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Service Provider ID: 9

# **Drinking Water Quality Management Plan (DWQMP)**

## **ANNUAL REPORT 2021/2022**

## Glossary of terms

ADWG 2004	Australian Drinking Water Guidelines (2004). Published by the National Health and Medical Research Council of Australia
ADWG 2011	Australian Drinking Water Guidelines (2011). Published by the National Health and Medical Research Council of Australia
<i>E. coli</i>	<i>Escherichia coli</i> , a bacterium which is considered to indicate the presence of faecal contamination and therefore potential health risk
HACCP	Hazard Analysis and Critical Control Points certification for protecting drinking water quality
mg/L	Milligrams per litre
NTU	Nephelometric Turbidity Units
MPN/100mL	Most probable number per 100 millilitres
CFU/100mL	Colony forming units per 100 millilitres
<	Less than
>	Greater than

## 1. Introduction

This report documents the performance of Barcoo Shire Council's drinking water service with respect to water quality and performance in implementing the actions detailed in the drinking water quality management plan (DWQMP) as required under the *Water Supply (Safety and Reliability) Act 2008* (the Act).

The report assists the Regulator to determine whether the approved DWQMP and any approval conditions have been complied with and provides a mechanism for providers to report publicly on their performance in managing drinking water quality.

This template has been prepared in accordance with the *DWQMP report guidance note* published by the Department of Natural Resources, Mines and Energy, Queensland, accessible at [www.business.qld.gov.au/industries/mining-energy-water/water/industry-infrastructure/industry-regulation/drinking-water/annual-report](http://www.business.qld.gov.au/industries/mining-energy-water/water/industry-infrastructure/industry-regulation/drinking-water/annual-report).

## 2. Overview of Operations

Barcoo Shire incorporates the towns of Jundah, Stonehenge and Windorah, and covers an expanse of 61,974 sq km. The population of the shire is approximately 312 (ABS 2021). The administration centre of Barcoo Shire is 220 km south of Longreach in the township of Jundah.

Barcoo Shire Council is a small drinking water service provider as defined under the Act and provides drinking water to a population of approximately 190 people. Each town is serviced by dual water reticulation, a treated, potable water supply as well as an untreated non-potable supply.

Barcoo Shire Council is responsible for the following water supply schemes:

- **Jundah**

Raw water is sourced from a nearby waterhole on the Thomson River. This river water is coagulated and treated by conventional sedimentation and rapid sand filtration in a package module. After chlorination, it transfers to a ground level reservoir and from there it is pumped into a high-level reservoir which supplies the town.

Bore water is stored in a small ground level reservoir prior to treatment in the reverse osmosis plant and transfers to the same ground level reservoir as the treated river water. The reverse osmosis plant hasn't been in operation since November 2014.

- **Windorah**

Raw water is sourced from two nearby waterholes on the Cooper Creek. This river water is coagulated and treated by conventional sedimentation and dual media rapid gravity filtration in a package plant. After chlorination, it transfers to a ground level reservoir and from there it is pumped into a high-level reservoir which supplies the town. A new WTP is currently under construction and to be commissioned in late 2022.

- **Stonehenge**

Raw water is sourced from a nearby waterhole on the Thomson River and is pumped to an off-stream storage during river flows. Water from the off-stream storage is pumped, with addition of coagulant, to a small flocc-sed unit and then into a flow balance tank. The water then passes through a pressure filter and is chlorinated before being transferred to a ground level reservoir from which it is pumped into a high-level reservoir which supplies the town.

### 3. Actions taken to implement the DWQMP

#### **Progress in implementing the risk management improvement program**

Refer to the Appendices for a summary of progress in implementing each of the Improvement Program actions.

#### **Revisions made to the operational monitoring program to assist in maintaining the compliance with water quality criteria<sup>1</sup> in verification monitoring.**

Revisions were made to the operational monitoring program as part of the amended DWQMP approved on 24/6/2022.

#### **Amendments made to the DWQMP**

A full review was undertaken of the DWQMP in October & November 2021, with an application to amend the DWQMP being submitted on 16 December 2021. The amendments were made to address concerns from the regulator regarding chlorine and chlorate management and the imminent commissioning of a new WTP at Windorah. There were also updates to the Risk Management Improvement Plan and general updates relating to contact details, staff roles/responsibilities and water quality data. The amended DWQMP was approved, with conditions, on 24/6/2022.

### 4. Compliance with water quality criteria for drinking water

The water quality criteria mean health guideline values in the most current Australian Drinking Water Guidelines, as well as the standards in the Public Health Regulation 2005. Refer to Appendix A for the monitoring results.

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

This financial year there were five (3) instances where the Regulator was notified under sections 102 or 102A of the Act and one (1) ongoing incident.

#### **Non-compliances with the water quality criteria and corrective and preventive actions undertaken**

None

#### **Prescribed incidents or Events reported to the Regulator and corrective and preventive actions undertaken.**

The detection of a parameter with no water quality criteria in all three towns occurred in December 2018. The event involved readings between 1.3 – 3.7 mg/L for chlorate. Follow up testing was undertaken with levels gradually declining by July 2019 but increasing again over the following summer period. A trend is developing with lower readings in winter and higher readings in summer. The preventative actions involved ensuring that treatment plant operators employ good practice when batching chlorine solution for the purpose of disinfection. Further action in changing to

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<sup>1</sup> Refer to *Water Quality and Reporting Guideline for a Drinking Water Service* for the water quality criteria for drinking water.

sodium hypochlorite for disinfection at both Jundah and Windorah has been taken along with the change in filter backwash water source at Jundah. Monitoring of this event/parameter is ongoing.

On 21/12/2021 the notification of a drinking water event was made for Stonehenge. The incident occurred due to a leakage in the coagulant dosing line. This resulted in high turbidity readings in the treated water storage tanks. Upon detection, the WTP was shut down, the dosage line was replaced and the affected storages drained and cleaned. The filter was then backwashed before the WTP was started up again. A boiled water alert was issued and testing for *E. Coli* was undertaken until turbidity readings were brought back to the required levels. The incident was concluded on 31/3/2022.

