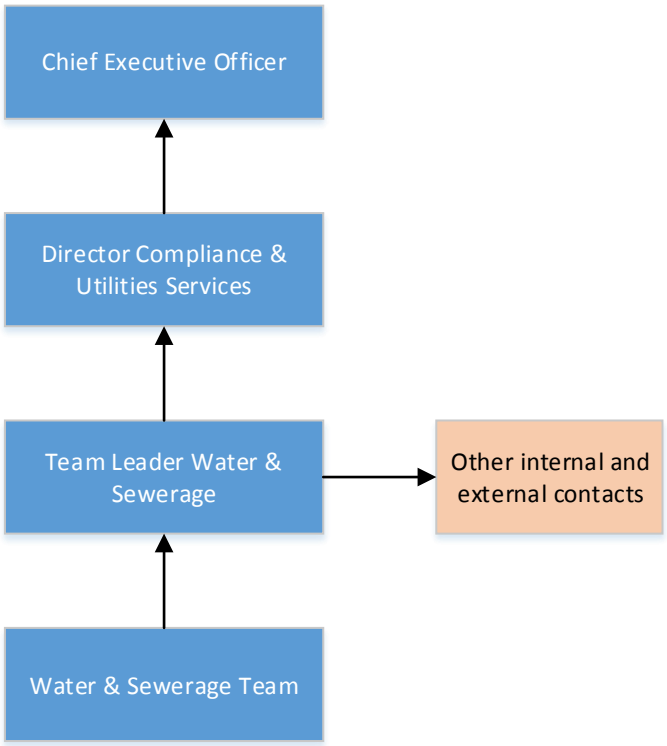


Figure 7 MICC reporting lines

A contact list of key people, agencies and businesses is kept, to ensure the communication process is effective and efficient. Table 24 and Table 25 list the key internal and external contacts for a drinking water incident or emergency.

The Team Leader Water & Sewerage remains on call to attend to incident and emergency situations as required.

The Team Leader Water & Sewerage is responsible for keeping the contacts list updated.

6.3 Community notification

During an incident or emergency, MICC's Promotion and Development Coordinator and/or the Chief Executive Officer is the designated person/s to communicate to the community and media, if the need arises.

Community notification or key messages such as 'boil water notice', 'do not drink water' etc. (if required), will be channelled through the Promotion and Development Coordinator and/or the

Chief Executive Officer. The Team Leader Water & Sewerage or the Senior EHO will consult with the DEWS to determine need for community notification such as boil water notice.

All employees are kept informed of any incident / emergency that requires community notification, as they provide informal points of contact for the community.

Table 24 Internal emergency contacts

Internal	Details
Michael Kitzelmann	Chief Executive Officer (CEO) Mount Isa City Council 0437 933 869
Sharon Ibardolaza	Director Corporate and Financial Service Acting Deputy Chief Executive Officer Mount Isa City Council 0405 135 208
Michael Salmon	Director Compliance and Utilities Services Mount Isa City Council 0427 254 265
Emilio Cianetti	Director Engineering Services Mount Isa City Council 0417 769 412
Ricardo Marino	Manager Technical Services Mount Isa City Council 0427 379 260
Stephen Wagner	Team Leader Water and Sewerage Mount Isa City Council 0407 565 350
Greg Hovi	Water & Sewerage Project Coordinator & Plumbing Inspector Mount Isa City Council 0417 745 720
Andrea O'Hara	Administration Officer Water & Sewerage Mount Isa City Council 0439 854 646
Priviledge Mapiye	Senior Environmental Health Officer Mount Isa City Council 0439 662 766
Ela Warszczynski	Laboratory Technician Mount Isa City Council 07 4743 6085
Jasmine Barber	Promotion and Development Coordinator Mount Isa City Council 0409 197 900

Table 25 External emergency contacts

External Contact	Details
Department of Energy and Water Supply (Water Planning & Regulation)	1300 596 709
Queensland Health (Environmental Health Branch)	07 3234 0111
Mount Isa Water Board – Chief Executive Officer (Stephen Farrelly)	0413 637 723
Cairns Regional Council - Laboratory Services (Mark Wuth)	07 4044 8344
Mount Isa Police (Officer in charge)	07 4744 1111
Mount Isa Fire and Ambulance Service (Mount Isa SES)	07 4743 2601
State Emergency Service (Local Controller)	07 4643 2601
Telecoms service provider (Telstra)	13 22 03
Electricity Provider (Ergon)	13 22 96
Local radio (ABC News Radio)	13 99 94
Local Newspaper (North-West Star)	07 4743 3355
Mount Isa Hospital (Deputy Director of Nursing)	07 4744 4444
Camooweal Health Centre (Director of Nursing)	07 4748 2159
Happy Valley State School	07 4645 0333
Central State School	07 4743 2096
Sunset State School	07 4437 3444
Healy State School	07 4437 3555
Saint Joseph's Primary School	07 4743 4303
Good Shepherd Catholic College	07 4743 2509
Spinifex State College Junior Campus	07 4740 1111
Spinifex State College Senior Campus	07 4744 7222
Mount Isa State Special School	07 4745 0888
St Kieran's Catholic School	07 4744 9000
Townview State School	07 4745 4444
C&K Happy Valley Community Kindergarten	07 4743 2670
Barkly Highway State School	07 4437 8333
Mount Isa School of the Air	07 4744 8333
Good Start Early Learning – Mount Isa	07 4743 2400
Captain Kid Child Care Centre	07 4743 6311
St Paul's Lutheran Church Child Care Centre	07 4743 2859
C&K Sunset Community Kindergarten	07 4743 3735
Injilinji Pre-School & Kindergarten	07 4743 5359
Estelle Cardiff Community Kindergarten Assoc	07 4743 4718
Mount Isa Christian College	07 4743 4649

6.4 Staff training

Incident and emergency training is informally carried out at Water & Sewerage Team meetings (i.e. as a toolbox talk). MICC is currently considering carrying out incident exercises to test incident response.

7 OPERATIONAL AND VERIFICATION MONITORING PROGRAMS

7.1 Operational monitoring

A key characteristic of operational monitoring is that it should provide an immediate indication of performance to prompt immediate short-term corrective actions and maintain drinking water quality. Furthermore, monitoring should be conducted with appropriate frequency to reveal any failures and allowing sufficient time to act.

Operational monitoring is detailed in Table 26, and performance criteria for the key parameters is provided in Table 27. In addition to grab samples, online instrumentation is used for monitoring free chlorine at Reservoirs 2 and 4. These instruments are currently not connected to SCADA (see RMIP).

The CCP procedure (see Appendix E) identifies additional performance criteria and monitoring for the effective operation of the water supply system. Corrective actions are described in the CCP procedure and/or the other DWQMP Standard Operating Procedures.

Table 26 Operational monitoring schedule

	Mount Isa		Camooweal	
Parameter	**Terminal Reservoir**	**Reservoirs 1-6**	**Bores 1-2**	**Header Tank**
Free chlorine	W	W C (Res 2&4)	-	M
E. coli	-	-	M F*	-
Total coliforms	-	-	M F*	-
HPC	M	M	-	M
pH	W	W	M F*	M
Turbidity	W	W	M F*	M

* Event-based (wet season – November to March)

Legend *(Tables 25 and 27)*

W – weekly

F – fortnightly

M – monthly

Q – quarterly

Y – yearly

5Y – 5 yearly

C – continuous

Table 27 Operational limits

Parameter	Mount Isa		Camooweal	
	Terminal Reservoir	Reservoirs 1-6	Bores 1-2	Header Tank
Free chlorine (mg/L) **(Refer to CCP procedure)**	<1.0	ADJSTMT <0.2, >2.0 **CRITICAL <0.1, >4.5**	-	ADJSTMT <0.2, >2.0 **CRITICAL <0.1, >4.5**
E. coli (MPN/100mL)	-	-	Positive	-
Total coliforms (MPN/100mL)	-	-	-	-
HPC (cfu/mL)	>200	>200	-	>200
pH	<6.5, >8.5	<6.5, >8.5	<6.5, >8.5	<6.5, >8.5
Turbidity (NTU)	>2.5	>2.5	>1.0	>1.0

Operational limits for free chlorine reflect the limitations of the current infrastructure, i.e. chlorine dosing at Camooweal, and Mount Isa Reservoirs 2 and 4 that is not able to be remotely viewed and controlled via SCADA. Fixed dose rates generally target 0.3 – 0.5mg/L to avoid overdosing, excess DBP formation (noting THM results have exceeded 200ug/L as recently as March 2017), and customer complaints. The adjustment limit remains 0.2mg/L to ensure that low chlorine levels are addressed whenever possible.

