ANNUAL REPORT 2022/2023 (FINANCIAL YEAR)

City of Townsville

Drinking Water Quality Management Plan

SPID	506
Postal Address	PO Box 1268, Townsville Water, QLD 4810
Principal Contact	Trisha Knavel, Drinking Water Quality Officer
Report Prepared by	Trisha Knavel, Drinking Water Quality Officer
Report contains	Activities undertaken over the 2022/2023 financial year in operating Townsville City Council's drinking water service.
	Summary of drinking water quality for Townsville's three drinking water schemes.
	Summary of Council's performance in implementing their approved Drinking Water Quality Management Plans.

Contents

Abbreviations and Acronyms

Acronym	Definition
ADWG	Australian Drinking Water Guidelines
Council	Townsville City Council
DBP	Disinfection by-product
DWS	Drinking Water Scheme
DWQMP	Drinking Water Quality Management Plan
E. coli	Escherichia coli
Hypo	Sodium hypochlorite
MIB	Methylisoborneol
N. fowleri	Naegleria fowleri
NATA	National Association of Testing Authorities
PAC	Powdered activated carbon
The Regulation	Public Health Regulation 2005
The Regulator	Office of the Water Supply Regulator
RMIP	Risk Management Improvement Program
SCADA	Supervisory Control and Data Acquisition
THM	Trihalomethanes
WTP	Water Treatment Plant

Approvals

In signing this approval:

I agree that the report meets the standards required and approve the report to be submitted to Water Supply Regulation, Department of Regional Development, Manufacturing and Water.

Travis Richards
General Manager Water and Resource Recovery
Townsville City Council

Water Supply in Townsville

2022/2023 Fast Facts

3
drinking water supply schemes

Maximum daily water demand
180 ML

28,478 ML
of residential drinking water supplied to 229,385 residents

4,328 ML
Volume of non-revenue drinking water supplied

0.1
customer water quality complaints per 1,000 connections

$864
Typical water bill based on 200kl per annum

88,160
residential properties connected

2,753 km
of water mains

$61,864
spent on capital improvements

$1,134,593
Replacement cost of Townsville's water supply assets

1. Executive Summary

Townsville City Council's (Council) Drinking Water Quality Management Plan (DWQMP) was approved in August 2012. Included in the approval notice was the requirement to submit an annual water quality report to outline the performance of Council against their DWQMP as required under the *Water Supply (Safety and Reliability) Act 2008*.

Council has met all requirements under its DWQMP, the Australian Drinking Water Guidelines 2011 (ADWG) and the *Public Health Regulation 2005* (the Regulation) for the reporting period, the reporting period being the 2022/2023 financial year.

Council has three Drinking Water Schemes (DWS): Townsville DWS, Giru/Cungulla DWS and Paluma DWS. Although their DWQMPs are separate, one annual report for all three schemes is submitted to the Office of the Water Supply Regulator (the Regulator).

The Regulation for *Escherichia coli (E. coli)* requires that 98% of samples taken in a 12-month period should not detect *E. coli* Annual compliance for the three schemes was met with 99.99% compliance for Townsville DWS, 100% compliance for Giru/Cungulla DWS and 100% compliance for Paluma DWS.

Five notifications of non-compliance and two events were submitted to the Regulator for the three schemes for the reporting period:

- 3 *E. coli* detections
- 2 disinfection by-product (DBP) exceedances
- 2 events

There were 50 customer complaints regarding drinking water quality:

- 22 dirty water complaints
- 3 milky water complaints
- 19 taste/odour complaints
- 3 owner's side issues
- 2 suspected illness
- 1 calcium deposits

Townsville continues to experience harmful algal blooms in the Ross River Dam. Working together with Trility, the Regulator, Queensland Public Health and industry experts, Council continues to provide treated water that meets the ADWG.

This DWQMP annual report is made available to our customers through our public website, upon request through email to **enquiries@townsville.qld.gov.au** or inspection upon request at the Customer Service Centre, 103 Walker Street, Townsville City.

2. Overview

Water and Resource Recovery is a significant business activity of Council and is a registered service provider under the *Water Supply (Safety and Reliability) Act 2008*. Water and Resource Recovery is responsible for the management of the city's potable water supply network and provision of safe and reliable water to the residents of Townsville, Paluma township and Cungulla township. Public health is protected through proactive identification and minimisation of public health related risks associated with drinking water.

Council's DWQMP was submitted to the Regulator on 21 June 2011. It was approved with conditions on 29 August 2012. Townsville's first DWQMP audit was undertaken in July 2016. The plan was reviewed, with significant amendments made in January 2018. The amendments were approved with conditions on 23 April 2018. The plan is reviewed every two years with an external audit undertaken every four years. The latest regulatory audit was undertaken in December 2020 and the plan review was approved in November 2021. The most recent review was undertaken with the expertise of environmental consultancy Viridis and was submitted in August 2023.

Water and Resource Recovery services a population of approximately 193,162 with 88,750 connected properties, in three drinking water schemes: Townsville DWS, Paluma DWS and Giru/Cungulla DWS. This annual report relates to all three schemes.

Table 1. Summary of Townsville's Drinking Water Schemes

Scheme Name	Water Treatment Plant (WTP)	Water Source	Treatment Processes	Treatment Capacity	Towns Supplied
Townsville Drinking Water Scheme	Douglas WTP (Angus Smith Drive)	Ross River Dam (water supplemented from the Burdekin Dam through the Haughton Pipeline when required)	Conventional treatment with chlorine disinfection	232 ML/D	Townsville
	Northern WTP (Kinduro)	Paluma Dam/ Crystal Creek	Ultrafiltration with chlorine disinfection	40 ML/D	
Giru/Cungulla Drinking Water Scheme	Giru WTP (Cromarty Creek Road)	Haughton River	Conventional treatment with chlorine disinfection	2 ML/D	Cungulla township
Paluma Drinking Water Scheme	Paluma WTP (Lennox Crescent)	Paluma Weir	Ultrafiltration, UV and chlorine disinfection	90 KL/D	Paluma township

Giru WTP supplies water to Cungulla township and Giru township. Water is supplied to Giru township through agreement with the Burdekin Shire Council. Management of Giru's drinking water quality is covered under the Burdekin Shire Council's DWQMP.

40,760ML of potable water was produced in the 2022/2023 financial year.

Water and Resource Recovery maintains and operates:

- 2 major water storages (Ross River Dam and Paluma Dam)
- 2 weirs (Paluma Weir and Blacks Weir)
- 26 water pumping stations
- 23 chlorinators
- 41 reservoirs (treated water storage facilities)
- 2,753 km of water distribution mains.

3. Actions Taken to Implement the DWQMP

3.1 Management of Council's DWQMP

Water and Resource Recovery employs a Water Quality Team of experienced operators, scientists, engineers, and plumbers who work to monitor, regulate, and improve water quality for all DWSs. Collectively, they handle water quality non-compliances, water quality complaints and queries from customers, monitor all critical control points, the Water Sampling Plan and closely monitor the subsequent data it generates. The team includes the Water Quality Officer (custodian of the DWQMP), Senior Water Systems Engineer, Water Resources Engineer, Coordinator Compliance Water & Resource Recovery, Commercial Compliance Officer, Coordinator Water Networks, Bulk Water Maintenance Officer and the Water Operators.

The Water Quality Team hold a weekly water quality meeting, as well as a weekly operations meeting with Townsville DWS's contractor Trility. A water quality governance meeting is held with management every two months and is chaired by the General Manager Water and Resource Recovery.

A Technical Team was established in February 2020 in response to the presence and persistence of cyanobacteria in the main raw water source for the Townsville DWS. The Technical Team provides expert advice and management of the risks associated with algal blooms and the treatment and supply of potable water to the Townsville community. The team includes representatives from Council, Trility, Townsville Laboratory Services and Beca/Hunter H_2O.

3.2 Training

All staff involved with water treatment and supply obtain the "Aquacard" which is managed through Council's internal Learning Management System. Aquacard is a Qldwater course which gives an overview of water quality risks, particularly when working on or around water infrastructure. It provides a simple overview of what contaminants are, the risks they pose, how they can enter a drinking water system and the responsibilities of those working on infrastructure to reduce that risk. It includes practical guidance on how to operate within work sites including good housekeeping and disinfection practices.

Water and Resource Recovery staff members continue to complete the Water Industry Worker Program. The Water Industry Worker Program was developed in partnership with Qldwater, government, industry and training providers to help retain skilled staff and improve future opportunities for workers through industry specific training. The program is focused on the formal recognition of skills and training employees within the construction and maintenance field in the water industry. A large component of this training is drinking water quality and the role of the worker in maintaining safe supply as a public health requirement of their role.

The Water Quality Officer will undertake the Best Practice Drinking Water Quality Management Course through University of Queensland's IWES educational program. IWES is Australia's most successful continuing education program for professionals responsible for industry environmental performance.

In conjunction with the Australian Water Association, Council hosted the North Queensland Water Industry Conference in August 2023: "Water in the North Driving Opportunity and Prosperity." This was a chance for water, wastewater, and associated suppliers of equipment in North Queensland to come together and share their knowledge and experiences.

3.3 Operation of Douglas WTP and Northern WTP

Trility operate the Douglas WTP and Northern WTP under a managed contract for Council. The contract is managed through informal weekly operations meetings, formal monthly operational management team meetings and formal quarterly contract management committee meetings.

3.4 Education

Since the easement of all COVID-19 restrictions, face-to-face engagements have continued to increase from the previous financial year, with around 2,165 students engaged across Eco-Catchment Education Tours and classroom visits during the 2022/23 financial year. This number is anticipated to increase further with new schools reaching out to engage with Council's water education services and the release of the new Australian Curriculum version 9.0, which will see Year 4 students learning about the total water cycle. Resources and activities are currently being created to align with the new curriculum and support teacher delivery of classroom lessons.

Council also continues to support major school events, including St Benedict's Catholic School's EcoFest, Kelso State School's Under 8's Day, and Eco Warriors Challenge, with opportunities to engage more than 300 students and parents at each event.

For National Water Week 2022, the theme was "Our Water Stories," which provided an opportunity to highlight the important work Council does in the water space. A short educational video series was launched detailing Council's water treatment process and wastewater treatment process. These have already been utilised in classroom learnings across Townsville schools, in particular Year 7 who are learning about alternative water sources and treatment processes.

The videos can be viewed here:
National Water Week - Chelsea and Jake Water Stories
National Water Week - Laura and Eric Water Stories
National Water Week - Alana and Leah Water Stories

The Adopt-a-Creek program is a citizen science program that is run in conjunction with Council's Creekwatch program and delivered by our partner OzFish Unlimited. The program empowers local schools and community groups to act as custodians of their local waterways through education and involvement in catchment management. Connecting schools and community groups to their local waterways enhances water quality through stewardship. So far 6 primary schools, 2 high schools and 1 community group have been involved in the program.