On 18/1/2022 the notification of a drinking water event was made for Jundah. The incident occurred due to an issue with the electrical supply, which affected the coagulant dosing pump, with the pump ceasing to operate. This resulted in high turbidity readings in the treated water storage tanks. Upon detection, the WTP was shut down and fully cleaned with the ground level treated water storage being drained and flushed. A boiled water alert was issued and testing for *E. Coli* was undertaken until turbidity readings were brought back to the required levels. *E. Coli* was detected in the treated water testing during this event. The incident was concluded on 18/1/2022.

On 9/6/2022 the notification of a drinking water event was made for Windorah. The incident occurred when a load of drinking water was brought from Jundah to top up the stored treated water volume at Windorah. When the load of water was transferred into the ground level storage, sediment in the bottom of the reservoir was stirred up and caused an elevated turbidity reading, which was then transferred to the elevated reservoir. A boiled water alert was issued and testing for *E. Coli* was undertaken along with backwashing of the filter and mains flushing until turbidity readings were brought back to the required levels. The incident was concluded on 16/6/2022.

## 6. Customer complaints related to water quality

Barcoo Shire Council is required to report on the number of complaints, general details of complaints, and the responses undertaken.

Throughout the year, the following complaints about water quality were received:

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

	Suspected Illness	Discoloured water	Taste and odour	Total
Jundah	0	0	0	0
Windorah	0	2 (24.4 per 1000)	0	2 (24.4 per 1000)
Stonehenge	0	0	0	0
Total	0	2 (9.6 per 1000)	0	2 (9.6 per 1000)

### Suspected Illness

Nil

### Discoloured water

Upon investigation, both complaints were found to be as a result of issues on the customer side of the meter.

### Taste and odour

Nil

## 7. Findings and recommendations of the DWQMP auditor

An audit of the DWQMP was completed on 13/5/2022. The audit found two minor non-compliances as follows:

- For the verification sampling taps the actual location of the specific taps sampled was unclear in some cases.
- The integrity of the measures to prevent vermin and runoff ingress of the water storage tank rooves was subject to minor defects but was not considered consistent with the level of protection implied in the DWQMP.

The audit also identified the following Opportunities for Improvement:

- General
  - BSC should seek to keep its reagents and standards within date and properly stored and either replace them, or defensibly extend their shelf lives, once expired
  - Using the new DWQMP and SWIMLocal settings to improve prioritisation of the alert settings and to include error trapping constraints in case of typographical data entry errors.
  - Improved signage and labelling would help improve the operability of the plants and reduce the risk of confusion for relief operators or maintenance personnel. In the interests of supply continuity and emergency response some improvements in this respect are warranted.
  - Seeking means to streamline and focus operator workloads, potentially using prioritisation and automation.
- Windorah
  - The value of replacing the Aerodrome sampling tap site with one more representative of the majority of the exposed population could be considered.
- Jundah
  - Means to ensure adequate turnover of the Jundah high level treated water storage tank to avoid dead water with little to no chlorine residual being potentially drawn into supply.

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

A full review was undertaken of the DWQMP in October & November 2021, with an application to amend the DWQMP being submitted on 16 December 2021. The amendments were made to address concerns from the regulator regarding chlorine and chlorate management and the imminent commissioning of a new WTP at Windorah. There were also updates to the Risk Management Improvement Plan and general updates relating to contact details, staff roles/responsibilities and water quality data.

## Appendix A – Summary of compliance with water quality criteria

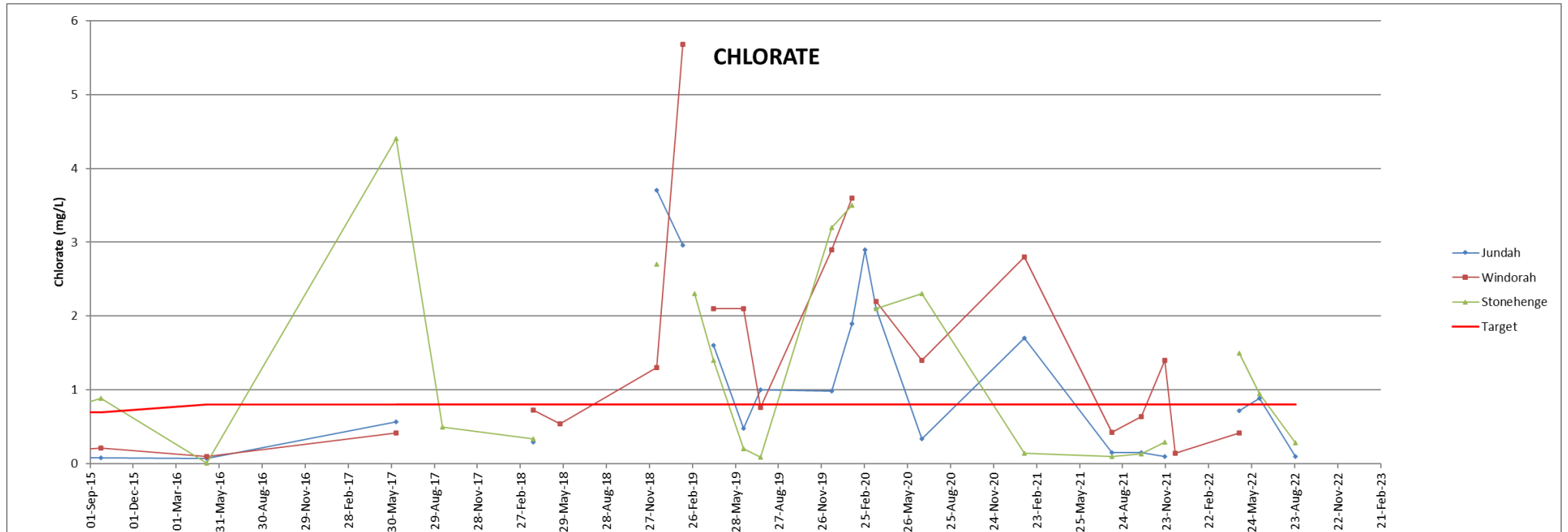
The results from the verification monitoring program have been compared against the levels of the water quality criteria specified by the Regulator in the *Water Quality and Reporting Guideline for a Drinking Water Service*.