Operational limits for turbidity in Mount Isa reflect the fact that MICC is not treating water for pathogen removal; MIWB are responsible for water treatment. Turbidity results in distribution system samples are generally an aesthetic issue caused by disturbed sediment.

7.2 Verification monitoring

Verification of drinking water quality provides an assessment of the overall performance of the system and the ultimate quality of the drinking water being supplied to ‘customers’. Verification incorporates monitoring drinking water quality as well as assessment of consumer satisfaction.

7.2.1 Laboratory testing

MICC has its own internal laboratory. The testing and sampling procedures are held in a hard copy folder at the laboratory, and followed by staff (note there is currently an improvement action for QA/QC procedures). Analysis is undertaken using portable laboratory equipment for testing pH, turbidity and chlorine. The IDEXX methods are used for bacteriological testing (e.g. Colilert-18 for *E. coli*). Parameters which cannot be tested in-house (e.g. THMs, metals, pesticides) are sent to an external NATA accredited laboratory. As of September 2017, a week’s worth of samples will also be sent to the external NATA lab for *E. coli* analysis once per quarter, for verification of MICC’s in house results.

The Team Leader Water and Sewer receives notification (electronic copies) of the verification testing results, and the results are reviewed within 24 hours of receiving the laboratory reports. The Team Leader is responsible for assessing and reviewing the data to ensure compliance. Any exceedances are managed in accordance to Level 3 Water Quality Incidents (refer section 6). Non-compliances are discussed with operational staff and managed in accordance with standard operating procedures. Results are recorded in an Excel spreadsheet with the sample number, date, time and location, and any comments recorded.

The verification monitoring is deemed sufficient to indicate supply of safe quality drinking water. *E. coli* is tested weekly at 3 sites in the Mount Isa scheme and monthly at 4 sites in the Camooweal scheme. This exceeds the minimum monitoring frequency outlined in the Public Health Regulation 2005 for a service provider of MICC's size.

Table 28 outlines the testing schedule for MICC's verification monitoring, and Table 29 summarises the source water monitoring parameters.

Table 28 Verification monitoring testing schedule

	Mount Isa		Camooweal	
Parameter	**Terminal Reservoir**	**Reticulation** (City Council, Edna Park, Selwyn Park)	**Bores 1 & 2**	**Reticulation** (BP Station, Hospital, Police Station, Rest Area)
E. coli	W	W	-	M
Total coliforms	W	W	-	M
Free chlorine	W	W	-	M
pH	-	M	-	M
Turbidity	-	M	-	M
THMs	Q	Q	Q	Q
Iron	Q	Q	-	-
Source monitoring[1]	Y	-	Y	-
Source monitoring[2]	5Y	-	5Y	-

Table 29 Source water monitoring parameters

Source Water Monitoring	Parameters		
Group 1 (Annual)	Nitrate Nitrite Aluminium Arsenic Barium Beryllium Boron Cadmium	Chromium Copper Iodide Iron Lead Manganese Mercury Molybdenum	Nickel Selenium Silver Zinc Fluoride Hardness Total Dissolved Solids
Group 2 (5 Yearly)	Pesticides	Radionuclides	

7.2.2 Customer complaint monitoring

Monitoring of consumer comments and complaints can provide valuable information on potential problems that may not have been identified by performance monitoring of the water supply system. Consumer satisfaction with drinking water quality is largely based on a judgment that the aesthetic quality of tap water is 'good', which usually means that it is colourless, free from suspended solids and has no unpleasant taste or odour.

Complaints from the general public go to MICC directly, as the supplier of drinking water to Mount Isa. Any complaints that MICC regards as related to the MIWB's operations are forwarded to MIWB for action. All complaints are recorded on the Complaints Form and investigated. A summary of past complaints is briefly described in section 4.1.2.

8 RISK MANAGEMENT IMPROVEMENT PROGRAM

All unacceptable risks are required to be actioned over time to reduce the residual risk level to an acceptable level. Table 30 provides the current Risk Management Improvement Program, including status of all actions.

It is the responsibility of the Team Leader Water & Sewerage to ensure that this document is communicated to relevant employees and operators. The support and commitment of council is essential for the continual improvement of the MICC's activities related to drinking water.

All projects will be internally funded through either the Capital Program or the Operations and Maintenance budget, depending on the nature of the project and council approval.

The progress against the improvement program actions will be recorded by the Administration Officer Water & Sewerage. This program is to be reviewed as appropriate and at least annually with the DWQMP annual report.

Table 30 Risk management improvement program

Ref	Scheme	Action	Responsibility	Due date	Status	Comment
WQ3	Mount Isa	Investigate and identify users that may be of potential concern; check backflow requirements and gaps; maintain backflow register; and enforce council backflow policy. This will need to be undertaken by a Trade Waste Officer or like and most probably will need to be recruited by MICC.	Team Leader Water & Sewerage	30/06/18	In progress	Difficulties in recruiting for the Trade Waste Officer role has extended the timeframe task. Backflow register has been completed.
WQ6	Camooweal	Investigate possibility of installing a telemetry system, which would provide remote visibility and be able to send alarms on chlorine system. Include online turbidity analyser with remote visibility and alarming.	Team Leader Water & Sewerage	31/12/18	Not yet started	Funding still to be obtained
WQ8	Mount Isa	Investigate mixing and online chlorine dosing in the remaining reservoirs, with alarms for dosing failure or faults.	Team Leader Water & Sewerage	30/06/18	In progress	Funding for 2016-17 obtained. If work extends into 2017-18 it will need to be re-applied for.
WQ9	System Wide	Prepare Operations and Maintenance (O&M) manuals for the schemes, detailing routine tasks undertaken.	Team Leader Water & Sewerage	30/06/18	In progress	Funding approved, and external consultant engaged to assist
WQ11	System Wide	Strengthen laboratory QA/QC practices, including SOPs, calibration, record keeping etc to ensure high quality results	Laboratory Technician	30/06/18	In progress	Delayed due to high laboratory workload (STP commissioning)
WQ12 (New)	Mount Isa	Address vermin proofing issues at Reservoir 3 and seek funding for reservoir replacement	Team Leader Water & Sewerage	30/06/18	In progress	Temporary vermin proofing measures installed
WQ13 (New)	Mount Isa	Undertake hydraulic modelling of network in collaboration with MIWB and reconfigure network to improve water circulation and decrease water age.	Team Leader Water & Sewerage	30/06/18	In progress	Model in the process of being calibrated (as of August 2017).

Completed actions have been removed from the RMIP table. Refer to DWQMP Reports for comments on completed actions.

9 REVIEW AND AUDIT

Informal reviews of water quality incidents, customer complaints, and RMIP progress are undertaken every 12 months when the annual reports are prepared.

This DWQMP, and associated standard operating procedures, are formally reviewed every 2 years in line with DEWS requirements as outlined in the Information Notice for the Decision.

External audits are undertaken every 4 years, also in line with the regulatory requirements.

10 REFERENCES

Department of Environment and Resource Management 2010, *Drinking Water Quality Management Plan Guideline*, Urban Water Policy and Management, Queensland Government.

Eberhard, S. 2003, Nowranie Caves and the Camooweal Karst Area, Queensland: Hydrology, Geomorphology and Speleogenesis, with Notes on Aquatic Biota, *Helictite*, Vol.38, No.2, Pp 27-38

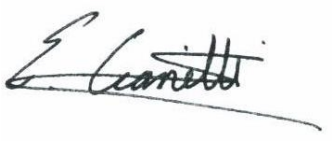
NHMRC & NRMMC 2011, National Water Quality Management Strategy: *Australian Drinking Water Guidelines. 6th Ed*., National Health and Medical Research Council and Natural Resource Management Ministerial Council, Australian Government, Canberra.

APPENDIX A
DRINKING WATER QUALITY POLICY

APPLIES TO STATUTORY POLICIES ONLY

This an official copy of the **Drinking Water Quality Policy**, made in accordance with the provisions of *Local Government Act and Regulations, Public Records Act, Mount Isa City Council's Local Laws, Subordinate Local Laws and current Council Policies.*

Statutory Policies comply with a legislative requirement; the **Drinking Water Quality Policy** is approved by the Mount Isa City Council for the operations and procedures of Council.



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Emilio Cianetti
Chief Executive Officer

DOCUMENT VERSION CONTROL					
I/R	853569	FILE	1208 Policy Register	POLICY TYPE	Statutory (Council)
VERSION	DATE	RESOLUTION NO.	DETAILS		
V1	13.08.2013	OM28/08/13 Adopted	Responsible Officer Manager Utility Services Description Adopted as APPENDIX A of the Drinking Water Quality Management Plan.		
V2	15.06.2016	OM10/06/16 Amended	Responsible Officer Director Engineering Services Description Formatting; Update to Policy Statement BOUND to Mount Isa City Council Drinking Water Quality Management Plan "APPENDIX A" Water Quality Policy.		

