



Drinking Water Quality Management Plan

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Report contains	<p>Activities undertaken over the 2021/2022 financial year in operating Townsville City Council's (Council) drinking water service.</p> <p>Summary of drinking water quality for Townsville's three drinking water schemes.</p> <p>Summary of Council's performance in implementing their approved Drinking Water Quality Management Plans (DWQMP).</p>



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Abbreviations and Acronyms

Acronym	Definition
ADWG	Australian Drinking Water Guidelines
BWA	Boil Water Advisory
CCP	Critical Control Point
DBP	Disinfection By Product
DO	Dissolved Oxygen
DW	Dirty water
DNRME	Department of Natural Resources, Mines and Energy
DWQMP	Drinking Water Quality Management Plan
GAC	Granular Activated Carbon
Hypo	Sodium Hypochlorite
LIMS	Laboratory Information Management System
MW	Milky water
NATA	National Association of Testing Authorities
OS	Owners Side
PAC	Powdered Activated Carbon
RMIP	Risk Management Improvement Program
RRD	Ross River Dam
THM	Trihalomethanes
TLS	Townsville Laboratory Services
T&O	Taste and Odour
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 Townsville Water and Resource Recovery
Townsville City Council*

Water Supply in Townsville

2021/2022

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

properties connected



2682 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 Townsville Water against their DWQMP as required under the Water Supply (Safety and Reliability) Act 2008.

Townsville Water has met all requirements under its DWQMP, the Australian Drinking Water Guidelines 2011 (ADWG) and the Public Health Regulation 2005 for the reporting period. The reporting period being the 2021/2022 financial year.

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

Annual compliance with the Public Health Regulation 2005 (the regulation) for Escherichia coli (*E. coli*) for the three schemes was met with 99.85% compliance for Townsville Drinking Water Scheme, 99.75% compliance rate for Giru/Cungulla Drinking Water Scheme and a compliance rate of 99.83% for Paluma Drinking Water Scheme. (The regulation requires that 98% of samples taken in a 12-month period should not detect *E. coli*).

Twelve notifications of non-compliance and two events were submitted to the Office of the Water Supply Regulator (The Regulator) for the three schemes for the reporting period:

- 5 *E. coli* detections,
- 5 disinfection-by-product (DBP) exceedances,
- 1 chlorine exceedance
- 1 fluoride exceedance
- 2 events

There were 164 customer complaints regarding drinking water quality:

- 26 dirty water complaints,
- 9 milky water complaints,
- 116 taste/ odour complaints
- 11 owner's side issues
- 2 Suspected illness.

COVID-19 and its restrictions in Queensland throughout the year did not impact on water treatment, water quality or water sampling.

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

2. Overview

Townsville 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. Townsville 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 Office of the Water Supply Regulator on 21st June 2011. It was approved with conditions on 29th August 2012. Townsville's first DWQMP Audit was undertaken in July of 2016. The plan was reviewed, with significant amendments made in January 2018. The amendments were approved with conditions on 23rd 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 submitted for approval in August 2021.

Townsville Water services a population of approx. 194,072 with 87,593 connected properties, in three drinking water schemes: Townsville Drinking Water Scheme, Paluma Drinking Water Scheme and Giru/ Cungulla Drinking Water Scheme. This annual report relates to all three schemes.

Table 1. Summary of Townsville's Drinking Water Schemes

Scheme Name	Water Treatment Plant	Water Source	Treatment Processes	Treatment Capacity	Towns Supplied
Townsville Drinking Water Scheme	Douglas Water Treatment Plant (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 Water Treatment Plant (Kinduro)	Paluma Dam/ Crystal Creek	Ultrafiltration with chlorine disinfection	40 ML/D	
Giru/ Cungulla Drinking Water Scheme	Giru Water Treatment Plant (Cromarty Creek Road)	Haughton River	Conventional treatment with chlorine disinfection	2 ML/D	Cungulla Township
Paluma Drinking Water Scheme	Paluma Water Treatment Plant (Lennox Crescent)	Paluma Weir	Ultrafiltration, UV and chlorine disinfection	90 KL/D	Paluma Township

Giru Water Treatment Plant 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.

44,826ML of potable water was produced in the 2021/2022 financial year. Townsville Water and Resource Recovery maintains and operates 2 dams (Ross River Dam and Paluma Dam), 2 weirs (Paluma

Weir and Blacks Weir), 23 water pumping stations, 18 chlorinators, 41 reservoirs (treated water storage facilities) and 2,658.3 km of water distribution mains.

3. Actions taken to Implement the DWQMP

3.1 Management of Council's DWQMP

The Water Quality Officer is the custodian of the DWQMP. Both the Team Leader Water Treatment and Water Quality Officer's role is to monitor, regulate and improve water quality for Townsville. They deal with water quality non-compliances, water quality complaints and queries from customers, monitor all Critical Control Points (CCPs), the water sampling plan and the subsequent data it generates. They are part of a broader Water Quality Team which also includes the Water Operations Coordinator, Commercial Compliance Officer, Bulk Water Maintenance Officer and the Water Operators. These Officers have operational and technical expertise in relation to water quality and supply.

The Water Quality Team hold a weekly water quality meeting, with water quality also discussed at weekly planning meetings and at toolbox meetings with staff as required. 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 Blue Green Algae in the main raw water source for the Townsville DWS. The Technical Team provides expert advice and management of the risks associated with algae blooms to the treatment and supply of potable water to the Townsville community. The team includes representatives from Council, Trility, Townsville Laboratory Services and Hunter H2O.

3.2 Training

All staff involved with water treatment and supply obtain the "Aquacard" and this is managed through our internal Learning Management System (LMS). Aqua card 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 that 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.

Ten staff members have completed the Water Industry Worker Program, and four more staff are working towards it. 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 focussed 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.

3.3 Operation of Douglas Water Treatment Plant and Northern Water Treatment Plant

Trility operate the Douglas Water Treatment Plant and Northern Water Treatment Plant 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

Despite disruptions and restrictions from the COVID-19 pandemic early in the second half of this financial year, Townsville Water engaged 1,346 school students in various face-to-face eco-catchment tours and classroom visits, up from the previous financial year. Over 300 students and parents were engaged at the annual Eco Fest at St Benedict's School with the primary focus this year on wastewater and the 3 P's campaign. Virtual tours continue to support student online learning with the addition of lesson plans now available for teachers and students to use with the water treatment and wastewater treatment virtual tours.

A suite of curriculum-linked education resources including total water cycle fact sheets have been created to support in class learning for schools. The Water Program and resource kit for early learning centres was launched in the second half of the financial year with several centres already utilising the program

to educate children as young as 3 on the importance of saving water. Additional learning plans and resources are expected to be released in the new financial year.

For National Water Week 2021, Townsville Water held a drawing competition for all primary school students. The competition aligned with the Giant Water Hunt Augmented Reality event held at Riverway during the school holidays. The winning entry had their artwork displayed and come to life using the Eye Jack AR app. We received over 90 submissions, with the winning entry a year 6 student from Mundingburra State School. In addition, Townsville Water promoted Water Night, a national campaign lead by the Smart Approved Water Mark Association which aims to increase public awareness around water behaviours and encourage residents restrict their water use for one night.

The informative water education videos were launched during National Water Week October 2022.

3.5 Major Capital Projects

3.5.1 Ross River Dam to Douglas Water Treatment Plant Pipeline Duplication

The Ross River Dam to DWTP pipeline provides approximately 85% of the city's water. Council is investing \$60 million to duplicate the pipeline to increase the resilience of this key asset and further enhance Townsville's water security. Council awarded two separate packages of work to local construction firm CivilPlus who commenced construction works

on the pipeline duplication in May 2022. The Project is expected to be completed late in 2023 and will generate 150 jobs locally through the various phases. The 9.5km duplicate pipeline will cross the Ross River closer to the dam and run parallel to the river through the Department of Defence's Mount Stuart Training Area before connecting to the DWTP.

3.5.2 Haughton Pipeline Project

Stage Two 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 30 kilometres 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 One of the pipeline is complete with Stage Two construction planned to commence in April 2023.

3.6 Risk Management Improvement Program

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

A DWQMP Risk Assessment with key staff Consulting was undertaken in October 2022 facilitated by Viridis. A new RMIP was generated and included in the latest Drinking Water Quality Management Plan 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 12 non-compliances with water quality criteria and 2 water supply events reported for the 2021/2022 financial year.

DWI-506-21-09013 - Townsville DWS - High Chlorine

On 1st July 2021 chlorine above the ADWG limit of 5mg/L was detected at Roseneath Reservoir, Roseneath. 5.96mg/L was detected by the operator with a handheld meter on his morning check. The operator immediately turned off sodium hypochlorite (hypo) dosing and began flushing the system. Work crews were dispatched to site to extensively flush to pull minimally chlorinated (chlorinated at Douglas WTP) water through and remove high chlorine from dead-ends. Chlorine residuals were monitored to ensure chlorine concentrations returned to limits at all supply points.

The flow paced hypo dosing was having issues the day previous. The hypo dosing is flow paced and an

issue occurred with the circuit with the instrument techs attending site to restore the system. However, a few hours later the circuit tripped again. When it tripped, it defaulted to read maximum water flow. The hypo was dosed to meet this maximum flow which was not reflective of real flow and excess hypo was dosed through the night. SCADA raised an alarm but the incorrect escalation of alarms was followed with the alarm being disabled in error with no further alarms being raised. When SCADA was checked the following morning by the Water Treatment Supervisor it was realised that chlorine was >5mg/L and operator was dispatched immediately to site.

The default of the flow meter circuit has been changed to stop hypo dosing if the circuit trips. As the water is chlorinated at Douglas WTP and this reservoir is a secondary chlorination point there will be no risk to public health even if hypo is not dosed in the reservoir. A low chlorine alarm has been programmed to alert of low chlorine if circuit is tripped.

SCADA has been programmed to only allow the Bulk Water Engineer or Water Treatment Team Leader to deactivate alarms.

DWI-506-21-09059 - Townsville DWS - *E. coli*

On 11th August 2021 1 *E. coli* cfu/100ml was detected at Arcadia Reservoir, Magnetic Island. Free chlorine was 0.62mg/l, total chlorine 0.77mg/L, turbidity 0.2NTU and pH 8.09 so adequate disinfection should have occurred. Arcadia is fed from Douglas WTP and re-chlorinated at Picnic Bay reservoir which had a total chlorine of 1.41mg/L and no *E. coli* detected. *E. coli* were not detected in Horseshoe Bay Reservoir. Resample of Arcadia Reservoir did not detect *E. coli*.

Arcadia Reservoir was hand dosed with hypo to increase chlorine residual. Reservoir operations were deemed to be the issue with a common inlet/outlet at the end of a supply line on Magnetic Island. Reservoir chlorine will be monitored daily. If chlorine drops below 1mg/L it will be hand dosed.