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

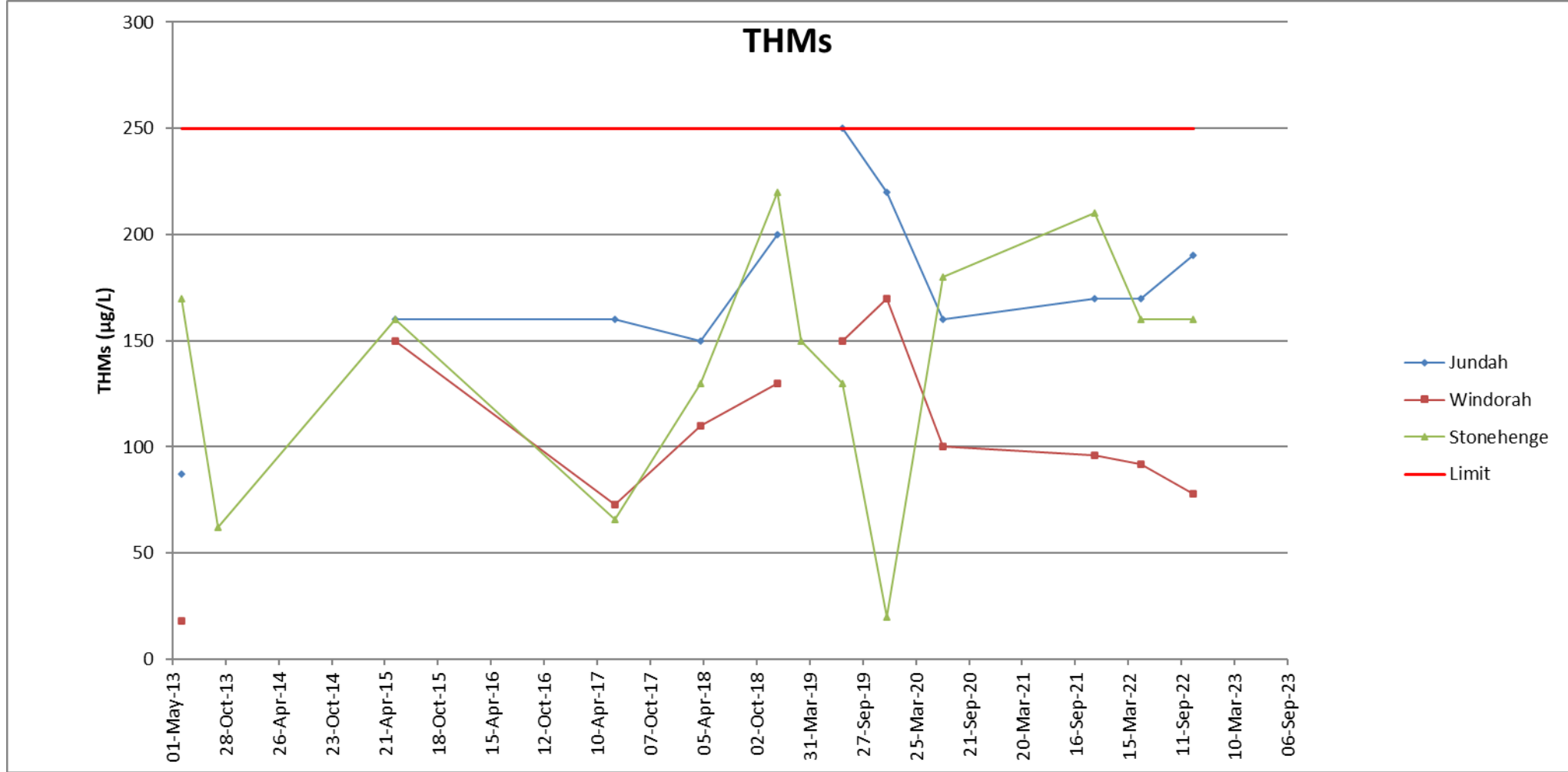
The verification monitoring did not meet the requirements as stated in the DWQMP on the following occasions:

- The fortnightly testing for *E. Coli* in Jundah was only undertaken once in July 2021 and October 2021
- The fortnightly testing for *E. Coli* in Windorah was only undertaken once in August 2021, October 2021 and May 2022

