



BOULIA DRINKING WATER QUALITY MANAGEMENT PLAN

Service Provider ID 18

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GLOSSARY

ADWO	Acting Director of Works and Operations
ADWG	Australian Drinking Water Guidelines
BSC	Boulia Shire Council
CEO	Chief Executive Officer
CCP	Critical Control Point
DWSP	Drinking Water Service Provider
DWQMP	Drinking Water Quality Management Plan
<i>E. coli</i>	<i>Escherichia coli</i>
GAB	Great Artesian Basin
mg/L	Milligrams per Litre
NTU	Nephelometric Turbidity Unit
OCP	Operational Control Point
O & M	Operation and Maintenance
PFAS	Per - and Polyfluoroalkyl Substances
PVC	Polyvinyl Chloride
QWSR	Queensland Water Supply Regulator
RA	Risk Assessment
Regulator, DLGWV	Department of Local Government, Water and Volunteers
RMIP	Risk Management Improvement Programme
SCADA	Supervisory Control and Data Acquisition
SPID	Service Provide Identification Number
WSP	Water Service Provider
WTP	Water Treatment Plant

1.0 INTRODUCTION

1.1 Drinking Water Quality Management Plan Overview

This document describes how Boulia Shire Council provides a safe and reliable drinking water service to the community of Boulia in conjunction with the *Water Supply (Safety and Reliability) Act 2008 (the Act)* which commenced on the 1st of July 2008.

The purpose of *the Act* is to provide for the safety and reliability of water supply throughout Queensland and it includes provisions relating to the management of drinking water quality, aimed at protecting public health. This outcome is achieved primarily through a regulatory framework for drinking water quality which requires Drinking Water Service Providers to:

- Undertake monitoring and reporting on drinking water quality;
- Have an approved Drinking Water Quality Management Plan (DWQMP).

This DWQMP was prepared in-line with the DWQMP Guideline issued by the Department of Local Government, Water and Volunteers (DLGWV).

The operation of a water service or a drinking water service is also covered under other State and Commonwealth Legislation. The requirements of the *Water Supply (Safety and Reliability) Act 2008* do not negate the requirements of other Legislation unless expressly stated. The Drinking Water Service Provider (DWSP) is responsible for obtaining any necessary approvals under other Acts to ensure the compliant operation of their services. Other State and Commonwealth Legislation relating to the operations of water services may include:

- *Water Legislation Act 2016*
- *Public Health Act 2005*
- *Public Health Regulation 2018*
- *Plumbing and Drainage Act 2018*
- *Planning Act 2016*
- *Disaster Management Act 2003*
- *Environmental Protection Act 1994*
- *Water Act 2000*
- *Trade Practices Act 1974*
- *Work Health and Safety Act 2011*
- *Food Act 2006*

1.2 Registered Service Details

This DWQMP Plan relates to the water supply services owned and operated by:

Boulia Shire Council, Service Provider ID 18

18 Herbert Street

BOULIA 4829

P: (07) 4746 3188

E: admin@boulia.qld.gov.au

The first point of contact in relation to this plan is:

Shane Gray, Chief Executive Officer

P: (07) 4746 3188

M: 0429 463 188

E: ceo@boulia.qld.gov.au

1.3 Chief Executive Officer Endorsement

Boulia Shire Council recognises the importance of this DWQMP in the management and provision of safe and reliable drinking water services to the reticulated parts of the Shire. BSC aims to maintain an integrated approach to ensuring that the requirements of this DWQMP are adhered to by all BSC staff and any contractors operating on behalf of BSC. In particular, BSC endorses all outcomes from the current Risk Assessment and all items outlined in the Risk Management Improvement Programme.

Shane Gray
.....

Date.....12/05/2026.....

Shane Gray

Chief Executive Officer

1.4 Boulia Shire Council

The Boulia Shire is located in Queensland's central-west and covers an area of 61,176km² with a population of approximately 458 people (as per the 2021 census from the Australian Bureau of Statistics; Figure 1). The Shire consists of two towns; Boulia and Urandangi. The administrative center of the Shire and main works depot are located in Boulia, approximately 450km west of Longreach.

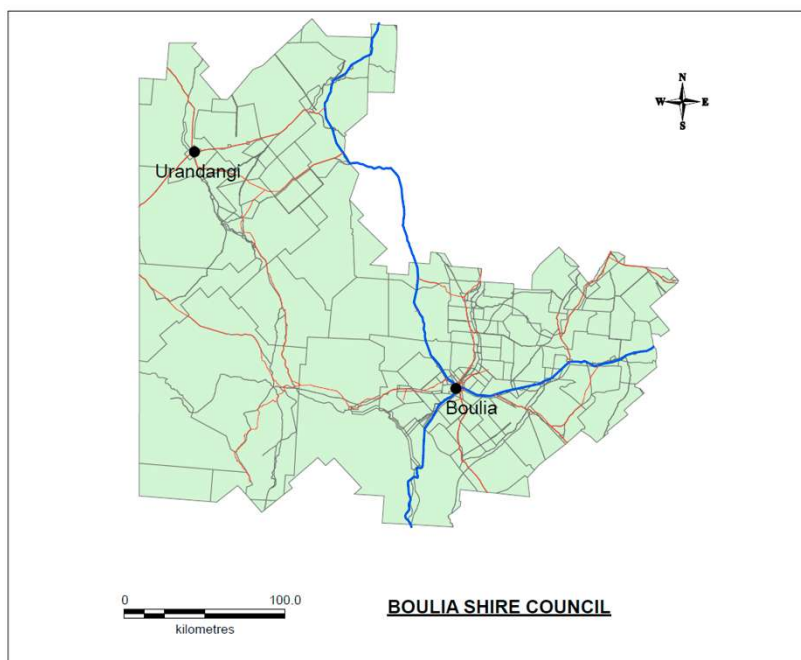


Figure 1: Boulia Shire Council.

Council only provides potable water to the town of Boulia, which sources its water from sub-artesian bores. The Urandangi drinking water scheme, which also sources its water from sub-artesian bores, was transitioned to a non-potable scheme in December 2024 following on from several flood events which caused wide-scale infrastructure damage, making it no longer viable to run the scheme as a potable service.

Table 1 below outlines the current population and connections for the towns of Boulia and Urandangi, whilst Figure 2 depicts Boulia Shire Council's location in relation to Queensland's major centers.

Table 1: Boulia Shire Council water supply details.

Scheme Name	Communities Served	Water Source	Treatment	Current (2026)*		
				Population	Connections	Average Demand
Boulia	Boulia	Sub-artesian bores	Chlorination	325	131	74.1
Urandangi	Urandangi	Sub-artesian bores	Not applicable – non-potable scheme.			

* Current population trends are taken from Council's 2024-25 FY KPI reporting. The QLD Government's Statistics Office indicated that the average annual growth rate for Outback QLD in the last 5 years (2021-26) was 0.3%, with a projected increase of 0.4% for the next five years (2026-31). Therefore, future water demand for the towns is estimated to remain unchanged.

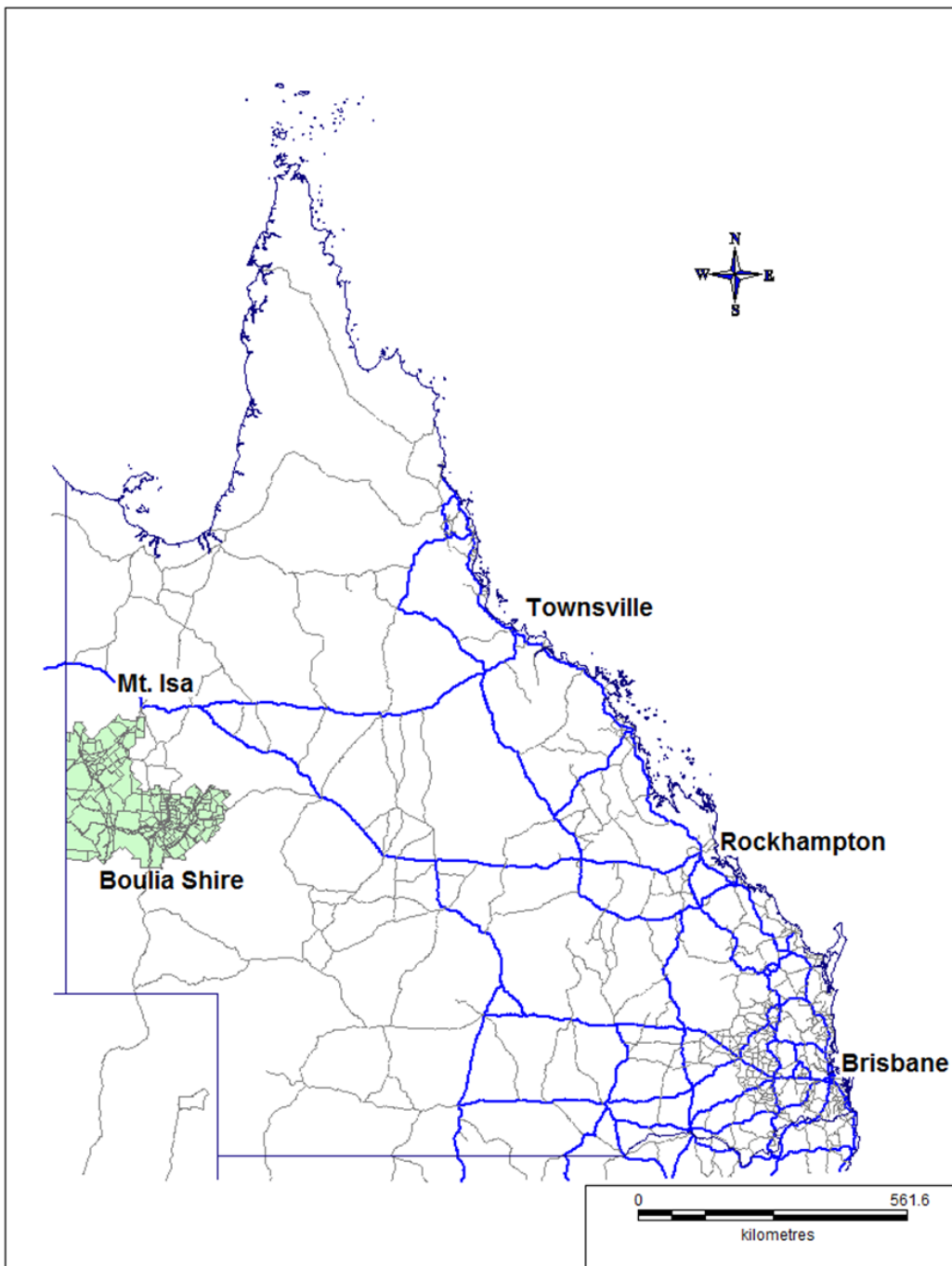


Figure 2: Boulia Shire Council area and location relative to Queensland.

1.5 Boulia Shire Council Stakeholders

Table 2: Boulia Shire Council stakeholders.

Organisation	Contact Name and Details	DWQMP Relevance	How the stakeholder is engaged in the DWQMP
Boulia Shire Council	Shane Gray Chief Executive Officer P: (07) 4746 2116 E: ceo@boulia.qld.gov.au	Council CEO	DWQMP oversight.
	Gordon Magann Acting Director of Works and Operations P: (07) 4746 3188 M: 0409 028 474 E: dwo@boulia.qld.gov.au	Manager of Infrastructure and Projects	Risk management participant and DWQMP implementation.
	Mari Gunderson Storeperson P: (07) 4746 2144 M: 0427 128 212 E: store@boulia.qld.gov.au	Water Operator	Risk management participant and DWQMP implementation.
	Jade Sacipovic Water Operator P: (07) 4746 2144 E: boulia21@hotmail.com	Water Operator	DWQMP implementation.
GBA Consulting Engineers	Stuart Bourne Partner P: (07) 4651 5177 E: GBourne@gbaengineers.com.au	Planning, design and construction of works	Risk management participant and engineering support.
	Isabeau Gavel Senior Environmental Officer P: (07) 4651 5177 M: 0418 411 920 E: igavel@gbaengineers.com.au	Consultancy services	Risk management participant and preparation of DWQMP and Annual Reports.
Saintelex Australia Pty Ltd	Glenn Sainty P: 0455 566 193 E: gsainty@saintelexcaust.com.au	External Contractor	Servicing of Electrochlorination Unit
Water Supply Regulator	P: 1300 596 709 (24-hour hotline) E: DrinkingWater.Reporting@dlgwv.qld.gov.au	Water Supply Regulator	Approval of DWQMP documentation.
Queensland Health Public Health Unit	82-86 Bolsover Street, Rockhampton QLD 4700 PO Box 946, Rockhampton QLD 4700 P: (07) 4920 6989	Public Health Unit	Advice regarding Public Health.
SGS Melbourne EH&S	10/585 Blackburn Rd, Notting Hill VIC 3186 P: (03) 9574 3200 E: Au.SampleReceipt.Melbourse@sgs.com	Water Analysis Authority	Chemical Analysis.

Organisation	Contact Name and Details	DWQMP Relevance	How the stakeholder is engaged in the DWQMP
Mt Isa Waterboard	31 Carbonate St, Mt Isa 4825 P: 0434 094 743 E: info@mountisawater.qld.gov.au	Water Analysis Authority	Chemical Analysis (specifically <i>E.coli</i> monitoring).
QLD Government Chief Information Office	P: (07) 3215 3951 E: ggisvrt@qld.gov.au	Cyber Security Hotline	Cyber Security Assistance.
Boulia Town Sensitive Users			
Boulia Primary Health Care Centre	49 Wills St, Boulia QLD 4829 P: (07) 4746 2300	Sensitive User	Sensitive User.
Boulia State School	Templeton St, Boulia, QLD 4829 P: (07) 4746 3151	Sensitive User	Sensitive User.

2.0 CATCHMENT CHARACTERISTICS

2.1 The Great Artesian Basin

The Boulia Shire is located in Central-western QLD's Channel Country bordered by the Northern Territory to the west, Diamantina Shire to the south, Winton Shire to the east and Mt Isa and Cloncurry Shires to the north. Three major river systems flow through the Shire, the Georgine River (flowing past Urandangi in the north), the Burke River (on which the town of Boulia is situated) and the Hamilton River (flows in the Shire's east), all of which form part of the broader Lake Eyre Catchment.