REVIEW DUE	05/2018 Review by Council
EXTINGUISHED	00.00.0000 Resolution No: OM00/00/00 No further action required.

Drinking Water Quality Policy

RESOLUTION NO. OM10/06/16 VERSION V2

Purpose

This policy supports Mount Isa City Councils commitment to the effective management of drinking water and the associated distribution system, to provide responsible, safe and sustainable drinking water that meets the needs of our customers, stakeholders and communities.

Scope

This policy applies to all activities undertaken by Mount Isa City Council associated with the supply of drinking water to water service areas of Mount Isa and Camooweal.

Policy Statement

Mount Isa City Council is committed to managing its water supply effectively to provide a safe, high-quality product that consistently meets the Australian Drinking Water Guidelines and other regulatory requirements.

To achieve this, in partnership with relevant stakeholders and regulatory agencies, **Mount Isa City Council** will:

- Distribute water from Councils service reservoirs to supply points for each customer reliably in sufficient quantity to meet normal peak demands in a manner which protects water from contamination.
- Use a risk-based approach in which potential threats to water quality are identified and balanced.
- Have in place appropriate contingency plans and incident emergency response processes to respond to and manage water quality incidents.
- Routinely monitor the quality of drinking water and use effective reporting mechanisms to provide relevant and timely information and promote confidence in the water supply and its management.
- Comply with the regulatory requirements of the Water Supply (Safety and Reliability) Act 2008 (QLD) and aesthetic and health related criteria of the Australian Drinking Water Guidelines 2011.
- Provide training to all relevant employees to ensure that they are aware of this policy and are involved in the implementation of our Drinking Water Quality Management Plan.
- Provide community and relevant stake holders with relevant and timely information; and
- Openly communicate this policy to the community to encourage public awareness.

Mount Isa City Council will implement and maintain a drinking water quality management system consistent with its approved Drinking Water Quality Management Plan (June 2015) and ensuring that our water services targets are met as per the Customer Service Standards (September 2015).

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

Associated Documents

- Mount Isa City Council Drinking Water Quality Management Plan (June 2015)
- Queensland Drinking Water Quality Management Plan Guideline (September 2010)
- Australian Drinking Water Guidelines (2011)
- Water Supply (Safety and Reliability) Act 2008
- Customer Service Standards (September 2015)

APPENDIX B
LEGAL AND OTHER REQUIREMENTS REGISTER

Requirement	Authority/ Organisation	Detail	How Addressed by MICC	Responsibility
Common Law	Commonwealth	MICC will ensure that the water service is operated with a high level of transparency and the following items are addressed to minimise risk under common law: - Comply with relevant laws and industry codes and guidelines; - Have clear contractual arrangements between suppliers and users of drinking water; Have an effective management system in place which considers risk, quality assurance and environmental issues; Ensure the distribution network does not readily degrade the quality of water before supplying to the consumer; Ensure that all employees involved in the operation are adequately trained and supervised; and Accurately monitor and report results for drinking water quality.	MICC complies with the ADWG. The DWQMP outlines management systems that consider risk and QA, employee training and monitoring and reporting for drinking water quality.	Chief Executive
Environmental Protection Act 1994	Environmental Protection Agency	The Act aims to protect within the context of ecologically sustainable development, through a wide range of tools. Under the Act it is an offence to cause environmental harm, unless it is permitted under a number of scenarios. However, the Act provides a defence (EP Act s 436(2)) for environmental harm if the environmental harm occurs as the result of a lawful activity and the operator complied with the general environmental duty. The Act states 'a person must not carry out any activity that causes, or is likely to cause, environmental harm unless the person takes all reasonable and practicable measures to prevent or minimise the harm'. Therefore, MICC must ensure that the general environmental duty is followed, to minimise legal liability.	MICC follows best environmental management practices to minimise environmental impacts that may occur from their activities, operations and services. MICC has site based management plans for its landfill.	Chief Executive
Public Health Act 2005 / Regulation 2005	Queensland Health	Part 5A of the Act outlines provisions about drinking water including improvement notices and offences for supplying unsafe drinking water. The Public Health Regulation 2005 Schedule 3A outline standards for quality of drinking water. It specifies frequency of sampling and acceptable values for Escherichia coli in the reticulation system and fluoride concentration.	MICC reports exceedences of the Public Health Act requirements to DEWS who then report to Queensland Health.	Manager Utility Services
Water Act 2000	Department of Environment & Heritage Protection	This Act provides for the sustainable management of water and other resources and the establishment and operation of water authorities.	MICC fulfils its duties as a water service provider	Chief Executive
Water Supply (Safety and Reliability) Act 2008	Department of Energy and Water Supply - Queensland Water Supply Regulator	This Act requires a water service provider to develop a drinking water quality management plan. Recent changes to the Act (2014) requires the provider to collect data on a pre-determined list of KPIs; prepare a new customer service standard and submit a performance report about each of the KPIs each financial year.	MICC is operating under an approved amended DWQMP. MICC will adhere to new requirements enacted in 2014.	Director Compliance and Utilities Services
Drinking Water Guidelines - Regulatory guidelines 2010 made under the Water Supply (Safety and Reliability) Act 2008	Department of Energy and Water Supply - Queensland Water Supply Regulator	The Water Quality and Reporting Guideline for a Drinking Water Service is the first regulatory guideline and: - Provides information on the water quality standards established by Queensland Health; - Establishes the minimum water quality criteria that apply to drinking water, for parameters where Queensland Health has not set a standard; -Establishes reporting requirements related to drinking water quality: - First, in terms of their application whilst operating under a notice; - Second, when an approved Drinking Water Quality Management Plan is in place.	MICC must prepare the DWQMP according to these guidelines.	Director Compliance and Utilities Services
Australian Drinking Water Guidelines (ADWG)	NHMRC	The ADWG are intended to provide a framework for good management of drinking water supplies that, if implemented, will assure safety at point of use. The ADWG have been developed after consideration of the best available scientific evidence. They are designed to provide an authoritative reference on what defines safe, good quality water, how it can be achieved and how it can be assured.	MICC use the ADWG values as the indicator of the quality of their water being delivered to customers.	Director Compliance and Utilities Services
Fluoride Bill 2012 - legislative changes to Water Fluoridation Act 2008 and Regulation 2008	Department of Energy and Water Supply - Queensland Water Supply Regulator	The Fluoride Bill 2012 restores local control of fluoride management. Water Fluoridation Act was brought in in 2008 with the aim to have all of Queensland public water fluoridated by 2012. According to schedule 1 of the regulation, MICC as the public potable water supplier must add fluoride before 31 December 2012. Under certain circumstances, exemption may be applied for under s8(1) of the act.	MICC is not obliged to fluoridate.	Chief Executive