Table 2 - Verification monitoring results

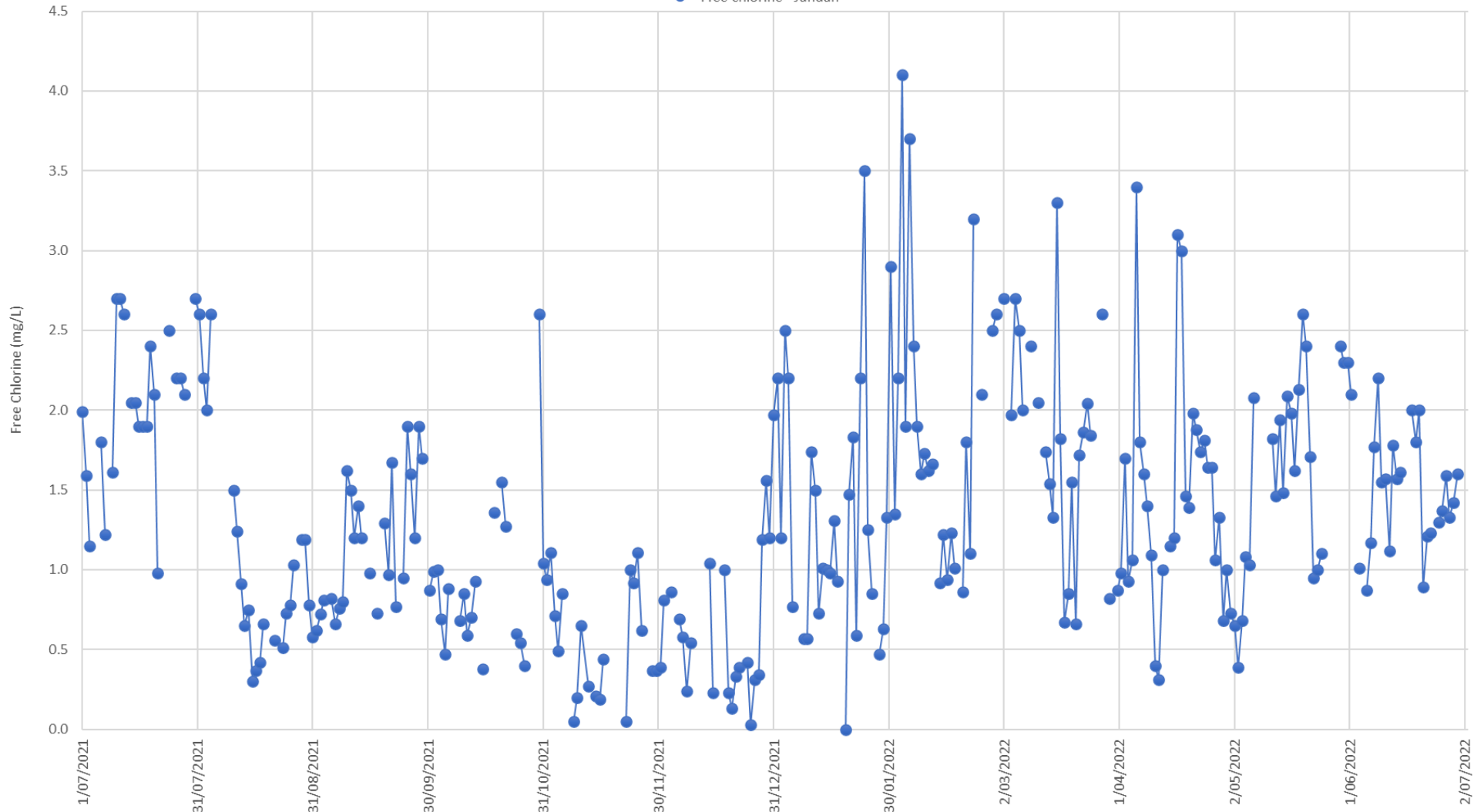






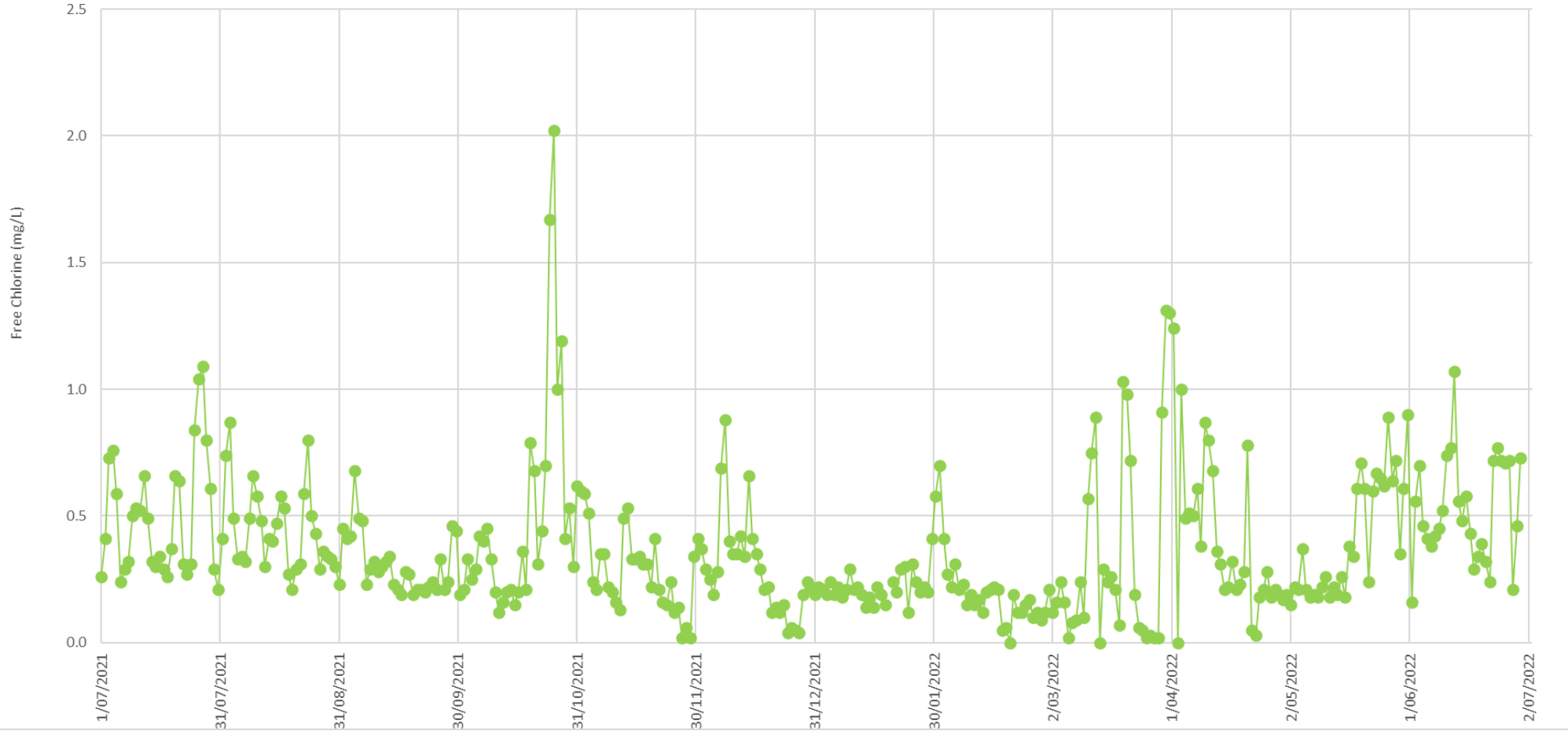
# FREE CHLORINE IN RETICULATION NETWORK

Free chlorine - Jundah



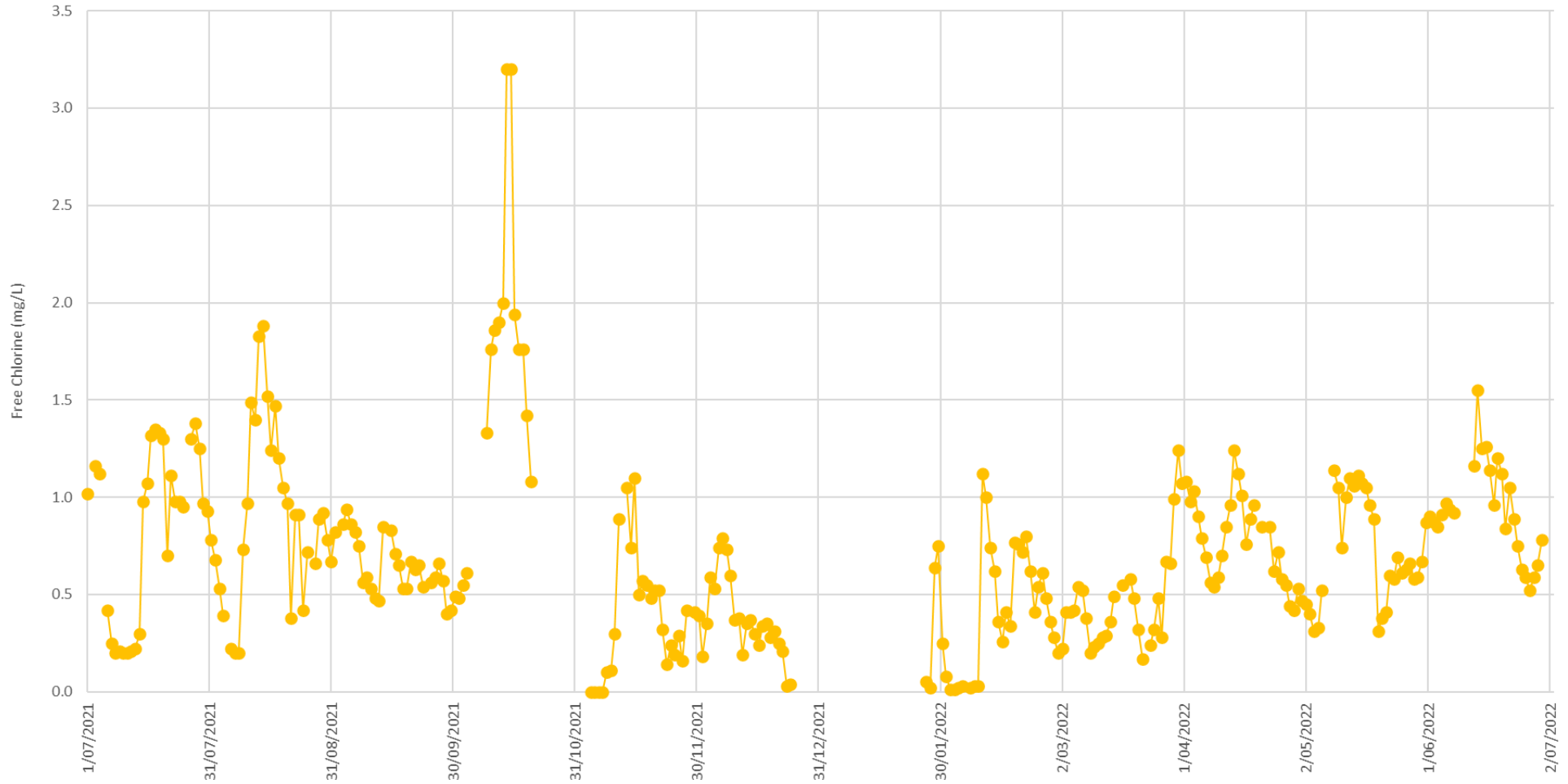
# FREE CHLORINE IN RETICULATION NETWORK

Free chlorine - Windorah



# FREE CHLORINE IN RETICULATION NETWORK

Free chlorine - Stonehenge



**Table 3 - Reticulation *E. coli* verification monitoring**

**CALCULATE PERCENTAGE USING A TWELVE (12) MONTH 'ROLLING' ANNUAL VALUE**

The *Public Health Regulation 2005* (the regulation) requires that 98 per cent of samples taken in a 12 month period should contain no *E. Coli*. This requirement is referred to as the 'annual value' in Schedule 3A of the regulation.

This requirement comes into effect once you have 12 months data and should be assessed every month based on the previous 12 months data (so that it is a 'rolling' assessment).

**Drinking water scheme:** Jundah

Year	2021 to 2022											
Month	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
<b>No. of samples collected</b>	3	8	7	1	11	8	8	8	11	4	8	12
<b>No. of samples collected in which <i>E. coli</i> is detected (i.e. a failure)</b>	0	0	0	0	0	0	4	0	0	0	0	0
<b>No. of samples collected in previous 12 month period</b>	82	78	78	76	79	79	83	83	83	84	84	89
<b>No. of failures for previous 12 month period</b>	0	0	0	0	0	0	4	4	4	4	4	4
<b>% of samples that comply</b>	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	95.2%	95.2%	95.2%	95.2%	95.2%	95.5%
<b>Compliance with 98% annual value</b>	YES	YES	YES	YES	YES	YES	NO	NO	NO	NO	NO	NO

Drinking water scheme: Windorah

Year	2021 to 2022											
Month	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
No. of samples collected	8	4	8	4	12	4	8	8	12	4	4	12
No. of samples collected in which <i>E. coli</i> is detected (i.e. a failure)	0	0	0	0	0	0	0	0	0	0	0	0
No. of samples collected in previous 12 month period	102	98	94	92	96	92	92	92	92	92	84	88
No. of failures for previous 12 month period	0	0	0	0	0	0	0	0	0	0	0	0
% of samples that comply	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Compliance with 98% annual value	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Drinking water scheme: Stonehenge