DWI-506-21-09282 - Giru/Cungulla DWS - Plant Shutdown High Raw Water Turbidity

A sustained raw water high turbidity event (>120 NTU for 7 days) caused the de-sludge system at the Giru WTP to become overwhelmed. The sludge backed

up and caused the filter bed to lift, resulting in high treated water turbidity (approx. 1NTU) to enter the Clear Water Storage (CWS). A high turbidity alarm was raised through SCADA at 12pm and the on-call foreman made the operational decision to turn the plant off until operators could be dispatched in the morning. Disinfection was not compromised as the treated water in the CWS remained <1 NTU.

Operators returned the filters to running optimally the following morning through jar testing and by being onsite were able to manage the sludge system. Fitters checked the turbidity analysers to ensure readings were correct. Water trucks (from Douglas WTP supply) maintained CWS to ensure there was enough water onsite to backwash. Filtered water was below 0.3NTU within 6 hours and there was no loss of supply to residents in Giru Township or Cungulla Township.

DWI-506-21-09307 – Townsville DWS – *E. coli*

On 14th December 2021, 11 *E. coli* cfu/100ml were detected in Cay Street, Saunders Beach. Free and total chlorine were 1.14mg/L and 1.79mg/L respectively. pH was 7.88 and turbidity 0.3NTU. Twelve other samples taken throughout the network on the same day did not detect *E. coli*. Deep Creek reservoir feeds the Cay Street sample point. *E. coli* were not detected in the reservoir and chlorine was 1.79mg/L (free) and 2.01mg/L (total). Resamples did not detect *E. coli*.

This sample point was a ball valve tap on the outside of a building, exposed to environmental factors and was not vandal proof. This sample point has been upgraded to a dedicated Ned Kelly sample point.

DWI-506-22-09417 – Townsville DWS- THMs

Samples taken on the 6th January and 10th January 2022 at Serene Valley Reservoir, Mt Elliot Reservoir, Mt Margaret Reservoir and Ponti Road Reservoir detected Trihalomethanes (THMs) above ADWG limits at 0.291, 0.34, 0.28 and 0.3mg/L respectively. All reservoirs are fed from Douglas WTP with a chlorine setpoint of 3.4mg/L. Temperature of the water in the reservoirs is high (>30oC) which aids chlorine decay and aids chemical reactions in the distribution system. The cyanobacteria bloom in Ross River Dam is resulting in a higher than usual organic load pre-filtration.

Powdered Activated Carbon (PAC) dosing was brought online as a toxin mitigation step and to aid taste and odour removal. This will also benefit organic removal to help reduce THM formation. PAC can only be dosed on modules 1 and 2 until the clarifiers are constructed for module 3 and 4 (Currently under construction and due to be brought online 2023). All other disinfection by-product (DBP) formation mitigation strategies are employed across water treatment and water distribution however, THMs are elevated every summer due to the warm sunny days. Resamples detected THMs within ADWG limits. TCC continue to monitor and mitigate for Disinfection By Products (DBPs).

DWI-506-22- 09428 – Townsville DWS – High Chlorates

Samples taken at Douglas WTP on 11th January 2022 detected chlorates at 814 µg/L in the treated water. Townsville has management strategies in place to manage chlorates at the water treatment plants and in the supply network however Townsville was experiencing daytime temperatures >36oC which aids

in the breakdown of hypo. Samples taken on the 12th January showed chlorates had reduced to 599 µg/L in the treated water due to a new hypo tank being brought online. As the hypo tank had been changed over in the time sample was taken and result returned there were no further actions that could be taken at Douglas WTP. The network was extensively sampled and chlorates >800 µg/L were not detected.

DWI-506-22-09433 – Townsville DWS – *E. coli*

Samples taken on 27th January 2022 detected 1 *E. coli* cfu/100ml at Arcadia Reservoir on Magnetic Island. Chlorine residual was low (0.2mg/L) when the sample was taken so the reservoir was hand dosed with hypo to improve disinfection. Thirty-four samples in the reticulation network taken on the day did not detect *E. coli*. Resample did not detect *E. coli* and chlorine had increased to 1.14mg/L. It was raining when sample was taken, which may have led to environmental contamination as aseptic technique for sampling was difficult to maintain.

DWI-506-22-09434 – Giru/ Cungulla DWS – *E. coli*

Samples taken on 27th January 2022 detected 1 *E. coli* cfu/100ml at Giru WTP Clear Water Storage. These storage tanks are minimally chlorinated onsite and primary disinfection occurs into both Cungulla Reservoir (Townsville City Council) and Giru Reservoir (Burdekin Shire Council). Free chlorine was 0.68mg/L, turbidity was 0.4NTU and pH was 7.05.

It was believed to be sampling error due to significant rainfall at the time the sample was taken making it difficult to follow aseptic technique. Chlorine residuals and all other parameters were good for

adequate disinfection, so a decision was made to wait for resample results before flushing the reservoir. Communication with Giru determined that they had adequate chlorine residuals in Giru Reservoir and the Giru network. Resamples did not detect *E. coli*.

DWI-506-22-09442 & DWI-506-22-09443 –Paluma DWS – DBPs

Samples taken on 28th January 2022 detected chlorates at 966µg/L and 938 µg/L at the Paluma Reservoir and house sample. Samples taken on 3rd February 2022 also detected chlorates above 800 µg/L at 902, 903, and 904 µg/L. THMs from samples taken on the same day were 0.27mg/L and 0.292mg/L in the Paluma house samples. The operator replaced old hypo with fresh hypo which included emptying out hypo tank, flushing the tank to ensure all old product was removed and filling with fresh hypo. Resamples reduced for THMs but chlorates were still high. With the cooler April weather chlorates and THMs concentration was effectively halved.

DWI-506-22-09476 – Townsville DWS – Trunk Main Failure

On the 16th February 2022 a resident on Magnetic Island contacted TCC with a report of “No Water” to Gifford Street, Horseshoe Bay. The lack of water was due to a water main break caused by the undermining of a thrust block during work conducted on nearby stormwater upgrades. Horseshoe Bay Reservoir emptied to 0%. The section of pipe was repaired and brought back into service and pumps were turned on to refill the reservoir. The reservoir did not fill. Investigations confirmed a leak on a pressure main where a Gibault on the 250mm stainless steel pipeline failed. The Gibault was repaired, and pumps restarted and again the reservoir did not fill.

Further investigations revealed that the 250 DICL line was leaking from a failed screw flange where the main transitioned underground requiring new pipe sections to be fabricated. During this repair period a potable water tanker and bottled water pallets were dispatched to the island to ensure residents had access to drinking water. Media announcements were provided to inform customers of the outage and where to collect water from. Slabs of bottled water were delivered to vulnerable customers and to households that were isolating due to Covid.

The main was repaired on Saturday 19th February at 4.30 am. Extensive flushing of the network was carried out and chlorine residuals and turbidity was monitored onsite with handheld meters. Bacteriological sampling was undertaken throughout the network and returned nil detections

A post incident review workshop was carried out which determined improvement focus areas and timelines for completion. These are being worked through currently.

DWI-506-22-09521 – Townsville DWS – Chlorates

Routine sampling at Mt Elliot Reservoir and Roseneath Reservoir on 1/03/2022 detected chlorates at 0.86mg/L and 0.88mg/l respectively. Both reservoirs are fed from Douglas WTP, are on the outskirts of Townsville and are re-chlorinated. Chlorate levels on 15/02/2022 at Douglas WTP detected chlorates at 0.715mg/L and due to water age in Townsville is most likely the same body of water. The reservoirs had emptied and refilled in the time taken to receive results and fresh sodium hypochlorite had been delivered to site. Resampling showed reduced chlorate levels throughout the network.

DWI-506-22-09559 – Townsville DWS – *E. coli*

Routine sampling at Hillside Crescent detected 1 *E. coli* cfu/100ml on 5/4/2022. All parameters were within range for adequate disinfection with free chlorine of 0.33mg/L and total 0.58mg/L, turbidity at 0.1 NTU, and pH 7.07. Hillside Crescent is fed from Top City Reservoir and sampling on the same day did not detect *E. coli*. Twenty-five samples taken in reticulation and at the Water Treatment Plant did not detect *E. coli*. Sample point is a dedicated Ned Kelly. Area was flushed and resample was taken.

Resample did not detect *E. coli*. Condition assessment of Top City Reservoir determined that the roof requires repair and will be repaired as part of the 2022/2023 reservoir renewal budget.

DWI-506-22-09645 – Townsville DWS – Fluoride

On 15/06/2022 the fluoride analysers at Douglas WTP measured 1.5mg/l on the inlet to Treated Water Storage Tanks. The fluoride system disabled automatically triggering a plant shutdown. Due to plant shut down water was not released from the treated water tanks. Clear water storage tanks were scoured of water, so tanks could be diluted further with unfluoridated water and bought back online. The fluoride systems were isolated and disabled so that they could not operate.

Sampling of the Mt Louisa Reservoir on the 15/06/2022 returned a fluoride concentration of 0.63mg/L. Due to supply issues for sodium fluoride the fluoride dosing system remains off.

5. Compliance with Water Quality Criteria for Drinking Water

Townsville Water has a comprehensive sampling regime “from catchment to tap” which covers catchments, raw water supply, water treatment and water distribution. Over 100,000 tests are taken annually for various parameters including but not limited to chlorine, pH, turbidity, alkalinity, metals, chemical, pesticides, disinfection by products, 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 - “Ned Kelly’s”.

All samples are taken and analysed by Townsville Laboratory Services, a National Association of Testing Authorities (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 have access to the Laboratory Information Management System (LIMS) to obtain results as required. All results above ADWG limits are called through immediately to the Water Quality Officer (Team Leader Water Treatment 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 has been largely compliant with the water quality criteria for the financial year, having 12 water quality incidents and two water supply events.

Five reportable incidents were due to *E. coli* detections, five disinfection by-products above the ADWG limit (DWQMP limits for chlorates) one for high chlorine, one for high fluoride and two water supply events reported. Details for the incidents and events are included in section 5 above.

Council were 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 four *E. coli* incidents for Townsville DWS with a 99.85% compliance rate for the reporting year. And one incident in Giru/Cungulla DWS with a 99.75% compliance rate for three reporting year. There were no *E. coli* detected at Paluma DWS with a 99.83% compliance rate. This rate is due to a detection of *E. coli* in October 2020 and the rolling average calculation rate.

Table 2: Number of *E. coli* Incidents and Percentage Annual Compliance with the Public Health Regulation 2005.