APPENDIX C
STAKEHOLDER AND COMMUNICATION REGISTER

Organisation	Contact	Accountability / Responsibility	Commitment / Involvement	Reporting	Frequency	Method
Department of Energy & Water Supply	Water Planning & Regulation Phone: 1300 596 709 Email: drinkingwater.reporting@dews.qld.gov.au	Regulator	- Approve DWQMP - Issue notices about monitoring and reporting requirements to drinking water service providers - Set water quality criteria for parameters for which no standards have been set by Queensland Health - Enforce notices and DWQMPs and undertaking investigations and compliance actions	DWQMP review	Every 2 years	Electronically
				External system audit	Every 4 years following DWQMP approval in 2013	Electronically
				E. coli detection	As required	Verbal communication within 3 hours and written confirmation within 24 hours. (The regulator will notify Queensland Health). If detected in the follow up sample verbal and written communication will need to be given. An incident management report is required on resolution
				Pathogen detection	As required	Verbal communication within 3 hours and written confirmation within 24 hours. (The regulator will notify Queensland Health). If detected in the follow up sample verbal and written communication will need to be given. An incident management report is required on resolution
				Detection of chemical value above ADWG guidelines	As required	Verbal communication within 3 hours and written confirmation within 24 hours. (The regulator will notify Queensland Health). If guideline values are breached in the follow up sample verbal and written communication will need to be given. An incident management report is required on resolution
				Detection of gross alpha or beta radioactivity above screening value	As required	Verbal communication within 3 hours and written confirmation within 24 hours. (The regulator will notify Queensland Health). If annual exposure from all radionuclides is breached verbal and written communication will need to be given. An incident management report is required on resolution
				Detection of parameter for which there is no ADWG value	As required	Verbal communication within 3 hours and completion of incident form within 24 hours
				An event likely to affect drinking water quality	As required	Verbal communication immediately, followed by the completion of the incident form
				Annual report on DWQMP implementation	120 business days from end of financial year	Electronic communication
Mount Isa Water Board	Contact: Hannah Cooper, Engineering Manager Contact No.: 07 4740 1030 E-mail: hcooper@mountisawater.qld.gov.au	Upstream Bulk Water Supplier	Waer quality complaints, issues, incidents and emergencies, operations	Non-compliant water quality, operational issue	As required	Electronic, verbal, face-to-face Within 3 hours for water quality incidents reported to DEWS
Queensland Health	Sector: Tropical Public Health Unit Name: As avilable Contact No.: 07 4744 9100	Public Health	- Setting drinking water quality standards under the Public Health Act / Regulation 2005 - Issuing and enforcing improvement notices where the safety of drinking water may be compromised - Issuing and enforcing public health orders where a public health risk is identified.	Any event likely to have an immediate affect on public health, or requiring a public health alert.	As required	Verbal communication immediately, followed by written confirmation.
MICC customers	Sensitive Receptors - Dialysis patients Contact No: See list in Emergency Plan	Public Health	This group could be easily affected by poor water quality.	Any event that could have an immediate effect on this group.	As required	Telephone as soon as possible.
	Sector: ABC Radio - North West Queensland Contact No: (07) 4744 1311		Helps disseminate water quality information	N/A	As required	Telephone

APPENDIX D
RISK REGISTER

Mount Isa Unmitigated Hazard Assessment

Hazard	Impact	Source(s)	Notes	Consequence	Likelihood	Risk	Uncertainty	Comment
Biological								
Bacteria	H	Back flow; Ingress through reservoir roof or low-pressure zone or air valves in mains; Main breaks; Maintenance; Cross contamination; Change of flow in a main or scouring a reservoir.	Water quality data analysis: no *E. coli* detected for the past past 2 years. Some low detections of HPC and total coliforms. Supply from MIWB is now filtered.	Major	Possible	**Very High (C4)**	Confident	Risk has been assessed in the hazardous events worksheet. There has not been any *E. coli* detected in the supply for the past two years. MIWB is now undertaking membrane filtration for their supply which has significantly improved water quality. The hazardous event of backflow is an issue and should be addressed as discussed in the hazardous events worksheet.
Cyanotoxins	H	MIWB Raw Water	Readily inactivated by chlorine in MIWB disinfection process	Moderate	Unlikely	**Medium (B3)**	Confident	
Opportunistic Pathogens (Nagleria & Legionella)	H	Detention time; Temperature >25°C; Backflow	Temperatures can become >25°C in storage reservoirs.	Major	Possible	**Very High (C4)**	Reliable	There could be some potential for growth in the network. However, considering the reasonably low levels of environmental bacteria (HPC) and presence of residual chlorine, it is not considered to be an issue at this time.
Problem alga/ bacteria/ macrophytes	A	None	All of the MICC system is sealed and covered.	Insignificant	Rare	**Low (A1)**	Confident	There are no further sources in the MICC system.
Protozoa	H	Maintenance; Ingress through low-pressure zone or air valves in mains; Main breaks.	Contamination of tools; Possible ingress through air valve pits and main breaks, especially if it is adjacent to a sewer main.	Major	Unlikely	**High (B4)**	Reliable	Risk has been assessed in the hazardous events worksheet. Based on the barriers in place it is not considered to be an issue.
Viruses	H	Maintenance; Main breaks.	Possible ingress through air valve pits and main breaks, especially if it is adjacent to a sewer main. Contamination of tools.	Major	Possible	**Very High (C4)**	Reliable	Based on the barriers in place it is not considered to be an issue.
Chemical								
Aluminium	H	None	No sources in the MICC system.	Minor	Unlikely	**Low (B2)**	Confident	No sources in the MICC system, therefore, MIWB risk follows through.
Arsenic	H	Mains break.	Naturally occurring in the geology.	Minor	Unlikely	**Low (B2)**	Reliable	The mineralised arsenic is mainly insoluble. Therefore, it is not considered to be an issue.
Chlorine	H	Chemical addition	Addition of chlorine to reservoirs.	Minor	Possible	**Medium (C2)**	Reliable	Risk assessed in the hazardous events worksheet, not considered to be an issue.
Disinfection by-products (e.g.. THMs, NDMA & HAAs)	H	Chemical addition; Detention time; Ingress of non-potable water (organic matter).	Addition of chlorine to reservoirs.	Moderate	Possible	**High (C3)**	Reliable	Risk assessed in the hazardous events worksheet. Although there has not been any THMs exceedences in the MICC supply, the inherent risk from MIWB follows through.
Fluoride	H	None	Not added yet.	Minor	Rare	**Low (A2)**	Confident	No sources in the MICC system, therefore, MIWB risk follows through.
Cadmium	H	None	No sources in the MICC system.	Minor	Rare	**Low (A2)**	Confident	No sources in the MICC system, therefore, MIWB risk follows through.
Zinc	A	Mains break	Naturally occurring in the geology.	Minor	Rare	**Low (A2)**	Confident	Based on the barriers in place it is not considered to be an issue.
Nickel	H	None		Minor	Rare	**Low (A2)**	Confident	No sources in the MICC system, therefore, MIWB risk follows through.
Copper	H	Mains break	Naturally occurring in the geology.	Minor	Rare	**Low (A2)**	Confident	Based on the barriers in place it is not considered to be an issue.
Lead	H	Mains break	Naturally occurring in the geology.	Minor	Unlikely	**Low (B2)**	Confident	Based on the barriers in place it is not considered to be an issue.
Mercury	H	None	No sources in the MICC system.	Minor	Unlikely	**Low (B2)**	Confident	No sources in the MICC system, therefore, MIWB risk follows through.
Hydrocarbons	H	Incorrect materials	It is possible that hydrocarbons could leach out of materials used in the water system, if not correctly selected.	Minor	Possible	**Medium (C2)**	Confident	Sources in the MICC are not considered to be significant and would not increase the risk.
Hydrogen sulphide/sulphide	A/H	None	No sources in the MICC system.	Insignificant	Rare	**Low (A1)**	Confident	No sources in the MICC system, therefore, MIWB risk follows through.
Iron	A	Main breaks; Maintenance; Sloughing.	Build up in the mains can be dislodged from change in flow.	Moderate	Possible	**High (C3)**	Reliable	Although there has not been any iron exceedences in the MICC supply, the inherent risk from MIWB follows through. With the membrane filtration undertaken by MIWB, this risk may be reduced in due course.
Manganese	A/H	Main breaks; Maintenance; Sloughing	Build up in the mains can be dislodged from change in flow.	Moderate	Unlikely	**Medium (B3)**	Reliable	There has not been any manganese exceedences in the MICC supply, the inherent risk from MIWB follows through.
Nitrate & nitrite	H	None	No sources in the MICC system.	Insignificant	Rare	**Low (A1)**	Confident	No sources in the MICC system, therefore, MIWB risk follows through.
Pesticides	H	Main break	Household and farm spraying.	Minor	Rare	**Low (A2)**	Confident	It is not considered that the sources identified would alter the risk.
Pharmaceuticals and EDCs	H	None	No sources in the MICC system.	Insignificant	Rare	**Low (A1)**	Confident	No sources in the MICC system, therefore, MIWB risk follows through.
Sodium	A	None	No sources in the MICC system.	Insignificant	Rare	**Low (A1)**	Confident	No sources in the MICC system, therefore, MIWB risk follows through.
Sulphate	H	None	No sources in the MICC system.	Insignificant	Rare	**Low (A1)**	Confident	No sources in the MICC system, therefore, MIWB risk follows through.
Toxins	H	Wilful contamination	Intentional contamination of the water supply.	Catastrophic	Rare	**Medium (A5)**	Reliable	This hazard covers a worst case scenario.
Physical								
Colour	A	Main breaks; Maintenances; Change of flow in a main or scouring a reservoir.	Build up in the mains can be dislodged from change in flow. Scouring in reservoirs could occur if water is dropped down too fast during maintenance.	Minor	Possible	**Medium (C2)**	Reliable	Some dirty water complaints have been received, although this is on the decline now with the membrane filtration and slight ease of drought conditions.
DO	A	Main breaks; Maintenances; Change of flow in a main or scouring a reservoir.	Scouring in reservoirs could occur if water is dropped down too fast during maintenance. This suspension would consume available DO.	Minor	Possible	**Medium (C2)**	Reliable	The sources in the MICC system are not considered major.
Hardness	A	None	No sources in the MICC system.	Insignificant	Rare	**Low (A1)**	Confident	No sources in the MICC system, therefore, MIWB risk follows through.
pH	A/H	Chemical addition	Addition of chlorine to reservoirs.	Minor	Possible	**Medium (C2)**	Confident	There has not been any pH out-of-spec results recorded.
Radiological	H	None	No sources in the MICC system.	Insignificant	Rare	**Low (A1)**	Confident	No sources in the MICC system, therefore, MIWB risk follows through.
Supply	-	Mains break	If not attended to, could lead to a loss of supply.	Minor	Unlikely	**Low (B2)**	Reliable	There are more than 24 hours of storage in the distribution.
Taste and odour	A	Overdosing of chlorine; Detention time.	Council manages all water quality complaints, which may account for T&O changes between the MIWB and MICC.	Minor	Possible	**Medium (C2)**	Reliable	Some odour complaints have been received.
Total dissolved solids	A	None	No sources in the MICC system.	Moderate	Rare	**Low (A3)**	Confident	No sources in the MICC system, therefore, MIWB risk follows through.
Turbidity	A	Main breaks; Maintenances; Change of flow in a main or scouring a reservoir.	Builds up in the mains, can be dislodged from change in flow. Scouring in reservoirs could occur if water is dropped down too fast during maintenance.	Minor	Possible	**Medium (C2)**	Confident	Turbidity has not been an issue in the MICC managed supply.