The average annual rainfall for Boulia is 257.6mm with a mean maximum temperature of 31.8°C. Majority of the rain falls during the wet season between late November and April. Very little rainfall is needed to bring the country to a standstill. Following flood rains, the main river channels fill quickly and then spread out either side onto the floodplain. The Burke River often floods during the wet season resulting in the roads to the south of the town being regularly cut. For the rest of the year there is little rainfall in the area and the Burke River volume drops considerably until there is no water and it dries up.

The potable water supply for Boulia is sourced from the Great Artesian Basin (GAB), which covers approximately one-fifth of the Australian continent (Figure 3) and contains 8.7×10^6 GL of groundwater in the Jurassic sandstone aquifers. The GAB is the largest groundwater and artesian basin in the world and supports a wide array of pastoral, agricultural, mining, cultural and tourism activities in addition to rural communities.

The water of the GAB is held in sandstone layers laid down by continental erosion of higher ground during the Triassic, Jurassic, and early Cretaceous periods, during a time when much of what is now inland Australia was below sea level. The sandstone was then covered by a layer of marine sedimentary rock shortly afterwards, forming a confining layer and trapping water in the sandstone aquifer. The age of the groundwater determined by carbon-14 and chlorine-36 measurements combined with hydraulic modelling, ranges from several thousand of years for the recharge areas in the north to nearly 2 million years in the south-western discharge zones. At this age the water would be expected to display a consistent quality.



Figure 3: Great Artesian Basin area and location (blue shading) relative to Australia.

3.0 BOULIA DRINKING WATER SCHEME

The Boulia Drinking Water Scheme consists of six sub-Artesian bores; Town Bores 5-9 (note that old Town Bores 1- 4 have been decommissioned and no longer form part of the water supply system). Being sub-artesian bores that are all <100m deep, the potential for surface contaminants (e.g. septic tank discharges) leaching into the aquifers is high. Therefore, the water is disinfected prior to reticulation.

Water is pumped from all bores on demand and directed into a manifold which combines the raw water. A Salt Water Electrochlorination disinfection system is positioned between the combined raw water manifold and the ground-level reservoir. A small percentage of the raw water line is diverted through the electrochlorination unit and dosed with Sodium Hypochlorite.

The Electrochlorination Unit is filled with salt, which is hydrolysed on-site to produce Sodium Hypochlorite. Water must enter the electrochlorination unit at 30°C, this is achieved by running the water through a cooler located within the WTP. The level of chlorine dosage (kg/hr) is set and controlled by the chlorine residual analyser/controller, with the injection point located upstream of the ground level reservoir. A second analyser and manual Chlorine dosing point is located after the high level reservoir. The dosing rate of this injection point can be adjusted as necessary from the main switch board which is located in the WTP. This second dosing point assists Council in maintaining the Free Chlorine residual throughout the town, particularly when water usage is low during the cooler months. Both analysers continually monitor the Free Chlorine residual at the injection points and this information is displayed on the main switchboard in the WTP.

From the ground-level reservoir, water is either pumped directly to town or into a 26m high elevated reservoir. A remote-controlled system activates the pumps when the elevated reservoir drops below 50% capacity which allows it to be refilled. When the elevated reservoir is at capacity the pumps deactivate. The remote-controlled system is accessible via the internet which displays graphs containing data on bore usage/rotation and reservoir levels. The system can be adjusted by contacting the system operators.

Alarms are in place for when reservoir levels get too low or too high. At the WTP a beacon located on the outside of the building will come on if the system goes off-line but no other alerts (i.e. text message to water operators) are currently available. SCADA and telemetry systems and alarm notifications were supposed to be brought online with the commissioning of the electrochlorination unit in 2024, however, there have been some technical issues that Council are currently troubleshooting with the Contractor. To compensate for this, Council undertakes working day visual inspections of the WTP.

All Water Operators were trained by the Contractor in the operation of the electrochlorination system when it was commissioned. It should be noted that the system has been designed to be as user friendly as possible, with minimal training required. As the system is relatively new, Council are still in the process of writing up in-house operation and maintenance procedures for the WTP's operation, however, an operation manual is kept on-site at the WTP.

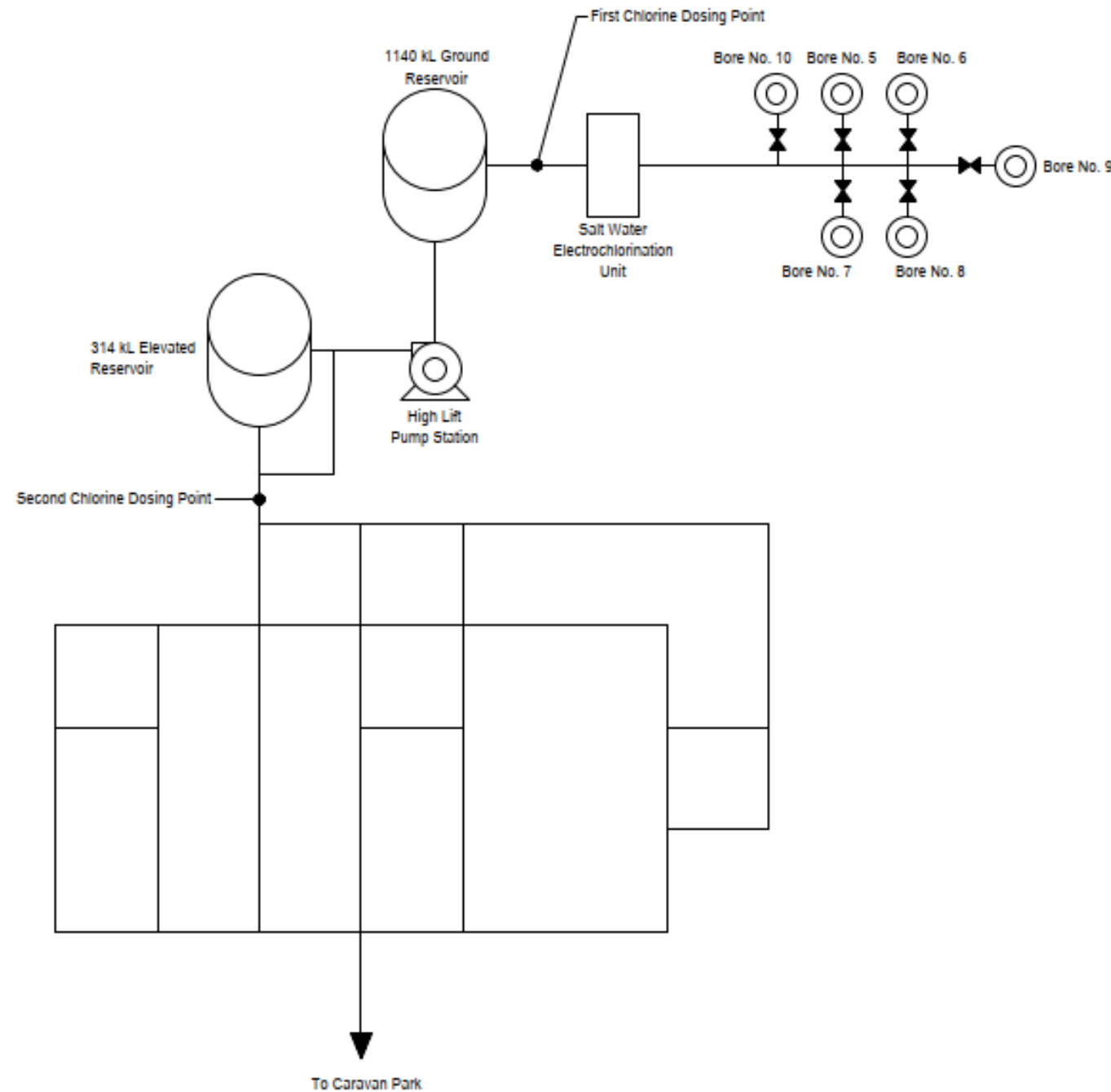
3.1 Infrastructure

Table 3: Boulia drinking water scheme infrastructure details.

Component		Details					
Source Bores	Name	Bore 5 – Hospital	Bore 6 – Airport	Bore 7 – Powerhouse	Bore 8 – SES	Bore 9 – Washdown	Bore 10 – Pump Station
	Details	RN: 93060 Depth: 84.5m Drill Date: 1995 Aquifer: Hooray Sandstone Details: Sealed	RN: 118071 Depth: 82m Drill Date: 2003 Aquifer: Hooray Sandstone Details: Sealed	RN: 146260 Depth: 82m Drill Date: 2010 Aquifer: Hooray Sandstone Details: Sealed	RN: 146262 Depth: 83m Drill Date: 2010 Aquifer: Hooray Sandstone Details: Sealed	RN: 146261 Depth: 78m Drill Date: 2010 Aquifer: Hooray Sandstone Details: Sealed	RN: 209710 Depth: 84m Drill Date: 2024 Aquifer: Hooray Sandstone Details: Sealed
	% of Supply	Varies according to programme, however, Bore 8 (SES) is usually the last to come online and therefore, generally only used when water usage is high.					
	Reliability	100%	100%	100%	100%	100%	100%
	Catchment Categorisation	Class II Vulnerability.					
	Contamination Sources	Agricultural practices, septic tank discharges, industrial wastes.					
	Water Quality Issues	All Bores - Elevated Iron, Total Dissolved Solids and Sodium. Washdown Bay Bore – Occasional elevated Gross Alpha. SES Bore – Elevated Iron and Turbidity.					
Treatment	Electrochlorination	Self regulates Chlorine dosage based on water usage.					
Disinfection	Location	Combined source water line.					
	Type	Sodium Hypochlorite, hydrolysed on-site using salt.					
	Dose Rate	0.04- 0.34 kg/hr					
	Target Residual Levels	Chlorine is dosed at an approximate target of 8L/hr to achieve a target residual between >0.2 mg/L and <5 mg/L. If the Free Chlorine residual cannot be maintained (i.e. if the WTP were to go offline due to a fault), Chlorine tablets can be manually dosed in the ground-level reservoir. However, the high Iron content of Boulia's water makes it harder for the tablets to dissolve. Since the commissioning of the electrochlorination unit, there is also an option to manually dose using the hydrolysed Sodium Hypochlorite.					
	Duty/Standby	Single duty.					

Component		Details
	WTP Automatic Shut-down	The WTP beacon comes on when the water coming into the electrochlorination unit hits 43°C and the plant will shut down when the temperature reaches 45°C. Similarly, the plant will automatically shut down when the Free Chlorine level is too low/high.
Bypasses and Variations		The WTP cannot be bypassed. If it were to shut-down due to a fault or taken off-line, water can still be reticulated from the combined raw water line, through the electrochlorination unit and into the ground level reservoir (and onto the town). If this were to occur, Council can manually dose the ground-level reservoir using Chlorine tablets or Sodium Hypochlorite (if it were still being hydrolysed on-site).
Distribution System	Pipe Material	Poly
		Age range: 12- 32 years (2026)
		Approx. % of total length: 65%
		Rural Poly
		Age range: 10 years (2026)
		Approx. % of total length: 28%
		uPVC
		Age range: 69 years (2026)
		Approx. % of total length: 6%
		Blue Brute
		Age range: 19-24 years (2026)
		Approx. % of total length: 1
	Areas with long detention periods?	None.
	Areas with low water pressure?	None.
Reservoirs	Ground Level	Capacity: 1.14 ML
		Roofed: & vermin-proof: Yes
		Runoff directed off roof: Yes
		Construction materials: Concrete tank, aluminium roof.
	Elevated	Capacity: 0.314 ML
		Roofed: & vermin-proof: Yes
		Runoff directed off roof: Yes
		Construction materials: Galvanised steel.

Boulia Water Distribution Schematic



BORE INFORMATION	
BORE NO.	DATA
Town Bore No. 5 (Hospital) RN 93060	Constructed 1995 Depth 84.5m SWL 21.3m (1995) 5L/S (1995)
Town Bore No. 6 (Airport) RN 118071	Constructed 2003 Depth 82m SWL 31.1m (2003) 5L/S (2003)
Town Bore No. 7 (Power House) RN 146260	Constructed 2010 Depth 82m SWL 39m 2L/S
Town Bore No. 9 (Washdown) RN 146261	Constructed 2010 Depth 84m SWL 27m 4L/S
Town Bore No. 8 (SES / Backup Bore) RN146262	Constructed 2010 Depth 83m SWL 25m 3L/S
Town Bore No. 10 (Pump Station) RN209710	Constructed 2024 Depth 84m SWL 41m 3L/S

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09/03/2026

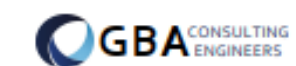


Figure 4: Boulia drinking water supply schematics.

*Note that old town bores 1- 4 have been decommissioned.

3.2 Boulia Disinfection System History

In 2014, a specialist review of the Boulia scheme was undertaken, which identified a significant risk of biological contamination within Boulia's source water. This led to the implementation of a basic disinfection system in 2014 (suspending chlorine tablets in the ground level reservoir) until funding could be sought for a conventional chlorine dosing system. In late 2019, BSC commissioned an automated chlorine gas disinfection plant, chosen due to the benefit of increasing the oxidation of Iron so that it could be precipitated out before entering the distribution system.

Nonetheless, Council experienced challenges in keeping the chlorine gas system operational. The system never operated as designed due to Boulia's harsh climate and it had elements that required specialist expertise to troubleshoot and repair. Additionally, chlorine gas bottles were sourced from Adelaide which posed logistical challenges to allow for the timely arrival of gas so that supplies did not run out.

In June 2024, the gas disinfection system was replaced with a Salt Electrochlorination Unit. This removed the safety hazard associated with the use of Chlorine Gas; however, it has not been in effect long enough to determine if it is robust enough for Boulia's harsh climate.

3.3 Sudden Population Increases

Where an event might cause for sudden population increases, the primary risk to Boulia's drinking water supply is ensuring there is sufficient Sodium Hypochlorite to handle the expected increase in water usage. To manage this, Council will ensure they check all chemical supplies prior to major events. If an issue were to arise, Council's solution would be to move people on to the other towns as quickly as possible. Where this is not feasible, a boil water alert may be considered to compensate for the lack of disinfection or chlorine contact time.

Each year in July, Boulia hosts camel races. During this weekend, the population increases from around 200 people to approximately 3000. To date, this population increase has not negatively impacted upon the town's water quality or supply. Council manages this influx of people to the town by ensuring that operational monitoring is conducted prior to any race events to ensure that there are no issues with the drinking water supply.