Drinking Water Scheme	No. of samples taken	Number of Incidents	% Annual Compliance
Townsville	3348	4	99.85%
Paluma	135	1	99.83%
Giru/ Cungulla	206	0	99.75%

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 Councils Customer Request management system. Each complaint has a unique identification number which enables the complaint to be followed from start to finish. There were 164 drinking water quality complaints for the reporting period with 107 relating to a earthy taste in the water supplied from Douglas WTP due to the presence of MIB.

Figure 1: Number of drinking water quality complaints per financial year.

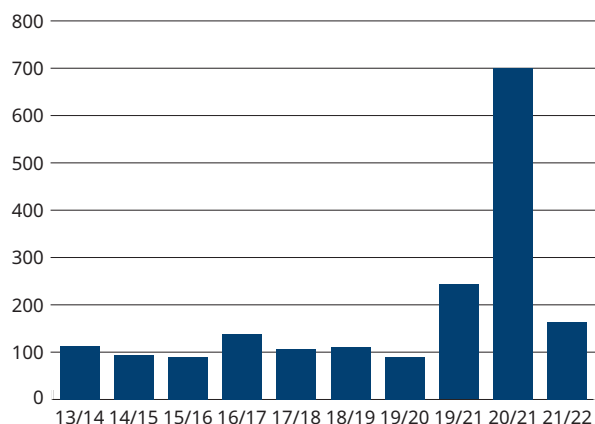


Table 3: Number of dirty water July 1st 2021 to June 30th 2022 complaints by type.

Type of Water Quality Complaint	Dirty Water	Milky Water	Taste/ Odour	Suspected illness/ Customer Concern	Owners Side	MIB
164	26	9	9	2	11	107

There were six main types of water quality complaints in Townsville as outlined below:

Dirty Water (DW)

There were 26 dirty water (DW) complaints. DW 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 DW complaint is lodged, a water reticulation crew is dispatched to flush the area until the DW 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.

Milky Water (MW)

There were 9 Milky Water (MW) complaints. MW 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. MW 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.

Taste and Odour (T&O)

There were 9 taste and odour (T&O) complaints not caused by MIB which will be discussed separately below. T&O complaints in Townsville are generally caused by

- DW events
- 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 T&O complaints, flush where required and take samples for further investigation if warranted.

Owners Side Issues

Owners side issues of which there were 11 are caused by

- Flick mix taps - near the end of the life of flick mix taps (after seven to ten years) the inside braided hose degrades and leaves a black oily residue in the water. This issue is rectified through a phone call to customers to explain the issue and the requirement for a private plumber to install new taps.
- Hot water systems - nearing the end of their life and the breakdown of the anode inside. Townsville Water analyse samples through TLS where required and communicate with customers through these issues.
- Internal pipework

Suspected Illness

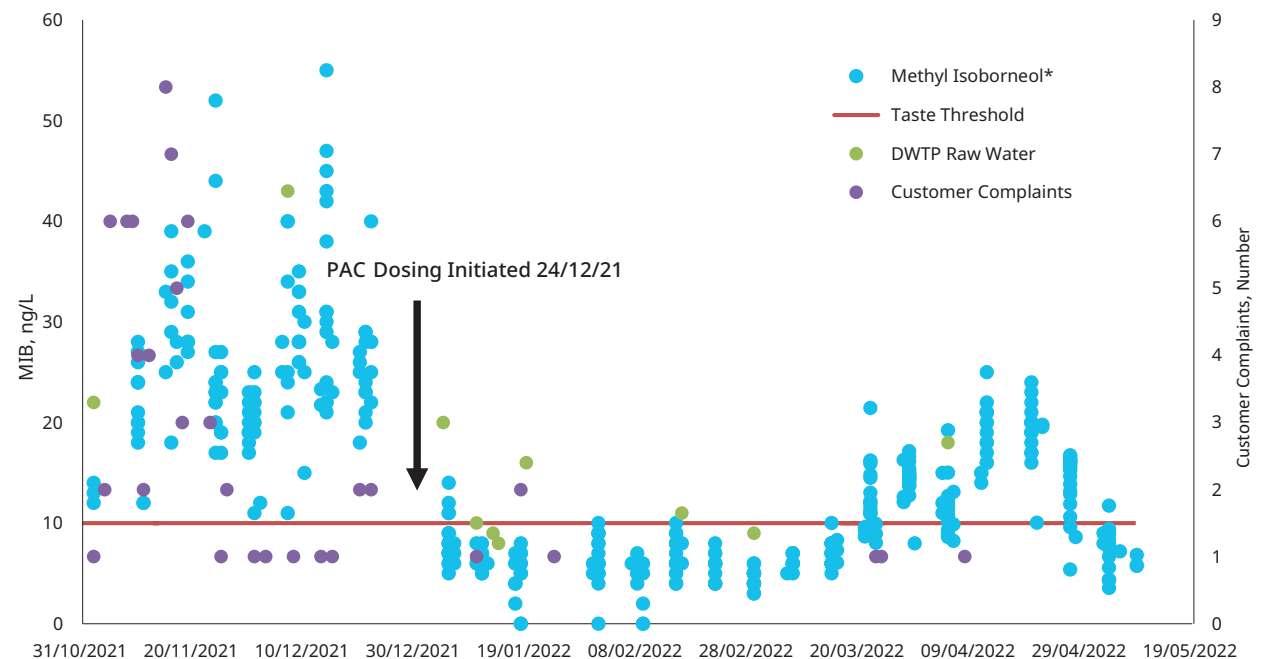
There were two suspected illness complaints this year. These were the results of the water tasting "off". Residents were contacted and water from their residence analysed through TLS showing that water met the ADWG limits and was safe to drink. MIB was suspected as the cause of the "off" taste.

MIB Taste and Odour Event

107 complaints were lodged relating to drinking water from the Douglas WTP supply having an earthy taste. Complaints began mid-October with samples from reticulation detecting MIB just below taste threshold at ~7ng/L. By early November concentrations had increased to >20ng/L and by early December had increased to >30ng/L.

The highest concentration detected was 55ng/L on the 24th November. It is most likely the cyanobacterial bloom is the generator of the MIB with cyanobacteria known producers of MIB. Powdered Activated Carbon (PAC) dosing was brought online on 24th December 2021. Currently PAC can only be used on Mod 1 and 2 and so the PAC treated water needs to be shandied with water from Mod 3 and 4. The result is that MIB removal is dependent on both raw water concentration and treated water demand. However, overall has been successful in removal of the offensive taste and odours and reduction in complaints as per figure 2.

Figure 2: Customer complaints increase as MIB concentrations increase. PAC dosing reduced MIB concentration.



7. Outcome and Recommendations of Audit

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

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

Appendix A.
**Risk Management
Improvement Program**



Component	Improvement Action Target Dates	Target Date	Actions taken to Date	Status and revised Target Date	Responsible Officer	Complete	Comments
Townsville Drinking Water Scheme							
Organics and Colour	Pipes/reservoirs – Documentation of system ‘age’ optimisation is required to ensure continuity. Currently this is primarily undertaken by one person.		Further people to be trained and documentation of procedures to occur.	Dec-21	Water Treatment Team Leader and WQ Officer		Another FTE has been trained into this role providing redundancy. Procedure to be documented.
Crypto Model	Clarification and UV required at Douglas Water Treatment Plant to reduce Cryptosporidium risk	2021	Construction of clarifier pre mod 3 and 4 has begun with end date of 2022 for module 3 ontrack and mod 4 due for rnd March 2023, wet season depending	2025/2026 construction to begin	General Manager Townsville Water and Waste		UV design underway. To go to construction in (2025/2026)
Geosmin (Taste and Odour)	Treatment strategies to remove geosmin are to be investigated, including PAC dosing even though this was noted as having a negative impact on membrane performance/life.		Trility have engaged Hunter H2O to investigate the removal of geosmin and MIB with PAC at both DWTP and NWTP. Temporary PAC dosing has been installed at DWTP to negate cyanobacteria toxin risk. This may also be useful for MIB/ geosmin removal. PAC pre module 1&2 has been online since December	2024	Team Manager Water Operations	Ongoing	Temp PAC dosing has been installed at DWTP. Permanent solution is in design stage . Issues with installing PAC on membranes at NWTP and geosmin levels have reduced in this part of the network so not required at this stage.
Chain of Custody	It was suggested that the lab numbering system and Trility numbering system for samples could be aligned and pre-labelled bottles could be used to ensure an efficient process	1/01/2022	TRILITY external WQ data management system will assign bottle numbers. Meta-data and scheduling complete, trouble-shooting of COC errors underway.	Complete	Trility	Complete	COC and bottles now rederece both numbering systems.
Monitoring Instruments	It is recommended that the NWTP SCADA trend/ history display settings be updated to ensure tath the information aligns with the instantaneous readings	1/10/2021	Team Leader and Process Controller completed spot check of all meters. Check to be added to each annual instrument service	Complete	Trility	Complete	
Reagent Management	Produce a procedure to ensure that the daily operator checks for calibration include a check for expired chemicals				Team Leader Water Treatment	Complete	pH buffer labelled, hypo not on site long enough to expire, other chemicals do not have use by dates
Reagent Management	Stop the practice of using decanted chemicals		Procedure in place for decanting chemicals		Team Leader Water Treatment	Complete	Hypo - safe handling of chemicals, smaller quantities required to mitigate chlorate risk

Component	Improvement Action Target Dates	Target Date	Actions taken to Date	Status and revised Target Date	Responsible Officer	Complete	Comments
Program Structure	It is suggested that the flushing and testing results be entered into an electronic spreadsheet to assist in planning and program operational responses due to seasonal issues.	Dec-21	This is not an operational issue currently (data is kept on worksheets and WQO has access to these if required) and we do not have staff capability at the moment. Project is underway to capture all data in LIMs and this will be included in the project	Dec-23	Water quality Officer and Team Leader Water Treatment		
Geographical Zone Coverage	Continue with plans to add the sampling locations to a GIS layer in Townsville Maps	Jun-22	All assets have asset numbers and GPS. These have been provided to GIS for mapping	Jan-24	Water Quality Officer	Ongoing	All data has been supplied to GIS. Waiting on data to be mapped.
SCADA Alarm Management	Create an access procedure for manager rights to be only allowed to change set-point values	Dec-21	Discussions with SCADA techs to define scope	Mar-22	Manager Water and Waste		
SCADA Alarm Management	Include conditions where and when set-points are permissible such as temperature changes from winter to summer and vice versa	Dec-21	Discussions with SCADA techs to define scope	Mar-22	Manager Water and Waste		
<i>SCADA Alarm Management</i>	Add a process to alert the administrator if someone leaves or changes roles	Sep-21		Mar-22	Manager Water and Waste	Complete	SCADA techs check twice a year and when staff leave the organisation
<i>Cross-Contamination Management</i>	Update procedures to include machinery disinfection prior to use in water management situations where cross-contamination may be a risk	Sep-21		Dec-21	Manager Water and Waste		Procedure in draft and with TCC safety department for sign off.
<i>Cross-Contamination Mitigation</i>	Continue with plans to produce a detailed flushing and disinfection procedure. It is suggested that machinery disinfection is included in the procedure	Sep-21	Procedure in draft and with safety department for sign off	Dec-21	Manager Water and Waste		Procedure in draft and with TCC safety department for sign off.
Sourcing of Quality Assured Materials	Continue with plans to complete a purchasing procedure for materials that come into contact with drinking water to ensure that all drinking water materials that come into contact with drinking water to ensure that all drinking water materials purchased are certified to Australian Standards or are WaterMark approved	Dec-21	This is included in contracts for purchase	Mar-22	Manager Water and Waste		