Find out more: **https://www.townsville.qld.gov.au/water-waste-and-environment/creek-to-coral/community-partnerships**

3.5 Major Capital Projects

3.5.1 Ross River Dam to Douglas WTP Pipeline Duplication

The Ross River Dam to Douglas WTP Pipeline provides approximately 85% of the city's water. Council is building a new pipeline to increase the resilience of this key asset and further enhance Townsville's water security. This project is proudly funded by the Queensland Government in association with Townsville City Council.

Council awarded two separate packages of work to local construction firm CivilPlus. Construction of the first package of works from the dam downstream to include a river crossing has been completed. The installation of pipe on package 2 continues on the eastern side of Ross River through the Department of Defence's Mount Stuart Training Area. The project is due for completion in mid 2024.

3.5.2 Haughton Pipeline Project

Stage 2 of the Haughton Pipeline Project will see the existing pipeline extended from the Haughton River to the Burdekin River near Clare and will include around 30km of pipe as well as the construction of a new pump station and high voltage power supply infrastructure. The pipeline will allow Council to draw bulk water supply from the Burdekin River and transport it to the Ross River Dam during extended dry periods to supplement seasonal inflows into the dam. Stage 1 of the pipeline is complete and Stage 2 of construction commenced in August 2023, with the first section of pipeline laid in the ground in October 2023.

3.6 Risk Management Improvement Program

The risk management improvement program (RMIP) implementation plan is included in Appendix A.

A DWQMP Risk Assessment facilitated by Viridis was undertaken in May and June 2023 with key staff. A new RMIP was generated and will be included in the latest DWQMP and includes the open actions from this RMIP. The new RMIP reporting will be included in next year's annual plan.

4. Information Supplied to the Regulator Regarding Non-Compliances and Prescribed Incidents

There were five non-compliances with water quality criteria and two water supply events reported for the 2022/2023 financial year.

DWI-506-22-09989 - Townsville DWS – *E. coli*

On 8 December 2022, 2 cfu/100ml of *E. coli* and 28 cfu/100ml of total coliforms were detected at Picnic Bay Reservoir on Magnetic Island. Free chlorine was 1.08 mg/L, total chlorine was 1.30 mg/L, turbidity was 0.24 NTU, colour was <1 and pH was 7.26, so adequate disinfection should have occurred. Supervisory Control and Data Acquisition (SCADA) showed the chlorine residual did not drop below low level and sat at 0.86mg/L at the time of reporting to the regulator. Picnic Bay is fed from Douglas WTP and supplies most of Magnetic Island (approx. 2,000 residents).

Horseshoe Bay Reservoir and Arcadia Reservoir are both fed from Picnic Bay Reservoir which did not detect *E. coli*, however Horseshoe Bay had 12 cfu/100ml total coliforms with a chlorine of 1.6 mg/L free and 1.8mg total. No *E. coli* or total coliforms were detected at Arcadia Reservoir and chlorine was 0.55 mg/L free and 0.88 mg/L total. No *E. coli* was detected at Douglas WTP or in reticulation on 6 December 2022.

A complete overview of the Magnetic Island Reservoirs was undertaken by the Water Quality Officer, Senior Water Engineer and Bulk Water Engineer. Horseshoe Bay Reservoir was determined to be in good condition but required an urgent clean that was carried out by divers on 23 March 2023. Arcadia Reservoir was determined to be in fair condition but required a roof repair. A private contractor determined a temporary repair was not feasible, and with consistently high DBPs detected in the reservoir, a decision was made to take Arcadia Reservoir offline.

Picnic Bay Reservoir requires a roof replacement and will occur when bypass pipework is installed. The bypass pipework design for Picnic Bay Reservoir was fast tracked and budget was acquired as a priority for roof renewal works. The roof replacement is to be delivered in the 2023/2024 financial year budget with works completed by 2025.

Verification monitoring showed a reduction in total coliforms and heterotrophic plate count throughout the network since Arcadia Reservoir was taken offline. No *E. coli* was detected since the first exceedance.

DWI-506-23-10152 – Townsville DWS – High Chlorates

On 4 January 2023, a chlorate value of 1002 µg/L was detected at Roseneath Reservoir. Chlorate exceedances were further detected at 4 other sample sites on the 31 January 2023: Bottom City Reservoir, Top City Reservoir, Yarrawonga Reservoir and Yarrawonga Park with values of 922 µg/L, 1,037 µg/L, 936 µg/L and 947 µg/L respectively. These samples are at sites where re-chlorination occurs and the sodium hypochlorite (hypo) was found to be two or three weeks in age. The weather at the time was hot (>30˚C) and water usage was low due to frequent rain. These combined factors provided ideal conditions for chlorine to decay and form chlorates.

Further exceedances continued through the summer (See Table 2).

Table 2: Chlorate values above the ADWG exceedance limit at specified sample points.

Date	Sample Point	Chlorate µg/L
01/02/2023	Mt Elliot Reservoir	872
07/02/2023	16 Brady Road	875
07/02/2023	Roseneath Reservoir	1,076
01/03/2023	Arcadia Reservoir	2,350
07/03/2023	Roseneath Reservoir	1,016
08/03/2023	Arcadia Reservoir	3,550
15/03/2023	Arcadia Reservoir	2,945
29/03/2023	Roseneath Reservoir	1,070
03/05/2023	Dahl Reservoir	1,106
04/05/2023	Roseneath Reservoir	978

All the affected sites are fed from Douglas WTP. Treated water from Douglas WTP is tested bi-weekly and all results were under the chlorate exceedance guideline value of 800 µg/L. A decision was made to take Arcadia Reservoir off-line mid-March due to its consistently high chlorates and expected roof replacement works. Roseneath Reservoir services only trucks in an industrial estate, so there was little risk to human consumption.

Council and Trility have DBP management strategies which include the following:

- Close monitoring of sodium hypochlorite age and replace it regularly to minimise DBPs from Douglas WTP through to reticulation.
- Trility receive their hypo in smaller and frequent batches that are always tested for chlorine demand and chlorate.
- Regular flushing occurs at all end points in the reticulation to pull fresh water through.
- Coogee, the hypo supplier, now have a batching plant based in Townsville to decrease transport time.
- Council maintains appropriately sized hypo tanks that are kept out of the sun.
- A dual tank system is used where possible.
- Chlorine residual is kept as low as possible without compromising disinfection.

DWI-506-23-10155 – Giru/Cungulla DWS – High Turbidity Event

On 5 February 2023, sustained rainfall in the catchment (Haughton River) increased the incoming turbidity at Giru WTP to >240 NTU. The chemistry of the incoming raw water was also different with heavy clay particles. Giru WTP was turned off to allow the higher turbidity water to bypass and for the operators to conduct jar testing to ensure correct chemistry for treatment.

Due to ingress of high turbidity water (>5 NTU) the clear water storages were scoured and refilled with compliant water that was carted from Townsville DWS. The clear water storages were isolated from each other and pumps to Cungulla were shut down so no transfer of water to Cungulla Reservoirs occurred. Burdekin Shire Council initially detected turbidity of 1.5 NTU in the reticulation. Further sampling on 5 February 2023 and 6 February 2023 detected average turbidities of ~0.64 NTU at the Giru Reservoir. *E. coli* and total coliforms were not detected in the treated water. The chlorine residual at Giru Reservoir was 0.89 mg/L and 0.56 mg/L in reticulation.

Once Giru WTP returned to producing water meeting the ADWG, the plant was turned back online on 6 February 2023. Weekly monitoring of the clear water storages on 9 February 2023 detected turbidity at 0.9 NTU with free and total chlorine at 0.88 mg/L and 1.15 mg/L respectively, and a pH of 6.92.

Burdekin Shire Council installed a skid arrangement to monitor pH, chlorine and turbidity, and dose hypo into the system. It is located at their pumps at Giru WTP prior to entering their reticulation system. Council has completed a scope of works to inhibit the ability to transfer turbid water to the Giru reticulation pumps by a high turbidity alarm trigger in filtered water.

DWI-506-23-10157 – Townsville DWS – *E. coli*

On 7 February 2023, 7 CFU/100ml *E. coli* and 8 CFU/100ml total coliforms were detected at Rollingstone Reservoir during routine sampling. Free and total chlorine were 1.12 mg/L and 1.19mg/L, respectively. Turbidity was 0.2 NTU and pH was 7.42. Rollingstone Reservoir is fed from Northern WTP. No *E. coli* or total coliforms were detected at the sample points fed from Rollingstone Reservoir (Marlin Street and Balgal Beach) or at Northern WTP.

Flushing was carried out downstream of the affected reservoir. *E. coli* was not detected in the re-sample or subsequent routine samples of the reservoir. The chlorine values were within targeted range.

It was noted that it was raining on the day of the initial sample on 6 February 2023. A condition assessment was completed by water consultancy Beca Hunter H_2O in December 2022 which determined that a whirlybird was missing and rust spots were forming on the roof. A contractor has since been to site and sealed the whirlybirds and repaired the rust spots. There have been no further *E. coli* detections at this sample point.

DWI-506-23-10204 – Townsville DWS – Cyanobacteria Event

On 27 February 2023, a new cyanobacteria species contributed to a total cyanobacteria biovolume of 25 mm3/L in Ross River Dam. The main risk from this previously undetected species was that it was unknown if it produced toxins and whether toxins potentially associated with it were susceptible to chlorination. Temporary powdered activated carbon (PAC) dosing only occurs on Modules 1 and 2 at Douglas WTP, so Level 2 water restrictions were put in place so more water could be processed through these modules. Restrictions enabled the filtration process to slow down to aid algal cell removal. Water quality and supply were monitored closely and not affected throughout the event.

Samples of the new species were sent to an external laboratory for speciation and toxin production determination. Toxin samples were also sent to a separate external laboratory for full toxin analysis. The species was identified as Pseudoanabaena limnetica, which is not a toxin producing species. With the onset of the cooler months, cyanobacteria biovolumes decreased to Alert Level 2 values (0.6 mm3/L).

DWI-506-23-10221 – Townsville DWS – High THMs

On 22 March 2023, trihalomethanes (THM) above the ADWG limit were detected at Picnic Bay, Horseshoe Bay and Arcadia Reservoirs at 250 µg/L, 260 µg/L, and 410 µg/L respectively. Investigation concluded the high results were a laboratory error due to an incorrectly adjusted internal standard recovery on the THM analysis. Correct values for Picnic Bay, Horseshoe Bay and Arcadia Reservoirs were 101 µg/L, 122 µg/L, and 142 µg/L, respectively.

Townsville Laboratory Services have quality assurance controls that align with their National Association of Testing Authority (NATA) accreditation. One of the advantages of having an internal laboratory is the ability to access results quicker through the Laboratory Information Management System and the quick communication between Townsville Laboratory Services and the Water Quality Officer as soon as the instrument delivers results. In this case, Townsville Laboratory Services staff communicated the high THM values before they were checked as per their quality assurance procedures.