4.0 BOULIA DRINKING WATER QUALITY

Boulia Shire Council maintains copies of water quality data from about 2015 onwards, all of which is trended in a master spreadsheet that is regularly updated by GBA Consulting Engineers. It is the responsibility of the Water Operator to ensure all internal and external water quality results are sent to GBA and to ensure all water quality data is reviewed and saved in Council's MAGIQ database. Additionally, Council has a SWIM Local licence which has been used to stored water quality data since 2024.

A review of historical water data for Boulia provides valuable information, assisting Council in understanding their source water characteristics and system performance over time and following specific events (i.e. heavy rainfall). This aids in the identification of hazards and allows for water quality data to be used to inform the Risk Assessment and Risk Management Improvement Programme.

In 2025, Council commissioned a new town Bore (Bore 10 – Pump Station). This was done via. consultation with and approval from the Regulator and QLD Health (approval obtained via email on the 19/11/2025). The water quality data for this new bore has been trended separately for the purpose of this amendment but moving forward will be trended with the rest of Council's town bores.

The data provided in Section 4.1 below confirms that the drinking water supplied by Council generally is within the ADWG with only a few occasional health and aesthetic exceedances (discussed in Section 4.2). Data for the distribution system is trended in Appendix B.

4.1 Boulia Drinking Water Quality Summary

Table 4: Boulia water quality monitoring data – source water (2017-2025).

Analyte	Units	Monitoring	Summary of Results						Guideline Values			
			Samples Tested	Maximum Value	Mean Value	Minimum Values	Std Dev	95 th %	Health	Exceedances	Aesthetic/Operational/Screening	Exceedances
<i>E. coli</i>	CFU/100ml	External	20	12.1	0.605	0	2.6371	0.605	1	1		
Total Coliforms	CFU/100mL	External	20	21.8	2.545	0	6.1314	18.855				
Turbidity	NTU	External	20	11	2.425	0.6	2.1728	5.11			5	1
Dissolved Organic Carbon	mg/L	External	45	5.4	1.1511	0.2	1.0852	3.4				
pH	pH Units	External	20	7.6	7.42	7.3	0.0927	7.6			≥6.5 & ≤8.5	0
Conductivity	µS/cm	External	20	1470	1378.5	1310	37.984	1441.5				
Total Dissolved Solids	mg/L	External	45	860	758.44	690	32.384	808			600	45
Chloride	mg/L	External	45	230	195.78	160	12.2	210			250	0
Fluoride	mg/L	External	45	1.1	0.9571	0.62	0.1148	1.1	1.5			
Selenium	mg/L	External	40	0.001	0.001	0.001	0	0.001	0.004	0		
Silica	mg/L	External	20	18	16.45	15	0.8047	18	80			
Silver	mg/L	External	20	0.001	0.001	0.001	0	0.001	0.1			
Sodium	mg/L	External	45	290	196.89	170	28.349	268			180	28
Nitrate	mg/L	External	20	0.01	0.01	0.01	0	0.01	50	0		
Nitrite	mg/L	External	20	0.01	0.01	0.01	0	0.01	3	0		
Total Iron	mg/L	External	45	0.86	0.2546	0.095	0.1394	0.484			0.3	7
Soluble Iron	mg/L	External	20	0.019	0.0074	0.001	0.0052	0.01805				
Total Manganese	mg/L	External	45	0.11	0.0538	0.023	0.0122	0.0684	0.1	1	0.05	31
Soluble Manganese	mg/L	External	20	0.095	0.0541	0.023	0.0142	0.08455				
Arsenic	mg/L	External	25	0.0025	0.0012	0.0005	0.0007	0.0025	0.01	0		

Analyte	Units		Summary of Results						Guideline Values			
		Monitoring	Samples Tested	Maximum Value	Mean Value	Minimum Values	Std Dev	95 th %	Health	Exceedances	Aesthetic/ Operational/ Screening	Exceedances
Cadmium	mg/L	External	30	0.0005	0.0002	0.00005	0.0002	0.0005	0.002	0		
Chromium	mg/L	External	30	0.0025	0.0012	0.0005	0.0006	0.0025	0.5	0		
Copper	mg/L	External	30	0.01	0.0023	0.001	0.0021	0.005	2	0	1	0
Mercury	mg/L	External	30	0.0005	0.0002	0.00005	0.0002	0.0005	0.001	0		
Lead	mg/L	External	45	0.001	0.0007	0.0001	0.0004	0.001	0.005	0		
Nickel	mg/L	External	5	0.0005	0.0005	0.0005	0	0.0005	0.02	0		
Zinc	mg/L	External	10	0.015	0.0041	0.001	0.0041	0.0105			3	0
Uranium	mg/L	External	41	0.005	0.0015	0.001	0.0013	0.005	0.017	0		
Gross Alpha	Bq/L	External	22	0.668±0.13	0.25±0.06	0.033±0.027	0.15±0.026	0.62±0.1			0.5	2
Gross Beta	Bq/L	External	22	0.303±0.075	0.15±0.05	0.043±0.041	0.075±0.009	0.28±0.073			0.5	0
Aesthetic Guideline Exceedance												
Screening Value Exceedance												
Health Guideline Exceedance												

Table 5: Boulia New Bore 10 – Water Quality Data (2025).

Parameters	Units	Samples Tested	Summary of Results					ADWG Value			
			Maximum Value	Mean Value	Minimum Values	Std Dev	95 th %	Health	Exceedances	Aesthetic/ Operational/ Screening	Exceedances
<i>E.coli</i>	CFU/100mL	3	0	0	0	0	0	1	0		
Total Coliforms	CFU/100mL	3	0	0	0	0	0				
Conductivity	µS/cm	3	1440	1420	1410	14.142	1437				
True Colour	HU	2	5	5	5	0	5			15	0
Dissolved Organic Carbon	mg/L	3	1	1	1	0	1				
pH	pH Units	3	7.6	7.5	7.4	0.0186	7.59			≥6.5 & ≤ 8.5	0
Total Dissolved Solids	mg/L	3	790	783.3	770	9.428	790			600	3
Turbidity	NTU	3	3.1	2.2	1.8	0.613	2.97			5	0
Chloride	mg/L	3	230	220	210	8.16497	229			250	0
Fluoride	mg/L	3	0.9	0.8	0.7	0.0816	0.89	1.5	0		
Nitrate	mg/L	3	0.01	0.01	0.01	0	0.01	50	0		
Nitrite	mg/L	3	0.01	0.01	0.01	0	0.01	3	0		
Sodium	mg/L	3	220	200	180	16.33	218			180	2
Selenium	mg/L	3	0.001	0.001	0.001	0	0.001	0.01	0		
Silica	mg/L	3	11	9	7.9	1.438	10.7			80	0
Silver	mg/L	3	0.001	0.001	0.001	0	0.001	0.1	0		
Total Iron	mg/L	3	0.27	0.25	0.22	0.0216	0.269			0.3	0
Soluble Iron	mg/L	3	0.007	0.0067	0.006	0.00047	0.007				

Parameters	Units	Samples Tested	Summary of Results					ADWG Value			
			Maximum Value	Mean Value	Minimum Values	Std Dev	95 th %	Health	Exceedances	Aesthetic/ Operational/ Screening	Exceedances
Total Manganese	mg/L	3	0.062	0.06	0.056	0.0024	0.062	0.5	0	0.1	0
Soluble Manganese	mg/L	3	0.058	0.0498	0.04	0.007886	0.05785				
Arsenic	mg/L	3	0.0005	0.0005	0.0005	0	0.0005	0.01	0		
Cadmium	mg/L	3	0.00005	0.00005	0.00005	0	0.00005	0.002	0		
Chromium	mg/L	3	0.0005	0.0005	0.0005	0	0.0005	0.05	0		
Copper	mg/L	3	0.001	0.001	0.001	0	0.001	2	0	1	0
Mercury	mg/L	3	0.0001	0.0001	0.0001	0	0.0001	0.001	0		
Lead	mg/L	3	0.0002	0.0002	0.0002	0	0.0002	0.005	0		
Nickel	mg/L	3	0.0005	0.0005	0.0005	0	0.0005	0.02	0		
Zinc	mg/L	3	0.001	0.001	0.001	0	0.001			3	0
Uranium	mg/L	1	0.001	0.001	0.001	0	0.001	0.017	0		
Gross Alpha	Bq/L	3	0.396±0.15	0.236±0.095	0.15±0.049	0.113±0.042	0.373±0.144			0.5	0
Gross Beta	Bq/L	3	0.265±0.064	0.144±0.051	0.055±0.044	0.089±0.009	0.25±0.062			0.5	0
Aesthetic Guideline Exceedance											
Health Guideline Exceedance											

Table 6: Boulia water quality monitoring data – distribution system (2017-2025).

Analyte	Units		Summary of Results						Guideline Values			
		Monitoring	Samples Tested	Maximum Value	Mean Value	Minimum Values	Std Dev	95 th %	Health	Exceedances	Aesthetic/ Operational/ Screening	Exceedances
Free Chlorine	mg/L	In-house	597	1.99	0.82	0	0.39	1.5	5	0	0.2	37
E. coli	CFU/100ml	External	57	0	0	0	0	0	1	0		
Total Coliforms	CFU/100mL	External	18	0	0	0	0	0				
Turbidity	NTU	External	24	1.7	0.7042	0.5	0.326	1.44			5	0
pH	pH Units	External	63	8.1	7.8048	7.3	0.19	8.1			≥6.5 & ≤8.5	0
Conductivity	µS/cm	External	63	1500	1368.3	1300	56.39	1499				
Dissolved Organic Carbon	mg/L	External	63	4.5	1.3476	0.2	1.349	4.3				
True Colour	HU	External	21	5	2.1429	1	1.807	5			15	0
Total Dissolved Solids	mg/L	External	63	970	750.48	670	43.73	819			600	63
Chlorate	mg/L	External	30	0.24	0.0583	0.01	0.076	0.191	0.8	0		
Trihalomethanes	mg/L	External	60	0.046	0.0056	0.002	0.008	0.024	0.25	0		
Chloride	mg/L	External	63	230	204.13	180	12.68	230			250	0
Fluoride	mg/L	External	63	1.3	0.9992	0.8	0.127	1.2	1.5	0		
Selenium	mg/L	External	45	0.001	0.001	0.001	0	0.001	0.004	0		
Silica	mg/L	External	6	24	20.167	16	3.236	23.75			80	0
Silver	mg/L	External	6	0.001	0.001	0.001	0	0.001	0.1	0		
Sodium	mg/L	External	30	240	177.67	150	20.11	210			180	10
Nitrate	mg/L	External	24	0.01	0.01	0.01	0	0.01	50	0		
Nitrite	mg/L	External	24	0.01	0.01	0.01	0	0.01	3	0		
Total Iron	mg/L	External	63	0.71	0.1396	0.026	0.106	0.317			0.3	4
Soluble Iron	mg/L	External	63	0.056	0.0109	0.001	0.01	0.0277				

Analyte	Units		Summary of Results						Guideline Values			
		Monitoring	Samples Tested	Maximum Value	Mean Value	Minimum Values	Std Dev	95 th %	Health	Exceedances	Aesthetic/ Operational/ Screening	Exceedances
Total Manganese	mg/L	External	66	0.18	0.035	0.002	0.029	0.06675	0.1	3	0.05	10
Soluble Manganese	mg/L	External	66	0.047	0.0084	0.0005	0.014	0.04275				
Arsenic	mg/L	External	45	0.001	0.0009	0.0005	0	0.001	0.01	0		
Cadmium	mg/L	External	45	0.0001	9E-05	0.00005	0	0.0001	0.002	0		
Chromium	mg/L	External	45	0.0012	0.0009	0.0005	0	0.001	0.05	0		
Copper	mg/L	External	45	0.021	0.0053	0.001	0.006	0.0174	2	0	1	0
Mercury	mg/L	External	45	0.0004	0.0001	0.00005	0	0.0001	0.001	0		
Lead	mg/L	External	63	0.001	0.0006	0.0002	0	0.001	0.005	0		
Nickel	mg/L	External	6	0.0005	0.0005	0.0005	0	0.0005	0.02	0		
Zinc	mg/L	External	6	0.007	0.0033	0.001	0.002	0.00675			3	0
Uranium	mg/L	External	60	0.001	0.001	0.001	0	0.001	0.017	0		
Gross Alpha	Bq/L	External	11	0.379±0.092	0.24±0.06	0.17±0.05	0.06±0.01	0.34±0.08			0.5	0
Gross Beta	Bq/L	External	11	0.196±0.053	0.14±0.05	0.1±0.04	0.03±0.004	0.19±0.05			0.5	0
Operational Exceedance												
Aesthetic Guideline Exceedance												
Health Guideline Exceedance												

4.2 Boulia Water Quality Summary

Boulia's source water has naturally elevated levels of Turbidity, Iron, Total Dissolved Solids (TDS) and Sodium. In general, the water treatment process addresses the elevated Turbidity and Iron concentrations with minimal ADWG aesthetic exceedances for these parameters detected within the distribution system. However, elevated TDS and Sodium concentrations are often detected above their ADWG aesthetic values in the source and distribution water.

The ADWG aesthetic value for Sodium has been set at 180mg/L, based on the taste threshold for Sodium in water. In terms of health risks associated with the consumption of elevated levels of Sodium, there is evidence linking excess intake with cardiovascular disease, however, Sodium intake via the drinking water supply only makes a modest contribution when compared to an individual's total intake; therefore, no health guideline value has been set for Sodium concentrations in drinking water. It should also be noted that Boulia's average Sodium concentration within the distribution system sits at 178mg/L, under the ADWG aesthetic of 180mg/L.

Regarding TDS, there are no health effects directly associated with elevated concentrations in drinking water, however, concentrations above the ADWG aesthetic value of 600 mg/L can cause palatability issues within the water supply. Boulia's distribution system had an average TDS concentration of 750mg/L, only slightly above the ADWG aesthetic of 600mg/L. Furthermore, no palatability customer complaints have been received, suggesting that these elevated concentrations are not a major issue for the scheme.

Regarding ADWG health exceedances, Council do occasionally detect *E.coli* within their source water. However, there have been no positive *E.coli* detections within the treated water since the implementation of the disinfection system, highlighting the efficacy of the water treatment process. In recent years, Council have experienced several low Chlorine incidents within the scheme, where the Free Chlorine residual within the distribution system has fallen below the lower critical limit of 0.2mg/L. At the time these were reported to the Regulator as drinking water events, with Boil Water Alerts put in place while the events were investigated.

Council have also recently been investigating elevated Manganese and Gross Alpha concentrations within the scheme which are discussed in more detail in Sections 4.21. and 4.2.2 below.