Component	Improvement Action Target Dates	Target Date	Actions taken to Date	Status and revised Target Date	Responsible Officer	Complete	Comments
Security of Supply	Raw Water Pipeline Break - Duplication of raw water pipeline	Dec-23	Tenders commenced Sept 2021, Work underway with project completion end 2023 (wet season dependant)	Dec-23	Manager Assets	Ongoing	
Chlorine target limits	Grundfos Pump required at Dahl Reservoir	Dec-21	Submitted to assets for procurement and installation	Jun-22	Water Treatment Team Leader	Complete	
Water Quality	Complete analytical review of WQ data for all schemes	Aug-22	Completed in July 2022 and used in the Risk Assessment Workhop	Aug-22	Water Quality Officer	Complete	
Hazards and Risks	Update Risk Assessment and generate RMIP	Aug-22	Completed in July 2022 and used in the Risk Assessment Workhop	Aug-22	Water Quality Officer	Complete	
GIS Mapping	GIS Map supply zones for Townsville DWS	Aug-22	Completed and included in latest DWQMP	Aug-22	Water Quality Officer	Complete	
Vulnerable Customers	Describe the process for contacting and informing vulnerable Customers	Aug-22	Completed and included in latest DWQMP	Aug-22	Water Quality Officer	Complete	
Paluma Drinking Water Scheme							
Pathogens - Crypto	Consider training work crews on the risk of contamination of potable mains during repair works	Aqua Card roll out 2020/2021 to all work crews	New procedure on mains disinfection has been drafted and is being commented on currently by supervisors.	Dec-24	Team Manager Water and Waste		Aqucard has been rolled out, Procedure in draft and with safety department for sign off
Iron	Consider monitoring for soluble iron in the supernatant to increase confidence that soluble iron is not being returned at a high level and impacting performance.	Jun-19	Iron testing of supernatant occurs. Soluble iron included so that performance can be monitored.		Water Treatment Team Leader	Complete	
Chemical storage and in Date	Ensure that Operators are on-site for all chemical deliveries or introduce a security system to ensure only authorised external persons can deliver chemicals and is traceable.		There is a contract in place for elite to deliver and manage. A trility Audit has occurred and TM Water and Waste will look into this issue also	Dec-24	Team Manager Water and Wastewater		
Chemical storage and in Date	Consider a dual tank system for hypochlorite to ensure chemical turnover for degredation reasons including the formation of chlorates				Water Quality Officer	Complete	A dual tank system already occurs with 20l drums rotated when hypo is depleted.
Water Quality	Complete analytical review of WQ data for all schemes	Aug-22	Completed in July 2022 and used in the Risk Assessment Workhop	Aug-22	Water Quality Officer	Complete	
Hazards and Risks	Update Risk Assessment and generate RMIP	Aug-22	Completed in July 2022 and used in the Risk Assessment Workhop	Aug-22	Water Quality Officer	Complete	

Component	Improvement Action Target Dates	Target Date	Actions taken to Date	Status and revised Target Date	Responsible Officer	Complete	Comments
Giru/ Cungulla Drinking Water Scheme							
Development of algae/ algal toxin Trigger Scenarios	Procedure for detection of Algae/ Algal toxins requires to be developed. This is not of high risk as algal blooms have not been detected in the Haughton River supply but a procedure should still be in place.	Dec-19	Considered low risk as previously not detected and water source is run of river.	Dec-22	Water Quality Officer	To incorporate lessons learned in Townsville DWS and use same target and trigger scenarios	
Water Quality	Complete analytical review of WQ data for all schemes	Aug-22	Completed in July 2022 and used in the Risk Assessment Workshop	Aug-22	Water Quality Officer	Complete	
Hazards and Risks	Update Risk Assessment and generate RMIP	Aug-22	Completed in July 2022 and used in the Risk Assessment Workshop	Aug-22	Water Quality Officer	Complete	

Completed Actions (Completed pre 2021/2022 Reporting Year)

Component	Improvement Action Target Dates	Target Date	Actions taken to Date	Status and revised Target Date	Responsible Officer	Complete	Comments
Douglas WTP							
Douglas WTP Turbidity (Common and Modules 1 and 2)	Pre-treatment Clarifier - confirm design envelope for the clarifiers and ensure that it is utilised	Design 17/18 FY with construct 19/20 FY	Design finalised	End 17/18 FY for design	Manager Water and Waste	Complete	Design complete. Construction has begun .
Douglas WTP Turbidity (Common and Modules 1 and 2)	Sludge Handling – Confirm the amount of time available to 'stop' recycle to ensure that criticality is appropriate for the supernatant recycle system.		Supernatant return standard operating procedure to be developed 2019	1/07/2019	Trility Operations Manager	Complete	Scenario sheet developed and several case studies available. Summary was submitted to TCC Nov 2020
Douglas WTP Turbidity (Common and Modules 1 and 2)	Reservoirs – The reservoir cleaning program has stalled, for a number of reasons, but should be re-instated and prioritised.		Reservoir cleaning program has been reinstalled with first reservoirs to be cleaned in January 2019. From then on the reservoirs will be cleaned on a rotation with approx. 16 reservoirs cleaned each year.	1/01/2019	Water Treatment Engineer and Drinking Water Quality Officer	Complete	Contract Finalised and awarded to Southern Cross June 2021.
Douglas WTP Turbidity (Common and Modules 1 and 2)	Data is required to be assembled and reviewed to validate that the reactivator has been optimised.		Data readily available via online and daily grab sample results. Jar tests regularly conducted and alarms in place on reactivator clear water turbidity meter.	Summary of performance data and activities to be submitted Dec 2018. PCP to be added to WQP.	Trility Operations Manager	Complete	Trility has developed a summary of performance of the reactivators given the Good Practice guide and LT2ESWTR. Performance in 2019 and 2020 shows good alignment to both standards. Provided to TCC Nov 2020
Douglas WTP Turbidity (Modules 3 & 4 Direct Filtration))	Pre-treatment and Filtration – Performance trials are planned to confirm the raw water range under which the system can operate to produce safe water.		Operations Modification Program 5 has trialled under some conditions but not all. – Performance criteria agreed with TCC	Aim to complete further trials in 2019, subject to suitable raw water conditions.	Trility Operations Manager , Contract Compliance Officer	Complete	Existing data from flood period reviewed June 2020
Douglas WTP Pathogens- Crypto	Modelling is being undertaken to help clarify the likelihood of the presence of Crypto. and Giardia in 2017. This is to be used to increase certainty.	1/02/18	Modelling complete with RRD report from GHD finalised Feb 2018. Requirement for clarifier/ UV to conform to HBTs.	1/02/2018	Water Quality Officer	Complete	GHD Crypto Modelling Feb 2018

Component	Improvement Action Target Dates	Target Date	Actions taken to Date	Status and revised Target Date	Responsible Officer	Complete	Comments
Douglas WTP Pathogens- Crypto	Filtration - Compare performance against ADWG value of 0.20 and HBT guideline of 0.15NTU as 95 percentiles. Contract uses higher turbidity targets.		Performance checked as part of the RRD Crypto report. Shows that the plant meets for Mod 1 & 2.	1/02/2018	Water Quality Officer	Complete	
Douglas WTP Pathogens- Crypto	Sludge Handling - Confirm the control around returning supernatant. Including turbidity target.		Supernatant alarms 4.5 NTU H, 5 NTU HH and shutdown on High trip 10 NTU as per WQ plan. 10 minutes at or above these limits will trigger alarm, the trip will trigger a shutdown.	Complete 20/11/2018	Trility - Operations Support Engineer	Complete	
Douglas WTP Pathogens - E.coli and Virus	Disinfection point Chlorination - Complete tracer testing to confirm modelling of C.t.		Tracer study completed November 2017, report complete with executive summary review and report submission to client by end November.	1/12/2018	Operations Manager	Complete	
<i>Douglas WTP Pathogens - E.coli and Virus</i>	Disinfection point Chlorination - Investigate dedicated C.t chlorine analyser (prior to trim dose).		Options to be investigated in FY 2019 R&R plan	1/03/2019	Operations Manager	Complete	
Douglas WTP Pathogens - E.coli and Virus	Review Disinfection Control Plan to make sure that control philosophy is locked in and that there is no opportunity to control in a way that would jeopardise the C.t		Chlorine disinfection system upgraded for stable monitoring, control and alarms (PSDs). Baffles installed increasing C.t.	Online C.t. calculation planned early 2019	Operations Manager	Complete	
Pathogens - N.fowleri	Investigate and confirm the response of N.fowleri to settling.		Research project to be undertaken in Townsville, Paluma and Cungulla	Project Undetaken by Water Quality Officer to sample for N.fowleri to increase TCC's understanding of the risk.	Water Quality Officer	Complete	Project Undetaken by Water Quality Officer to sample for N.fowleri to increase TCC's understanding of the risk. N. fowleri was not detected but chlorine residual will be maintained at endpoints (0.5mg/L) to mitigate the theoretical risk (high water temperatures)