Camooweal Unmitigated Hazard Assessment

Hazard	Impact	Source(s)	Notes	Consequence	Likelihood	Risk	Uncertainty	Comment
Biological								
Bacteria	H	Cattle grazing; Sewage Treatment Plant; Rubbish tip (and illegal dumping) Back flow; Ingress through reservoir roof; Main breaks; Maintenance and/or cross contamination	No detections of *E. coli* in the past 4 years. Old bore 1 which has some issues identified during previous risk assessments is not in use.	Major	Possible	**Very High (C4)**	Estimate	Risk assessed in the hazardous events worksheet. Increased monitoring during the rainy/wet season will be undertaken to investigate any influence from surface water and aquifer recharge.
Cyanotoxins	H	None	Not an issue for groundwater.	Insignificant	Rare	**Low (A1)**	Certain	Not considered an issue.
Opportunistic Pathogens (Nagleria & Legionella)	H	Environmental Temperature >25°C; Ingress of non-potable water	Not considered to be an issue.	Major	Unlikely	**High (B4)**	Confident	Based on the barriers in place it is not considered to be an issue.
Problem algae/ bacteria/macrophytes	A	None	No history of iron bacteria.	Insignificant	Rare	**Low (A1)**	Certain	Not considered an issue.
Protozoa	H	Cattle grazing; Sewage Treatment Plant Illegal tipping Maintenance; Main breaks.	Old bore 1 which has some issues identified during previous risk assessments is not in use. Deep bores ~100m	Major	Unlikely	**High (B4)**	Estimate	Risk assessed in the hazardous events worksheet. Increased monitoring during the rainy/wet season will be undertaken to investigate any influence from surface water and aquifer recharge.
Viruses	H	Sewage Treatment Plant; Illegal tipping Maintenance; Main breaks.	No detections of *E. coli* in the past 2 years. Old bore 1 which has some issues identified during previous risk assessments is not in use.	Major	Unlikely	**High (B4)**	Estimate	Similar to risk from bacteria.
Chemical								
Aluminium	H	None	No sources in the catchment.	Insignificant	Rare	**Low (A1)**	Reliable	Not considered an issue.
Arsenic	H	None	No sources in the catchment. Water quality data analysis shows no issues.	Insignificant	Rare	**Low (A1)**	Reliable	Not considered an issue.
Chlorine	H	Chemical addition	No sources in the catchment.	Minor	Possible	**Medium (C2)**	Reliable	Risk assessed in the hazardous events worksheet. Not considered an issue, no chlorine exceedences have been recorded.
Disinfection by-products (e.g.. THMs, NDMA & HAAs)	H	Chemical addition; Detention time; Ingress of non-potable water (organic matter).	No sources in the catchment.	Minor	Unlikely	**Low (B2)**	Reliable	Not considered an issue.
Fluoride	H	None	Water quality data analysis shows no issues.	Insignificant	Rare	**Low (A1)**	Reliable	Not considered an issue.
Cadmium	H	None	No sources in the catchment. Water quality data analysis shows no issues.	Insignificant	Rare	**Low (A1)**	Reliable	Not considered an issue.
Zinc	H	None	No sources in the catchment. Water quality data analysis shows no issues.	Insignificant	Rare	**Low (A1)**	Reliable	Not considered an issue.
Nickel	H	None	No sources in the catchment. Water quality data analysis shows no issues.	Insignificant	Rare	**Low (A1)**	Reliable	Not considered an issue.
Copper	H	None	No sources in the catchment. Water quality data analysis shows no issues.	Insignificant	Rare	**Low (A1)**	Reliable	Not considered an issue.
Lead	H	None	No sources in the catchment. Water quality data analysis shows no issues.	Insignificant	Rare	**Low (A1)**	Reliable	Not considered an issue.
Mercury	H	None	No sources in the catchment. Water quality data analysis shows no issues.	Insignificant	Rare	**Low (A1)**	Reliable	Not considered an issue.
Hydrocarbons	H	3 Service stations Illegal tipping Back flow;	Service stations have underground tank.	Minor	Unlikely	**Low (B2)**	Reliable	Not considered an issue.
Hydrogen sulphide/ sulphide	A/H	None	Not considered to be an issue; water does not have any unpleasant odour.	Insignificant	Rare	**Low (A1)**	Reliable	Not considered an issue.
Iron	A	Natural geology Main breaks	Water quality data analysis shows no issues.	Insignificant	Rare	**Low (A1)**	Reliable	Not considered an issue.
Manganese	A/H	Natural geology	Not considered to be an issue.	Insignificant	Rare	**Low (A1)**	Reliable	Not considered an issue.
Nitrate & nitrite	H	None	No sources in the catchment.	Insignificant	Rare	**Low (A1)**	Reliable	Not considered an issue.
Pesticides (all types)	H	Illegal tipping Back flow	Water quality data analysis shows no issues.	Insignificant	Rare	**Low (A1)**	Reliable	Not considered an issue.
Pharmaceuticals and EDCs	H	None	No sources in the catchment.	Insignificant	Rare	**Low (A1)**	Reliable	Not considered an issue.
Sodium	A	None	No sources in the catchment.	Insignificant	Rare	**Low (A1)**	Reliable	Not considered an issue.
Sulphate	H	None	No sources in the catchment.	Insignificant	Rare	**Low (A1)**	Reliable	Not considered an issue.
Toxins	H	Illegal tipping Wilful contamination	Malicious activity contaminating the water supply.	Catastrophic	Rare	**Medium (A5)**	Reliable	There has been a history of locals turning off the chlorine, but not contaminating the water. However, this has ceased since security has been increased.
Physical								
Colour	A	Main breaks; Maintenance	Not considered to be an issue.	Minor	Possible	**Medium (C2)**	Reliable	Not considered an issue.
DO	A	Main breaks; Maintenance	Not considered to be an issue.	Insignificant	Rare	**Low (A1)**	Reliable	Not considered an issue.
Hardness	Business Risk	Dolomite geology	Hardness exceeds ADWG aesthetic limit	Minor	Almost certain	**High (E2)**	Reliable	Public are used to the aesthetic water quality, no feasible action to address hardness level. Not carried through to risk assessment.
pH	A/H	None	Water quality data analysis shows no issues.	Insignificant	Rare	**Low (A1)**	Confident	Not considered an issue.
Radiological	H	Natural geology	Testing has shown levels are below the ADWG screening level	Insignificant	Rare	**Low (A1)**	Reliable	Not considered an issue.
Reduced output volume	-	Mains break	2 bores used, not considered to be an issue.	Minor	Unlikely	**Low (B2)**	Reliable	Not considered an issue.
Taste and odour	A	Dolomite geology Overdosing of chlorine; Detention time.	Water is acceptable, but does have a mineral taste.	Minor	Possible	**Medium (C2)**	Reliable	Not considered an issue.
Total dissolved solids	A	Dolomite geology	TDS exceeds ADWG aesthetic limit	Minor	Likely	**High (D2)**	Reliable	Public are used to the aesthetic water quality, no feasible action to address TDS level. Not carried through to risk assessment.
Turbidity	A	Natural Main breaks; Maintenance	Turbidity from bores is below ADWG aesthetic limit	Minor	Possible	**Medium (C2)**	Reliable	Not considered an issue.