4.2.1 Manganese

Elevated Manganese concentrations were only identified as a potential risk for the scheme in July 2025 when the ADWG health and aesthetic values were revised and lowered. This prompted Council to undertake a review of their historic data (Tables 4 and 6) which concluded that Manganese concentrations within Boulia's source water occasionally fluctuate above the ADWG health and aesthetic values.

As this was only recently identified as a potential risk for the scheme, Council are still investigating and will continue to monitor Manganese concentrations to determine if any further mitigation measures are required. To date, the average Manganese concentration within the distribution system is 0.035mg/L, below the ADWG aesthetic of 0.05mg/L.

4.2.2 Gross Alpha

Council detected two exceedances in Boulia's source water of the ADWG Gross Alpha screening value during 2025, both recorded at the Washdown Bay Bore. Follow-up testing undertaken each time found Gross Alpha concentrations to be within the ADWG screening value. As such, it was concluded that similar to Manganese, Boulia's source water at the Washdown Bay Bore occasionally fluctuates above the ADWG

screening value. As part of this investigation, monitoring for Radium-226, Radium-228 and Uranium-238 was also undertaken which did not identify any exceedances (Table 7).

Table 7: Radionuclide monitoring undertaken in Boulia in response to the 2025 Gross Alpha exceedances.

Analyte	Units	Summary of Results				ADWG Values	
		Samples Tested	Maximum Value	Mean Value	Minimum Values	Screening	Exceedances
Washdown Bay Bore							
Radium-226	Bq/L	2	<0.001	<0.001	<0.001	0.5	0
Radium-228	Bq/L	2	0.156±0.022	0.103±0.0215	0.051±0.021	0.5	0
Uranium-238	Bq/L	2	0.175±0.033	0.148	<0.12	0.5	0
Distribution System							
Radium-226	Bq/L	2	0.093±0.021	0.091±0.0195	0.089±0.018	0.5	0
Radium-228	Bq/L	2	0.19	0.13	0.071±0.028	0.5	0
Uranium-238	Bq/L	2	<0.013	<0.013	<0.013	0.5	0

As the water from Boulia's six bores is blended before being distributed to customers and exceedances are only being detected at the Washdown Bay bore, the risk of Gross Alpha exceedances upon public health is still considered low, particularly as the average concentration within the distribution system is 0.24±0.06 Bq/L, well within the ADWG screening value of 0.5 Bq/L. Therefore, the primary mitigation measure at this stage is for Council to continue monitoring Gross Alpha concentration. If for some reason Council's reliance on the Washdown Bay Bore in the blended water increases, Council will undertake a round of verification monitoring to ensure that safe drinking water is still being provided. However it should be noted that it can take 4-8 weeks for Council to receive external monitoring results for Gross Alpha and thus, it may not be feasible to wait for test results in an emergency.

4.3 PFAS

Council undertook monitoring for PFAS in 2025 as part of the commissioning process for the new town bore (Pump Station Bore). Results from this monitoring are provided in Table 8 below, along with results from monitoring undertaken in 2019. This data was used to inform Boulia's risk assessment provided in Section 5 below.

Table 8: PFAS sampling undertaken within the Boulia scheme.

Characteristic	26/02/2019	26/08/2025
Perfluorooctanoic Acid (PFOA; mg/L)		
Boulia Council Depot	<0.000001	
Bore 5 (Hospital)		<0.000002
Bore 6 (Airport)		<0.000002
Bore 10 (Pump Station)		<0.000002
<i>Health (0.0002mg/L)</i>	<i>0.0002</i>	<i>0.0002</i>
Perfluorooctane Sulfonic Acid (PFOS; mg/L)		
Boulia Council Depot	<0.000002	
Bore 5 (Hospital)		<0.000002
Bore 6 (Airport)		<0.000002
Bore 10 (Pump Station)		<0.000002
<i>Health (0.000008mg/L)</i>	<i>0.000008</i>	<i>0.000008</i>

Perfluorohexane Sulfonic Acid (PFHxS; mg/L)		
Boulia Council Depot	<0.000002	
Bore 5 (Hospital)		<0.000002
Bore 6 (Airport)		<0.000002
Bore 10 (Pump Station)		<0.000002
<i>Health (0.00003mg/L)</i>	<i>0.00003</i>	<i>0.00003</i>
Perfluorobutane Sulfonic Acid (PFBS; mg/L)		
Boulia Council Depot	<0.000004	
Bore 5 (Hospital)		<0.000004
Bore 6 (Airport)		<0.000004
Bore 10 (Pump Station)		<0.000004
<i>Health (0.001mg/L)</i>	<i>0.001</i>	<i>0.001</i>

4.4 Customer Complaints

BSC is committed to providing a level of customer service that does not attract complaints, however, Council acknowledges the right of persons to provide feedback (both positive and negative) on its services and/or to lodge a complaint. Council is therefore equally committed to providing an effective resolution to all complaints received.

All complaints must be received in writing. The formal BSC Complaints Form can be accessed online via the link: <https://www.boulia.qld.gov.au/customer-requestcomplaint-form/customer-requestcomplaint-form-1>

Complaints can also be emailed to admin@boulia.qld.gov.au or lodged via letter or in person at Council's administrative centre:

18 Herbert Street, Boulia QLD 4829

Where assistance is required to lodge a complaint, Council Customer Service staff will provide reasonable assistance, such as helping to fill out the complaint form.

Each complaint received will be acknowledged and recorded in Council's system. Where a complaint cannot be resolved within 10 business days, the receiving officer will negotiate with the complainant a timeframe for the resolution of the complaint.

It should be noted that it is not uncommon for informal complaints to be made to Council. Due to Boulia's small population, most individuals know they can talk directly to the water operators and/or plumbers for any drinking water related issues. If informal complaints are made regarding water quality, these are investigated by Council with details of the investigation outcomes recorded in Council's document management system.

To date, there have been no formal complaints within the Boulia drinking water scheme. Council acknowledges that in the past, informal complaints may have been made and not properly recorded. Moving forward Council will ensure that all informal/formal complaints are documented.

5.0 HAZARD IDENTIFICATION AND RISK ASSESSMENT

The hazard identification and risk assessment for the DWQMP was undertaken using the risk methodology detailed in the Departmental guideline. The Boulia Risk Assessment outlined in Table 14 details the mitigated and unmitigated hazard assessment for the Boulia scheme which includes:

- Identified hazards or hazardous events;
- Hazard or hazardous event sources;
- An assessment of the unmitigated maximum risk level, determined by considering the consequence and likelihood of each hazard or hazardous event occurring in the absence of any controls;
- Existing preventative measures implemented to counteract each hazard or hazardous event to reduce the maximum unmitigated risk level;
- A re-assessed residual risk level which details the final risk level of a hazard or hazardous event that is applicable when the appropriate mitigation measures have been implemented. The residual risk is determined using the same methodology as the initial maximum risk assessment; however, changes to the assessed likelihood should result in an overall lower risk level.

The latest Risk Assessment workshop was held by Council in October 2025 as detailed in Section 5.2 below. This workshop involved a review of Boulia's Risk Assessment with amendments made as necessary. Moving forward, Council intends to review the Risk Assessment every 2 years, to coincide with the DWQMP Regular Reviews. All amendments will be referred to the Acting Director of Works and Operations for input, review and acceptance of the new risk assessment.

5.1 Risk Assessment Methodology

In assessing the risk score of each hazard or hazardous event, the first step is to determine the consequence. Consequence categories used are outlined in Table 9 below.

Table 9: Consequence Descriptors.

Consequence	Descriptors
Insignificant	Negligible injury or health effects, isolated complaints related to aesthetic parameters. Little to no disruption to the normal operation of the scheme.
Minor	Negligible injury or health effects, widespread complaints related to aesthetic parameters.
Moderate	Potential acute health impact or potential chronic health impact.
Major	Acute health impact, no declared outbreak expected.
Catastrophic	Declared outbreak expected with an acute health impact. One or more fatalities or large number of hospitalisations.

Once the consequences were identified, the likelihood of each consequence occurring was determined using the Likelihood categories outlined in Table 10 below.

Table 10: Likelihood Descriptors.

Likelihood	Descriptors
Almost Certain	Expected to occur in most circumstances - hazard is considered to be present on a daily to weekly basis.
Likely	Could occur at some time - occurs more often than once per month and up to once per week.
Possible	Might occur at some time - occurs more often than once per year and up to once a month.
Unlikely	Could occur at some time - unlikely but may occur once every 1- 5 years.
Rare	Hazard is expected to arise in exceptional circumstances; <1 occurrence every 5 years.

The risk scores were then assessed using the likelihood and consequence matrix provided in Table 11 below. The risk score was calculated by the intercept of likelihood and consequence.

Table 11: Risk Matrix used for the Boulia Risk Assessment.

Likelihood	Consequence				
	Insignificant	Minor	Moderate	Major	Catastrophic
Almost Certain	Medium- 6	High- 10	High- 15	Extreme- 20	Extreme- 25
Likely	Medium- 5	Medium- 8	High- 12	High- 16	Extreme- 20
Possible	Low- 3	Medium- 6	Medium- 9	High- 12	High- 15
Unlikely	Low- 2	Low- 4	Medium- 6	Medium- 8	High- 10
Rare	Low- 1	Low- 2	Low- 3	Medium- 5	Medium- 6

Finally, uncertainty was assessed using the definitions outlined in Table 12 below. Assessing uncertainty provides an indication of the need to undertake further work or gather more data to ensure that the risk assessment is accurate and reliable.

Table 12: Uncertainty Definitions used for the Hazard and Hazardous Events Assessment.

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

The acceptable risk level in relation to public health depends very much on the Likelihood and Consequence descriptors used for the assessment. For the criteria used by BSC, all risk levels identified as Medium or less are considered acceptable risks for the scheme.

In some cases, actions have been taken to reduce low or medium level risks, while other high level risks have been left unmitigated. These decisions are based on two factors:

- the magnitude of the risk, and
- the cost and difficulty of actions required to reduce the risk.

All unacceptable risks identified in the Risk Assessment are used to inform the Risk Management Improvement Programme, outlined in Section 6 below.

5.2 Risk Assessment Team

Individuals who participated in the most recent 2024 Risk Assessment workshop are detailed in Table 13 below.

Table 13: Risk assessment workshop 2025 team.

Name	Organisation	Position	Reason For Inclusion
Gordon Magann	BSC	Acting Director of Works and Operations	Supervisor
Andrew Spyarakis	BSC	Works Manager	Supervisor
Mari Gunderson	BSC	Water Operator	WTP Operator
Isabeau Gavel	GBA Consulting Engineers	Senior Environmental Officer	Responsible for DWQMP Amendment

Table 14: Boulia drinking water scheme risk assessment.

RA ID	Hazard/ Hazardous Event	Hazard Source	Unmitigated Risk Assessment			Primary Preventative Measure	Other Preventative Measures	Mitigated Risk Assessment				Documented Procedures	Comments	RMIP Item
			Likelihood	Consequence	Risk Level			Likelihood	Consequence	Risk Level	Uncertainty			
Source Water														
RA1	Bacteria and Virus	Contamination in the artesian aquifer	Likely	Catastrophic	Extreme – 20	Chlorine disinfection	Water quality monitoring at borehead and within the distribution	Rare	Catastrophic	Medium – 6	Confident		Mitigated risk level is as low as possible.	
RA2	Protozoa	Contamination in the artesian aquifer	Likely	Catastrophic	Extreme – 20	Chlorine disinfection	Water quality monitoring at borehead and within the distribution	Rare	Catastrophic	Medium – 6	Confident		Mitigated risk level is as low as possible.	
RA3	Bacteria and Virus	Borehead integrity compromised causing ingress through cracked casing	Unlikely	Catastrophic	High – 10	Chlorine disinfection	Working day visual inspection	Rare	Catastrophic	Medium – 6	Confident	Borehead Inspection Procedure	Mitigated risk level is as low as possible. Boreheads were all sealed in 2019.	
RA4	Protozoa	Borehead integrity compromised causing ingress through cracked casing	Unlikely	Catastrophic	High – 10	Chlorine disinfection	Working day visual inspection	Rare	Catastrophic	Medium – 6	Confident	Borehead Inspection Procedure	Mitigated risk level is as low as possible. Boreheads were all sealed in 2019.	
RA5	Loss of Water Supply	Long-term power supply failure	Possible	Major	High – 12	Back-up generator	Elevated reservoir increases water storage for the town	Rare	Catastrophic	Medium – 6	Confident	Borehead Inspection Procedure	Mitigated risk level is as low as possible.	
RA6	Loss of Water Supply	Bore failure	Possible	Catastrophic	High – 15	Town is supplied by 6x bores, therefore, back-up supplies are available	Working day visual inspections	Rare	Catastrophic	Medium – 6	Confident	Borehead Inspection Procedure	Mitigated risk level is as low as possible. If bores were to fail, the town could be supplied using up to 3x bores during winter and 4x bores during summer with water restrictions in place.	
RA7	Loss of Water Supply	Bore failure caused by flood	Possible	Catastrophic	High – 15	All bores are located above the flood zone	Town is supplied by 6x bores, therefore, back- up supplies are available	Rare	Catastrophic	Medium – 6	Confident		Mitigated risk level is as low as possible.	
RA8	Loss of Water Supply	Bore failure caused by fire	Possible	Catastrophic	High – 15	Bores are located in clear compounds, away from any flammable debris	Town is supplied by 6x bores, therefore, back- up supplies are available	Rare	Catastrophic	Medium – 6	Confident		Mitigated risk level is as low as possible.	
RA9	Loss of Water Supply	Bore failure caused by natural disaster	Possible	Catastrophic	High – 15	Flood and fire (assessed above) are the most likely disasters to impact the	Town is supplied by 6x bores, therefore, back-	Rare	Catastrophic	Medium – 6	Confident		Mitigated risk level is as low as possible.	