DWI-506-23-10275 – Townsville DWS – *E. coli*

On 11 May 2023, 9 CFU/100ml of *E. coli* and 80 CFU/100ml total coliforms were detected at Cope Street Park (7 Collings Street) in Wulguru during routine sampling. The sample point had a free chlorine of 1.56 mg/L, total chorine of 1.65 mg/L, turbidity of 0.3 NTU and pH of 7.52. This sample point is fed from Douglas Reservoir, which is fed from Douglas WTP. No *E. coli* was detected at the reservoir or any other sample points within reticulation.

The sample point was flushed, re-sampled and the area investigated for anything that could compromise the water quality at the time of re-sample. The investigation at the time of re-sample did not identify any environmental issues that would have compromised the sample. *E. coli* was not detected from the re-sample or subsequent routine sampling. Chlorine was 0.55 mg/L free and 1.35 mg/L total. The area around the sample point was found to be clear of debris or anything that could affect the sample. There have been no further detections of *E. coli* at this sample point.

5. Compliance with Water Quality Criteria for Drinking Water

Water and Resource Recovery has a comprehensive sampling regime “from catchment to tap” which covers catchments, raw water supply, water treatment and water distribution. More than 100,000 tests are taken annually for various parameters including but not limited to chlorine, pH, turbidity, alkalinity, metals, chemical, pesticides, DBPs, per- and polyfluoroalkyl substances and microbiological.

Treated water samples are taken from dedicated sample points in Council-owned parks and open spaces. These sample points are housed in secure vandal proof casings known as a “Ned Kelly”.

All samples are taken and analysed by Townsville Laboratory Services, a NATA accredited lab. Results are emailed to the Water Quality Team as soon as they are verified and finalised by the laboratory. The Water Quality Team also has access to the Laboratory Information Management System to obtain results as required. All results above ADWG limits are called through immediately to the Water Quality Officer (Team Leader Water Treatment or Compliance Coordinator if Water Quality Officer is not available). Exceedance reports are generated weekly or as required. All water quality data is monitored, and trends analysed throughout the year by the Water Quality Officer.

COVID-19 restrictions did not affect sampling type or frequency. Townsville Water and Resource Recovery has been largely compliant with the water quality criteria for the financial year, having five water quality incidents and two water supply events.

Three reportable incidents were due to *E. coli* detections and two were for disinfection by-products above the ADWG limit (DWQMP limits for chlorates), although the incident for high THMs was determined to be lab error. Details for the incidents and events are included in Section 4 above.

Council was compliant with the Public Health Regulation 2005 which requires “nil cfu/100ml found in 98% of the samples taken for a 12-month period” for all three schemes for the period.

There were three *E. coli* incidents for Townsville Drinking Water Scheme with a 99.90% compliance rate for the reporting year. There were no *E. coli* detected at Giru/Cungulla DWS or Paluma DWS, both with a 100% compliance rate for the reporting year.

Table 3: Number of E. coli Incidents and Percentage Annual Compliance with the Public Health Regulation 2005.

DWS	No. of samples taken	Number of Incidents	% Annual Compliance
Townsville	3,204	3	99.90%
Paluma	128	0	100.00%
Giru/ Cungulla	196	0	100.00%

There have been no failures to meet sampling frequencies and all locations were sampled.

Drinking water quality performance (verification monitoring) is included in Appendix B. This is a snapshot of the most relevant water quality parameters for the three schemes. If further detailed information is required residents (or businesses) are asked to contact the Water Quality Officer through email **enquiries@townsville.qld.gov.au** or by calling Customer Service on 13 48 10.

6. Details of Complaints Made to the Provider About the Drinking Water Service Supplied to the Customers

All customer water quality complaints are lodged through Council's 24-hour Operations Centre, with all information regarding the complaint and how it was rectified recorded in Council's Customer Relationship Management system. Each complaint has a unique identification number which enables the complaint to be tracked from initial request to completion. There were 50 drinking water quality complaints for the reporting period.

Figure 1: Number of drinking water quality complaints per financial year. The spike in customer complaints in 2020/2021 was due to the water discolouration event.

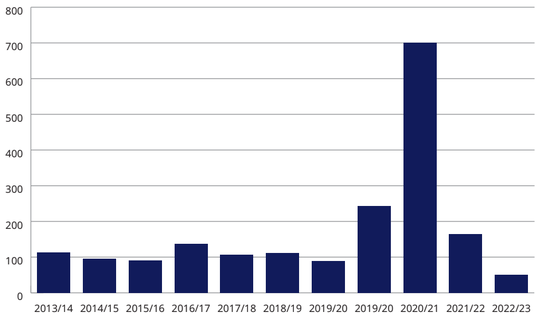


Table 4: Number of dirty water complaints by type 1 July 2022 to 30 June 2023.

Type of Water Quality Complaint	Dirty Water	Milky Water	Taste/ Odour	Suspected Illness/ Customer Concern	Owner's Side	Calcium Deposits
Number of complaints 2022/2023	22	3	19	2	3	1

There were six main types of water quality complaints in Townsville: dirty water, milky water, taste and odour, owner's side issues, suspected illness and calcium deposits.

1. Dirty Water

There were 22 dirty water complaints. Dirty water results when sediments from the bottom of the pipes are stirred up due to works occurring in the area such as pipe repairs, water trucks filling from hydrants and construction works with heavy machinery. It can also be caused by changing velocities in pipes stirring up the sediment. When a dirty water complaint is lodged, a water reticulation crew is dispatched to flush the area until the dirty water is removed, and the chlorine residuals are back within specification. Customers are advised to flush their side by running sprinklers. Customers receive a call the following day to ensure water remains clear before their complaint is closed out.

2. Milky Water

There were three milky water complaints. Milky water is caused when air becomes trapped in the water under pressure, forming tiny air bubbles. As these air bubbles escape, they cause the water to look milky. Milky water occurs following large main repairs or when new mains are commissioned. The issue generally resolves itself over time as the air bubbles escape, but if not the mains are flushed by work crews.

3. Taste and Odour

There were 18 taste and odour complaints. Taste and odour complaints in Townsville are generally caused by:

- Dirty water events
- Methylisoborneol (MIB)/Geosmin
- High chlorine (or sudden changes in chlorine concentration)
- Old or new pipework on customer's side of the meter
- Old hot water systems

Water and Resource Recovery liaises with all customers for all taste and odour complaints, flush where required and take samples for further investigation if warranted.

4. Owner's Side Issues

Owner's side issues, of which there were four, are caused by:

- Fuel/hydrocarbons/paint/volatile organic compound spills – spillages of hydrocarbons, BTEX chemicals and volatile organic compounds on residents' lawns can seep into the soil and permeate polyethylene piping causing taste and odour issues. Compounds of note can include: paint, petrol and fuels.
- Hot water systems – nearing the end of their life and the breakdown of the anode inside. Council analyses samples through Townsville Laboratory Services where required and communicate with customers through these issues.
- Internal pipework

5. Suspected Illness

There were two suspected illness complaints this year. These were the results of the water tasting "off". Residents were contacted and water from their residence was analysed through Townsville Laboratory Services, showing that water met the ADWG limits and was safe to drink. MIB was suspected as the cause of the "off" taste.

6. Calcium Deposits

There was one complaint of white scale appearing on a car after being washed. Mineral deposits such as calcium can remain on cars when water evaporates quickly. After washing a car, it is recommended to dry it off with a chamois, rather than allowing it to dry naturally.

7. Outcome and Recommendations of Audit

The regulatory audit was undertaken by Northern Water Management in December 2020.

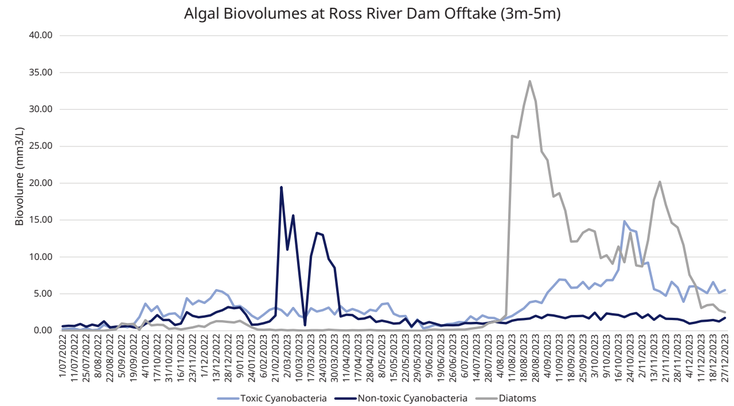
The outcome of the audit was outlined in last years' DWQMP Annual Report and findings are managed through the RMIP.

8. Ongoing Harmful Algal Blooms

Ross River Dam harbours two types of harmful algal blooms: cyanobacteria (also known as blue-green algae) and diatoms. Cyanobacteria were first detected in Ross River Dam in 2018. Since then, a significant bloom has developed and water treatment has required ongoing management. Over the years significant additions have been made to the water treatment processes at Douglas WTP including improved monitoring, pre-chlorination on all modules, PAC dosing on Modules 1 and 2 and the addition of clarification on Modules 3 and 4. The permanent design for PAC dosing on all modules are complete but waiting on the new raw water pipeline to be operational for direct dosing into the pipeline. Every summer the bloom duration and biovolume increases, with February/March 2023 concentrations at 14-25 mm3/L (DWI-506-23-10204) at offtake level. The weather conditions of long, hot days were providing optimal conditions for growth and after recent rainfall, there was a wash-in of nutrients to the water body.

Diatoms were first detected in high levels in the Ross River Dam in 2021. Their existence persists but were in low biovolumes throughout the 2022/2023 reporting period. Water and Resource Recovery continues to work with Trility, the Regulator, Queensland Health, and industry experts to mitigate and treat the cyanobacteria and diatoms.

Figure 2. Average algae biovolumes at offtake level within Ross River Dam. Note the spike in February/ March 2023 cyanobacteria event contributed by the species Pseudoanabaena limnetica.



Appendix A.