Component	Improvement Action Target Dates	Target Date	Actions taken to Date	Status and revised Target Date	Responsible Officer	Complete	Comments
Pathogens - N.fowleri	Pipes/reservoirs - Need to investigate the prevalence of N.fowleri.				Drinking Water Quality Officer	Complete	Project Undertaken by Water Quality Officer to sample for N.fowleri to increase TCC's understanding of the risk. N. fowleri was not detected but chlorine residual will be maintained at endpoints (0.5mg/L) to mitigate the theoretical risk (high water temperatures)
Pathogens - N.fowleri	Pipes/reservoirs - High and low turnover -Investigate options to increase the chlorine residual above 0.5 mg/L (reservoirs, lines, dead ends) to ensure effective barrier to N.fowleri				Drinking Water Quality Officer	Complete	Project Undertaken by Water Quality Officer to sample for N.fowleri to increase TCC's understanding of the risk. N. fowleri was not detected but chlorine residual will be maintained at endpoints (0.5mg/L) to mitigate the theoretical risk (high water temperatures)
High Chlorine	Investigate Julago system cut-off to ensure that it minimises the risk of over-dosing chlorine			1/06/2019	Water Treatment Engineer	Complete	
Water Emergency Response Plan	Updated copy to be included in DWQMP	1/01/19	Undergoing updates and changes currently.	1/01/2019	Manager Water Operations	Complete	
HACCP	Requires updating (last updated 2009). This will be included in Trility's Water quality plans due to be finalised 2018		Critical control points regularly reviewed and tested as part of water quality management system. 2019 Undertake review of HACCP and consider consolidating HACCP and WQP	1/12/2019	Trility - Operations Manager	Complete	The latest version of Trility Water Quality Plans for DWTP and NWTP have been supplied.
Chlorates in Network	Investigate replacing Sodium Hypochlorite dosing system with a chlorine gas dosing system.	2020	Design to be undertaken in 2018 financial year.	Submitted to the State for comments on the Major Hazard Facility - Out of control of TCC	Principle Lead Engineering and Design - Engineering and Assets Department	Complete	Design completed and determined it would be a Major Hazard Facility (MHF)Ongoing discussions with Queensland safety, Queensland Health and OWSR has dertermined that a MHF poses more risk than the level of chlorteswe are seeing in the network. TCC will continue to manage chlorates as they are doing currently.
Network Schematic	Requires updating to include recent infrastructure.	1/01/2019		1/01/2019	Water Quality Officer	Complete	

Component	Improvement Action Target Dates	Target Date	Actions taken to Date	Status and revised Target Date	Responsible Officer	Complete	Comments
Northern WTP							
Northern WTP - Turbidity	Filtration Node – False positives have been identified in the past and an investigation into sample preparation to eliminate false positives is underway		Trility have replaced turbidity analysers (with a different brand) to see if this false positives. Ongoing to see if this has been successful.		Rob D	Complete	No false positives have occurred since new turbidity analysers have been installed.
Northern WTP - Pathogens - Crypto	Modelling is being undertaken to help clarify the likelihood of the presence of Cryptosporidium and Giardia in 2017.		GHD Cryptosporidium report submitted August 2018. Confirms the requirement for UV addition on NWTP to conform to HBTs.		Water Quality Officer	Complete	
Northern WTP - Pathogens - E.coli and virus	Confirm virus removal capability of the membrane and whether coagulant is or is not required to claim virus removal with the membranes.		Confirmed the virus log removal of the membranes is 4.0 without coagulant. Supporting documentation provided to TCC	29/11/2018		Complete	
	Confirm the C.t (max flow, min level, Chlorine minimum (1)) available at the WTP and compare this to the typical target C.t of 15 mg.min/L.		Supporting data and calculations to be provided	1/02/2019	Operations Support Engineer	Complete	
Geosmin (Taste and Odour)	Consider measuring the level of geosmin in the open channel between Paluma and Crystal creek intake to confirm the source of Geosmin as well as continuing to investigate the source water.	1/06/2019	Dependent upon geosmin being detected in concentrations high enough to cause an issue	Parked	Drinking Water Quality Officer	Parked.	Parked as the geomin concentration has decreased in the raw (and thereby treated) water and presently is low enough to not cause any issues. There has been some discussion that the increase in geosmin was caused by an increase in organics in Paluma Dam post Cyclone Yassi.
Iron	Confirm iron results in raw and treated water. There is a discrepancy between the numbers in the raw (soluble) and the performance of the membranes. Essentially all of the soluble should pass through the membranes but the monitoring suggests that the membranes are pulling out 'soluble' iron. This could mean that the iron is colloidal and not 'true' soluble.	1/06/2020	As this is not causing an issue with water quality it has been pushed out to June 2020. Monitoring will be ongoing to enable the collection of sufficient data.		Water Quality Officer	Complete	Raw water iron for both soluble and total is monitored since April 2017, Treated water is monitored for total iron. Iron levels in retic are low.
Iron	Include event based monitoring to investigate iron spikes in the raw water.				Water Quality Officer	Complete	Event based monitoring also occurs unless the WTP is switched off for safety or operational concerns.

Component	Improvement Action Target Dates	Target Date	Actions taken to Date	Status and revised Target Date	Responsible Officer	Complete	Comments
HACCP	Requires updating (last updated 2009). This will be included in Trility's Water quality plans due to be finalised 2018.		As per DWTP HACCP			Complete	Latest versions have been supplied by Trility and are included in TCCs DWQMP.
Crypto Model	UV may be required for NWTP. This requires investigating and funding if required		Report August 2018 shows UV is required for NWTP to meet HBTs. Design specs for UV funded for this financial year.	1/06/2019	Manager Water and Wastewater	Complete	Designs have been completed. Will present for approval to include in the 2023/24 Capital Program.
<i>Vermin Control</i>	Install gauze to the whirly bird roof vent on the clear water storage tank to prevent vermin entry	1/11/2021	Initial inspection and measurement by contractor complete.	End Dec 2021	Trility		
<i>Reagent Management</i>	Ensure that all reagents are in date	1/08/2021	All reagents have been checked and are in date		Trility	Complete	
<i>Reagent Management</i>	Dispose of expired chemicals	1/08/2021	Monthly check added to monthly inspection schedule. Complete 20/07/2021		Trility	Complete	
Reagent Management	Produce a procedure to ensure that the daily operator checks for calibration include a check for expired chemicals	1/08/2021	Corporate procedure already requires "Prior to commencing the calibration, ensure that the calibration standards or other related materials in use are within their expiry dates". Reminder also added to daily lab sheet. Complete 21/07/2021		Trility	Complete	
Reagent Management	Stop the practice of using decanted chemicals	1/08/2021	Decanted chemicals necessary for pH calibration. Work instruction updated to ensure pH buffer solutions disposed on completion of daily calibration. Complete 21/07/2021		Trility	Complete	
Townsville City Council							
Instrument Management Program	Ensure that all TCC instruments on all sites are covered under a regular external calibration program and all regular calibrations are recorded in operational spreadsheets		Verifications occur inhouse on a schedule using standards. It is cheaper and easier to replace instruments than send for calibration externally. All handheld chlorine analysers are calibrated by Townsville Laboratory Services on a scheduled program.		Team Leader Water Treatment	Complete	Verifications occur inhouse on a schedule using standards. It is cheaper and easier to replace instruments than send for calibration externally. All handheld chlorine analysers are calibrated by Townsville Laboratory Services on a scheduled program.

Component	Improvement Action Target Dates	Target Date	Actions taken to Date	Status and revised Target Date	Responsible Officer	Complete	Comments
Reagent Management	Ensure that all reagents are in date		All reagents have been checked and out of date chemicals removed at both PWTP and Giru WTP		Team Leader Water Treatment	Complete	
Reagent Management	Dispose of expired chemicals		All reagents have been checked and out of date chemicals removed at both PWTP and Giru WTP		Team Leader Water Treatment	Complete	
RMIP Implementation	Many RMIP actions in the DWQMPS were not complete by due dates. It is recommended that new dates are chosen with internal consultation undertaken to ensure this work is approved and timeframes set. Discuss changes to the RMIP with the Regulator and revise the DWQMps accordingly.		Meeting held July 2021 with GM Water and Waste, Team Manager Water and Wastewater, Water Treatment Team Leader and Water Quality Officer to revise target dates and work through all OFI raised in the December Audite (which have been included in the RMIP).	1/07/2021		Complete	
Program Structure	It is suggested that regular/ monthly DWQM meetings are restarted to ensure tht prgram review and other DWQMP areas are added		These have been scheduled to begin August 2021 and occur quarterly		General Manager Water and Waste	Complete	
Sampling Frequencies	Review the large number of monitoirng zones and resulting monthly samples to determine if efficiencies can be made		A large scale review was underatken 5 years ago. The plan is constantly looked at and updated as needs are required, such as the inclusion of new suburbs/ reservoirs and as water quality changes occur.		Water Quality Officer	Complete	Not required at the present time
Process Management	As an added layer of protection, it is suggested that the Lims system automatically send through weekly exceedance reports or an alternative be used to ensure that this list has been addressed via cross-checking of those actions raised in paradigm		This cannot be automated. Has been added as an outlook reminder to occur weekly by the Water Quality Officer.		Water Quality Officer	Complete	
Cross Check of SCADA and Reported Results	It is suggested that the site results to formailise in a procedure to match the site test results with SCADA results to ensure that the SCADA information is accurate. This should be undertaken for CCPs				Team Leader Water Treatment	Complete	Daily verification is undertaken on anaylsers by rained operators- check analysers and this is fed back from SCADA. Instrument PM schedule also picks up SCADA values

Component	Improvement Action Target Dates	Target Date	Actions taken to Date	Status and revised Target Date	Responsible Officer	Complete	Comments
Paluma DWS							
Turbidity	The values and times in the PLC/HMI need to be confirmed as aligning with the Control plan for CCP1.	1/08/2019	Can check values in the plant settings, however will not know if this will actually occur until it happens. These values are correct, however they are short-lived and do not reflect membrane performance		Water Treatment Engineer	Complete	
Turbidity	Validate shutdown on High Turbidity	1/08/2019	Can check values in the plant settings, however will not know if this will actually occur until it happens. These values are correct, however they are short-lived and do not reflect membrane performance		Water Treatment Engineer	Complete	
Turbidity	Record the turbidity profile following a GAC backwash to ensure that spurious CCP1 alarms do not occur following a GAC backwash	1/04/2019	Can check values in the plant settings, however will not know if this will actually occur until it happens. These values are correct, however they are short-lived and do not reflect membrane performance		Water Treatment Engineer	Complete	
Turbidity	Include the Supernatant turbidity in the plant log sheet as an operational control point (OCP) with a target and warning levels for the Operator to take action.	1/08/2019	Can check values in the plant settings, however will not know if this will actually occur until it happens. These values are correct, however they are short-lived and do not reflect membrane performance		Water Treatment Engineer	Complete	
Pathogens - Crypto	Formulate and institute an onsite effluent management system policy including an inspection regimen for high risk systems that if failure occurs increases the pathogen load on the WTP.		If failure occurs on any part of the plant the plant will automatically shut down		Water Treatment Engineer	Complete	
Pathogens - Crypto	Training on the identification and repair of damaged membranes is required to allow action following an integrity failure.	1/10/2019	Pinning kit has been bought. Training occurred as part of Cert III Operator Training. Aquamanage attended site 2019 to train staff and audit site		Bulk Water Engineer	Complete	
Pathogens - E.coli and viruses	Confirm the Virus removal capacity of the membranes and the impact of stopping coagulation.	1/04/2019	Minimal impact to virus removal after stopping coagulation. Membrane modules have a pore size of 0.04µm and post UV disinfection and chlorination.		Water Treatment Engineer	Complete	
Pathogens - E.coli and viruses	Confirm the C.t of the reservoir operating at minimum level		Reservoir has a contact time of days. The inlet and outlet are not common and short circuiting does not occur		Water Treatment Engineer	Complete	