RA ID	Hazard/ Hazardous Event	Hazard Source	Unmitigated Risk Assessment			Primary Preventative Measure	Other Preventative Measures	Mitigated Risk Assessment				Documented Procedures	Comments	RMIP Item
			Likelihood	Consequence	Risk Level			Likelihood	Consequence	Risk Level	Uncertainty			
						scheme. GAB water supply provides water security during droughts	up supplies are available							
RA10	Loss of Water Supply	Bore failure caused by sabotage/damage to bore	Possible	Catastrophic	High – 15	Bores are located in locked compounds	Town is supplied by 6x bores, therefore, back-up supplies are available. Working day visual inspections	Rare	Catastrophic	Medium – 6	Confident	Borehead Inspection Procedure	Boulia is a small town, suspicious activity would be noticed. Mitigated risk level is as low as possible.	
RA11	Loss of water supply	3G network outage	Unlikely	Major	Medium – 8	Boulia pump telemetry system was upgraded from 3G to 4G (2022).	Working day inspections of ground level reservoir.	Rare	Major	Medium – 5	Confident			
RA12	Turbidity	Naturally elevated Turbidity levels present in the source water, above the ADWG	Likely	Major	High – 16	Chlorine disinfection	Water quality monitoring	Rare	Major	Medium – 5	Confident		Water quality monitoring shows average Turbidity to be 2.4 NTUs in the source water, within the ADWG aesthetic.	
RA13	TDS/Sodium	Naturally elevated TDS/Sodium levels present in the source water, above the ADWG	Likely	Insignificant	Medium – 5	Water quality monitoring		Likely	Insignificant	Medium – 5	Confident		Water quality monitoring shows only slight elevations above the ADWG aesthetic values. This is considered acceptable by Council.	
RA14	Iron	Naturally elevated Iron levels present in the source water, above the ADWG	Likely	Minor	Medium – 8	Chlorine disinfection to oxidise Iron	Water quality monitoring and blended source water to reduce the effect of elevated concentrations from one bore	Possible	Minor	Medium – 6	Confident		Water quality monitoring shows only occasional elevations above the ADWG aesthetic value in the source water.	
RA15	Manganese	Naturally elevated Manganese levels present in the source water, above the ADWG	Possible	Moderate	Medium – 9	Water quality monitoring	Blended source water to reduce the effect of elevated concentrations from one bore	Possible	Moderate	Medium – 9	Reliable		Water quality monitoring shows occasional elevations above the ADWG aesthetic/health values in the source water, however, average source water concentration is 0.4mg/L, below the ADWG aesthetic.	

RA ID	Hazard/ Hazardous Event	Hazard Source	Unmitigated Risk Assessment			Primary Preventative Measure	Other Preventative Measures	Mitigated Risk Assessment				Documented Procedures	Comments	RMIP Item
			Likelihood	Consequence	Risk Level			Likelihood	Consequence	Risk Level	Uncertainty			
RA16	Radiological Activity	Naturally elevated Radiological Activity levels present in the source water, above the ADWG	Possible	Moderate	Medium – 9	Source water is blended to reduce the effect of elevated Gros Alpha at the Washdown Bay bore	6-monthly water quality monitoring	Possible	Moderate	Medium – 5	Reliable		Potential concern for elevated Gross Alpha at the Washdown Bay Bore, however, monitoring has shown that the blending of the bore water does not carry over exceedances at this bore to the distribution system	
RA17	Heavy Metals	Naturally elevated Heavy Metal levels present in the source water, above the ADWG	Possible	Moderate	Medium – 9	6-monthly verification monitoring		Rare	Moderate	Low – 3	Reliable		Heavy metal monitoring has been undertaken since 2017 with no ADWG exceedances detected	
RA18	PFAS	Naturally elevated PFAS levels present in the source water, above the ADWG	Rare	Moderate	Low – 3	Verification monitoring	Bores are not located near any known PFAS sources	Rare	Moderate	Low – 3	Reliable		Monitoring undertaken in 2019 and 2025 did not identify any PFAS concentrations above the laboratory reporting limits. Refer to Section 4.3 above.	
Disinfection System														
RA20	Pathogenic ingress	Chlorine dosing equipment failure or under dosing.	Possible	Catastrophic	High – 15	Manual dosing can be done from the ground level reservoir.	Online monitoring at the WTP and working day visual inspections. Regular services of disinfection system.	Unlikely	Catastrophic	High – 10	Estimate		WTP shuts down if the Free Chlorine residual gets too high/too low, however no SCADA alarms to indicate when disinfection system is off-line (apart from flashing light on the building).	ID B2: Upgrades to the disinfection system.
RA21	Chlorine	Chlorine over does.	Possible	Major	High – 15	Target Chlorine does is set at 1.5 mg/L.	Online monitoring at the WTP and working day visual inspections.	Rare	Major	Medium – 5	Confident		To date, no elevated Chlorine incidents have ever been recorded in the scheme	
RA22	Disinfection system malfunction	Lack of water operator expertise and/or knowledge of system.	Possible	Catastrophic	High – 15	Operation and Maintenance Procedures	Regular services of disinfection system	Unlikely	Catastrophic	High – 10	Estimate		Bigger chiller unit installed in February 2026 to assist with high temperature faults.	ID B2: Upgrades to the disinfection system.
RA23	Pathogenic ingress	High Turbidity reducing disinfection effectiveness.	Possible	Catastrophic	High – 15	Oxidisation and settling through disinfection process	Verification and operational monitoring.	Rare	Catastrophic	Medium – 6	Confident			

RA ID	Hazard/ Hazardous Event	Hazard Source	Unmitigated Risk Assessment			Primary Preventative Measure	Other Preventative Measures	Mitigated Risk Assessment				Documented Procedures	Comments	RMIP Item
			Likelihood	Consequence	Risk Level			Likelihood	Consequence	Risk Level	Uncertainty			
RA24	Elevated Chlorate levels in drinking water	Disinfection by-products.	Possible	Major	High – 12	Verification monitoring.		Rare	Major	Medium – 5	Confident		No ADWG exceedances reported to date.	
RA25	Elevated Trihalomethane levels in drinking water		Possible	Major	High – 12	Verification monitoring.		Rare	Major	Medium – 5	Confident			
RA26	Bacteria, Virus & Protozoa	Inadequate Chlorine contact time	Possible	Catastrophic	High – 15	Reservoirs provide time for Chlorine contact		Rare	Catastrophic	Medium – 6	Confident		Water quality data indicates Free Chlorine residual is able to be maintained in distribution (except during drinking water events), therefore CCT is considered adequate and to date has not been an issue for the scheme.	
RA27	Pathogenic Ingress	No SCADA or telemetry at the WTP	Possible	Catastrophic	High – 15	Working Day visual inspections of WTP and regular services of system by contractor	Disinfection	Possible	Catastrophic	High – 15			Working day visual inspections at the WTP are being conducted to ensure it is operating correctly. Bigger chiller unit installed in February 2026 to assist with high temperature faults.	ID B2: Upgrades to the disinfection system.
RA28	Bacteria, Virus & Protozoa	Failure of the WTP cooler unit	Possible	Catastrophic	High – 15	Working Day visual inspections of WTP	Manual Chlorine dosing	Possible	Catastrophic	High – 15			Bigger chiller unit installed in February 2026 to assist with high temperature faults. Likelihood remains possible as the new unit has not been installed long enough to determine if this has resolved the issue.	ID B2: Upgrades to the disinfection system.
Reservoirs														
RA29	Bacteria & Virus	Contamination from pathogenic ingress into reservoirs	Unlikely	Catastrophic	High – 10	Chlorine disinfection.	Working day visual inspections of reservoirs. Reservoirs are vermin proof. Water quality monitoring	Rare	Catastrophic	Medium – 6	Confident	Reservoir Inspection Procedure.	Reservoir cleaning undertaken in 2024 indicated that the lining in the GL reservoir is peeling.	ID B3: Funding application for water infrastructure upgrades, including GL reservoir lining.
RA30	Protozoa	Contamination from pathogenic ingress into reservoirs	Unlikely	Catastrophic	High – 10	Chlorine disinfection.	Working day visual inspections of reservoirs. Reservoirs are vermin proof. Water quality monitoring	Rare	Catastrophic	Medium – 6	Confident	Reservoir Inspection Procedure.		

RA ID	Hazard/ Hazardous Event	Hazard Source	Unmitigated Risk Assessment			Primary Preventative Measure	Other Preventative Measures	Mitigated Risk Assessment				Documented Procedures	Comments	RMIP Item
			Likelihood	Consequence	Risk Level			Likelihood	Consequence	Risk Level	Uncertainty			
RA31	Pathogenic or chemical ingress or damage to infrastructure	Contamination or damage from illegal access to reservoirs	Unlikely	Catastrophic	High – 10	Reservoirs are located in a fenced compound with locked gates.	Working day visual inspections of reservoirs, including ensuring compound fence is intact and gate locked.	Rare	Catastrophic	Medium – 6	Confident	Reservoir Inspection Procedure.	Scheme located in small town where break-ins would be noticed.	
RA32	Bacteria, Virus & protozoa	Sediment disturbance of accumulated sludge and biofilm in reservoirs due to loss of water supply.	Unlikely	Major	Medium – 8	Working day visual inspections of reservoirs to ensure loss of water supply doesn't occur	Chlorine disinfection. Reservoir cleaning every 2- 3 years.	Rare	Major	Medium – 5	Reliable		Reservoirs last cleaned in 2024. Regular cleaning organised through the RAPADSWA group every 3-4 years.	
Distribution System														
RA33	Bacteria & Virus	Contamination during repair, maintenance or commissioning of water mains	Possible	Catastrophic	High – 15	Chlorine disinfection	Staff trained to exercise correct hygiene practices.	Rare	Catastrophic	Medium – 6	Confident	Water Mains Repair, Maintenance Procedure	Currently no plumber in Boulia but a plumber can be sourced from Mt Isa (and sometimes Diamantina Shire) as required. In an emergency a plumber can be mobilised quickly due to good relationships with Council.	
RA34	Protozoa	Contamination during repair, maintenance or commissioning of water mains	Possible	Catastrophic	High – 15	Chlorine disinfection	Staff trained to exercise correct hygiene practices.	Rare	Catastrophic	Medium – 6	Confident	Water Mains Repair, Maintenance Procedure		
RA35	Bacteria & Virus	Contamination from pathogenic ingress caused by backflow	Possible	Catastrophic	High – 15	Chlorine disinfection	Positive pressure in reticulation system. New/small systems - shut-downs are rare. Water services have non-return valves fitted.	Rare	Catastrophic	Medium – 6	Confident		High risk locations include town common stables and sewerage treatment plant.	ID B1: Install non-return valves at high-risk locations.
RA36	Protozoa	Contamination from pathogenic ingress caused by backflow	Possible	Catastrophic	High – 15	Chlorine disinfection	Positive pressure in reticulation system. New/small systems - shut-downs are rare. Water services have non-return valves fitted.	Rare	Catastrophic	Medium – 6	Confident			

RA ID	Hazard/ Hazardous Event	Hazard Source	Unmitigated Risk Assessment			Primary Preventative Measure	Other Preventative Measures	Mitigated Risk Assessment				Documented Procedures	Comments	RMIP Item
			Likelihood	Consequence	Risk Level			Likelihood	Consequence	Risk Level	Uncertainty			
RA37	Bacteria & Virus	Contamination from long detention time of water in the main.	Possible	Catastrophic	High – 15	Chlorine disinfection. Flushing water mains that have a long detention time based on bacteriological results	Scheme has a compact distribution system	Rare	Catastrophic	Medium – 6	Confident	Water Mains Repair, Maintenance Procedure	Long main to racecourses to be flushed prior to any events.	
RA38	Iron	Iron oxidisation and/or precipitation within the distribution	Possible	Moderate	Medium – 9	Chlorine disinfection	Air scouring occurs every 2- 3 years	Rare	Moderate	Medium – 6	Confident		Iron monitoring in the distribution system identifies minimal ADWG aesthetic exceedances	
Whole of System														
RA39	Unable to locate assets	Outdated records	Possible	Major	High – 12	Distribution system drawings	Asset register	Rare	Major	Medium – 5	Reliable		Mains drawings were updated in 2021 to reflect rising main manifold.	
RA40	Lack of skilled/trained staff.	Inability for staff to respond to drinking water events or changes in drinking water quality due to lack of formal training/skills.	Possible	Major	High – 12	Operation and maintenance procedures.		Rare	Catastrophic	Medium – 6	Reliable		Staff do nit have formal qualifications but in-house training is regularly undertaken (at least annually or if new water staff are hired) to ensure all water operators are familiar with the scheme and its requirements.	
		Inability to attract and retain skilled staff	Possible	Major	High – 12	Interim staff are able to be obtained while permanent positions are filled		Rare	Catastrophic	Medium – 6	Reliable			
RA41	Cyber Security breach	Breach of Council's internal system causing access to restricted information.	Possible	Moderate	Medium – 9	Restricted administrative privileges.	Multi-factor authentication for all users. Back-up systems in place. Council data is stored on a document management system with high grade security protection.	Rare	Moderate	Low – 3	Reliable		Operation of the Boulia scheme does not rely on computerised technologies. If a breach were to occur, they would only obtain remote access to records (e.g. SWIM Local) and not remote access to infrastructure.	
RA42	Pathogenic ingress	Shortage of supply of essential materials for treatment purposes due to weather (i.e. flooding).	Possible	Catastrophic	High – 15	Store sufficient amounts of materials to allow for disruptions to freight.	Plan available to fly in supplies in an emergency.	Rare	Catastrophic	Medium – 6	Confident		Electrochlorination unit allows for Sodium Hypochlorite to be hydrolysed on-site.	

RA ID	Hazard/ Hazardous Event	Hazard Source	Unmitigated Risk Assessment			Primary Preventative Measure	Other Preventative Measures	Mitigated Risk Assessment				Documented Procedures	Comments	RMIP Item
			Likelihood	Consequence	Risk Level			Likelihood	Consequence	Risk Level	Uncertainty			
RA43	Bacteria	Flights carrying water samples delayed or cancelled	Unlikely	Catastrophic	High – 10	Collect new samples and schedule testing for next available flight	Testing scheduled at beginning of each 6-month period to allow for delays. <i>E.coli</i> samples now sent by car to Mt Isa Water Board.	Rare	Catastrophic	Medium – 6	Confident			
RA44	Chemical ingress		Unlikely	Major	Medium – 8			Rare	Major	Medium – 5	Confident			
RA45	Plumbing issue	No town plumber	Possible	Major	High – 12	Plumber can be sourced from Mt Isa or Diamantina Shire		Rare	Major	Medium – 5	Reliable		Currently no plumber or electrician in Boulia but a plumber can be sourced from Mt	
RA46	Electrical issue	No town electrician	Possible	Major	High – 12	Electrician can be sourced from Mt Isa		Rare	Major	Medium – 5	Reliable		Isa (and sometimes Diamantina Shire) and an electrician from Mt Isa as required. In an emergency they can be mobilised quickly due to good relationships with Council. Ergon also assists with some electrical faults if in town.	