Risk Management Improvement Program

Criteria	Findings	Recommendation/s	Improvement Action Comments	Target Date	Actions Taken to Date	Status and Revised Target Date	Responsible Officer	Complete
Details of Infrastructure for Providing the Service								
A schematic layout for each scheme must be included in the plan.	Schematics need to be updated from the last review and follow infrastructure updates.	Douglas WTP and Northern WTP schematics need to be updated (increased dosing including PAC at Douglas WTP).	Schematics updated and included in latest DWQMP review.	1/03/2023		1/03/2023	Commercial Compliance Officer	Complete
		Schematics to be updated for Paluma (latest schematics are not in the DWQMP).	Schematics updated and included in latest DWQMP review.	1/03/2023		1/03/2023	Water Quality Officer	Complete
		Schematics to be updated for Giru/Cungulla (latest schematics are not in the DWQMP).	Schematics updated and included in latest DWQMP review.	1/03/2023		1/03/2023	Water Quality Officer	Complete
Source details for each scheme must be provided in the plan – water source/s and source infrastructure.	Raw water quality data was presented and reviewed.	Clearly show on Northern WTP schematic that there is an air gap and raw water from Crystal Creek cannot be sent straight to reservoirs.	Plant bypass shown on the updated schematic June 2023.	1/03/2023		1/03/2023	Commercial Compliance Officer	Complete
Treatment process details for each drinking water source must be provided in the plan – the process steps, relationship, operation, loading, stand-by equipment, flow from each source, distribution area, list of chemicals.	The Giru/Cungulla scheme run by Townsville City Council supplies water outside of the Council area. It is best practice for these stakeholders to be involved in the risk assessment process.	Paluma WTP schematic needs to be updated to show all dosing, monitoring points and bypasses correctly (e.g. bypassing screen filter).	Latest schematic March 2023 includes all dosing, monitoring points and bypassing.	1/03/2023		1/03/2023	Water Quality Officer	Complete
A description of any variations to process operation (for example, bypassing a process step) must be included in the plan.			Updated schematic 09/03/2023 has been included in the latest DWQMP review.	1/03/2023		1/03/2023	Senior Water Systems Engineer	Complete
Key stakeholders	Trility and Queensland Health attended the workshop on both days. Burdekin Shire Council representative was not invited (this was an oversight, not intentional).	Invite relevant staff to the next DWQMP review from Burdekin Shire Council for the Giru/Cungulla risk assessment.	Ensure Water Treatment Team Leader invites relevant staff from Burdekin Shire Council. Two represenatives attended the workshop and review (May 2023).	By next review and ongoing			Water Quality Officer	Complete

Criteria	Findings	Recommendation/s	Improvement Action Comments	Target Date	Actions Taken to Date	Status and Revised Target Date	Responsible Officer	Complete
Water Quality Information								
The plan must include a summary of the analysis and interpretation of available and relevant water quality information.	Water quality parameters analysed and reviewed up to 2022.	Updated the DWQMP including appendices with the latest water quality information.	Sampling plan to be checked and updated as minor changes have occurred.	1/06/2023			Water Quality Officer	Complete
	Separate monitoring programs to investigate the likelihood of *Naegleria fowleri (N. fowleri)* did not find a significant detection.						Water Quality Officer	Ongoing
	Include radiological monitoring in source water monitoring as per ADWG and MIB/Geosmin/Blue-green algae monitoring across all schemes and source waters (including Giru and Paluma)						Water Quality Officer	Complete
	Check that hydrocarbon results present a breakdown for benzene, toluene, ethylbenzene and xylene as well as hydrocarbon fractions.	Has been included in sampling.					Water Quality Officer	Complete
	Ned Kelly GIS coordinates and add to mapping layer.	This project has been stalled. All sample points have GPS coordinates and asset tags. Talks with Assets to reestablish project.	All sample points are in GIS layer.			1/09/2023	Water Quality Officer	Complete
Catchment Characteristics								
Hazards and Hazardous Events								
The hazards and hazardous events and the sources of the hazards and hazardous events that could adversely affect water quality must be documented in the plan, including for – catchment, sourcing infrastructure, treatment plants, disinfection process(es) and distribution system.	Cyanobacterial toxins and algal bloom outbreaks have now been included in the risk assessment.	Ensure there are cyanobacterial outbreak response plans for each drinking water scheme.	Blue-green algae plan has been developed for Ross River Dam. Separate plan for Paluma Dam, Paluma Weir and Giru WTP needs to be developed.	1/12/2023			Water Quality Officer	

Criteria	Findings	Recommendation/s	Improvement Action Comments	Target Date	Actions Taken to Date	Status and Revised Target Date	Responsible Officer	Complete
Whole of service hazards and hazardous events (including cyber security threats and breaches with regard to water quality) and the sources of the hazards and hazardous events must be documented in the plan.	Improvements to treatment infrastructure (e.g. completion of additional clarifiers at Douglas WTP, duplication of raw water supply lines, additional dosing options such as PAC) have been noted for improvement.	Update the risk assessment once infrastructure upgrades have been completed, commissioned, and are operating at Douglas WTP e.g. clarifiers, raw water pipeline, PAC.	Once works have been complete the Water Quality Officer will need to organise a risk assessment to assess the new risk. May be undertaken by Trility or engage consultant.	1/12/2025			Water Quality Officer	
Risk Assessment and Management								
The plan must detail the risk assessment methodology used for each scheme including:	Risk assessment methodology has been presented in the DWQMP.	Added to most recent review of DWQMP.						Complete
• reference to a published version such as ADWG, HACCP, AS/NZS ISO 31000	A series of detailed assessments have been completed over time with slightly different presentations.	Added to most recent review of DWQMP.						Complete
Operations and Maintenance Procedures								
The plan must contain, for each existing preventive measure identified, a list of the documented operation and maintenance (or other) procedures that are required to ensure the integrity of the measures, including: title, date last revised, the process used for maintaining the documented procedures, the process for implementing the procedures.	Cyanobacterial toxins and high cell counts have been found in source waters resulting in potential elevated risks.	Ensure there are cyanobacterial outbreak response plans for each drinking water scheme.	As above - response plans required.	1/12/2023			Water Quality Officer	
	There was a discussion around the manual dosing of reservoirs. Noting that there was some variation in the concentration of chlorine used.	Immediately develop/update procedure for manual dosing in to reservoirs. Include calculations with new concentration of hypo, dilution rates and quantity.	"? Calcium tablets. Mt Margaret: No manual handling as have pump system. New inlet main by 2024/2025. Ponti Road: Design for recirc system. Design finish 2024/2025, construct 2025/2026. Arcadia and Brookhill: Same as Ponti Road."	1/06/2024			Senior Water Engineer	

Criteria	Findings	Recommendation/s	Improvement Action Comments	Target Date	Actions Taken to Date	Status and Revised Target Date	Responsible Officer	Complete
Management of Incidents and Emergencies								
The process for managing drinking water incidents and emergencies must be described in the plan, including: incidents and emergencies (including cyber security), the level of emergency (for example, green, amber, red or level 1, 2), summary of action(s) taken for each level including emergency contacts, internal and external communication processes and protocols, responsible positions.	Water carting to Cungulla is currently restricted because there are only two local companies in the area.	Include in the emergency response plans, emergency supply options for Cungulla in the event that water cannot be safely supplied from the WTP. This may require Council to have their own water truck available or enter into specific agreements with other companies.	Two companies with 6 trucks provides redundancy. Only licensed potable water carriers are used but this needs to be formalised in a Work Instruction/ procedure.	1/12/2024			Water Quality Officer	
			Work Instruction for carting water.	1/12/2023			Water Quality Officer	
			Onsite power - Generator - Investigate.	1/12/2024			Senior Water Engineer	
	During a water quality emergency, a timely response is required. This often involves the need to immediately see infrastructure on the ground to respond appropriately and assist investigations. It was noted that the GIS mapping which was relied upon was often out of date or insufficient.	New development water infrastructure mapping into the GIS system should be completed within a month to reduce the risk.		1/12/2024	Add as item to Water Quality Governance Action Plan		Team Manager Network Service Delivery	
		Include a process step in emergency response plans to check construction drawings.	2-3 year wait for Council mapping system to update.	1/12/2024	Add as item to Water Quality Governance Action Plan		Team Manager Network Service Delivery	

Criteria	Findings	Recommendation/s	Improvement Action Comments	Target Date	Actions Taken to Date	Status and Revised Target Date	Responsible Officer	Complete
Improvement Program								
Describe the management measures proposed for each unacceptable residual risk. The process for providing the relevant information to the regulator must also be described. The description must include:	Procedures around installation of new main (both by contractors for acceptance by Council and Council-installed mains upgrade projects) need to be improved.	Chlorine only is being sampled for a new main when they are commissioned. A full water quality suite should be tested for all bulk network mains that are planned completed including by Project Department (mains renewals program).		1/07/2025	Action included in Drinking Water Quality Governance meeting.		Water and Resource Recovery	
• measures, actions, strategies or processes	Under planning in DA approval conditions, inspections occur. When the Assets team say the new main is ready, water unit start with flush and take residuals and put valves etc in place. Pipes are capped but not disinfected. Internal issue with safety requiring eyewash stations need to be rectified. Need to disinfect pipes after replacement. Need to test downstream for suitable parameters after new main installation.	Add to the isolation procedure that the chlorine residual is recorded on paperwork when it's taken onsite for new mains in new developments.	This needs to be written in the project brief.	1/07/2025	Action included in Drinking Water Quality Governance meeting.		Water and Resource Recovery	
• priority for implementation	Mapping system improvements showing valves and live information on which valves are open (Operations Centre and operators can see).	Put in place a process for DA to make the water unit aware of proposed new water infrastructure once the DA is approved.		1/07/2025	Action included in Drinking Water Quality Governance meeting.		Water and Resource Recovery	
• timeframe		Ensure the documented process for bringing disused reservoirs back online included risk assessment, improved security measures and water quality testing.	Look for procedure and add to paradigm.	1/12/2024			Senior Water Engineer	

Criteria	Findings	Recommendation/s	Improvement Action Comments	Target Date	Actions Taken to Date	Status and Revised Target Date	Responsible Officer	Complete
Information Management								
Operational Monitoring								
The plan must contain details of the operational monitoring program, including:	Changes noted in risk assessment.	Place critical control points (CCP) wall charts at the Giru WTP.	Series of meetings with Water Quality Officer, Team Leader Water Treatment and Water Treatment Operators to update CCPs. Updated CCP information posters at all sites June 2023.	1/06/2023			Water Quality Officer/ Senior Water Engineer	Complete
• summary of how excursions are managed and/or corrective action is taken.								
Verification Monitoring								
The plan must contain details of the verification monitoring program, including:	No changes.	To be updated - minor changes have occurred over time.		1/12/2023			Water Quality Officer	
• summary of how excursions are managed and/or corrective action is taken.								
Northern Water Treatment Plant								
Protazoa risk	Open unprotected catchment, evidence of people swimming in Crystal Creek.	Continue with plans to install UV at Northern WTP.	Julian to check design of UV at Northern WTP. Budget for 2024/2025.	1/12/2025			Team Manager Water Resources and Dam Safety	
Cyanobacteria	Monitoring program in place has not detected Cyanobacteria in the catchment.	Ensure blue-green algae plan is in place. Trility have AMP which we can use for now.		1/06/2025			Water Quality Officer	
Final disinfection	Confirm C.t for NWTP.	Check this has been confirmed.	C.t confirmed. Feedback on SCADA.	1/06/2023		1/06/2023	Water Quality Officer	Complete
Fluoride overdose	Fluoride dosing CCP.	Is this included in CCPs?	Yes - CCP 6.	1/06/2023		1/06/2023	Water Quality Officer	Complete
Supernatant return	Only 10% by volume is returned. Zero discharge site.	Confirm the control around returning supernatant including a turbidity target.		1/12/2023			Water Quality Officer	