Component	Improvement Action Target Dates	Target Date	Actions taken to Date	Status and revised Target Date	Responsible Officer	Complete	Comments
Pathogens - N.fowleri	Continue to engage with Public Health around the risk associated with N. fowleri and any additional actions that may be recommended.		N. fowleri testing is currently being undertaken in Townsville to understand the risk further. Samples will be taken in Paluma summer 2020.		Water Quality Officer	Complete	N. fowleri has not been detected in any sampling undertaken. Risk will continue to be managed by ensuring a chlorine of 0.5mg/L through the distribution network.
	Inspect the treated water reservoir for sediment build up that could shield N. fowleri and schedule cleaning if excessive sediment is found.		Reservoir was cleaned prior to plant installation and has a roof. Reservoir is inspected for sediments regularly.		Water Treatment Engineer	Complete	Reservoir condition assessment completed April 2021. "It is not considered the current condition of the reservoir would present any significant adverse impacts to water quality or developing water quality issues"
Organics and THMs	Consider using ACH 100% of the time to extend the life of the GAC adjusting the dose so as not to negatively impact on the operation of the membranes.	1/10/2019	Consulted Aquamanage - Not nessasarry - colour - binding membranes and wasting chemical		Water Treatment Engineer	Complete	Aquamanage were consulted to confirm if this was the case. They confirmed it was not necessary as it may result in binding membranes and will waste chemical. It may be used in the future if colour becomes an issue.
	Consider replacing the GAC in the months prior to the wet season when the THMs appear to be at their highest. New GAC will have the greatest capacity to adsorb organics and limit THM formation		Investigations currently underway around THM formation potential (NPOC and dissolved NPOC) pre and post GAC (and from the weir itself) to understand how the GAC is currently working and to greater understand the type of organics in the system.		Water Treatment Engineer	Operational Issue	Ongoing monitoring of THM formation potential (pre and post GAC) will drive when GAC needs to be replaced.
Chlorate	Investigate the opportunity to utilise chlorine gas, including the cost, WHS elements and the impact on the treatment process (chlorine gas will lower the pH and pre-caustic will need to be utilised)	1/01/2022	This has been removed from the budget as not considered a priority by Council.		Team Manager Water and Wastewater	Parked	
Security	Ensure Backwash clarifier is locked to prevent sabotage risk		Once fence is erected it will negate the clarifier risk. Both have been rolled in to one.	1/12/2021	Team Manager Water and Wastewater	Complete	
Security	Continue plans to erect security fencing around Paluma WTP		Once fence is erected it will negate the clarifier risk. Both have been rolled in to one.	1/12/2021	Team Manager Water and Wastewater	Complete	
Chemical storage and in Date	Ensure that the PWTP hypochlorite injection tnk and spare container are stored in a bund		This is a 50 litre hypo container. Storage area is too small for a bund even a small pallet bund. If the hypo tank splits the chlorine will dissipate into the surrounding hardstand.		Team Manager Water and Wastewater	Complete	

Component	Improvement Action Target Dates	Target Date	Actions taken to Date	Status and revised Target Date	Responsible Officer	Complete	Comments
Chemical storage and in Date	Ensure that there is a safe work procedure for hypochlorite decanting at Deep Creek and PWTP, and also for diluting or mixing of other chemicals		Procedure in place		Water Treatment Team Leader	Complete	
Chemical storage and in Date	There needs to be a quality assured batch certificate for chemical deliveries which identifies the concentration of chemical being supplied. Each delivery docket number must link to that certificate. The service provider must also be checked for ongoing quality compliance.		Panel of providers in place. Not enough FTEs to attend every site on delivery		Team Manager Water and Wastewater	Complete	
Water Stabilisation	It is suggested that the sodium hydroxide dosing recommences at PWTP with acid dosing for pH adjustment. This will assist in prolonging asset life.		pH injection point is close to analyser. Reticulation pH is consistently between 6.5-8.5 and it has been decided to leave sodium hydroxide dosing off for now.		Team Manager Water and Wastewater	Complete	
Plant Bypass	It is suggested that the bypass at the PWTP be physically removed and blank phlanges be installed		Painted locked caps are on the bypass. Security fence to be installed by December 2021. Very difficult for anyone to open the bypass. Decision made to leave as it.		Team Manager Water and Wastewater	Complete	
Jar testing	Complete the Paluma Jar Testing methodology document as it should include a proforma		This is not an OCP or CCP. Decision made to leave as it.		Team Manager Water and Wastewater	Complete	
Jar testing	Add the jar testing records to an electronic operational monitoring spreadsheet to allow future reference for troubleshooting		This is not an OCP or CCP. Decision made to leave as it.		Team Manager Water and Wastewater	Complete	
Giru/Cungulla DWS							
Turbidity	Incorporate routine supernatant monitoring to add certainty to the performance of residuals handling.		Reclaim lagoon water quality is monitored monthly. Online Turbidity Analyser has been installed and alarmed on SCADA	1/06/2019	Water Treatment Engineer	Complete	
Turbidity	Coagulation Control needs to be documented to ensure that everyone is targeting the same thing.		Diary notes kept. Jar test to target the best flocculation. With dose changed accordingly.	1/01/2019	Water Treatment Engineer	Complete	
Turbidity	Confirm the correct location for the filtered water outlet turbidity meter (individual filter turbidity (IFE) is the benchmark).		Filtered water turbidity meter was installed in December. 1. Below the filter media and 2. return to service water line. This is monitored.	1/12/2018	Water Treatment Engineer	Complete	

Component	Improvement Action Target Dates	Target Date	Actions taken to Date	Status and revised Target Date	Responsible Officer	Complete	Comments
Turbidity	Align filter turbidity target, alert and critical limits with ADWG and best practice.		Instrument techs to write code to retain turbidity values only when the plant is operational and to calculate the 95th percentile compliance. - Complete. SADA alrms at 0.3NTU and max at 1NTU	1/06/2019	Water Treatment Engineer	Complete	
Turbidity	Supernatant flows monitored, not yet alarmed or online. Opportunity to include allowing for early detection of failure, disturbance, particularly when the wash-water system is stressed.		Project determined that susceptible to air and sand during backwash resulting in nuisance alarms every time a backwash occurs. There is no advantage to this.	1/06/2019	Water Treatment Engineer	Complete	
Pathogens - Crypto	Operational Control Point (OCP) required to be documented and put into practice to assist in management of supernatant return.	1/03/2019		1/06/2021	Water Treatment Team Leader	Complete	
	High level tank is a risk, budget allocated for tank replacement and action should be pursued. Pressure pumps to be utilised in the interim.	1/06/2019	Tank, decking and tower on track to be replaced this financial year. Pressure pumps currently installed and being utilised.	1/06/2019	Bulk Water Engineer	Complete	Tank and decking has been replaced and reinstated.
Pathogens – E. coli and Virus	Free chlorine analyser to be installed and alarming incorporated into the system control	1/06/2018	Free chlorine analyser has been installed and feedback is on SCADA.		Water Treatment Engineer	Complete	
Pathogens – E. coli and Virus	Free chlorine analyser to be installed and alarming incorporated into the system control		Project in place to alarm in SCADA	1/04/2019	Water Treatment Engineer	Complete	
Pathogens - N.fowleri	As per E. coli move towards an online continuous free chlorine analyser to confirm that chlorine has been dosed and a C.t has been achieved and a minimum of 0.5 mg/L free chlorine is maintained leaving the WTP.		Free chlorine analyser has been installed and feedback is on SCADA.		Water Treatment Engineer	Complete	
Pathogens - N.fowleri	Need to investigate the prevalence of Naegleria fowleri.		Project undertaken in Townsville		Water Quality Officer	Complete	
Pathogens - N.fowleri	Investigate options to increase the chlorine residual above 0.5 mg/L (reservoirs, Cungulla Balance Tank, lines and dead ends)		Target limit for chlorine has been increased in the CWS to > 0.5mg/L. Townsville aims to maintain free chlorine in reservoirs and at dead ends through extensive monitoring program and flushing where appropriate. Where required additional re-chlorination is installed i.e. Brookhill Reservoir		Water Quality Officer	Complete	

Component	Improvement Action Target Dates	Target Date	Actions taken to Date	Status and revised Target Date	Responsible Officer	Complete	Comments
Organics and Colour	Suggest that measuring true colour of filtered water on jar testing will assist in managing coagulation (helps to identify the 'best' dosing regimen).		A palintest kit has been purchased. Training need to be organised and its use implemented.	1/06/2019	Water Treatment Engineer	Parked	
pH	Ensure that coagulation pH targets are recorded and utilised by all staff.		Coagulation pH range of 6.4 to 7.2 has been established and communicated to operators	1/06/2018	Water Treatment Engineer	Complete	
	Need to incorporate triggers for operating soda ash, when does it turn on / off.		Too difficult to set an absolute number. Depends upon many factors and the Water Treatment Engineer decides operationally when this is to occur	1/06/2018	Water Treatment Engineer	Complete	
Verification of Drinking Water Quality	Undertake project to acquire handheld devices and store all water quality results in Lims1		Project currently underway to get operators recording data in tablets. Then this data can be transferred and stored in LIMS		Bulk Water Engineer		
Water Emergency Response Plan	Updated copy to be included in DWQMP	1/12/2019	Response plan is being updated and changed presently.		Water Quality Officer	Complete	

Appendix B.
**Drinking Water Quality
Performance**



Giru/Cungulla Drinking Water Scheme

Scheme Component	Parameter Category	Parameter	Unit of Measure	Limit of Reporting (LOR)		# of Samples Detected	# Exceed ADWG Guidelines Value	Min Value	Max Value	Avg Value	95th %tile	Comments	
				Count									
Giru	Source Water Giru Raw Water (Haughton River)	Thermotolerant Coliforms	Total Coliform	org/100ml	1	45	44	0	0	19900	1274	6600	
		Thermotolerant Coliforms	<i>E.coli</i>	MPN/100ml	1	46	19	0	0	161	6.96	25.5	
		Turbidity	Turbidity	NTU	0.1	45	45	0	2.6	73.9	11.56	37.64	
		pH	pH	pH Units	1	45	45	0	6.91	7.78	7.37	7.74	
		Metals	Iron, Total	mg/L	0.005	45	45	0	0.02	3.3	0.65	2.52	
		Metals	Manganese, Total	mg/L	0.001	45	45	0	0.006	0.1	0.04	0.09	
		Pesticides	Pesticides	µg/L	Suite sampled x1		0	0	<LOR	<LOR	<LOR	<LOR	
		Protazoa	Cryptosporidium	oocysts/10 L	1	2	0	0	ND	ND	ND	ND	
		Protazoa	Giardia	oocysts/10 L	1	2	0	0	ND	ND	ND	ND	
		PFAS/ PFOA	PFAS/ PFOA	µg/L	Suite sampled x1		0	0	<LOR	<LOR	<LOR	<LOR	
Giru	Water Treatment Plant Giru Clear Water Storage	Thermotolerant Coliforms	Total Coliform	org/100ml	1	37	1	0	<LOR	1	0.03	<LOR	
		Thermotolerant Coliforms	<i>E.coli</i>	MPN/100ml	1	44	1	1	<LOR	1	0.02	<LOR	DWI-506-22-09434
		Turbidity	Turbidity	NTU	0.1	45	42	0	<LOR	1.8	0.3	0.79	
		pH	pH	pH Units	1	45	44	0	6.65	7.31	6.99	7.29	
		Metals	Iron, Total	mg/L	0.005	45	32	0	<LOR	0.05	0.01	0.02	
		Metals	Manganese, Total	mg/L	0.001	45	44	0	0.0006	0.02	0.01	0.02	
		Pesticides	Pesticides	µg/L	Suite sampled x10		0	<LOR	<LOR	<LOR	<LOR	<LOR	