6.0 RISK MANAGEMENT IMPROVEMENT PROGRAMME

Boulia's Risk Management Improvement Programme (RMIP) includes all the unacceptable risks from the Risk Assessment. High priority actions are those that are intended to be implemented within 12 months of this review (depending on the timing of the DWQMP Approval and the linkage to budget cycles). Note that some items may not be supported as high priority items by Council due to funding issues, in which case their priority will be reduced, to be implemented when funding is received. Medium priority actions are those that Council intends to include in the next budget cycle but are likely to be implemented as a staged approach (depending on what gets approved in the budget). Any items not approved will be re-proposed the following year. Low priority actions are likely to be implemented beyond a 3-year timeframe. This reflects the operational realities for a small Council with a limited budget. Nonetheless, these items have been identified and documented so that Council can maintain a focus on them.

The RMIP was reviewed and amended in February 2025 via. consultation with the BSC Acting Director of Works and Operations. Moving forward, Council intends to review all completion target dates at 6-monthly intervals to ensure that the processes are in place for items to be completed within their forecast timeframes. Target dates for all RMIP items were determined via. consultation with Council staff responsible for the respective items.

The RMIP is the ultimate responsibility of the Acting Director of Works and Operations.

Table 15: Boulia drinking water scheme Risk Management Improvement Programme.

RA Code	RMIP Code	Hazard/Hazardous Event	Improvement Item	Priority	Target Date/s	Comments	Rationale for Implementation Schedule	Responsibility
RA35	B1	Pathogenic ingress from backflow.	Install non-return valves at backflow high-risk locations.	Low	Dec 2028	High-risk locations have been identified (town common stables and sewerage treatment plant).	Due to no recent <i>E.coli</i> detections and Council's ability to maintain the Free Chlorine residual within the scheme (except during low Chlorine events unrelated to non-return valves), this item is considered low priority and will be addressed when there is budget.	Acting Director of Works and Operations
RA20, RA22, RA27, RA28	B2	Pathogenic ingress from WTP malfunction.	Upgrades to the chlorine disinfection system.	High	Dec 2027	Council are currently still working through troubleshooting some issues with the system via. consultation with Trility and Evoqua/Xylem. This includes setting up the SCADA and telemetry system and relevant alarms, staff training and writing procedures to accompany alarm settings and operation of the new WTP.	This item is high priority as alarms at the WTP will assist with the operation of the scheme and help prevent incidents/events.	Acting Director of Works and Operations
RA29, RA30	B3	Pathogenic ingress.	Water infrastructure upgrades	High	Dec 2028	Council is currently seeking funding for water infrastructure upgrades (priority 1 project). This will address the peeling reservoir lining in the GL reservoir identified in 2024, in addition to possible WTP upgrades.	This item is high priority but dependent upon funding availability and therefore, the implementation timeframe is likely to be more long-term.	Acting Director of Works and Operations

7.0 OPERATION AND MAINTENANCE PROCEDURES

All BSC water operators receive on-the-job training to ensure they understand operating procedures, document management and record keeping requirements. To assist with operational tasks, Council maintains a series of Operation and Maintenance Procedures which are updated every two-years to coincide with the DWQMP Review. Table 16 below outlines all procedures used for the Boulia scheme.

Table 16: Boulia scheme Operation and Maintenance Procedures.

Scheme Component / Sub-component	Preventive Measure Managed	Documented Procedure	Version Date	Comments
Whole of System	Boulia Drinking Water Scheme	Boulia Drinking Water Scheme Operating Procedures	February 2026	Reviewed February 2026, next review February 2028.
Sourcing Infrastructure & Distribution System	Repair, Maintenance and Commissioning of Mains	Repair, Maintenance and Commissioning of Mains	February 2026	Reviewed February 2026, next review February 2028.
		Mains Flushing		
	Infrastructure	Borehead Inspection Procedure, detailing requirements for 6-monthly inspections		
Water Treatment Plant	General operation and maintenance procedures	WTP Operating Manual	June 2024	Hard copy located at WTP.
Reservoirs	Infrastructure	Reservoir Inspection Procedure, detailing requirements for 6-monthly inspections	February 2026	Reviewed February 2026, next review February 2028.
Water Sampling	Water Quality Monitoring	Drinking Water Quality Instructions	February 2026	Reviewed February 2026, next review February 2028.

7.1 Critical and Operational Control Points

Council have also developed a series of Critical Control Points (CCPs) and Operational Control Points (OCPs) to assist in the management of Boulia's drinking water:

- **CCP1:** Disinfection
- **CCP2:** *E.coli* Detection
- **OCP1:** Free Chlorine in the Distribution System

CCP1 Disinfection			
What is measured?	Where / how is it measured?	What is the Control Point?	What are the Hazards?
Free Chlorine	Continuous online monitoring from the WTP	Sodium Hypochlorite dosing of combined raw water	Bacteria Viruses Protozoa
Target Value: 1.5 mg/L (WTP Chlorine dosing target)			
Alert Level: <1.5 mg/L or >3.5 mg/L for <30 minutes Responsibility: Water Operator		Critical Limit: <0.5 mg/L or >4 mg/L for >30 minutes Responsibility: Water Operator	
1. Immediately take grab sample to verify result. 2. Check calibration records and re-calibrate equipment if required. 3. Check Chlorine dose pumps and cylinders (e.g. for leaks), adjust Chlorine dose if required. 4. Check upstream processes are working well. 5. Undertake detailed assessment of Chlorine dosing system. 6. Re-sample. Reporting: Make note in WTP log book and notify Director of Works		1. Immediately take grab sample to verify result. 2. Contact Supervisor, consider the need for manual Chlorine dosing in ground level reservoir. 3. Undertake thorough inspection with Supervisor. 4. Sample and test for Free Chlorine in the ground level reservoir and distribution system. 5. Consider flushing mains / reservoir as necessary. 6. Re-sample. If Free Chlorine is still low, commence sampling at reservoir / distribution system for <i>E.coli</i>. 7. Recommence pumping water to reservoir if Free Chlorine has been corrected. Reporting: make note in WTP log book, notify Water Supply Regulator if Free Chlorine lower or upper limits are reported in the distribution system (<0.2 mg/L or >5 mg/L).	

CCP2: *E.coli* Detection (Distribution)

What is measured?	Where /how is it measured?	What is the Control Point?	What are the Hazards?
<i>E.coli</i> , Total Coliforms, Turbidity	In-house and external verification monitoring	<i>E.coli</i> detections	Pathogenic ingress Public Health Risk
Target Value: No <i>E.coli</i> detections in distribution system			
Alert Level: Turbidity >5 NTU & Elevated Total Coliforms Responsibility: Water Operator		Critical Limit: <i>E.coli</i> detection (1 CFU/100mL) Responsibility: Water Operator	
1. Notify Acting Director of Works and Operations. 2. Ensure the Free Chlorine residual is being maintained above 0.2mg/L at the WTP and within the distribution system. 3. If Free Chlorine is low, check Chlorine does pumps, re-calibrate and adjust Chlorine dose rate as required. 4. Flush Mains. 5. Re-sample for Free Chlorine, Turbidity and Total Coliforms. 6. If exceedances are still being detected, re-commence flushing. 7. If <i>E.coli</i> is detected, escalate to Critical Limit response. 8. If <i>E.coli</i> is not being detected and Turbidity and Total Coliforms are no longer elevated after mains flushing and the Free Chlorine residual is being maintained at the WTP and within the distribution, re-commence the normal operation of the scheme. Reporting: Alert Acting Director of Works and Operations.		1. Inform Acting Director of Works and Operations and issue Boil Water Alert. 2. Notify Drinking Water Regulator. 3. Isolate the affected area if possible and commence investigation into exceedance. 4. Re-test for <i>E.coli</i> to ensure it was not a sampling error. 5. Ensure the Free Chlorine residual is being maintained above 0.2mg/L at the WTP and within the distribution system. 6. If Free Chlorine is low, check Chlorine does pumps, re-calibrate and adjust Chlorine dose rate as required. 7. Flush Mains. 8. Re-sample for Free Chlorine, Turbidity and Total Coliforms. 9. If <i>E.coli</i> is still being detected, re-flush the mains. 10. The Boil Water Alert is to remain in place until monitoring detects no <i>E.coli</i> and the Free Chlorine residual is being maintained above 0.2 mg/L. 11. Complete incident reporting forms. Note that Boil Water Alerts can only be lifted via. consultation with QLD Health and the Water Regulator. Reporting: Alert Acting Director of Works and Operations and Drinking Water Supply Regulator.	

OCP1 Free Chlorine in the Distribution System			
What is measured?	Where / how is it measured?	What is the Control Point?	What are the Hazards?
Free Chlorine	Weekly grab sample from the distribution system	Chlorine leaving the WTP	Bacteria Viruses Protozoa
Target Value: >0.2 mg/L, <4 mg/L			
Alert Level: <0.2 mg/L or >4 mg/L Responsibility: Water Operator			
1. Immediately re-sample to verify result. 2. Flush downstream hydrant for 10 minutes and re-sample. 3. If the Free Chlorine residual is still at the Alert Level, check CCP 2 Disinfection to ensure adequate disinfection at WTP. 4. Check Free Chlorine residual in reservoir. 5. If Chlorine dosing and reservoir are normal, re-flush mains for another 10 minutes. 6. Re-sample. If Free Chlorine is still low, commence sampling at reservoir / distribution system for <i>E.coli</i>. 7. If Alert Level is still being exceeded or <i>E.coli</i> is detected, notify Water Supply Regulator and check CCP 1 <i>E.coli</i> Detection. Reporting: Fill in the OCP reporting form and alert Supervisor.			

8.0 OPERATIONAL AND VERIFICATION MONITORING

The water quality monitoring programme is an essential part of the operation of the Boulia scheme to ensure it's operating within its performance limits and providing safe drinking water. The programme has been developed and modified in response to historical data analysis and requirements under the ADWG.

If any ADWG aesthetic or health exceedances are identified, it is the responsibility of the Water Operator to notify the Acting Director of Works and Operations for further escalation of the incident.

8.1 Operational Monitoring

In Boulia, operational monitoring includes but is not limited to visual inspections for any maintenance issues of the drinking water infrastructure. Council currently has two Turbidity and two Chlorine meters which allows for operational testing to continue while one meter is sent externally for calibration. Council also has one conductivity and one pH metre. All water quality meters are sent for external calibration annually. To date, external calibration has not resulted in any missed in-house testing.

Table 17: Boulia operational monitoring programme.

Location in System	Parameter	Sampling			Target Dosing Limit	Action if target limit exceeded	Critical Free Chlorine Limit	Action if critical limit exceeded	Positions Responsible for Monitoring
		Frequency	Method	Location					
Treatment Plant	Free Chlorine	Continuous	Online Meter	Combined raw water line downstream of treatment plant	1.5mg/L	Recalibrate chlorine monitor, check and clean sensors	0.5 mg/L	Recalibrate chlorine monitor Check and clean sensors If low: Manually dose into reservoir and check Free Chlorine residual in distribution system.	Water Operator
Bores, System Wide	General Maintenance	Working Days	Visual Inspection	Bore 5 (Hospital) Bore 6 (Airport) Bore 7 (Powerhouse) Bore 8 (SES, Backup bore) Bore 9 (Washdown Bay) Bore 10 (Pump Station) Reticulation	N/A	N/A	N/A	On working days, the Water Operator is required to visually inspect the scheme for maintenance issues. Where maintenance is required, this is to be notified to the ADWO. Visual checks ensure all barriers such as bore condition, seals and valves, Reservoir condition, roof hatches or doors remain closed for the Reservoirs.	Water Operator
Reservoirs	General Maintenance	Working Days	Visual Inspection	Boulia Ground Level and Elevated Reservoirs	N/A	N/A	N/A	A visual inspection of the ground level and elevated reservoirs are required on working days to ensure that pumps are functioning properly and the town is being supplied with water. Where maintenance is required, this is to be notified to the ADWO.	Water Operator

8.2 Water Quality Monitoring

Council sends most of their external verification monitoring samples to the NATA accredited SGS Laboratory in Melbourne. Samples are taken by staff in Boulia, before being put on a flight to Brisbane and couriered through to the lab in Melbourne.

Due to distance, Council have previously struggled with getting *E.coli* verification monitoring samples to the lab within the 24-hr holding period. To overcome this, Council sought permission from the Regulator to use the Mt Isa Waterboard for all *E.coli* verification monitoring. While the Mt Isa Waterboard lab is not NATA accredited, they are working on obtaining accreditation and have sufficient experience and resources necessary to reliably test for *E.coli*. Moving forward, this is Council's preferred option for external *E.coli* monitoring.

The Boulia's in-house monitoring programme is provided in Table 18 below with the external monitoring programmes outlined in Tables 19 and 20 below. While Council prioritises and adheres to the water quality monitoring programmes, there have been instances in the past where testing has been missed due to unavoidable circumstances such as road closures or unavailable staff.

Table 18: Boulia in-house water quality monitoring programme.

Parameter	Frequency	ADWG/ Operational	Method	Location	Annual Sample Number	Position Responsible
Raw Water						
<i>E. coli</i>	6-monthly	1 MPN/100mL – Health	Grab Sample	6x samples every 6-months: - Hospital Bore - Airport Bore - Powerhouse Bore - SES Bore - Washdown Bay Bore - Pump Station Bore	12	Water Operator
Total Coliforms		N/A	Grab Sample			
Turbidity		5 NTU – Aesthetic	Grab Sample			
Iron		0.3 mg/L – Aesthetic	Grab Sample			
Distribution System						
Free Chlorine	Continuous	>0.2, <5 mg/L – Operational	Online Meter	Combined raw water line downstream of treatment plant	N/A	Water Operator
<i>E. coli</i>	Monthly	1 MPN/100mL – Health	Grab Sample	3x Samples per month: - GLR Outlet - Caravan Park - Council Depot	36	
Total Coliforms	Monthly	N/A	Grab Sample			
Turbidity	Monthly	5 NTU – Aesthetic	Grab Sample			
pH	Monthly	>6.5, <8.5 – Aesthetic	Grab Sample			
Conductivity	Monthly	N/A	Grab Sample			
Free Chlorine	Weekly	>0.2, <5 mg/L – Operational	Grab Sample	3x Samples per week: - GLR Outlet - Caravan Park - Council Depot	144	

Table 19: Boulia external water quality monitoring programme – Distribution System.