Criteria	Findings	Recommendation/s	Improvement Action Comments	Target Date	Actions Taken to Date	Status and Revised Target Date	Responsible Officer	Complete
Douglas Water Treatment Plant								
Protazoa risk (septic and cattle in catchment)	GHD Crypto Report highlights the requirement for clarifiers on Module 3 and 4.	Complete installation of clarifiers on Module 4.	Currently due for operation end March 2023.	1/06/2023		1/03/2023	Water Quality Officer	Complete
Protazoa risk (septic and cattle in catchment)	GHD Crypto Report highlights the requirement for UV on Module 3 and 4.	Install UV on all modules (on treated water) at Douglas WTP.	Design complete. With Assets for funding.	1/12/2025			Water Quality Officer	
Cyanobacterial toxins	Develop Blue-Green Algae Response Plan.	Developed for Ross River Dam and Douglas WTP.					Water Quality Officer	Complete
Loss of supply	One raw water supply line to Douglas WTP. Has had a significant failure 2020.	Raw water pipeline duplication project is underway.	Raw water pipeline construction is underway. Project underway for hook up of new main.	1/06/2024			Water Quality Officer	
PAC dosing failure	No duty standby, temporary installation.	Design for permanent PAC dosing underway so that all modules can be dosed. Will be installed on new raw water pipeline at the pumps for a longer contact time.	Cannot proceed until duplication pipeline is complete and clarifiers operational on Module 3 and 4.	1/12/2025			Water Quality Officer	
Manganese above ADWG or high enough to cause customer complaints	Permanent pre-chlorination.	Pot perm has been considered and is not advisible.	Pre-chlorination permanent solution is being designed currently with permamnent dosing installation due 2024/2025.	1/06/2025			Water Quality Officer	
Fluoride overdose	Fluoride dosing CCP.	Is this included in CCPs?	As above. Fluoride is included in the CCPs.	1/06/2023		1/06/2023	Water Quality Officer	Complete
Disinfection- chlorine -underdose	To confirm the C.t work has been done on baffle walls and tracer study undertaken.	Complete tracer testing to confirm modelling for C.t	C.t confirmed and coded on fedback on SCADA.	1/06/2023		1/06/2023	Water Quality Officer	Complete
		Investigate dedicated C.t. chlorine anlyser prior to trim dose. Review disinfection control plan to ensure control philosophy is locked in.	C.t confirmed and coded on fedback on SCADA.	1/06/2023		1/06/2023	Water Quality Officer	Complete
Superntant return	Only 10% by volume is returned.	Confirm the control around returning superntant including a turbidity target.	Supernatant turned off due to toxin risk from cyanobacteria.				Water Quality Officer	Parked

Criteria	Findings	Recommendation/s	Improvement Action Comments	Target Date	Actions Taken to Date	Status and Revised Target Date	Responsible Officer	Complete
Paluma Water Treatment Plant								
Organics removal - disinfection by-products	Occassional THM spikes.	Investigate the use of ACH to extend the life of GAC and overall decrease organics and THMs. Confirm impact of fouling of the membranes. ACH can be used to target colour and organic removal.	ACH being used.	1/06/2024			Senior Water Engineer	
Cyanobacteria	Unknown risk.	Include cynaobacteria testing in raw water (Paluma Weir).		1/06/2024			Water Quality Officer	Complete
Raw water valve failure (if valve leaks, raw water can graviate through WTP)		Verify operation of inlet valve and outlet valve.		1/06/2024			Senior Water Engineer	
Treatment coagulation		Investigate the impact of coagulation on the membrane fouling rate and cleaning interval.		1/06/2024			Senior Water Engineer	
Treatment GAC	High colour causing dirty water complaints if GAC exhausted. Also lead to higher THMs.	Consider replacing GAC in the lead up to summer to ensure that GAC is adsorbing the maximum amount when the organics challenge and the THM formation potential is the highest. GAC needs to be replaced when the membrane UVT and GAC UVT start to come together.	Chelsea trend UVT to confirm GAC.	1/06/2024			Senior Water Engineer	
Treatment GAC		Record the turbidity profile following a GAC bckwash to confirm that it will not set off the turbidity alarm.		1/06/2024			Senior Water Engineer	
Disinfection - chlorine under-dose		Confirm C.t. (max flow, min level, chlorine minimum) for Paluma storage.		1/06/2024			Senior Water Engineer	
Paluma supernatant return	Recirculated water increases risk of protazoan breakthrough. This is a zero discharge site.	Check the process and develop a procedure to target return at 10% of process flow.		1/06/2024			Senior Water Engineer	
	Long term failure of ACH dosing into the thickener feed and gradual build up of turbidity.	Monitor turbidity of supernatant and include a turbidity target as Operational Control Point.	New turbidity meter.	1/01/2025			Senior Water Engineer	

Criteria	Findings	Recommendation/s	Improvement Action Comments	Target Date	Actions Taken to Date	Status and Revised Target Date	Responsible Officer	Complete
Iron	Total iron is x>10 times the raw water (returning back into plant from supernatant).	Consider monitoring for soluble iron in the supernatant.	Organise to test for this.	1/03/2023			Water Quality Officer	Complete
Giru Water Treatment Plant								
Manganese	Seasonally elevated.	Document the process if elevated metals are detected in the raw water supply.	Relook at data.	1/06/2023			Water Quality Officer	Complete
Aluminium	Naturally occuring high aluminium.	Conduct a review into aluminium exceedances in treated water above aesthetic limits.	Laura to distribute data.	1/06/2023			Water Quality Officer	Complete
Radiological	? Naturally occuring in raw water - low confidence.	Include radiological sampling in raw water monitoring program as per ADWG.		1/01/2023			Water Quality Officer	Complete
Cyanobacteria	No data exists as not monitored.	Include cyanobacteria sampling in the Haughton River. When data is obtained develop a Blue-Green Algae Response Plan.		1/01/2023			Water Quality Officer	Complete
	Typically not required, used after rain events if alkalinity is low.	Need to incorate triggers for the turning on/ off soda ash.	Review- soda ash is primarily used to control pH.	1/12/2024			Senior Water Engineer	
Treatment chemical dosing		Develop procedures for jar testing and development of chemical dosing rates based on source water events and turbidy.	Chelsea to develop with JT. Jar Testing training with WTS.	1/12/2024			Senior Water Engineer	
Pre-treatment clarifier		Incorporate routine supernatant monitoring to add certainty to the performance. Coagulation control needs to be documented to ensure tht all operators are targeting the same thing.		1/12/2024			Senior Water Engineer	
	Effective coagaulation will remove a percentage of organics. Targets are currently for turbidity and "good floc".	Suggest measuring true colour of filtered water on jar testing will assist in managing coagulation.		1/12/2024			Senior Water Engineer	

Criteria	Findings	Recommendation/s	Improvement Action Comments	Target Date	Actions Taken to Date	Status and Revised Target Date	Responsible Officer	Complete
		Ensure that coagulation pH targets are recorded and utilised.		1/12/2024			Senior Water Engineer	
Treatment - filtration	Critical setpoint - combined turbidity meter set at critical limit of 0.4NTU (5 minutes). High is 0.8NTU (no time limit). Alarm only, no auto action.	Check alarms for filtered water turbidity. Install individual filter turbidity analysers.	Two chambers with common backwash means it is essentailly one filter. There is an analyser for this.	1/12/2024			Senior Water Engineer	
			Automatic shutdown of plant on high high turbidity of 0.8NTU.	1/12/2024			Senior Water Engineer	
CCPS		Place CCP wall charts in Giru as these have been removed at some stage.		1/12/2023			Senior Water Engineer	Complete
Treatment filtration	HBTs - crypto risk.	Meter location and alignment of filter critical limits with ADWG and best practice. Continuous online monitoring of individual filters is recommended. Combined turbidity limit should be set at 0.2NTU.	Compliance calculation.	1/12/2024			Senior Water Engineer	
Sludge handling	Protazoa and micrbobial risk. Poor performance of lagoon increases the number of organisms in the feed into the WTP. Supernatant turbidity monitored, not alarmed and not online. Opportunity to allow for early detection of failure, particularly when washwater is stressed.	Supernatant turbidity monitored (continuous but not online) 10% by volume maximum return. Develop OCP with procedure to target 5% and alarm at 7.5%.		1/12/2024			Senior Water Engineer	
Primary disinfection	Chlorate	Include chlorate monitoring at Cungulla reservoir and house samples to ensure it remains low risk.		1/01/2023			Water Quality Officer	Complete
Primary disinfection	*N. fowleri*	Check effectiveness of primary dosing at this point for *N. fowleri.*		1/12/2024			Water Quality Officer	
Stakeholder engagement		Invite representatives of Burdekin Shire Council to next risk assessment workshop.		1/06/2023			Water Quality Officer	Complete

Criteria	Findings	Recommendation/s	Improvement Action Comments	Target Date	Actions Taken to Date	Status and Revised Target Date	Responsible Officer	Complete
		Check agreement with Burdekin Shire Council is still relevant and up to date.	Price plan modelling currently being undertaken.	1/12/2023			Commercial Compliance Officer	
Protazoa risk	Review sludge management system at Giru WTP.	Review sludge management system at Giru WTP.	Options report developed for Giru.				Senior Process engineer	Parked
Storage and Distribution								
Distribution	THMs, adequate C.t.	Develop a list of reservoirs that have common inlet/outlet.		1/06/2023			Water Maintenance Officer	Complete
	Chlorine overdose - due to hand dosing.	Immediately develop/update procedure for manual dosing in to reservoirs. Include calculations with new concentration of hypo, dilution rates and quantity.		1/12/2024			Senior Water engineer	
		Complete program of works for Brookhill, Arcadia, Mount Margaret and all hand dosed reservoirs to install chemical doing system. Remove the need to manually dose reservoirs.		1/12/2025			Senior Water engineer	
	N. fowleri	Ongoing *N.fowleri* monitoring amd review risk in next risk assessment.	Monitor chlorines and have extensive flushing program to mitigate risk.	1/06/2023			Water Quality Officer	Ongoing
Loss of supply		Giru/ Cungulla preparation procedures (potential to isolate high reservoir).	Procedure already developed.	1/06/2023			Senior Water engineer	Complete
Backflow prevention		Need to ensure that standpipe users are following code and document which hydrants they can take water from.		1/06/2023			Water Quality Officer	Complete
Backflow prevention	Reuse (recycled water).	Wally Tallis Way at Queensland Country Bank Stadium has at least one for the water and recycled water network. Ensure these are included in the list for annual checks.	Stadium irrigation infrastructure is recycled pipework. Connection to network. This needs to be formalised. This is a cross connection that needs to be accounted for.	1/12/2025			Team Manager Network Service Delivery	