Mount Isa Risk Register

Component	Hazardous Event	Potential Hazard		Limiting Hazard/s	Maximum Risk	Preventive Measures	Monitoring	Event Consequence	Event Likelihood	Event Risk	Comments	Level of Uncertainty	Risk Treatments	Risk Treatment Ref	Comment at 2017 Review
Bulk Water	**Receipt of out-of-specification treated water**	Receipt of contaminated water into the supply system.	ADWG parameters	Bacteria	**Very High (C4)**	Incident reporting procedures for MIWB and MICC; Regular communications between MIWB and MICC operators	Verification monitoring (MITR sampling location)	Major	Rare	**Medium (A4)**	There has been no *E. coli* reported over the past four years. The incoming supply is tested but the sample is taken off a dead leg so it is not too representative of the incoming water.	Confident	n/a	n/a	No change
Reservoirs	**Deterioration of water quality in reservoirs as a result of variable residence times; Stagnation**	Variable residence time may cause a loss of the disinfection residual. The system is not operated to manage retention times.	Bacteria; Turbidity; Taste and odour.	Bacteria	**Very High (C4)**	Chlorine residual; Management of levels in reservoirs; Auto chlorine dosing in reservoirs 2 and 4; Manual chlorine dosing in other reservoirs as required; PAX mixers in reservoirs 2 and 4; Sizing of system to meet demand	Chlorine residual; Biological monitoring.	Major	Possible	**Very High (C4)**	Improvement in water quality has been noted following filtration by MIWB. Changes in demand are irregular, can make managing the water levels difficult. Chlorine can get low in the reservoirs at times. Reservoir 2, which was problematic during previous risk assessments has now been repaired, fixed and auto chlorine dosing and PAX mixer installed. There is potentially 1.5 days storage in the network, which should result in an acceptable water age.	Confident	Dosing and mixing to be installed in all reservoirs	WQ8	Risk upgraded in light of audit findings (repeated CCP failures)
Reservoirs	**Vandalism or willful contamination**	Access by humans and willful contamination leading to potential poor quality water.	Bacteria; Viruses; Protozoa; Toxins.	Bacteria	**Very High (C4)**	Chlorine residual; Security fences; Removal of access ladders; Locks on hatches; Security cameras (dummy).	Visual inspections; Chlorine residual.	Major	Rare	**Medium (A4)**	Security cameras are in the pipeline but dummy cameras have been put up as deterent. Unauthorised access to the reservoirs has been achieved by climbing fences and using stairwell access, although not recently.	Confident	n/a	n/a	No change
Reservoirs	**Poor mixing within reservoir**	Poor mixing in a reservoir leading to pockets of reduced quality water.	Bacteria; Opportunistic pathogens; Turbidity; DBPs.	Bacteria	**Very High (C4)**	Management of levels in reservoirs; PAX mixers in reservoirs 2 and 4.	Verification monitoring	Major	Possible	**Very High (C4)**	Except for Reservoir 6, they all have a common inlet outlet. *E. coli* has not been detected over the past two years, low numbers of HPC were recorded. Reservoir 2, which was problematic during previous risk assessments has now been repaired, fixed and auto chlorine dosing and PAX mixer installed. Although DBPs are not the limiting hazard, it is considered that poor mixing could lead to increased water ages and corresponding increases in DBP concentrations. However, no THMs exceedences have been noted.	Reliable	Dosing and mixing to be installed in all reservoirs	WQ8	Risk upgraded in light of audit findings (one of the mixers was not operating)
Reservoirs	**Disturbance of Sediment**	Stirring of foreign matter leading to a deterioration in water quality.	Bacteria; Viruses; Protozoa; Turbidity; Taste and odour; Colour; pH.	Bacteria	**Very High (C4)**	Managing tank levels; Chlorine residual; Formalised reservoir inspection and cleaning program.	Verification monitoring	Major	Rare	**Medium (A4)**	Reservoirs are cleaned at least every 5 years.	Reliable	n/a	n/a	No change
Reservoirs	**Vermin**	Access by animals (including birds) leading to: - Microbiological contamination, from animal droppings and dead animals. - Loss of disinfection residual due to additional chlorine demand.	Bacteria	Bacteria	**Very High (C4)**	Chlorine residual; Sealed storages; Formalised reservoir inspection program.	Visual inspections	Major	Rare	**Medium (A4)**	Reservoir inspections are implemented. Reservoir inspection procedure has been developed. HPC numbers have been very low in recent years.	Estimate	Dosing and mixing to be installed in all reservoirs Funding to be sought for Res 3 replacement	WQ8 WQ12	No change to risk level despite audit findings. Vermin proofing defect at Res 3 was immediately addressed. New RMIP action to replace Res 3. Uncertainty increased.
Reservoirs	**Ingress or wash-in of contaminated water**	Ingress of animals faecal matter and leaf litter via roof drainage leading to: - Microbiological contamination, from animal droppings, rotting vegetation. - Natural organic matter, e.g. leaf litter.	Bacteria; Protozoa; Colour; Taste and odour; Turbidity; Lead; Copper; DBPs; Sulphur.	Bacteria	**Very High (C4)**	Chlorine residual; Sealed storages; Formalised reservoir inspection program.	Visual inspections	Major	Rare	**Medium (A4)**	Reservoir inspections are implemented. Reservoir inspection procedure has been developed. HPC numbers have been very low in recent years. No *E. coli* has been detected over the past four years.	Estimate	Dosing and mixing to be installed in all reservoirs Funding to be sought for Res 3 replacement	WQ8 WQ12	No change to risk level despite audit findings. Vermin proofing defect at Res 3 was immediately addressed. Open hatch on reservoir immediately closed. New RMIP action to replace Res 3. Uncertainty increased.
Reservoirs	**Overdosing of chlorine**	Chlorine dosing system malfunction or incorrect dose pump setting leads to overdose	Chlorine	Chlorine	**Medium (C2)**	CCP Procedure Limitations of dosing pumps and size of reservoirs make overdose difficult. Dosing pumps positioned higher than chlorine tanks Customer complaint monitoring Weekly dosing system checks when samples collected	Verification monitoring	Minor	Unlikely	**Low (B2)**	No chlorine overdosing events in recent history.	Reliable	n/a	n/a	Added at 2017 review
Reservoirs	**Underdosing of chlorine**	Reduced barrier to a subsequent contamination event	Bacteria	Bacteria	**Very High (C4)**	CCP Procedure Weekly dosing system checks when samples collected	Verification monitoring	Major	Rare	**Medium (A4)**	Note - underdosing of chlorine is not in itself a hazard. Another hazardous event has to occur to result in a public health risk. These hazardous events	Reliable	n/a	n/a	Added at 2017 review
Pumps Stations	**Sediment disturbance on start-up**	Change in flow direction, which would disturb sediment in the mains.	Turbidity; Bacteria; Protozoa; Viruses; Colour; Iron; Manganese.	Turbidity	**Medium (C2)**	Flushing prior to operation; Servicing the pumps	Verification monitoring; Visual inspection.	Moderate	Rare	**Low (A3)**	Pumps haven't been started up in >10 years. They are used to transfer water from the Low Zone to the High Zone. These zones are isolated, and the pumps are a contingency measure only.	Confident	n/a	n/a	No change
Reticulation	**Ingress of non-potable water**	Ingress of contaminants through: - Pipe joints; - Air valves; - Leaking valves and hydrants; - Aging infrastructure. Ingress caused by loss of pressure in mains during: - Pipe burst; - Pipe repairs; - Very high flows (e.g. firefighting).	Bacteria; Taste & odour; Colour; Turbidity; Protozoa; Viruses; Toxic metals; Hydrocarbons; Toxins.	Protozoa	**High (B4)**	Mains repairs and hygiene procedures; On-the-job staff training	Verification monitoring	Major	Rare	**Medium (A4)**	On average, there are approximately 2-3 mains breaks per month. The same crews operate on water and sewer but there is a formal hygiene procedure in place.	Reliable	n/a	n/a	No change
Reticulation	**Backflow**	Backflow from a third party's asset: - Illegal connection (connection not to plumbing code); - Unintentional flow from a downstream entity's asset, due to operational error/ignorance. - Two-way operation of a main.	Bacteria; Opportunistic pathogens; Protozoa; Viruses; Hydrocarbons; Taste and odour; Pesticides; Fertilisers; Toxins.	Bacteria	**Very High (C4)**	Plumbing code for backflow connections; Vacuum breakers on hose lines	No program currently in place	Major	Unlikely	**High (B4)**	No major processing facilities are connected to the MICC. Domestic issues are considered to be the greatest risk. Although the limiting hazard is bacteria, the risk can also be from toxins, other pathogens hence risk is high.	Reliable	Investigate and identify users that may be of potential concern; check backflow requirements and gaps; maintain backflow register; and enforce council backflow policy.	WQ3	No change. Backflow register has been completed, but no Trade Waste Officer to enforce policy.
Reticulation	**High flow or changes in flow rate or direction in pipelines**	High flow and rapid changes in flow rate in pipelines leading to scouring and sloughing of slimes and sediment.	Turbidity; Taste & odour; Bacteria; Toxic metals; Colour; Viruses; Protozoa; Aluminium; Iron; Manganese.	Turbidity	**Medium (C2)**	None	Verification monitoring	Minor	Unlikely	**Low (B2)**	Maintenance activities could cause a change in direction or flow rate when systems are isolated. The turbidity is generally caused by sloughing.	Confident	n/a	n/a	No change
Reticulation	**Dead ends**	Stagnant water in pipelines caused by: - Dead ends. - Pipes' low-water demands or mothballing.	Bacteria; Iron; Manganese; Colour; Dissolved oxygen; Taste and odour; Turbidity.	Turbidity	**Medium (C2)**	Flushing program	Targeted monitoring of dead ends.	Minor	Possible	**Medium (C2)**	Remove dead ends when pipe replacements are done.	Confident	n/a	n/a	Risk upgraded from low to medium (still not a significant risk) - will be addressed by new hydraulic model
Reticulation	**Formation of Disinfection By-products**	The reaction of chlorine with organic material to create DBPs.	Disinfection by-products (e.g., THMs, NDMA & HAAs)	Disinfection by-products (e.g., THMs, NDMA & HAAs)	**High (C3)**	Managing reservoir levels to reduce water age; Procedures to prevent ingress of non-potable water	Verification monitoring	Moderate	Possible	**High (C3)**	High risk passed from MIWB hence carried through. MICC monitoring results show that THMs have not exceeded the ADWG guideline value. Monitoring will be continued to monitor risk. MIWB is undertaking steps to reduce risk from DBPs.	Confident	n/a	n/a	No change. No risk treatment can be undertaken by MICC that does not conversely increase pathogen risk.