Characteristic	Parameter	ADWG &/or Regulation/ Screening Value	Associated Hazard	Sampling Locations	Annual Sample Number	Analysing Authority	Response to Exceedances	Positions Responsible
Microbial quality	<i>E.coli</i>	Nil Detect – Health	Bacteria	3x Locations every 6-months: - GLR Outlet - Caravan Park - Council Depot	6	SGS Environmental Services Australia PTY LTD & Mt Isa Waterboard	Refer to Incident Management Plan. For ADWG health value exceedances, notify OWSR and complete incident reporting forms. For aesthetic exceedances, continue to monitor and escalate further if no longer an acceptable risk.	Overall Responsibility: Chief Executive Officer Implementation, review and actions: Acting Director of Works and Operations Operations: Water Operator
Physical	Conductivity	N/A	<i>Hazards that arise from the natural geological processes in the aquifer.</i>					
	True Colour	15 HU - Aesthetic						
	Dissolved Organic Carbon	N/A						
	pH	pH ≤6.5- ≥8.5 – Aesthetic						
	Total Dissolved Solids	600 mg/L – Aesthetic						
	Turbidity	5 NTU – Aesthetic						
Inorganics	Chlorate	0.8mg/L – Health						
	Trihalomethanes	0.25mg/L – Health						
	Chloride	250mg/L – Aesthetic						
	Fluoride	1.5mg/L – Health						
	Nitrate	50mg/L – Health						
	Nitrite	3mg/L – Health						
	Selenium	0.004mg/L – Health						
	Silica	80mg/L – Aesthetic						

Characteristic	Parameter	ADWG &/or Regulation/ Screening Value	Associated Hazard	Sampling Locations	Annual Sample Number	Analysing Authority	Response to Exceedances	Positions Responsible
	Silver	0.1mg/L - Health						
	Sodium	180mg/L - Aesthetic						
	Total Iron	0.3mg/L - Aesthetic						
	Soluble Iron	N/A						
	Total Manganese	0.05mg/L - Aesthetic 0.1mg/L - Health						
	Soluble Manganese	N/A						
Radiological Activity	Uranium	0.017mg/L - Health						
	Gross Alpha	0.5 Bq/L - Screening						
	Gross Beta	0.5 Bq/L - Screening						
Heavy Metals	Arsenic	0.01mg/L - Health						
	Cadmium	0.002mg/L - Health						
	Chromium	0.05mg/L - Health						
	Copper	1mg/L - Aesthetic 2mg/L - Health						
	Mercury	0.001mg/L - Health						
	Lead	0.005 - Health						
	Nickel	0.02 mg/L - Health						
	Zinc	3 mg/L - Aesthetic						

Testing frequency for distribution system verification monitoring is to be conducted at 6-monthly intervals, once in the wet season and once in the dry season.

Table 20: Boulia external water quality monitoring programme – Source Water.

Characteristic	Parameter	ADWG &/or Regulation/ Screening Value	Associated Hazard	Sampling Locations	Annual Sample Number	Analysing Authority	Response to Exceedances	Positions Responsible
Microbial quality	<i>E.coli</i>	Nil Detect – Health	Bacteria					
Physical	Conductivity	N/A	<i>Hazards that arise from the natural geological processes in the aquifer.</i>	6x Locations every 6-months: - Hospital Bore - Airport Bore - Power House Bore - SES Bore - Washdown Bore - Pump Station Bore	12	SGS Environmental Services Australia PTY LTD & Mt Isa Waterboard	Refer to Incident Management Plan. For ADWG health value exceedances, notify OWSR and complete incident reporting forms. For aesthetic exceedances, continue to monitor and escalate further if no longer an acceptable risk.	Overall Responsibility: Chief Executive Officer Implementation, review and actions: Acting Director of Works and Operations Operations: Water Operator
	Dissolved Organic Carbon	N/A						
	pH	pH ≤6.5- ≥8.5 – Aesthetic						
	Total Dissolved Solids	600 mg/L – Aesthetic						
	Turbidity	5 NTU – Aesthetic						
Inorganics	Chloride	250mg/L – Aesthetic						
	Fluoride	1.5mg/L – Health						
	Nitrate	50mg/L – Health						
	Nitrite	3mg/L – Health						
	Selenium	0.004mg/L – Health						
	Silica	80mg/L – Aesthetic						
	Silver	0.1mg/L – Health						
	Sodium	180mg/L – Aesthetic						
	Total Iron	0.3mg/L – Aesthetic						
	Soluble Iron	N/A						
	Total Manganese	0.05mg/L – Aesthetic 0.1mg/L – Health						

Characteristic	Parameter	ADWG &/or Regulation/ Screening Value	Associated Hazard	Sampling Locations	Annual Sample Number	Analysing Authority	Response to Exceedances	Positions Responsible
	Soluble Manganese	N/A						
Radiological Activity	Uranium	0.017mg/L - Health						
	Gross Alpha	0.5 Bq/L - Screening						
	Gross Beta	0.5 Bq/L - Screening						
Heavy Metals	Arsenic	0.01mg/L - Health						
	Cadmium	0.002mg/L - Health						
	Chromium	0.05mg/L - Health						
	Copper	1mg/L - Aesthetic 2mg/L - Health						
	Mercury	0.001mg/L - Health						
	Lead	0.005 - Health						
	Nickel	0.02 mg/L - Health						
	Zinc	3 mg/L - Aesthetic						

Testing frequency for source water verification monitoring is to be conducted at 6-monthly intervals, once in the wet season and once in the dry season.

9.0 INCIDENTS AND EMERGENCIES

Boulia Shire Council operates on a 3-level incident and emergency framework, starting at Level 1 (least severe) through to Level 3 (most severe); these are outlined in Table 21 below. It should be noted that during a full-scale emergency response and recovery scenario (e.g. a natural disaster), the Local Disaster Management Group is activated in accordance with BSC's Local Disaster Management Plan which can be accessed here: <https://www.boulia.qld.gov.au/downloads/file/1523/boulia-local-disaster-management-plan-2023-24>.

During an incident or emergency, Council will notify residents using the usual notification channels, including the Council website and Facebook Page.

The drinking water incident and emergency action plan for the Boulia scheme is provided in Section 9.1 below.

Table 21: BSC 3-level incident and emergency framework.

Alert Level	Description	Key Management Responses	Positions Responsible
Level 1 Low-Risk Operational Actions	Operational issues that could escalate if not responded to. These types of incidents are managed immediately and effectively by BSC staff, without any public health impact to the community. For example: - Exceedance of an operational limit managed through operational and maintenance procedures. - Exceedance of an ADWG aesthetic value that can be managed under the DWQMP. - Short-term drinking water infrastructure failure.	1. Notify Water Operator and / or Acting Director of Works and Operations (ADWO). 2. Check and act upon operation and maintenance procedures. 3. Take appropriate actions to rectify the situation.	Water Operator
Level 2 Medium-Risk Incidents and Emergencies	All ADWG health exceedances and incidents where normal actions under the DWQMP do not effectively manage the issue and there is a concern that public health may be impacted. These issues are generally identified through operational and verification monitoring. For example: - Detection of a parameter with no water quality criteria that may have an adverse impact upon public health. - Detection of an ADWG aesthetic/screening value exceedance that may have an adverse impact upon public health (e.g. radiological activity). - Minor exceedance of an ADWG health value. - Small scale outbreak of a waterborne disease. - Short-term loss of drinking water supply (<24 hours).	1. Report incident/event to ADWO and implement short-term management measures. 2. Where further health advice is required, notify Regulator. 3. Undertake incident investigation and appropriate corrective actions as soon as practicable to minimise the impact of the incident.	Water Operator, ADWO, Water Supply Regulator

Alert Level	Description	Key Management Responses	Positions Responsible
	• Cyber Security breach. • CCP exceedances		
Level 3 High-Risk Declared Disaster	This level of emergency or disaster requires coordination across departments and is dealt with at the CEO level. For example: • Widespread outbreak of a waterborne disease • Major loss of drinking water supply, e.g. >24 hours over wide area • Gross exceedance of an ADWG health guideline value for a chemical parameter (e.g. more than five times the ADWG health guideline limit). • Declared disaster. • Long-term drinking water infrastructure failure. • Detection of <i>E.coli</i> in the treated water.	1. Report incident/event to the Regulator. 2. Notify ADWO who will inform the Chief Executive Officer (CEO). 3. CEO makes the call to activate the Local Disaster Management Plan (as required) 4. Implement short-term management measures. 5. Undertake incident investigation.	Water Operator, ADWO, CEO and Water Supply Regulator

9.1 BSC Incident and Emergency Action Plan

Table 22: BSC drinking water Incident and emergency action plan.

Level	Incident Or Emergency	Summary Of Actions to be Undertaken	Positions Responsible for Actions
1	Exceedance of an operational limit managed through OCPs, CCPs and operational and maintenance procedures or exceedance of an ADWG aesthetic value that can be managed under the DWQMP	1. Water Operator to notify ADWO. 2. Ensure all control measures identified in the operation and maintenance procedures are functioning effectively. Review records for anomalies. If simple adjustment is required, make adjustment and record details. 3. If a more substantial system change is required (e.g. maintenance to overcome a recurring problem), advise ADWO so budget can be made available. 4. Organise system change or list for capital works as appropriate.	Water Operator, ADWO
	Short-term drinking water infrastructure fail	1. Water Operator to notify ADWO. 2. Determine the potentially affected area and isolate. 3. Inform concerned customers of the details of the incident and anticipated progress (if required). 4. Rectify the problem. 5. Investigate options to avoid any reoccurrence. 6. If a more substantial system change is required (e.g. maintenance to overcome a recurring problem), advise ADWO so budget can be made available.	Water Operator, ADWO
2	Detection of a parameter with no water quality criteria that may have an adverse impact upon Public Health OR detection of an ADWG aesthetic value exceedance that may have an adverse impact upon public health	1. Water Operator to notify ADWO. 2. Check with the testing laboratory to confirm the exceedance OR re-commence in-house monitoring to confirm aesthetic exceedance or adverse water quality criteria. 3. Report details of the exceedance to the Regulator within 3 hours via. the Drinking Water Hotline (P: 1300 596 709) and the online notification form within 24 hours (E: DrinkingWater.Reporting@dlgwv.qld.gov.au). Contact Public Health Unit if required. 4. Determine potentially affected area and advise effected customers (via. the usual communication channels) if required. 5. Commence investigation into water quality criteria or aesthetic exceedance. Some aesthetic exceedances or adverse water quality (e.g. Turbidity) may be able to be fixed with mains flushing. 6. Once investigation is complete and the issue fixed, re-test the drinking water supply and send samples to the external laboratory (if required) for confirmation that there are no issues. 7. Investigate options to avoid any reoccurrences. 8. Upon resolution, provide a written report to the Regulator (Part 2 of Incident Reporting Form).	Water Operator, ADWO, Regulator

Level	Incident Or Emergency	Summary Of Actions to be Undertaken	Positions Responsible for Actions
	Minor exceedance of an ADWG health value OR CCP breach	1. Water Operator to notify ADWO. 2. Where an exceedance has been observed check with the testing laboratory to confirm the exceedance. 3. Report details of exceedance or CCP breach to Regulator within 3 hours via. the Drinking Water Hotline (P: 1300 596 709) and the online notification form within 24 hours (E: DrinkingWater.Reporting@dlgwv.qld.gov.au). Contact Public Health Unit if required. 4. Determine if water quality can be corrected and the time/resources required. Ensure all control measures are functioning effectively. 5. Advise customers and make temporary water supply arrangements including bottled potable water if required. 6. Rectify the problem or inform consumers of ongoing water quality limitation. 7. Once rectified, re-test and send the water samples to an external lab for verification monitoring to confirm the issue has been resolved (if required). 8. Provide a written report to the Regulator (Part 2 of Incident Reporting Form).	Water Operator, ADWO, Regulator
	Short-term loss of drinking water (<24 hours)	1. Water Operator to notify ADWO. 2. Details of the supply loss or infrastructure fail are to be reported to the Regulator within 3 hours via. the Drinking Water Hotline (P: 1300 596 709) and the online notification form within 24 hours (E: DrinkingWater.Reporting@dlgwv.qld.gov.au). Contact Public Health Unit if required. 3. Determine the potentially affected area and advise effected customers (via. the usual communication channels) and implement temporary water restrictions if applicable. 4. Rectify the problem. 5. Investigate options to avoid any reoccurrence. 6. Upon resolution, provide a written report to the Regulator (Part 2 of Incident Reporting Form).	Water Operator, ADWO, Regulator

Level	Incident Or Emergency	Summary Of Actions to be Undertaken	Positions Responsible for Actions
	Cyber Security Breach	1. Water Operator to notify ADWO. 2. Determine the potentially affected area (i.e. access to WTP or remote access to Council files). 3. Alert Australian Government Cyber Security Hotline (P: (07) 3215 3951) 4. Notify Regulator within 3 hours via. the Drinking Water Hotline (P: 1300 596 709) and the online notification form within 24 hours (E:DrinkingWater.Reporting@dlgww.qld.gov.au) 5. Rectify the problem. Ensure all control measures are functioning effectively. 6. Investigate options to avoid any recurrence. 7. Upon resolution, provide a written report to Regulator (Part 2 of Incident Reporting Form), if required.	Water Operator, ADWO, Regulator
3	Widespread outbreak of a waterborne disease	1. Water Operator to notify ADWO. 2. ADWO to alert CEO to coordinate notification, investigation and response including activation of the Emergency Response Plan/Disaster Management Pant (as required). 3. Details of the outbreak are to be reported to Regulator within 3 hours via. the Drinking Water Hotline (P: 1300 596 709) and the online notification form within 24 hours (E:DrinkingWater.Reporting@dlgww.qld.gov.au). 4. Determine the potentially affected area and isolate if possible. Issue a Boil Water Alert and advise effected customers (via. the usual communication channels) or other precautions as required. 5. Flush all affected mains. 6. Provide additional chlorine dosing if practical and test for the Free Chlorine residual within the distribution system. 7. Undertake a comprehensive contamination investigation and take necessary corrective actions. 8. Upon resolution, provide a written report to the Regulator (Part 2 of Incident Reporting Form).	Water Operator, ADWO, Regulator, CEO
	Major loss of drinking water supply (>24 hours) OR long-term drinking water infrastructure fail	1. Water Operator to notify ADWO. 2. ADWO to alert CEO to coordinate notification, investigation and response including activation of the Emergency Response Plan/Disaster Management Pant (as required). 3. Details of the supply loss or infrastructure fail are to be reported to Regulator within 3 hours via. the Drinking Water Hotline (P: 1300 596 709) and the online notification form within 24 hours (E:DrinkingWater.Reporting@dlgww.qld.gov.au). 4. Determine the potentially affected area and advise effected customers (via. the usual communication channels) and implement temporary water restrictions if applicable. 5. Make temporary water supply arrangements if required.	Water Operator, ADWO, Regulator, CEO