Criteria	Findings	Recommendation/s	Improvement Action Comments	Target Date	Actions Taken to Date	Status and Revised Target Date	Responsible Officer	Complete
Backflow prevention		As constructed, record the asset and then it is put on the schedule. However non-own backflows are not on GIS. These may be recorded somewhere. Process needs to be checked and where they are recorded in the event of an incident.	Check with hydraulics - TJ.	1/12/2025			Team Manager Network Services	
Protazoa (*N. fowleri*)	Warm water temperatures in summer throughout Townsville supply.	Review the need for temperature monitoring in source water. Ongoing sampling for review at next DWQMP review. Investigate prevalence of *N. fowleri*. Investigate options to maintain chlorine residual above 0.5mg/L (reservoirs, lines and dead ends).	Temperature is monitored in source water and throughout distribution.	Ongoing			Compliance Coordinator	Ongoing
Reticulation - mains	Mains breaks.	Pipes are capped but not disinfected. Internal issue with safety requiring eyewash stations needs to be rectified. Need to disinfect pipework after replacement. Need to test downstream for suitable parameters after new main installation.	Procedure in draft. Need to be signed off by Safety.	1/12/2025			Senior Water Engineer	
Reticulation - mains	New main installations: Under planning in development application approval conditions, inspections occur. When the Assets team say the new main is ready, the Water team start with a flush and take residuals when they put valves etc. in place. Chlorine-only is being sampled for a new main when they are commissioned. Bulk network mains that are planned are completed by project department (mains renewal program).	Add to the isolation procedure the requirement to record chlorine residual onsite on required paperwork for new mains in new developments.		1/12/2025			Bulk Water Engineer	

Criteria	Findings	Recommendation/s	Improvement Action Comments	Target Date	Actions Taken to Date	Status and Revised Target Date	Responsible Officer	Complete
		Previously inspectors found out about new developments, currently there are no inspectors and Water Operations only find out about new developments coming online with new meter applications. Put in place a process for development applications to make aware once development applications approved.		1/12/2025			Team Manager Network Services	
Reticulation - pathogens	Continue ongoing program review of network water quality deterioration at the extents of the network.	Targeted flushing program - not documented.	Consider documenting flushing program.	1/12/2024			Senior Water Engineer	
Reservoirs - failure of (leaking)	Annual external assessment of reservoirs including roof. Drones and submersibles used. Sites with ladders have a cage with bottom locked or the site is fenced. West End Reservoir is built in the hill but offline currently.	Improve security measures when bringing disused reservoirs back online.		1/12/2024			Senior Water Engineer	
Reservoirs - contamination due to cleaning/maintenance		Review the contract for companies working in reservoirs to have completed "Aquacard" before working on reservoirs and obligation to disinfect before work and maintain water quality. This should be written into scope of work.	Laura to ask Sophie to put on new starter profiles. Talk to Assets and contracts (TJ, Odette) about condition assessments, reservoir cleaning program and major projects.	1/06/2024			Compliance Coordinator	
Reservoirs - water age		Continue to reduce water age to prevent THM formation.		Ongoing			Senior Water Engineer	Ongoing
Reservoirs- protazoa	Accumulation of *N.fowleri* in sludge at bottom of reservoirs may be stirred up. Contract in place for reservoir cleaning.		Ensure remains in budget.	Ongoing			Senior Water Engineer	Ongoing

Criteria	Findings	Recommendation/s	Improvement Action Comments	Target Date	Actions Taken to Date	Status and Revised Target Date	Responsible Officer	Complete
Chlorine overdose	Mount Jack chlorinator has cut off at 4mg/L. This does not exist at Julago.	Pumps that depress - Grundfos are at most sites and will be used at all moving forwards. Overview of all sites. Project for feedback on SCADA is underway.		1/12/2025			Senior Water Engineer	
Whole of system								
Terrorism/sabotage	All treatment plants are fenced. Most reservoirs are fenced. All reservoirs have locked cages around ladders and hatches. Locks in daisy chains when used by other utilities.	Complete project to have all reservoir sites secured. Review security arrangements and reconsider risk.		1/12/2025			Bulk Water Engineer	
Pathogens	Need to be immediately able to see infrastructure on the ground. Team that looks after this only have a few FTE's. Not under the control of Water Operations.	Water Operations only work within the mapping system. Response needs to include a process step where they can check construction drawings during an incident. New development mapping into the GIS should be completed within a month to reduce the risk.	The process is currently taking two years.	1/06/2025			General Manager TWRR	
All hazards	Giru and Paluma in remote areas. Call outs occur to Giru and Paluma WTP out of hours or in a rain event.	Dedicated Rangers live in Paluma and have been trained how to shut down plant safely. Giru can be shut down remotely via SCADA.	Improve SCADA - remote access Paluma - two servers - Callum.	1/12/2025			Senior Water Engineer	
All hazards	Loss of integrity in pipes/ treatment systems not working correctly due to aging assets and infrastructure.	Mapping system improvements showing valves and live information on which valves are currently open. (So OC and operators can see).	Massive undertaking - nice to have but not feasible. Critical valves are on GIS. Valve boxes are painted red (closed) blue (open) on the ground so that crews and operators can determein if they are open and closed.	Parked			Bulk Water Engineer	Parked
All hazards	Poor record keeping leads to information being missed resulting in a water quality incident.	Trility trialling a QR system for work instructions/ procedures. Allows accesss to latest WI/procedure on mobile device.	Consider same process for laboratory.	Parked			Water Quality Officer/ Commercial Manager Laboratory	Parked

Criteria	Findings	Recommendation/s	Improvement Action Comments	Target Date	Actions Taken to Date	Status and Revised Target Date	Responsible Officer	Complete
All hazards	Inappropriately skilled Water Operators	Succession planning – some information is not documented and is kept with individuals. Develop a recruitment plan to include succession planning.	Realignment of WRR with new positions added. However there are issues within the industry for recruitment and retention of trained water operators, trades peoples and engineers. WRR involved in projects with Qldwater Directorate to look at this as an industry.	Ongoing			General Manager TWRR	Ongoing
Pathogens	Many reservoir roofs allow ingress	Reservoir Roof Renewal Program requires involvement from Water Operations to drive the repair/replacement of high priority reservoirs for water quality risk.	Condition assessments of reservoirs is underway. Prioritisation will need input from Water Operations. Priority will be driven by reduced water quality in reservoirs.	1/12/2025			Senior Water Engineer/ Bulk Water Engineer	
Pathogens	*E. coli* detected at Magnetic Island reservoirs	Picnic Bay and Arcadia Reservoir roofs require temporary fix and permanenet fix.	Bolger Bay bypass completion due March 2024. Then Picnic Bay roof can be repaired.	1/12/2025			Senior Water Engineer	
Pathogens	*E. coli* detected at Rollingstone Reservoir	Rollingstone whirly bird requires replacment, roof requires repair.	Whirly bird replaced and temp roof repair complete.	1/12/2025			Senior Water Engineer	

Appendix B.
Drinking Water Quality Performance

Verification Monitoring

Townsville Water and Resource Recovery would like to thank all the employees of Townsville Laboratory Services for their ongoing hard work and constant support with source and drinking water verification monitoring. In early 2023, Townsville Laboratory Services achieved NATA Accreditation to test *Legionella sp.*, Sulphite, analysis of biotoxins and the analysis of bacterial endotoxins in water. Townsville Laboratory Services continues to perform above and beyond by developing new methods for more parameters.

Giru/Cungulla Drinking Water Scheme

	Scheme Component	Parameter Category	Parameter	Unit of Measure	Limit of Reporting (LOR)	Count	# of Samples Detected	# Exceed ADWG Guidelines Value	Min Value	Max Value	Avg Value	95th %tile	Comments
Giru	**Source Water** Giru Raw Water (Haughton River)	Thermotolerant Coliforms	Total Coliform	mpn/100ml	1	45	44	0	<LOR	24200	2925	18780	
		Thermotolerant Coliforms	*E. coli*	MPN/100ml	1	43	13	0	<LOR	105	4	9	
		Turbidity	Turbidity	NTU	0.1	45	45	0	1.3	35.1	7.35	29.72	
		pH	pH	pH Units	1	45	45	0	7.11	7.78	7.46	7.70	
		Metals	Iron, Total	mg/L	0.002	45	45	0	0.03	2.6	0.49	1.07	
		Metals	Manganese, Total	mg/L	0.0003	45	45	0	0.004	0.09	0.02	0.05	
		Pesticides	Pesticides	µg/L	Suite sampled x1		0	0	<LOR	<LOR	<LOR	<LOR	
		PFAS/ PFOA	PFAS/ PFOA	µg/L	Suite sampled x1		0	0	<LOR	<LOR	<LOR	<LOR	
	Water Treatment Plant Giru Clear Water Storage	Thermotolerant Coliforms	Total Coliform	CFU/100ml	1	37	1	0	<LOR	320	8.65	<LOR	
		Thermotolerant Coliforms	*E. coli*	CFU/100ml	1	45	1	0	ND	ND	ND	ND	
		Turbidity	Turbidity	NTU	0.1	45	43	0	<LOR	1.6	0.32	0.7	
		pH	pH	pH Units	1	45	45	0	6.76	7.55	7.04	7.38	
		Metals	Iron, Total	mg/L	0.002	45	36	0	<LOR	0.12	0.02	0.06	
		Metals	Manganese, Total	mg/L	0.0003	45	45	0	0.0005	0.1	0.0067	0.02	
		Pesticides	Pesticides	µg/L	Suite sampled x10		0	<LOR	<LOR	<LOR	<LOR	<LOR	