Year	2021 to 2022											
Month	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
No. of samples collected	8	8	8	4	12	8	8	13	12	4	8	8
No. of samples collected in which <i>E. coli</i> is detected (i.e. a failure)	0	0	0	0	0	0	0	0	0	0	0	0
No. of samples collected in previous 12 month period	104	104	100	100	104	104	104	105	105	105	101	101
No. of failures for previous 12 month period	0	0	0	0	0	0	0	0	0	0	0	0
% of samples that comply	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Compliance with 98% annual value	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

## Appendix B – Implementation of the DWQMP Risk Management Improvement Program



**Table 4 – Progress against the risk management improvement program in the approved DWQMP**

# JUNDAH

Process Step	Primary hazard	Source of Hazard/Event	Primary Preventive Measure	Residual Risk	RMIP			Comments	Status
				Risk Level	Immediate	Short Term	Long Term		
Water source - Thomson River	Protozoa (Crypto/Giardia) (Source Water)	On-site sewage management system discharges and failures	Media Filter	Extreme 20	Purchase turbidity meter - install as soon as possible. Undertaking potholing as first stage of developing shovel ready treatment plant upgrade proposal	Install turbidity meter and re-establish SMS alarms immediately on installation. Replace filter media with sand and GAC. Prepare concept plan for new water treatment plant for funding applications. Investigate UV disinfection	If turbidity remains high with new filter media, consider need for UV disinfection prior to new treatment plant. New treatment plant with monitoring and control if funding requests are successful	New meter purchased and installed. SMS alarms still to be completed. Filter media currently planned to be replaced in February 2023. Potholing completed. Council has secured funding to develop the design of a replacement WTP. Expected to be completed in July 2023.	
Water source - Thomson River	Protozoa (Crypto/Giardia) (Source Water)	Unrestricted access to livestock or wild/feral animals/birds	Media Filter	Extreme 20	Purchase turbidity meter - install as soon as possible. Undertaking potholing as first stage of developing shovel ready treatment plant upgrade proposal	Install turbidity meter and re-establish SMS alarms immediately on installation. Replace filter media with sand and GAC. Prepare concept plan for new water treatment plant for funding applications. Investigate UV disinfection	If turbidity remains high with new filter media, consider need for UV disinfection prior to new treatment plant. New treatment plant with monitoring and control if funding requests are successful	New meter purchased and installed. SMS alarms still to be completed. Filter media currently planned to be replaced in February 2023. Potholing completed. Council has secured funding to develop the design of a replacement WTP. Expected to be completed in July 2023.	
Water source - Thomson River	Bacteria/ Virus (Source Water)	Flood event, storm flow	Chlorine	Medium 6	Install chlorine meter	Prepare concept plan for new water treatment plant for funding applications. Consider gas chlorination/ Investigate UV disinfection		New meter purchased and installed. Council has secured funding to develop the design of a replacement WTP. Expected to be completed in July 2023.	
Water source - Thomson River	Turbidity	Drought, bushfire, runoff	Coag and settling tank	High 12	Undertaking potholing as first stage of developing shovel ready treatment plant upgrade proposal	Prepare concept plan for new water treatment plant for funding applications	New treatment plant with monitoring and control if funding requests are successful	Filter performance not able to be accurately determined due to lack of online monitoring. Potholing completed. Council has secured funding to develop the design of a replacement WTP. Expected to be completed in July 2023.	
Water source - Thomson River	Colour	Naturally occurring in raw water		High 12	Undertaking potholing as first stage of developing shovel ready treatment plant upgrade proposal	Prepare concept plan for new water treatment plant for funding applications	New treatment plant with monitoring and control if funding requests are successful	Historical WQ data indicates high raw water true colour Potholing completed. Council has secured funding to develop the design of a replacement WTP. Expected to be completed in July 2023.	
Poly dosing	Turbidity	Pump failure/underdosing	Daily checks	Medium 9		new treatment plant to have specifications for duty standby pumps		Nalco 8103 plus used as the coagulant. Robust performance over range of turbidity expected. Currently, coagulant is dosed with daily turbidity check only analysis of performance Development of specifications yet to commence.	
Poly dosing	Turbidity	Overdosing	Daily checks	Medium 6		new treatment plant to have specifications for duty standby pumps		Development of specifications yet to commence.	
Media Filter	Protozoa (Crypto/Giardia) (Source Water)	Inadequate filter operation or backwashing, mudball formation	Filter backwash	Extreme 20	Purchase turbidity meter - install as soon as possible. Undertaking potholing as first stage of developing shovel ready treatment plant upgrade proposal	Install turbidity meter and re-establish SMS alarms immediately on installation. Replace filter media with sand and GAC. Prepare concept plan for new water treatment plant for funding applications. Investigate UV disinfection	If turbidity remains high with new filter media, consider need for UV disinfection prior to new treatment plant. New treatment plant with monitoring and control if funding requests are successful	Potential evidence of filter operational issues. Filter media needs replacing. Chlorination effectiveness unlikely to be impacted, but cryptosporidium removal could not be guaranteed. New meter purchased and installed. SMS alarms still to be completed. Filter media currently planned to be replaced in February 2023. Potholing completed. Council has secured funding to develop the design of a replacement WTP. Expected to be completed in July 2023.	
Media Filter	Turbidity	Media loss	Media level testing	Medium 9		Replace media		Filter media currently planned to be replaced in February 2023.	
Chlorine dosing	Bacteria/ Virus (Reticulation)	Pump failure/underdosing	Chlorine dosing, daily checks	Extreme 20	Purchase chlorine meter - install as soon as possible. Undertaking potholing as first stage of developing shovel ready treatment plant upgrade proposal	Install chlorine meter and re-establish SMS alarms to operators. Prepare concept plan for new water treatment plant for funding applications	New treatment plant with monitoring and control if funding requests are successful	Single dosing pump and reliant on operator to identify issues. Historically a high chlorine dose would have mitigated a short term failure, but with need to reduce dose to mitigate chlorate, the risk of underdosing is higher. New meter purchased and installed. SMS alarms still to be completed. Council has secured funding to develop the design of a replacement WTP. Expected to be completed in July 2023.	
Chlorine dosing	Chlorine	Overdosing	Chlorine concentration manual daily checks	Medium 9	Purchase chlorine meter - install as soon as possible.	Install chlorine meter and re-establish SMS alarms to operators. Prepare concept plan for new water treatment plant for funding applications	New treatment plant with monitoring and control if funding requests are successful	Elevated free chlorine in network unlikely due to excessive detention time in clear water tank and reservoir before distribution to network, resulting in excessive chlorine deterioration, especially in higher temperatures. Chlorine differential between two tanks can be as high as 6 mg/L between the clear water tank and the reservoir. Based on dosing rates, total chlorine levels in network need to be explored New meter purchased and installed. SMS alarms still to be completed. Council has secured funding to develop the design of a replacement WTP. Expected to be completed in July 2023.	
Chlorine dosing	Chlorate	Breakdown of chlorine solution	Active management of chlorine stocks	High 12	Dilution of stock solution, and change in monitoring to target fresh batches to allow for disposal of out of specification chemical if necessary.	Prepare concept plan for new water treatment plant for funding applications	New treatment plant with monitoring and control if funding requests are successful	Chlorate management has to be balanced against effective disinfection. Change to batching of chlorine solution has been implemented. Council has secured funding to develop the design of a replacement WTP. Expected to be completed in July 2023.	
Reservoir	Bacteria/ Virus (Reticulation)	Excessive water detention leading to chlorine deterioration	System integrity	Medium 6	Main break repair to include requirement for disinfection by either addition of granular chlorine to repaired section, or by increasing chlorine from treatment plant and flushing chlorine through the reticulation network	Replace blue treated water reservoir.		Mains disinfection covered in 'Disinfection of Water Mains (potable supply)' procedure. Council has secured funding to replace the blue treated water reservoir with work currently planned to commence in February 2023.	
Reticulation	Taste and odour	Stagnation	Removal of dead ends, ring main circuit	Low 1		Complete installation of scour valves		Currently undertaking program of fitting of scour valves to enable scouring Ongoing with funding in the 2022/23 budget	
Whole of system	All hazards	Inadequate online monitoring or control	Inline turbidity and chlorine meter	High 15		Investigate replacing turbidity and chlorine meters on old plant or progress new treatment plant funding applications.		Turbidity analyser not operational during site visit due to calibration issues. Difficulty in accessing calibration standards due to isolated locality. Chlorine and turbidity inline analysers recently checked against handheld meters, inline meter accuracy issues detected New meter purchased and installed. Council has secured funding to develop the design of a replacement WTP. Expected to be completed in July 2023.	
Whole of system	All hazards	Inadequate operators/staff training	WTP operators completed Cert III in water industry treatment	Medium 8		Currently manage. Ensure contingency planning if operators move on.		Risk is when main operators are on leave - however have increased level of training so that there are 2 main operators a third trained person. Additional staff trained in WTP operation and Cert III	
Whole of system	All hazards	Not having operational procedures developed/available	DWQMP procedures developed	High 15	Ensure all CCP traffic light procedures are laminated and present in the treatment plant.			Completed	