Camooweal Risk Register

Component	Hazardous Event	Potential Hazard		Limiting Hazard/s	Maximum Risk	Preventive Measures	Monitoring	Event Consequence	Event Likelihood	Event Risk	Comments	Level of Uncertainty	Risk Treatments	Risk Treatment Ref	Comments in 2017 review
Bores	**Surface water infiltration**	Stormwater runoff ingress through bore casing and insecure borehead.	Viruses; Bacteria; Protozoa; Hydrocarbons; Turbidity; Colour.	Bacteria	**Very High (C4)**	Collar and casing on the bore; Borehead raised well above the ground with concrete slab around.	*E. coli* monitoring	Major	Unlikely	**High (B4)**	No *E. coli* detections in bores for the past four years. Old bore 1 which had some issues is not used, emergency purpose only.	Estimate	Improve visi bility of chorination system operation & performance (SCADA)	WQ6	Risk level upgraded in light of E. coli and turbidity results (see WQ assessment) Uncertainty level increased.
Bores	**Surface water infiltration through recharge**	Contaminated surface water may negatively impact water in the aquifer. Dumping of rubbish in surrounding caves could lead to groundwater contamination after rainfall event (see Eberhard 2003).	Viruses; Bacteria; Protozoa; Hydrocarbons; Turbidity; Colour.	Bacteria	**Very High (C4)**	Site inspections of cave entrances, especially Niggle Cave and Tar Drum Sink.	Verification monitoring	Major	Unlikely	**High (B4)**	No *E. coli* detections in bores for the past four years. Old bore 1 which had some issues is not used, emergency purpose only. STP and dump is located away from proximity of bores hence no potential for contamination at point of abstraction.	Estimate	Improve visi bility of chorination system operation & performance (SCADA)	WQ6	Risk level upgraded as above. Uncertainty level increased.
Bores	**Surface water infiltration through recharge**	Contaminated surface water may negatively impact water in the aquifer.	Viruses; Bacteria; Protozoa; Hydrocarbons; Turbidity; Colour.	Protozoa	**High (B4)**	Deep bores provide natural filtration	None	Major	Unlikely	**High (B4)**	Possibility of protozoa contamination is rare. Deep bores, unsure of groundwater direction. Old bore 1 which had some issues is not used.	Estimate	Increase monitoring of turbidity and *E. coli* at the bores during the wet season (twice monthly) to investigate any possible surface water influence. Install online turbidity at bores	WQ5 & WQ6	Risk level upgraded as above. Review ongoing monitoring data to assess whether risk level is appropriate, and decide on further actions to address risk if it remains high
Disinfection	**Failure of chlorination system**	Pathogens in final water (failure of Cl system).	Bacteria; Virus.	Bacteria	**Very High (C4)**	Security fence to avoid vandalism of dosing equipment; Training and procedures.	Regular inspections including weight of chlorine bottle. Verification monitoring	Major	Rare	**Medium (A4)**	The bore pumps are at a fixed speed, and the injector pump is also at a fixed speed. Need to make sure chlorinator is on the right set point. There has been an issue in the past where local residents have turned off the chlorine. Security has been improved, and fences have been erected. Chlorine is added as barrier against re-contamination and is important. Ongoing event testing as per improvement WQ5 will be required to verify this.	Estimate	Improve visi bility of chorination system operation & performance (SCADA)	WQ6	No change
Disinfection	**Overdosing of Chlorine**	Cl_2 outside ADWG Health limit; Taste & Odour complaints.	Chlorine; Taste & odour.	Chlorine	**Medium (C2)**	Training and procedures.	Verification monitoring	Minor	Rare	**Low (A2)**	High chlorine could be caused by vandalism or operator error, although chlorine failures are most likely to be under dosing.	Confident	n/a	n/a	Risk lowered due to no over-dose occurrences in >5 years Uncertainty level decreased.
Header tanks	**Stagnation**	Resulting in the loss of chlorine residual, allowing for potential contamination.	Bacteria; Taste and odour.	Bacteria	**Very High (C4)**	Levels set appropriately for tank turnover. Valving locked out to prevent isolation of tanks.	Verification monitoring	Major	Rare	**Medium (A4)**	Bore pumps are controlled on the header tank levels. Levels are set at a point that provides adequate turnover, so stagnation is not an issue in normal operation. However, it is possible to isolate the tanks, which would cause the water to stagnate, and may be delivered to town when reinstated. Bore pumps operate more than once a day, meaning the tanks' turnover.	Reliable	n/a	n/a	No change
Header tanks	**Vermin**	Vermin accessing the tanks and contaminating water.	Bacteria	Bacteria	**Very High (C4)**	Sealed lid, lockable hatch; Reservoir inspection program	Verification monitoring; Visual inspection.	Major	Rare	**Medium (A4)**	Tanks are completely sealed.	Reliable	n/a	n/a	No change
Reticulation	**Ingress of non-potable water**	Ingress of contaminants through: - Pipe joints; - Air valves; - Leaking valves and hydrants; - Aging infrastructure. Ingress caused by loss of pressure in mains during: - Pipe burst; - Pipe repairs; - Very high flows (e.g. firefighting).	Bacteria; Taste & odour; Colour; Turbidity; Protozoa; Viruses; Toxic metals; Hydrocarbons; Toxins.	Bacteria	**Very High (C4)**	Chlorine residual; Mains repair procedure; Flushing following mains repairs; Positive pressure	Chlorine residual testing; Verification monitoring	Major	Rare	**Medium (A4)**	Old cast-iron system; new areas are PVC. When the header tank was inadvertently switched off, it caused the pressure in the retic to increase and resulted in a number of main breaks. The valving has now been locked out to prevent this in future. Normally, there are minimal main breaks in the Camooweal system.	Reliable	n/a	n/a	No change
Reticulation	**Stagnation including dead ends**	Stagnant water in pipelines caused by: - Dead ends. - Pipes' low-water demands or mothballing.	Bacteria; Iron; Manganese; Colour; Dissolved oxygen; Taste and odour; Turbidity.	Bacteria	**Very High (C4)**	Flushing program, when feasible (no water restrictions); Residual chlorine	Targeted monitoring of dead ends.	Major	Rare	**Medium (A4)**	Austral and Nowrani Streets are dead ends.	Reliable	n/a	n/a	No change
Reticulation	**The reaction of chlorine with organic material to create DBPs.**	Disinfection by-products (e.g.. THMs, NDMA & HAAs)	Disinfection by-products (e.g.. THMs, NDMA & HAAs)	Disinfection by-products (e.g.. THMs, NDMA & HAAs)	**Low (B2)**	None	None	Minor	Rare	**Low (A2)**	Ground water has very low organic load hence low risk from formation of DBPs.	Reliable	n/a	n/a	No change