<LOR - Less than Limit of Reporting
ND - Not Detected

Giru/Cungulla Drinking Water Scheme

	Scheme Component	Parameter Category	Parameter	Unit of Measure	Limit of Reporting (LOR)	Count	# of Samples Detected	# Exceed ADWG Guidelines Value	Min Value	Max Value	Avg Value	95th %tile	Comments
Cungulla	**Transmission** Cungulla Reservoir	Thermotolerant Coliforms	Total Coliform	CFU/100ml	1	49	0	0	ND	ND	ND	ND	
		Thermotolerant Coliforms	*E. coli*	CFU/100ml	1	50	0	0	ND	ND	ND	ND	
		Turbidity	Turbidity	NTU	0.1	50	50	0	0.1	0.7	0.23	0.46	
		pH	pH	pH Units	1	50	50	0	6.89	7.85	7.4	7.67	
		Metals	Iron, Total	mg/L	0.002	50	36	0	<LOR	0.05	0.0033	0.006	
		Metals	Manganese, Total	mg/L	0.0003	50	47	0	<LOR	0.003	0.001	0.002	
		Disinfection Residual	Chlorine, Free	mg/L	0.05	50	50	0	0.81	1.96	1.54	1.89	
		Disinfection Residual	Chlorine, Total	mg/L	0.05	50	50	0	0.88	2.15	1.61	2.06	
		Disinfection By-product	Chlorates	µg/L	50	11	11	0	99	657	345	604	
		Disinfection By-product	Trihalomethanes	µg/L	8	49	49	0	23	74	40	69	
		MIB	MIB	ng/L	2	50	1	0	<LOR	3	<LOR	<LOR	
		Geosmin	Geosmin	ng/L	2	50	2	0	<LOR	3	<LOR	<LOR	
	Reticulation Cungulla Houses	Thermotolerant Coliforms	Total Coliform	CFU/100ml	1	102	1	0	<LOR	3	ND	ND	
		Thermotolerant Coliforms	*E. coli*	CFU/100ml	1	102	0	0	ND	ND	ND	ND	
		Turbidity	Turbidity	NTU	0.1	102	102	0	0.1	0.5	0	0.4	
		pH	pH	pH Units	1	102	102	0	6.4	7.72	7.25	7.54	
		Metals	Iron, Total	mg/L	0.002	50	32	0	<LOR	0.009	0.002	0.006	
		Metals	Manganese, Total	mg/L	0.0003	50	26	0	<LOR	0.001	<LOR	0.001	
		Metals	Lead	mg/L	0.0006	50	19	0	<LOR	0.001	<LOR	0.0009	
		Disinfection Residual	Chlorine, Free	mg/L	0.05	102	102	0	0.79	1.97	1.40	1.85	
		Disinfection Residual	Chlorine, Total	mg/L	0.05	102	102	0	0.84	2.33	1.47	1.97	

<LOR - Less than Limit of Reporting
ND - Not Detected

Paluma Drinking Water Scheme

Scheme Component	Parameter Category	Parameter	Unit of Measure	Laboratory Limit of Reporting (LOR)	Count	# of Samples Detected	# Exceed ADWG Guidelines Value	Min Value	Max Value	Avg Value	95th %tile	Comments
Source Water Paluma Weir	Thermotolerant Coliforms	Thermotolerant Coliforms	MPN/100ml	1	12	12	0	10	1050	300	979	
	Thermotolerant Coliforms	*E. coli*	MPN/100ml	1	12	12	0	10	910	252	833	
	pH	pH	pH Units	1	12	12	0	6.44	7.82	6.93	7.68	
	Metals	Iron	mg/L	0.002	12	12	0	0.34	1.2	0.63	1.02	
	Metals	Manganese	mg/L	0.0003	12	12	0	0.01	0.04	0.02	0.04	
	Turbidity	Turbidity	NTU	0.1	12	12	0	0.9	8.8	4.5	7.6	
	Cryptosporidium	Cryptosporidium	cells/10 Li	1	2	0	0	0	1	<LOR	<LOR	
	Giardia	Giardia	cells/10 Li	1	2	0	0	0	1	<LOR	<LOR	
Water Treatment Plant (Membrane Filtered Water)	pH	pH	pH Units	1	47	48	0	6.31	7.27	6.75	7.20	
	Turbidity	Turbidity	NTU	0.1	46	46	0	0.1	0.9	0.3	0.7	
	Colour	Colour, True	Pt-Co Units	1	47	38	0	<LOR	13	2	9	
	Colour	Colour, Apparent	Pt-Co Units	1	47	44	0	<LOR	15	3	11	
Transmission Paluma Reservoir	Thermotolerant Coliforms	Total Coliform	CFU/100ml	1	12	0	0	ND	ND	ND	ND	
	Thermotolerant Coliforms	*E. coli*	CFU/100ml	1	52	0	0	ND	ND	ND	ND	
	Disinfection Residual	Chlorine, Free	mg/L	0.05	57	57	0	0.69	1.86	1.32	1.75	
	Disinfection Residual	Chlorine, Total	mg/L	0.05	56	56	0	0.59	2.23	1.49	1.90	
	pH	pH	pH Units	1	58	58	0	6.46	8.02	6.93	7.48	
	Turbidity	Turbidity	NTU	0.1	58	58	0	0.1	0.8	0.3	0.7	
	Metals	Iron	mg/L	0.002	58	58	0	0.007	0.170	0.029	0.080	
	Metals	Manganese	mg/L	0.0003	58	58	0	0.0005	0.05	0.003	0.007	
	Metals	Aluminium	mg/L	0.0003	58	17	0	<LOR	0.09	0.01	0.03	
	Metals	Lead	mg/L	0.0006	58	2	0	<LOR	0.0008	<LOR	<LOR	
	Disinfection By-product	Chlorates	µg/L	50	12	12	0	157	599	375	588	
	Disinfection By-product	Trihalomethanes	µg/L	8	12	10	0	<LOR	74	21	50	

Paluma Drinking Water Scheme

Scheme Component	Parameter Category	Parameter	Unit of Measure	Laboratory Limit of Reporting (LOR)	Count	# of Samples Detected	# Exceed ADWG Guidelines Value	Min Value	Max Value	Avg Value	95th %tile	Comments
Reticulation Paluma Houses	Thermotolerant Coliforms	*E. coli*	CFU/100ml	1	70	0	0	ND	ND	ND	ND	
	Disinfection Residual	Chlorine, Free	mg/L	0.05	67	67	0	0.088	1.69	1.17	1.54	
	Disinfection Residual	Chlorine, Total	mg/L	0.05	67	67	0	0.61	1.87	1.31	1.74	
	pH	pH	pH Units	1	70	70	0	6.61	8.45	7.34	8.03	
	Turbidity	Turbidity	NTU	0.1	70	70	0	0.2	0.7	0.34	0.6	
	Metals	Iron	mg/L	0.002	70	70	0	0.004	0.18	0.06	0.11	
	Metals	Manganese	mg/L	0.0003	70	70	0	0.0006	0.01	0.0016	0.0036	
	Metals	Aluminium	mg/L	0.0003	70	40	0	<LOR	0.058	0.01	0.03	
	Metals	Lead	mg/L	0.0006	23	5	0	<LOR	0.0008	<LOR	0.0008	
	Fluoride	Fluoride (Naturally Occuring)	mg/L	0.02	24	24	0	0.05	0.10	0.08	0.09	
	Disinfection By-product	Chlorates	µg/L	50	12	12	0	165	588	369	560	
	Disinfection By-product	Trihalomethanes	µg/L	8	24	23	0	<LOR	119	32	88	

<LOR - Less than Limit of Reporting
ND - Not Detected

Townsville Drinking Water Scheme

Scheme Component	Parameter Category	Parameter	Unit of Measure	Limit of Reporting (LOR)	Count	# of samples detected	# DW Guidelines Value	Min Value	Max Value	Avg Value	95th %tile	Comments
Source Water Ross River Dam	Thermotolerant Coliforms	Total Coliforms	MPN/100ml	1	239	239	0	77	28300	3805	15400	
	Thermotolerant Coliforms	*E. coli*	MPN/100ml	1	271	86	0	<LOR	260	8	46	
	Turbidity	Turbidity	NTU	0.1	993	993	0	2.2	83.5	7.46	12.2	
	pH	pH	pH Units	1	993	993	0	6	9.26	7.52	8.28	
	Metals	Iron, Total	mg/L	0.002	1378	1378	0	0.05	8.7	0.29	0.73	
	Metals	Manganese, Total	mg/L	0.0003	1378	1378	0	0.009	0.96	0.08	0.23	
	Anions	Oxidised Nitrogen as N	mg/L	0.01	976	180	0	<LOR	0.17	<LOR	0.02	
	PFAS/PFOA	PFAS/PFOA	ug/L	<0.005/ <0.01	Suite sampled x13		0	<LOR	<LOR	<LOR	<LOR	
Source Water Paluma Dam	Thermotolerant Coliforms	Total Coliforms	MPN/100ml	1	140	140	0	51	23100	2539	9226	
	Thermotolerant Coliforms	*E. coli*	MPN/100ml	1	170	101	0	ND	12	2	9	
	Turbidity	Turbidity	NTU	0.1	182	182	0	0.4	48.6	2.5	5.7	
	pH	pH	pH Units	1	182	182	0	5.09	8.79	6.06	7	
	Metals	Iron, Soluble	mg/L	0.002	170	170	0	0.08	4.7	0.56	3.07	
	Metals	Manganese, Soluble	mg/L	0.0003	170	170	0	0.008	0.14	0.03	0.093	
	Anions	Oxidised Nitrogen as N	mg/L	0.01	182	55	0	<LOR	0.04	0.01	0.02	
	PFAS/PFOA	PFAS/PFOA	ug/L	<0.005/ <0.01	Suite sampled x6		0	<LOR	<LOR	<LOR	<LOR	

Scheme Component	Parameter Category	Parameter	Unit of Measure	Limit of Reporting (LOR)	Count	# of samples detected	# DW Guidelines Value	Min Value	Max Value	Avg Value	95th %tile	Comments
Water Treatment Plant Douglas WTP Raw Water	Thermotolerant Coliforms	Total Coliforms	MPN/100ml	1	73	73	0	1	8210	1828	5790	
	Thermotolerant Coliforms	*E. coli*	MPN/100ml	1	84	23	0	ND	495	9	4	
	Turbidity	Turbidity	NTU	0.1	356	356	0	0.4	66.9	5.5	8.2	
	pH	pH	pH Units	1	353	353	0	6.98	8.48	7.48	7.78	
	Anions	Sulphate	mg/L	0.5	10	10	0	0.74	2.2	1.05	1.98	
	Metals	Iron, Total	mg/L	0.002	51	51	0	0.03	2.3	0.227	0.435	
	Metals	Manganese, Total	mg/L	0.0003	51	51	0	0.01	0.17	0.0533	0.09	
	Geosmin/ MIB	Geosmin	ng/L	2	19	19	0	2	7	4.47	7	
	Geosmin/ MIB	MIB	ng/L	2	19	18	0	<LOR	23	11	20	
	Fluoride	Fluoride (Naturally Occuring)	mg/L	0.02	51	51	0	0.06	0.16	0.09	0.11	
	Metals	Arsenic	mg/L	0.001	4	4	0	0.001	0.002	0.0015	0.002	
	Metals	Selenium	mg/L	0.001	3	0	0	<LOR	<LOR	<LOR	<LOR	
	Metals	Mercury	mg/L	0.0006	4	0	0	<LOR	<LOR	<LOR	<LOR	
	Metals	Cadmium	mg/L	0.0001	4	0	0	<LOR	<LOR	<LOR	<LOR	
	Metals	Nickel	mg/L	0.001	4	0	0	<LOR	<LOR	<LOR	<LOR	
	Metals	Chromium	mg/L	0.001	4	1	0	<LOR	0.001	<LOR	<LOR	
	Giardia	Giardia	cysts/100ml	1	3	0	0	ND	ND	ND	ND	
	Cryptosporidium	Cryptosporidium	oocysts/10L	1	3	0	0	ND	ND	ND	ND	