# WINDORAH

Process Step	Primary hazard	Source of Hazard/Event	Primary Preventive Measure	Residual Risk	RMIP			Comments	Status
				Risk Level	Immediate	Short Term	Long Term		
Water source - Cooper Creek Waterholes	Protozoa (Crypto/Giardia) (Source Water)	Septic system overflows, discharges and failures	Media Filter	Extreme 20		New Treatment plant in construction, will be commissioned in early 2022. Multiple barriers, full SCADA control.		Backwash manually instigated. Backwash based on turbidity, or minimum frequency of every second day. Filter performance currently not meeting ADWG threshold for effective filter performance for protozoa removal (<0.2 NTU)	New WTP commissioned in October 2022.
Water source - Cooper Creek Waterholes	Protozoa (Crypto/Giardia) (Source Water)	Unrestricted access to livestock or wild/feral animals/birds	Media Filter	Extreme 20		New Treatment plant in construction, will be commissioned in early 2022. Multiple barriers, full SCADA control.		Cattle able to access raw water source. Campers often located adjacent to raw water off-takes	Please see above
Water source - Cooper Creek Waterholes	Colour	Naturally occurring in raw water	Mixed media filter (activated carbon)	High 12		New Treatment plant in construction, will be commissioned in early 2022. Multiple barriers, full SCADA control.		Historical WQ data indicates high raw water true colour	Please see above
Coagulation /floculation	Turbidity	Inadequate mixing or inadequate clarifier detention time	Static inline mixer; flow limited at approx. 2.3 L/s	High 12		New Treatment plant in construction, will be commissioned in early 2022. Multiple barriers, full SCADA control.		Carry-over of floc currently occurring from settling tank	Please see above
Media Filter	Protozoa (Crypto/Giardia) (Source Water)	Inadequate filter operation or backwashing, mudball formation	Daily turbidity monitoring	Extreme 20		New Treatment plant in construction, will be commissioned in early 2022. Multiple barriers, full SCADA control.		Following on from backwash, filter media does not settle well. Currently having issues with in-line turbidity meter. Average filter output turbidity 0.39 NTU, with 95th percentile 0.72 NTU	Please see above
Media Filter	Protozoa (Crypto/Giardia) (Source Water)	Excessive filter flow rates, filter preferential flow	Filter flow rate limited by plant design	High 10		New Treatment plant in construction, will be commissioned in early 2022. Multiple barriers, full SCADA control.		Backwash currently manually operated. Backwash tank fed from high level res. Backwash tank has large amount of algal growth	Please see above
Media Filter	Turbidity	Media loss	Media inspection and replacement	High 10		New Treatment plant in construction, will be commissioned in early 2022. Multiple barriers, full SCADA control.		Filter media periodically replaced	Please see above
Chlorine dosing	Bacteria/ Virus (Reticulation)	Pump failure/underdosing	Spare chlorine dosing pump maintained on-site	Extreme 20		New Treatment plant in construction, will be commissioned in early 2022. Multiple barriers, full SCADA control.		Need to record chlorine dosing rate. Chlorine sampling and testing issues (refer to discussion below)	Please see above
Chlorine dosing	Bacteria/ Virus (Reticulation)	Inadequate chlorine c.t.	Clear water tank and reservoir	High 10		New Treatment plant in construction, will be commissioned in early 2022. Multiple barriers, full SCADA control.		Maintaining chlorine dosing above 0.7 mg/L ensures adequate chlorine c.t. Current WTP target chlorine dosing threshold = 1.5 mg/L.	Please see above
Chlorine dosing	Chlorate	Excessive storage tank detention	Water storage turnover	High 12	Dilution of sodium hypochlorite stocks 200L to 600 L. Ensure Ct in clear water tank, not aim for residual in town in Summer 2021	Gas chlorination as part of new WTP to be commissioned in 2022.		Current dosing post-filter causes large amounts of chlorine degradation, especially in summer, resulting in excessive chlorine dosing, but inadequate chlorine in network. This is also contributing to elevated chlorate concentrations.	Change to batching of chlorine solution has been implemented. Gas chlorination implemented with new WTP commissioning in October 2022.
Clear water tank/reservoir	Protozoa (Crypto/Giardia) (Retic)	Animal access including birds, amphibians, reptiles or rodents	Tank hatches	High 15		New Treatment plant in construction, will be commissioned in early 2022. Multiple barriers, full SCADA control.		Unprotected access to clear water tank identified during site visit. Swallows currently nesting under clear water tank platform	Please see above
Reticulation	Bacteria/ Virus (Reticulation)	New mains	New mains hygiene practices	High 15		New Treatment plant in construction, will be commissioned in early 2022. Multiple barriers, full SCADA control.		Fittings were seen during site visit stowed under bird nests beneath high level tank, with bird faecal matter observed on the fittings	Please see above
Whole of system	All hazards	Inadequate online monitoring or control	Inline turbidity and chlorine meter	High 15		New Treatment plant in construction, will be commissioned in early 2022. Multiple barriers, full SCADA control.			Please see above
Whole of system	All hazards	Not having operational procedures developed/available	DWQMP procedures developed	High 15		New Treatment plant in construction, will be commissioned in early 2022. Multiple barriers, full SCADA control. Operators to be trained on new plant as part of commissioning.			Please see above