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	org/100ml	1	27	0	0	ND	ND	ND	ND	
		Thermotolerant Coliforms	<i>E.coli</i>	MPN/100ml	1	27	0	0	ND	ND	ND	ND	
		Turbidity	Turbidity	NTU	0.1	27	27	0	0.1	0.3	0.20	0.3	
		pH	pH	pH Units	1	27	27	0	6.96	7.76	7.47	7.75	
		Metals	Iron, Total	mg/L	0.005	27	13	0	<LOR	0.007	<LOR	0.004	
		Metals	Manganese, Total	mg/L	0.001	27	25	0	<LOR	0.009	<LOR	0.01	
		Disinfection Residual	Chlorine (free)	mg/L	0.05	27	27	0	1.01	1.91	1.46	1.85	
		Disinfection Residual	Chlorine (Total)	mg/L	0.05	27	27	0	1.12	2.16	1.60	2.01	
		Disinfection By products	Chlorates	µg/L	15	7	7	0	105	367	217.43	362.5	
		Disinfection By products	Trihalomethanes	µg/L	2	25	25	0	20	104	42.92	60	
		MIB	MIB	ng/L	2	27	1	0	<LOR	23	0.85	<LOR	
Geosmin	Geosmin	ng/L	2	27	6	0	<LOR	8	0.74	3			
Cungulla	Reticulation Cungulla Houses	Thermotolerant Coliforms	Total Coliform	org/100ml	1	98	1	0	ND	3	0.03	ND	
		Thermotolerant Coliforms	<i>E.coli</i>	MPN/100ml	1	98	0	0	ND	ND	ND	ND	
		Turbidity	Turbidity	NTU	0.1	100	99		<LOR	0.6	0.18	0.3	
		pH	pH	pH Units	1	100	100		6.58	7.77	7.28	7.63	
		Metals	Iron, Total	mg/L	0.005	50	27		<LOR	0.01	0.00	0.005	
		Metals	Manganese, Total	mg/L	0.001	50	29		<LOR	0.03	<LOR	<LOR	
		Metals	Lead	mg/L	0.0006	50	26		<LOR	0.001	<LOR	<LOR	
		Disinfection Residual	Chlorine (free)	mg/L	0.05	100	100		0.46	2.3	1.28	1.84	
Disinfection Residual	Chlorine (Total)	mg/L	0.05	100	100		0.55	2.31	1.39	2.05			

<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	190	75.92	184.5	
	Thermotolerant Coliforms	<i>E.coli</i>	MPN/100ml	1	12	12	0	10	120	55.83	114.5	
	pH	pH	pH Units	1	12	12	0	5.96	7.06	6.47	7.04	
	Metals	Iron	mg/L	0.002	12	12	0	0.35	1.2	0.75	1.15	
	Metals	Manganese	mg/L	0.0003	12	12	0	0.00	0.04	0.02	0.03	
	Turbidity	Turbidity	NTU	0.1	12	12	0	2.4	17.7	5.13	11.71	
	Cryptosporidium	Cryptosporidium	cells/10 Li	1	2	0	0	ND	ND	ND	ND	
	Giardia	Giardia	cells/10 Li	1	2	0	0	ND	ND	ND	ND	
Water Treatment Plant (Membrane Filtered Water)	pH	pH	pH Units	1	48	48	0	5.99	7.88	6.72	7.18	
	Turbidity	Turbidity	NTU	0.1	46	46	0	0.1	0.9	0.27	0.5	
	Colour	Colour, true	Pt-Co Units	1	40	38	0	<LOR	11	3.63	8	
	Colour	Colour, apparent	Pt-Co Units	1	46	44	0	<LOR	21	5.09	11	
	Metals	Iron	mg/L	0.002	49	49	0	0.009	0.35	0.05	0.17	
	Metals	Aluminium	mg/L	0.0003	49	28	0	<LOR	0.19	0.02	0.05	
Transmission Paluma Reservoir	Thermotolerant Coliforms	Total Coliform	org/100ml	1	12	0	0	ND	ND	ND	ND	
	Thermotolerant Coliforms	<i>E.coli</i>	MPN/100ml	1	61	0	0	ND	ND	ND	ND	
	Disinfection Residual	Chlorine (free)	mg/L	0.05	35	35	0	0.84	2.19	1.55	2.05	
	Disinfection Residual	Chlorine (total)	mg/L	0.05	35	35	0	1.02	2.53	1.76	2.19	
	pH	pH	pH Units	1	61	61	0	6.29	7.53	6.90	7.21	
	Turbidity	Turbidity	NTU	0.1	61	61	0	0.1	3.2	0.38	0.7	
	Metals	Iron	mg/L	0.002	61	61	0	0.009	0.35	0.05	0.18	
	Metals	Manganese	mg/L	0.0003	61	61	0	0.0004	0.009	<LOR	0.01	
	Metals	Aluminium	mg/L	0.0003	61	34	0	<LOR	0.25	0.02	0.05	
	Metals	Lead	mg/L	0.0006	61	3	0	<LOR	0.002	<LOR	<LOR	
	Disinfection By-product	Chlorates	µg/L	50	13	13	2	204	938	432.23	916.4	DWI-506-22-09443
Disinfection By-product	Trihalomethanes	µg/L	5	13	13	0	10	223	69.23	206.2		

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	MPN/100ml	1	72	0	0	ND	ND	ND	ND	
	Disinfection Residual	<i>Chlorine (free)</i>	mg/L	0.05	60	60	0	0.54	1.95	1.37	1.87	
	Disinfection Residual	Chlorine (total)	mg/L	0.05	60	60	0	0.69	19.5	1.83	2.07	
	pH	pH	pH Units	1	48	48	0	6.65	8.18	7.29	7.62	
	Turbidity	Turbidity	NTU	0.1	48	48	0	0.2	4.3	0.43	0.6	
	Metals	Iron	mg/L	0.002	72	72	0	0.02	0.28	0.07	0.19	
	Metals	Manganese	mg/L	0.0003	72	72	0	0.0004	0.05	<LOR	0.01	
	Metals	Aluminium	mg/L	0.0003	72	58	0	<LOR	0.077	0.02	0.04	
	Metals	Lead	mg/L	0.0006	24	11	0	<LOR	0.001	<LOR	<LOR	
	Fluoride	Fluoride (naturally occurring)	mg/L	0.02	24	22	0	<LOR	0.12	0.08	0.11	
	Disinfection By-product	Chlorates	µg/L	50	14	14	3	208	966	467.93	925.7	DWI-506-22-09443
	Disinfection By-product	Trihalomethanes	µg/L	5	26	26	2	18	292	85.65	255.25	DWI-506-22-09442

<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	org/100ml	1	272	272	0	365	86600	13711		
	Thermotolerant Coliforms	<i>E.coli</i>	MPN/100ml	1	219	97	0	<LOR	15	1		
	Turbidity	Turbidity	NTU	0.1	835	835	0	5	743	10.44		
	pH	pH	pH Units	1	835	835	0	6	9.97	7.41		
	Metals	Iron, Total	mg/L	0.005	1327	1327	0	0.02	4.4	0.35		
	Metals	Manganese, Total	mg/L	0.001	1327	1327	0	0.005	1.4	0.11		
	Anions	Nitrate	mg/L	0.01	756	85	0	<LOR	0.14	<LOR		
	PFAS/PFOA	PFAS/PFOA	ug/L	<0.005/ <0.01	Suite sampled x2		0	<LOR	<LOR	<LOR		
Source Water Paluma Dam	Thermotolerant Coliforms	Thermotolerant Coliforms	org/100ml	1	155	155	0	17	121000	4298		
	Thermotolerant Coliforms	<i>E.coli</i>	MPN/100ml	1	155	78	0	ND	29	2		
	Turbidity	Turbidity	NTU	0.1	155	155	0	1.2	295	4.47		
	pH	pH	pH Units	1	155	155	0	5	7.4	6.05		
	Metals	Iron, Soluble	mg/L	0.005	155	155	0	0.09	8	1.11		
	Metals	Manganese, Soluble	mg/L	0.001	155	155	0	0.01	0.22	0.04		
	Anions	Nitrate	mg/L	0.01	155	43	0	<LOR	0.07	0.01		
	PFAS/PFOA	PFAS/PFOA	ug/L	<0.005/ <0.01	Suite sampled x2		0	<LOR	<LOR	<LOR		

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
Douglas Water Treatment Plant Raw Water	Thermotolerant Coliforms	Total Coliforms	org/100ml	1	53	53	ND	ND	24200	7385	19900	
	Thermotolerant Coliforms	<i>E.coli</i>	MPN/100ml	1	52	52	ND	ND	11	1	4	
	Turbidity	Turbidity	NTU	0.1	355	355	0	0.05	58.5	7.49	12.67	
	pH	pH	pH Units	1	355	355	0	7	8.3	7.52	7.80	
	Anions	Sulphate	mg/L	0.5	12	12	0	0	1.3	0.72	1.3	
	Metals	Iron, Total	mg/L	0.005	51	51	0	0.11	1.2	0.26	0.62	
	Metals	Manganese, Total	mg/L	0.001	51	51	0	0.01	0.3	0.08	0.13	
	Geosmin/ MIB	Geosmin	ng/L	2	10	10	0	2	6	3.9	6	
	Geosmin/ MIB	MIB	ng/L	2	9	9	0	2	43	16	34.6	
	Fluoride	Fluoride (Naturally occurring)	mg/L	0.02	51	51	0	0.08	0.13	0.11	0.13	
	Metals	Arsenic	mg/L	0.001	4	4	0	<LOR	0.001	<LOR	<LOR	
	Metals	Selenium	mg/L	0.001	4	4	0	<LOR	<LOR	<LOR	<LOR	
	Metals	Mercury	mg/L	0.0006	4	4	0	<LOR	<LOR	<LOR	<LOR	
	Metals	Cadmium	mg/L	0.0001	4	4	0	<LOR	<LOR	<LOR	<LOR	
	Metals	Nickel	mg/L	0.001	4	4	0	<LOR	<LOR	<LOR	<LOR	
	Metals	Chromium	mg/L	0.001	4	4	0	<LOR	<LOR	<LOR	<LOR	
	Giardia	Giardia	cysts/100ml	1	4	4	0	<LOR	<LOR	<LOR	<LOR	
	Cryptosporidium	Cryptosporidium	oocysts/10L	1	4	4	0	<LOR	<LOR	<LOR	<LOR	