Scheme Component	Parameter Category	Parameter	Unit of Measure	Limit of Reporting (LOR)	Count	# of samples detected	# DW Guidelines Value	Min Value	Max Value	Avg Value	95th %tile	Comments
Water Treatment Plant Douglas WTP Treated Water	Thermotolerant Coliforms	Total Coliforms	cfu/100ml	1	102	0	0	ND	ND	ND	ND	
	Thermotolerant Coliforms	*E. coli*	cfu/100ml	1	103	0	0	ND	ND	ND	ND	
	Disinfection Residual	Chlorine, Free	mg/L	0.05	590	590	0	1.13	3.67	2.97	3.4	
	Turbidity	Turbidity	NTU	0.1	595	589	0	<LOR	0.5	<LOR	0.2	
	pH	pH	pH Units	1	591	591	0	7.35	7.80	7.57	7.67	
	Anions	Sulphate	mg/L	0.5	14	14	0	0.79	2.5	1.22	2.24	
	Anions	Oxidised Nitrogen as N	mg/L	0.01	16	16	0	0.03	0.14	0.08	0.13	
	Metals	Iron, Total	mg/L	0.002	143	43	0	<LOR	0.02	<LOR	0.01	
	Metals	Manganese, Total	mg/L	0.0003	82	79	0	<LOR	0.007	0.0015	0.006	
	Metals	Aluminium	mg/L	0.01	543	542	0	<LOR	0.104	0.028	0.052	
	Fluoride	Fluoride	mg/L	0.02	532	528	0	<LOR	0.78	0.45	0.71	
	Metals	Copper	mg/L	0.002	15	0	0	<LOR	<LOR	<LOR	<LOR	
	Metals	Zinc	mg/L	0.001	15	0	0	<LOR	<LOR	<LOR	<LOR	
	Metals	Arsenic	mg/L	0.001	5	5	0	<LOR	0.001	<LOR	0.001	
	Metals	Selenium	mg/L	0.001	5	0	0	<LOR	<LOR	<LOR	<LOR	
	Metals	Mercury	mg/L	0.0006	5	0	0	<LOR	<LOR	<LOR	<LOR	
	Metals	Cadmium	mg/L	0.0001	5	0	0	<LOR	<LOR	<LOR	<LOR	
	Metals	Nickel	mg/L	0.001	5	0	0	<LOR	<LOR	<LOR	<LOR	
	Metals	Chromium	mg/L	0.001	5	0	0	<LOR	<LOR	<LOR	<LOR	
	Disinfection By-product	Trihalomethanes	ug/L	8	57	57	0	17	119	59	104	
	Disinfection By-product	Chlorates	ug/L	50	40	39	0	<LOR	776	396	689	

Scheme Component	Parameter Category	Parameter	Unit of Measure	Limit of Reporting (LOR)	Count	# of samples detected	# DW Guidelines Value	Min Value	Max Value	Avg Value	95th %tile	Comments
Water Treatment Plant Northern WTP Raw Water	Thermotolerant Coliforms	Total Coliforms	MPN/100ml	1	43	43	0	1	687	71.00	211	
	Thermotolerant Coliforms	*E. coli*	MPN/100ml	1	46	30	0	ND	55	5.00	23	
	Turbidity	Turbidity	NTU	0.1	323	323	0	0.34	10.43	1.35	2.80	
	pH	pH	pH Units	1	324	324	0	0.66	96	10.14	10.68	
	Anions	Sulphate	mg/L	0.5	4	4	0	1.1	1.6	1.30	1.56	
	Metals	Iron, Total	mg/L	0.002	47	47	0	0.004	0.54	0.15	0.50	
	Metals	Manganese, Total	mg/L	0.0006	47	47	0	0.002	0.01	0.005	0.0087	
	Geosmin/ MIB	Geosmin	ng/L	2	44	17	0	<LOR	5.29	<LOR	<LOR	
	Geosmin/ MIB	MIB	ng/L	2	44	2	0	<LOR	5.2	<LOR	<LOR	
	Fluoride	Fluoride	mg/L	0.02	45	43	0	<LOR	0.18	0.04	0.11	
	Metals	Arsenic	mg/L	0.001	1	0	0	<LOR	<LOR	<LOR	<LOR	
	Metals	Selenium	mg/L	0.001	1	0	0	<LOR	<LOR	<LOR	<LOR	
	Metals	Mercury	mg/L	0.0006	1	0	0	<LOR	<LOR	<LOR	<LOR	
	Metals	Cadmium	mg/L	0.0001	1	0	0	<LOR	<LOR	<LOR	<LOR	
	Metals	Nickel	mg/L	0.001	1	0	0	<LOR	<LOR	<LOR	<LOR	
	Metals	Chromium	mg/L	0.001	1	0	0	<LOR	<LOR	<LOR	<LOR	
	Giardia	Giardia	cysts/100ml	1	2	0	0	ND	ND	ND	ND	
	Cryptosporidium	Cryptosporidium	oocysts/10L	1	2	0	0	ND	ND	ND	ND	

Scheme Component	Parameter Category	Parameter	Unit of Measure	Limit of Reporting (LOR)	Count	# of samples detected	# DW Guidelines Value	Min Value	Max Value	Avg Value	95th %tile	Comments
Water Treatment Plant Northern WTP Treated Water	Thermotolerant Coliforms	Total Coliforms	cfu/100ml	1	45	0	0	ND	ND	ND	ND	
	Thermotolerant Coliforms	*E. coli*	cfu/100ml	1	45	0	0	ND	ND	ND	ND	
	Disinfection Residual	Chlorine, Free	mg/L	0.05	323	323	0	1.23	1.97	1.78	1.9	
	Turbidity	Turbidity	NTU	0.1	322	322	0	<LOR	<LOR	<LOR	<LOR	
	pH	pH	pH Units	1	322	322	0	7.35	7.75	7.53	7.63	
	Anions	Sulphate	mg/L	0.5	11	11	0	1	2.9	1.59	2.65	
	Anions	Oxidised Nitrogen as N	mg/L	0.01	10	10	0	0.02	0.05	0.04	0.05	
	Metals	Manganese, Total	mg/L	0.0003	8	8	0	0.001	0.002	0.001	0.002	
	Metals	Iron, Total	mg/L	0.002	92	32	0	<LOR	0.02	0.002	0.008	
	Metals	Aluminium	mg/L	0.005	312	154	0	<LOR	0.1040	0.0080	0.0200	
	Fluoride	Fluoride	mg/L	0.02	303	204	0	<LOR	0.781	0.43	0.73	
	Metals	Copper	mg/L	0.002	11	1	0	<LOR	0.003	<LOR	<LOR	
	Metals	Zinc	mg/L	0.001	11	4	0	<LOR	0.007	0.0014	0.0055	
	Metals	Arsenic	mg/L	0.001	3	0	0	<LOR	<LOR	<LOR	<LOR	
	Metals	Selenium	mg/L	0.001	3	0	0	<LOR	<LOR	<LOR	<LOR	
	Metals	Mercury	mg/L	0.0006	3	0	0	<LOR	<LOR	<LOR	<LOR	
	Metals	Cadmium	mg/L	0.0001	3	0	0	<LOR	<LOR	<LOR	<LOR	
	Metals	Nickel	mg/L	0.001	3	0	0	<LOR	<LOR	<LOR	<LOR	
	Metals	Chromium	mg/L	0.001	3	0	0	<LOR	<LOR	<LOR	<LOR	
	Disinfection By-product	Trihalomethanes	ug/L	8	47	16	0	<LOR	53	<LOR	21	

Townsville Drinking Water Scheme

Scheme Component	Parameter Category	Parameter	Unit of Measure	Limit of Reporting (LOR)	Count	# of samples detected	# DW Guidelines Value	Min Value	Max Value	Avg Value	95th %tile	Comments
Transmission Reservoirs	Thermotolerant Coliforms	Total Coliforms	CFU/100ml	1	1104	16	0	ND	80	ND	ND	
	Thermotolerant Coliforms	*E. coli*	CFU/100ml	1	1104	2	2	ND	7	ND	ND	DWI-506-22-09989, DWI-506-23-10157
	Disinfection Residual	Chlorine, Free	mg/L	0.05	1105	1104	0	<LOR	4.07	1.39	2.11	
	Disinfection Residual	Chlorine, Total	mg/L	0.05	1105	1105	0	0.07	4.13	1.54	2.29	
	Turbidity	Turbidity	NTU	0.1	1105	1098	0	<LOR	3.4	0.2	0.4	
	pH	pH	pH Units	1	1104	1104	0	6.21	8.42	7.49	7.94	
	Metals	Iron, Total	mg/L	0.002	1104	627	0	<LOR	0.06	0.004	0.01	
	Metals	Manganese, Total	mg/L	0.0003	1104	1037	0	<LOR	0.05	0.002	0.005	
	Metals	Lead, Total	mg/L	0.0006	1104	20	0	<LOR	0.001	<LOR	<LOR	
	Disinfection By-product	Trihalomethanes	µg/L	8	1061	1034	1	<LOR	246	90	161	DWI-506-23-10221, lab error
	Disinfection By-product	Chlorates	µg/L	50	152	152	13	57	3550	450	1008	DWI-506-23-10152
Reticulation Houses	Thermotolerant Coliforms	Total Coliforms	CFU/100ml	1	2107	23	0	ND	80	ND	ND	
	Thermotolerant Coliforms	*E. coli*	CFU/100ml	1	2107	1	1	ND	9	ND	ND	DWI-506-23-10275
	Disinfection Residual	Chlorine, Free	mg/L	0.05	2110	2085	0	<LOR	3.08	1.18	1.88	
	Disinfection Residual	Chlorine, Total	mg/L	0.05	2110	2096	0	<LOR	3.27	1.30	2.08	
	Turbidity	Turbidity	NTU	0.1	2110	2093	0	<LOR	3.7	0.3	0.5	
	pH	pH	pH Units	1	2110	2110	0	6.23	8.63	7.51	8.13	
	Metals	Iron, Total	mg/L	0.002	433	264	0	<LOR	0.19	0.004	0.01	
	Metals	Manganese, Total	mg/L	0.0003	433	399	0	<LOR	0.080	0.002	0.006	
	Metals	Lead, Total	mg/L	0.0006	433	172	0	<LOR	0.007	<LOR	0.001	
	Fluoride	Fluoride	mg/L	0.02	433	432	0	<LOR	0.81	0.43	0.71	
	Disinfection By-product	Trihalomethanes	µg/L	8	527	512	0	<LOR	220	93	167	
	Disinfection By-product	Chlorates	µg/L	50	56	56	2	110	947	410	760	DWI-506-23-10152

<LOR - Less than Limit of Reporting
ND - Not Detected