# STONEHENGE

Process Step	Primary hazard	Source of Hazard/Event	Primary Preventive Measure	Residual Risk	RMIP			Comments	Status
				Risk Level	Immediate	Short Term	Long Term		
Water source - Thomson River Weir	Protozoa (Crypto/Giardia) (Source Water)	On-site sewage management system discharges and failures; Unrestricted access to livestock or wild/feral animals/birds	GAC filter	Extreme 20	Obtain costings for UV unit and present to Council	Replacement of GAC filter with media filtration		New treatment plant with monitoring and control considered in long term planning. Not yet sufficiently progressed to identify in improvement plan.	Costings for UV disinfection obtained and awaiting presentation to Council. Replacement of filter awaiting final long term replacement options to be presented and adopted by Council.
Pressure filter	Protozoa (Crypto/Giardia) (Source Water)	Inadequate filter operation or backwashing	Turbidity monitoring	Extreme 20	Purchase turbidity meter. Obtain costings for UV unit and present to Council	Install meter as soon as received and reinstate SMS alarms. Replacement of GAC filter with media filtration.			New meter purchased and installed. SMS alarms still to be completed. Costings for UV disinfection obtained and replacement of filter awaiting final long term replacement options to be presented and adopted by Council.
Pressure filter	Protozoa (Crypto/Giardia) (Source Water)	Excessive filter flow rates, filter preferential flow	Turbidity monitoring	High 10	Purchase turbidity meter. Obtain costings for UV unit and present to Council	Install meter as soon as received and reinstate SMS alarms. Replacement of GAC filter with media filtration.			New meter purchased and installed. SMS alarms still to be completed. Costings for UV disinfection obtained and replacement of filter awaiting final long term replacement options to be presented and adopted by Council.
Chlorine dosing	Bacteria/ Virus (Reticulation)	Pump failure/underdosing	Critical control points with daily grab samples	Extreme 20	Purchase chlorine meter	Installing a chlorine meter and reinstate SMS alarms			New meter purchased and installed. SMS alarms still to be completed.
Chlorine dosing	Chlorine	Overdosing	CCP with daily grab samples	Medium 9	Purchase chlorine meter	Installing a chlorine meter and reinstate SMS alarms			New meter purchased and installed. SMS alarms still to be completed.
Chlorine dosing	Bacteria/ Virus (Reticulation)	Inadequate chlorine c.t.	Clear water tank plus high level tank ensures adequate c.t.	Medium 6	Purchase chlorine meter	Installing a chlorine meter and reinstate SMS alarms		Chlorine CT validated in this recent update to the DWQMP	New meter purchased and installed. SMS alarms still to be completed.
Chlorine dosing	Chlorate	Excessive storage tank detention		High 12	Re-batch chlorine every week. Make new batch in a new storage container, and dispose of old solution and clean old container. Monitor 3 monthly, and source new chlorine if chlorate levels increase above 0.8 mg/L.	Consider UV and or chlorine gas as disinfection method			Change to batching of chlorine solution has been implemented. Consideration of UV and/or chlorine gas disinfection awaiting final long term replacement options to be presented and adopted by Council.
Whole of system	All hazards	Inadequate online monitoring or control	Daily operator monitoring	High 15	Within 6 weeks order turbidity and chlorine meters	Install turbidity meters as soon as received and reinstate SMS alarms.	Determine long term strategy for Stonehenge as new treatment plant may be better than retrofitting full SCADA control on current WTP.		New meter purchased and installed. SMS alarms still to be completed. Long term replacement options to be presented and adopted by Council in early-mid 2023.
Whole of system	All hazards	Not having operational procedures developed/available	DWQMP procedures developed	High 15	Ensure all CCP traffic light procedures are laminated and present in the treatment plant.				Completed