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
Douglas Water Treatment Plant Treated Water	Thermotolerant Coliforms	Total Coliforms	org/100ml	1	73	73	0	ND	5	ND	ND	
	Thermotolerant Coliforms	<i>E.coli</i>	MPN/100ml	1	74	74	0	ND	ND	ND	ND	
	Disinfection Residual	Chlorine, free	mg/L	0.05	700	700	0	<LOR	4.7	3.00	3.5005	
	Turbidity	Turbidity	NTU	0.1	701	701	0	<LOR	0.242	0.08	0.135	
	pH	pH	pH Units	1	699	699	0	6.51	7.72	7.54	7.65	
	Anions	Sulphate	mg/L	0.5	15	15	0	<LOR	1.4	0.85	1.4	
	Anions	Nitrate	mg/L	0.01	15	15	0	0.01	0.12	0.05	0.11	
	Metals	Iron, Total	mg/L	0.005	147	147	0	<LOR	0.07	<LOR	0.01	
	Metals	Manganese, Total	mg/L	0.001	74	74	0	<LOR	0.01	<LOR	<LOR	
	Metals	Aluminium	mg/L	0.005	551	551	0	<LOR	0.12	0.02	0.04	
	Fluoride	Fluoride	mg/L	0.02	551	551	0	0.09	0.78	0.61	0.73	DWI-506-22-09645, Fluoride >1.5mg was detected in the service line. High fluoride was not detected in the Clear Water Storages, Reservoirs or distribution netowrk.
	Metals	Copper	mg/L	0.002	15	15	0	<LOR	0.02	<LOR	0.01	
	Metals	Zinc	mg/L	0.001	15	15	0	<LOR	0.01	<LOR	0.003	
	Metals	Arsenic	mg/L	0.001	5	5	0	0.0006	0.001	0.00	0.001	
	Metals	Selenium	mg/L	0.001	5	5	0	<LOR	<LOR	<LOR	<LOR	
	Metals	Mercury	mg/L	0.0006	5	5	0	<LOR	<LOR	<LOR	<LOR	
	Metals	Cadmium	mg/L	0.0001	5	5	0	<LOR	<LOR	<LOR	<LOR	
Metals	Nickel	mg/L	0.001	5	5	0	<LOR	<LOR	<LOR	<LOR		
Metals	Chromium	mg/L	0.001	5	5	0	<LOR	<LOR	<LOR	<LOR		
Disinfection By-product	Trihalomethanes	ug/L	5	66	66	0	20	131	55.94	92		
Disinfection By-product	Chlorates	ug/L	5	142	142	1	96	814	331.99	611.80	DWI-506-22-09428	

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
Northern Water Treatment Plant Raw Water	Thermotolerant Coliforms	Total Coliforms	org/100ml	1	52	52	ND	ND	1410	87.23	349.95	
	Thermotolerant Coliforms	<i>E.coli</i>	MPN/100ml	1	52	52	ND	ND	225	8.04	17.45	
	Turbidity	Turbidity	NTU	0.1	363	363	0	0.081	7.32	1.25	1.88	
	pH	pH	pH Units	1	362	362	0	9.93	10.84	10.47	10.64	
	Anions	Sulphate	mg/L	0.5	12	12	0	0.02	0.14	0.06	0.12	
	Metals	Iron, Total	mg/L	0.005	52	52	0	0.03	0.37	0.18	0.32	
	Metals	Manganese, Total	mg/L	0.001	52	52	0	0.0007	0.01	0.01	0.01	
	Geosmin/ MIB	Geosmin	ng/L	1	20	20	0	<LOR	8.5	3.35	8.5	
	Geosmin/ MIB	MIB	ng/L	1	20	20	0	<LOR	7.3	1.13	6.07	
	Fluoride	Fluoride	mg/L	0.02	52	52	0	<LOR	0.36	0.04	0.09	
	Metals	Arsenic	mg/L	0.001	4	4	0	<LOR	<LOR	<LOR	<LOR	
	Metals	Selenium	mg/L	0.001	4	4	0	<LOR	<LOR	<LOR	<LOR	
	Metals	Mercury	mg/L	0.0006	4	4	0	<LOR	<LOR	<LOR	<LOR	
	Metals	Cadmium	mg/L	0.0001	4	4	0	<LOR	<LOR	<LOR	<LOR	
	Metals	Nickel	mg/L	0.001	4	4	0	<LOR	<LOR	<LOR	<LOR	
	Metals	Chromium	mg/L	0.001	4	4	0	<LOR	<LOR	<LOR	<LOR	
	Giardia	Giardia	cysts/100ml	1	6	0	0	ND	ND	ND	ND	
Cryptosporidium	Cryptosporidium	oocysts/10L	1	6	0	0	ND	ND	ND	ND		

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
Northern Water Treatment Plant Treated Water	Thermotolerant Coliforms	Total Coliforms	org/100ml	1	53	53	0	ND	ND	ND	ND	
	Thermotolerant Coliforms	<i>E.coli</i>	MPN/100ml	1	53	53	0	ND	ND	ND	ND	
	Disinfection Residual	Chlorine, free	mg/L	0.05	363	363	0	1.57	2.28	1.92	2.05	
	Turbidity	Turbidity	NTU	0.1	362	362	0	0.017	0.09	0.04	0.05	
	pH	pH	pH Units	1	362	362	0	7.36	7.65	7.54	7.62	
	Anions	Sulphate	mg/L	0.5	13	13	0	<LOR	1.6	1.20	1.6	
	Anions	Nitrate	mg/L	0.01	12	12	0	0.02	0.14	0.06	0.12	
	Metals	Manganese, Total	mg/L	0.001	55	55	0	<LOR	0.003	<LOR	0.002	
	Metals	Iron, Total	mg/L	0.005	121	121	0	<LOR	0.02	<LOR	0.006	
	Metals	Aluminium	mg/L	0.005	365	365	0	<LOR	0.10	0.01	0.0248	
	Fluoride	Fluoride	mg/L	0.02	362	362	0	<LOR	0.76	0.64	0.712	
	Metals	Copper	mg/L	0.002	12	12	0	<LOR	0.004	<LOR	<LOR	
	Metals	Zinc	mg/L	0.001	12	12	0	<LOR	0.004	0.002	<LOR	
	Metals	Arsenic	mg/L	0.001	4	4	0	<LOR	<LOR	<LOR	<LOR	
	Metals	Selenium	mg/L	0.001	4	4	0	<LOR	<LOR	<LOR	<LOR	
	Metals	Mercury	mg/L	0.0006	4	4	0	<LOR	0.0008	0.0002	<LOR	
	Metals	Cadmium	mg/L	0.0001	4	4	0	<LOR	<LOR	<LOR	<LOR	
	Metals	Nickel	mg/L	0.001	4	4	0	<LOR	<LOR	<LOR	<LOR	
Metals	Chromium	mg/L	0.001	4	4	0	<LOR	<LOR	<LOR	<LOR		
Disinfection By-product	Trihalomethanes	ug/L	5	51	51	0	<LOR	208	25.14	60.5		

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	org/100ml	1	858	21	0	<LOR	147	0.53	<LOR	
	Thermotolerant Coliforms	E.coli	MPN/100ml	1	858	3	2	<LOR	11	0.02	<LOR	DWI-506-21-09059,, DWI-506-22-09433
	Disinfection residual	Chlorine, free	mg/L	0.05	859	859	1	0.08	5.96	1.34	0.08	DWI-506-21-09013
	Disinfection residual	Chlorine, total	mg/L	0.05	858	3	0	<LOR	11	0.02	<LOR	
	Turbidity	Turbidity	NTU	0.1	862	856	0	<LOR	0.9	0.19	<LOR	
	pH	pH	pH Units	1	862	862	0	6.5	8.28	7.51	6.5	
	Metals	Iron, Total	mg/L	0.005	861	474	0	<LOR	0.09	<LOR	<LOR	
	Metals	Manganese, Total	mg/L	0.001	861	824	0	<LOR	0.01	<LOR	<LOR	
	Metals	Lead, Total	mg/L	0.0006	861	22	0	<LOR	0.001	<LOR	<LOR	
	Disinfection By-product	Trihalomethanes	µg/L	5	782	782	2	14	340	108.06	14	DWI-506-22-09417
Disinfection By-product	Chlorates	µg/L	50	162	130	2	<LOR	879	296.04	<LOR	DWI-506-22-09443, DWI-506-22-09521	
Reticulation Houses	Thermotolerant Coliforms	Total Coliforms	org/100ml	1	1962	32	0	ND	80	ND	ND	
	Thermotolerant Coliforms	E.coli	MPN/100ml	1	1962	2	2	<LOR	11	<LOR	<LOR	DWI-506-21-09307, DWI-506-22-09559
	Disinfection residual	Chlorine, free	mg/L	0.05	1969	1939	0	<LOR	142	1	<LOR	
	Disinfection residual	Chlorine, total	mg/L	0.05	1967	1956	0	<LOR	3	1	<LOR	
	Turbidity	Turbidity	NTU	0.1	1973	1955	0	<LOR	6.6	0.21	<LOR	6.6 NTU was detected at house sample (outlier). All other samples were <1 NTU, with a 95th percentile of <LOR
	pH	pH	pH Units	1	1973	1973	0	6	8.36	7.42	6	
	Metals	Iron, Total	mg/L	0.005	484	308	0	<LOR	<LOR	<LOR	<LOR	
	Metals	Manganese, Total	mg/L	0.001	484	464	0	<LOR	<LOR	<LOR	<LOR	
	Metals	Lead, Total	mg/L	0.001	483	256	0	<LOR	<LOR	<LOR	<LOR	
	Fluoride	Fluoride	mg/L	0.02	484	484	0	<LOR	1	1	<LOR	
	Disinfection By-product	Trihalomethanes	µg/L	5	552	552	0	15	239	117	15	
Disinfection By-product	Chlorates	µg/L	50	83	69	0	<LOR	785	305	<LOR		

<LOR - Less than Limit of reporting

ND- Not Detected

**TOWNSVILLE
WATER**