Whole of System Risk Register

Component	Hazardous Event	Potential Hazard		Limiting Hazard/s	Maximum Risk	Preventive Measures	Monitoring	Event Consequence	Event Likelihood	Event Risk	Comments	Level of Uncertainty	Risk Treatments	Risk Treatment Ref
Whole of System	**Incompatible materials**	Use of incompatible materials may cause release into water supply.	Toxins	Toxins	**Medium (A5)**	Council implements standard 4020; Use of qualified contractors	None	Minor	Unlikely	**Low (B2)**	Materials used should meet the standard.	Confident	n/a	n/a
Whole of System	**Malicious contamination**	The intentional contamination of the water supply.	Toxins; Hydrocarbons; Bacteria; Protozoa; Viruses; Taste and odour; Pesticides.	Toxins	**Medium (A5)**	Security fences; Locked hatches; Cameras (dummy);	Routine monitoring	Catastrophic	Rare	**Medium (A5)**	No history of such events.	Reliable	n/a	n/a
Whole of System	**Lack of Resources**	Loss of system knowledge and the ability to recruit skilled operators leading to inappropriate decision making, reduced knowledge and lack of maintenance of the system.	Turbidity; Bacteria; Protozoa; Toxic Metals.	Protozoa	**High (B4)**	On-the-job training; Training on chlorination; Operation manuals; Procedures	None	Major	Rare	**Medium (A4)**	Procedures such as mains/pipes breaks, mains and personnel hygiene, flushing etc have been developed.	Confident	n/a	n/a
Whole of System	**Loss of power**	Loss of treatment and water supply.	Reduced output volume	Reduced output volume	**Low (B2)**	Solar powered chlorinator - reservoir 4 in Mount Isa scheme.	None	Minor	Unlikely	**Low (B2)**	No historic issue. Ergon maintains electricity supply. The only issue would be if the hydraulic valve on Reservoir 2 failed in the open position, due to a loss of power. However, MICC has quick response time to fix this.	Reliable	n/a	n/a

APPENDIX E
CCP PROCEDURE

Mount Isa City Council
Critical Control Point Procedure

What is measured	Where or how is it measured	What is the control point	What are the hazards	Record Keeping
Free chlorine	**Mount Isa:** Weekly Grab samples at Reservoirs 1 - 6 **Camooweal:** Monthly Grab samples at Header Tank	**MICC chlorine dosing systems** (and MIWB bulk water quality)	Chlorine sensitive pathogens	**Monitoring data** - Excel Spreadsheet **Adjustment limit response actions** - Comment in spreadsheet **Critical limit response** - CCP Reporting form

REGULATORY LIMIT
>5.0 mg/L
(TOTAL CHLORINE)

Critical Limit
< 0.1 mg/L
OR
> 4.5 mg/L

Adjustment Limit
< 0.2 mg/L
OR
> 2.0 mg/L

Target
0.3 - 0.5 mg/L

Notify Team Leader Water & Sewerage IMMEDIATELY (Team Leader to Notify Senior EHO)

Senior EHO to call DEWS immediately on 1300 596 709 (Incident Reporting form to be submitted within 24 hours)

IF LOW (<0.1mg/L)

- Repeat test to confirm result
- Investigate/troubleshoot as per Adjustment Limit actions below
- Advise Team Leader Water & Sewerage
- Consider need for manual chlorine dosing
- Team Leader to communicate with Mount Isa Water Board if necessary
- Fill in CCP Reporting Form

IF HIGH (>4.5mg/L)

- Repeat test to confirm result, and also measure total chlorine
- Immediately advise Team Leader Water & Sewerage
- Switch off chlorine dosing temporarily (if applicable) and monitor levels
- Investigate/troubleshoot as per Adjustment Limit actions below
- Fill in CCP Reporting Form

Mount Isa Res 2 or 4, or Camooweal (chlorine dosing sites)

- Check dosing system is operational
- Check dose pumps, dosing lines, analysers etc
- Consider whether testing equipment needs calibration
- Has chemical strength changed? (e.g. fresh delivery recently)
- Adjust dose rate and monitor closely
- If necessary, arrange for repairs
- Advise Team Leader Water & Sewerage

At Reservoirs 1, 3, 5 or 6 (no chlorine dosing system)

- Consider whether testing equipment needs calibration
- Advise Team Leader Water & Sewerage
- Team Leader to contact Mount Isa Water Board if required
- Consider manual chlorine dosing (if <0.2mg/L)

- Routine dosing system & mixer checks (when collecting samples)
- Routine testing at all reservoirs and reticulation sites
- Adjust dose rates as required to maintain desired levels in reticulation
- Mount Isa - monitor sodium hypochlorite usage and order chemical as required
- Camooweal - monitor chlorine gas usage and order chemical as required
- Routine dosing system maintenance as needed
- Regular communications with Mount Isa Water Board

VERSION	2.0
APPROVED	STEPHEN WAGNER
DATE	21/08/2017

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Mount Isa City Council

Critical Control Point Procedure - HOW TO USE

What is measured **Where or how is it measured** **What is the control point** **What are the hazards** **Record Keeping**

This is the what, where and how. Importantly, remember the record keeping requirements.

REGULATORY LIMIT
>5.0 mg/L

These are the actions to take if a total chlorine reading is >5.0mg/L. This is a breach of the Australian Drinking Water Guidelines health limits and **must be reported to DEWS immediately**. Refer also to the Critical and Adjustment Limit actions in the red and orange boxes below

Critical Limit
< 0.1 mg/L
OR
> 4.5 mg/L

These are the actions to take if a reservoir free chlorine result is outside of the critical limits (<0.1 or >4.5mg/L)

If the total chlorine result is >5.0mg/L, then also refer to the purple box above

When investigating, refer also to the Adjustment Limit actions in the orange box below

Adjustment Limit
< 0.2 mg/L
OR
> 2.0 mg/L

These are the actions to take if a result is outside of the adjustment limits (<0.2 or >2.0mg/L)

This box contains suggestions for investigating potential problems. Use your experience to also consider other possibilities

Target
0.3 - 0.5 mg/L

These are the routine tasks that are undertaken as part of normal operations

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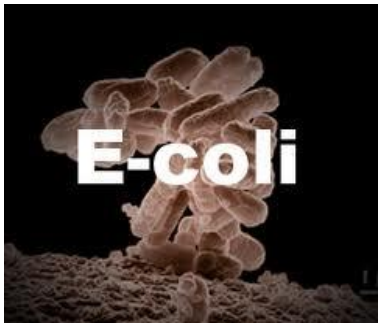
APPENDIX F
BOIL WATER / DO NOT DRINK TEMPLATES

Boil Water Notice
E. coli Bacteria Contamination



Regular monitoring for *E. coli* bacteria in the water supply system is conducted by Council. *E. coli* itself is generally not harmful but its presence in drinking water is associated with sewage and animal wastes. The presence of these bacteria indicates that the water may be contaminated with organisms that may cause disease.

Recent monitoring has shown *E. coli* to be present in the water supply system. As a precaution you are advised that water for consumption should be brought to a rolling boil. Water should then be allowed to cool and stored in a clean container with a lid and refrigerated.

Cooled boiled or bottled water should be used for:

- drinking, cooking, washing raw foods (such as seafood or salads), making ice, pet's drinking water and cleaning teeth
- dishes should be washed in hot soapy water or in a dishwasher. Children should take bottled or cooled boiled water to school.

Mount Isa City Council is working to alleviate the problem.

Precautions should be taken until further notice.

Please share this information with other people who drink this water, especially anyone who may <u>not</u> get this notice directly. For further information, contact Mount Isa City Council on (07) 4747 3200.

Do Not Drink Water Alert

Water contamination event

Mount Isa City Council is currently investigating potential contamination of the town water supply.

Until we can verify that your water is safe, we ask that you do not drink from the town water supply.

- Do not drink your tap water or use it for cooking.
- Boiling the water does not make it safe to drink.
- The water is safe for flushing toilets and washing clothes.

Mount Isa City Council are working to restore a safe water supply, and will keep the community informed about this incident.

Please share this information with other people who drink this water, especially anyone who may not get this notice directly. For further information, contact Mount Isa City Council on (07) 4747 3200.

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