Level	Incident Or Emergency	Summary Of Actions to be Undertaken	Positions Responsible for Actions
		6. Rectify the problem. 7. Investigate options to avoid any reoccurrence. 8. Upon resolution, provide a written report to Regulator (Part 2 of Incident Reporting Form).	
	Gross exceedance of an ADWG health value	1. Water Operator to notify ADWO. 2. ADWO to alert CEO to coordinate notification, investigation and response including activation of the Emergency Response Plan/Disaster Management Pant (as required). 3. Check with the testing laboratory to confirm the exceedance (a sudden gross exceedance is only likely to occur as the result of sabotage or an unreported chemical spill). 4. Report details of the exceedance to Regulator within 3 hours via. the Drinking Water Hotline (P: 1300 596 709) and the online notification form within 24 hours (E: DrinkingWater.Reporting@dlgwv.qld.gov.au) 5. Determine the potentially affected area and advise effected customers (via. the usual communication channels) not to drink the water. 6. Re-test the drinking water supply and send samples to the external laboratory for confirmation that health exceedance was not a testing error. 7. Make temporary supply arrangements, including bottled potable water if required. 8. Commence investigation into exceedance and rectify the problem. 9. Once, rectified, re-test the drinking water supply and send samples to the external laboratory to confirm that the problem has been fixed and the drinking water is safe for consumption. 10. Investigate options to avoid any reoccurrence. 11. Upon resolution, provide a written report to Regulator (Part 2 of Incident Reporting Form).	Water Operator, ADWO, Regulator, CEO
	Declared disaster	1. Water Operator to notify ADWO. 2. ADWO to alert CEO. 3. CEO to liaise with Local Disaster Management centre to monitor the potential effect of the disaster upon water supply and sewerage services. 4. If impact to drinking water services, details of the event to be reported to Regulator within 3 hours via. the Drinking Water Hotline (P: 1300 596 709) and the online notification form within 24 hours (E: DrinkingWater.Reporting@dlgwv.qld.gov.au) 5. If the water supply has been affected, consider a Boil Water Alert and take relevant actions as per the DWQMP and direction from the Local disaster Management Centre and Regulator.	Water Operator, ADWO, Regulator, CEO

Level	Incident Or Emergency	Summary Of Actions to be Undertaken	Positions Responsible for Actions
		6. If the water supply has been affected, upon resolution, provide a written report to Regulator (Part 2 of Incident Reporting Form).	
	Detection of <i>E.coli</i> in the treated water	1. Water Operator to notify ADWO. 2. ADWO to alert CEO to coordinate notification, investigation and response including activation of the Emergency Response Plan/Disaster Management Pant (as required). 3. Boil Water Alert to be issued and effected customers to be advised (via. the usual communication channels). 4. Details of the outbreak are to be reported to Regulator within 3 hours via. the Drinking Water Hotline (P: 1300 596 709) and the online notification form within 24 hours (E:DrinkingWater.Reporting@dlgww.qld.gov.au). 5. Determine the potentially affected area and isolate if possible. 6. Flush all affected mains. 7. Provide additional chlorine dosing if practical and test for the Free Chlorine residual within the distribution system. 8. Once corrective actions have been undertaken, re-test for <i>E.coli</i>, including verification monitoring to an external lab to confirm results. 9. Once verification monitoring can confirm no <i>E.coli</i> detections, consider lifting the Boil Water Alert via. consolation with QLD Health and the Regulator. 10. Upon resolution, provide a written report to Regulator (Part 2 of Incident Reporting Form).	Water Operator, ADWO, Regulator, CEO

10.0 INFORMATION MANAGEMENT

Boulia Shire Council is a relatively small organisation with a records system that is available to all relevant staff. Engineering services are provided by GBA Consulting Engineers (GBA) who are based in Barcaldine. GBA provides technical support for Council's water operations, preparing tender documents and specifications for new works and as-constructed data for completed works. GBA also develops, maintains, and distributes the works procedures to cover construction, maintenance, testing and inspections to control risks to water supply quality.

In Boulia, the Water Operator is responsible for operational issues such as monitoring bore pressures, bore water quality and reading water meters by completing visual inspections. The Water Operator maintains an inspection and maintenance report which is lodged on a monthly basis to the ADWO and GBA with operational monitoring water quality data and any maintenance issues or identified hazards. As a small town, the Water Operator also maintains informal lines of communication with the ADWO providing an additional avenue for addressing any drinking water issues. The

All drinking water related records are stored in MAGIQ, Council's document management system for a minimum of five years. This enables all Council employees access to the records as required. All drinking water quality data is trended in an excel spreadsheet (maintained by GBA) and more recently SWIM Local (maintained by BSC). It is the responsibility of the Water Operator to ensure all records are stored in MAGIQ and that the most current version of documents are readily available and marked as the current version. Multi-factor authentic and passwords are required for all Council employs to access their computers with back-up systems in place. Council also has high grade security protection

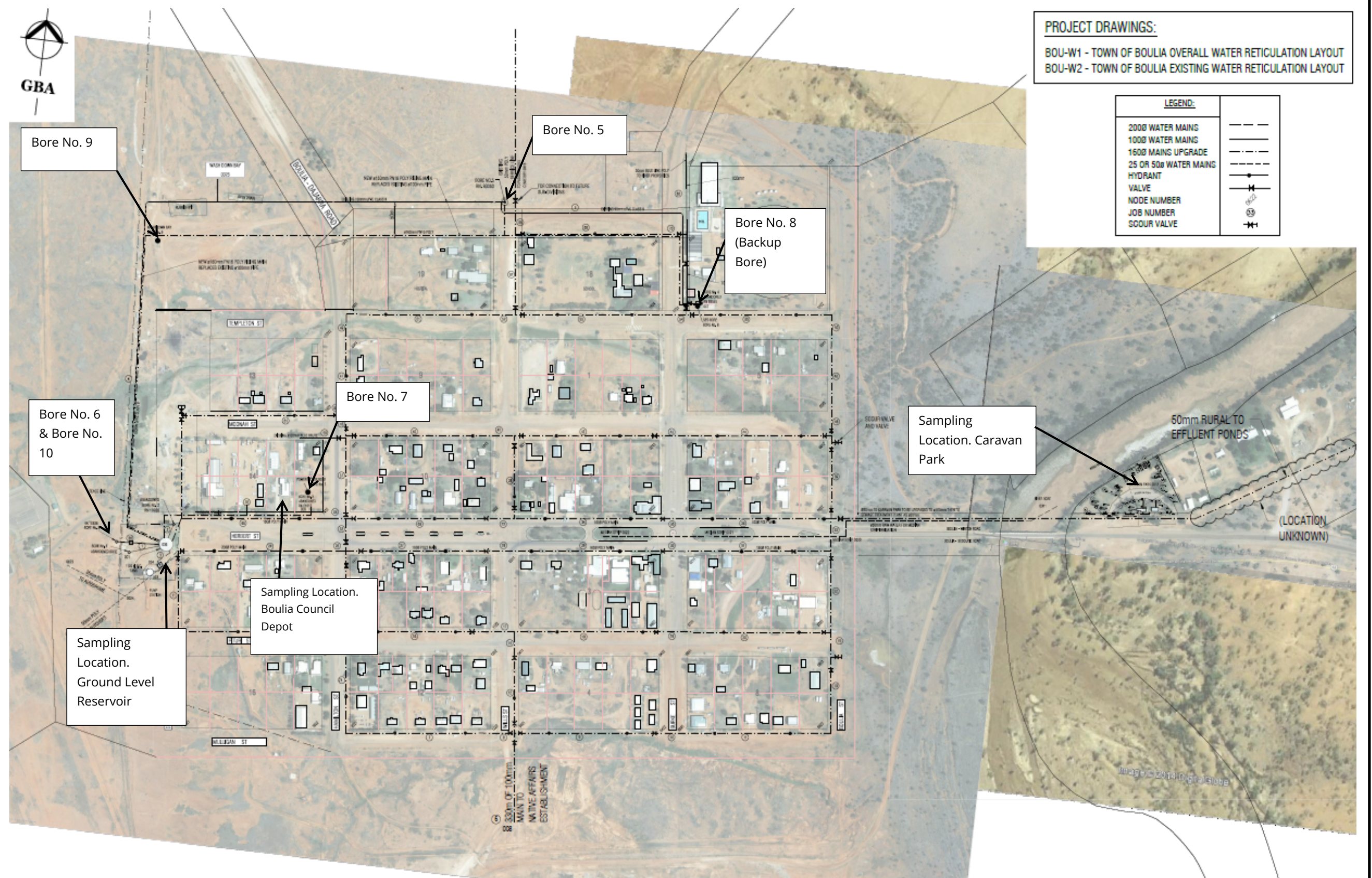
APPENDIX A
WATER SUPPLY LAYOUTS SUPERIMPOSED ON AERIAL PHOTOGRAPHS

1. Boulia Water Supply Scheme



PROJECT DRAWINGS:
BOU-W1 - TOWN OF BOULIA OVERALL WATER RETICULATION LAYOUT
BOU-W2 - TOWN OF BOULIA EXISTING WATER RETICULATION LAYOUT

LEGEND:	
200B WATER MAINS	---
100B WATER MAINS	----
160B MAINS UPGRADE	----
25 OR 50B WATER MAINS	----
HYDRANT	+
VALVE	+
NODE NUMBER	10
JOB NUMBER	10
SCOUR VALVE	+



APPENDIX B
BOULIA DISTRIBUTION SYSTEM WATER QUALITY TRENDS

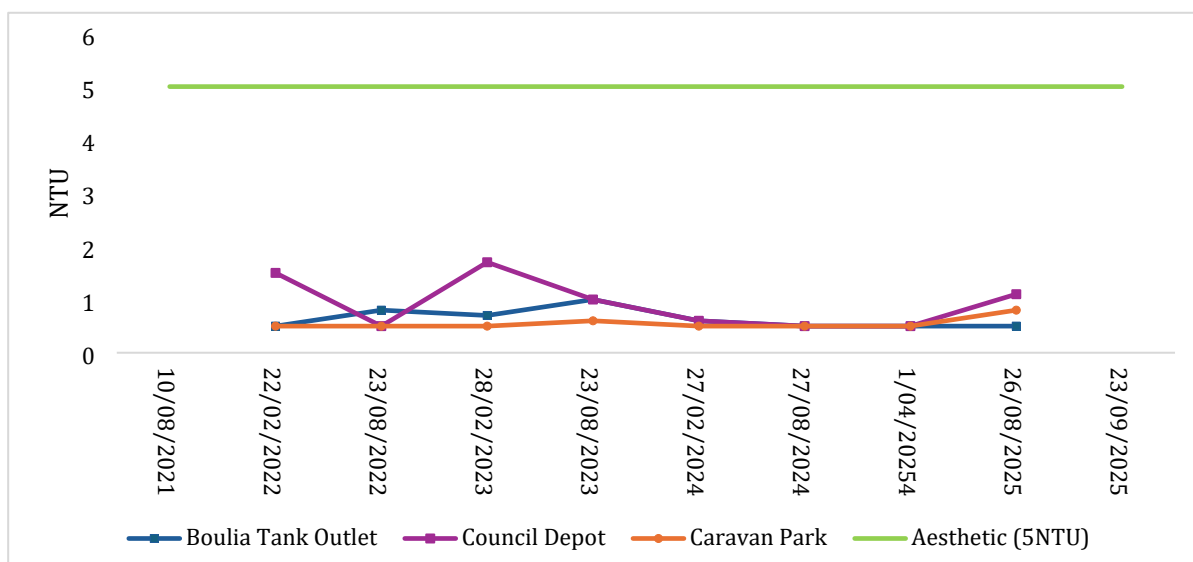


Figure 5: Turbidity trends for Boulia's distribution system (2022-2025).

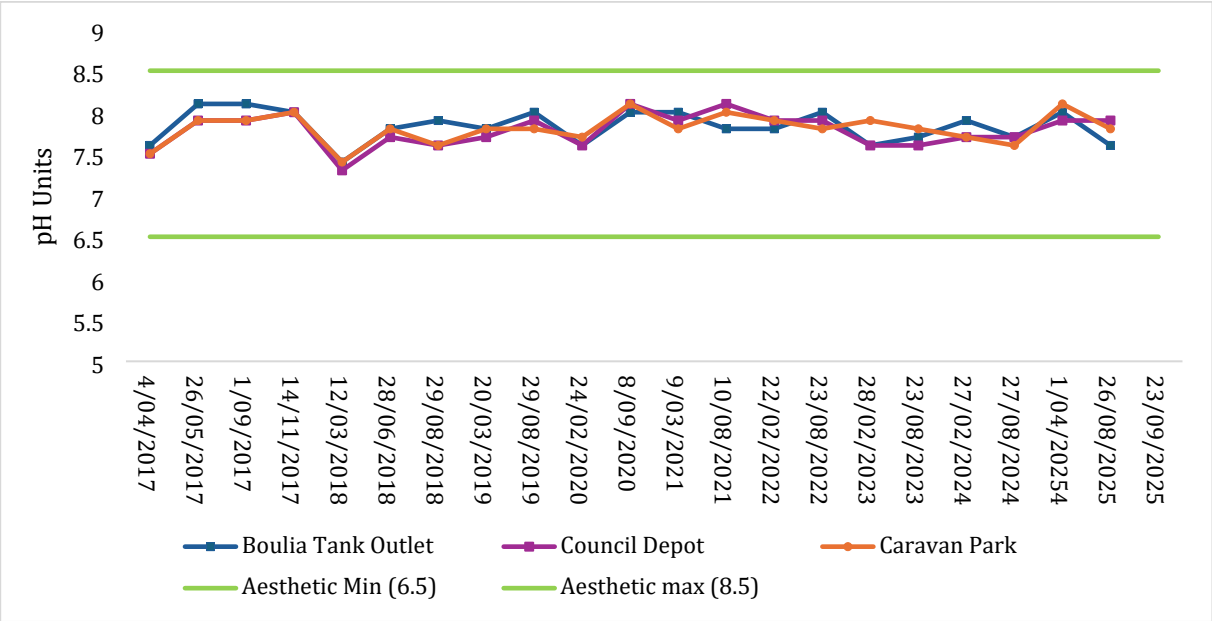


Figure 6: pH trends for Boulia's distribution system (2017-2025).

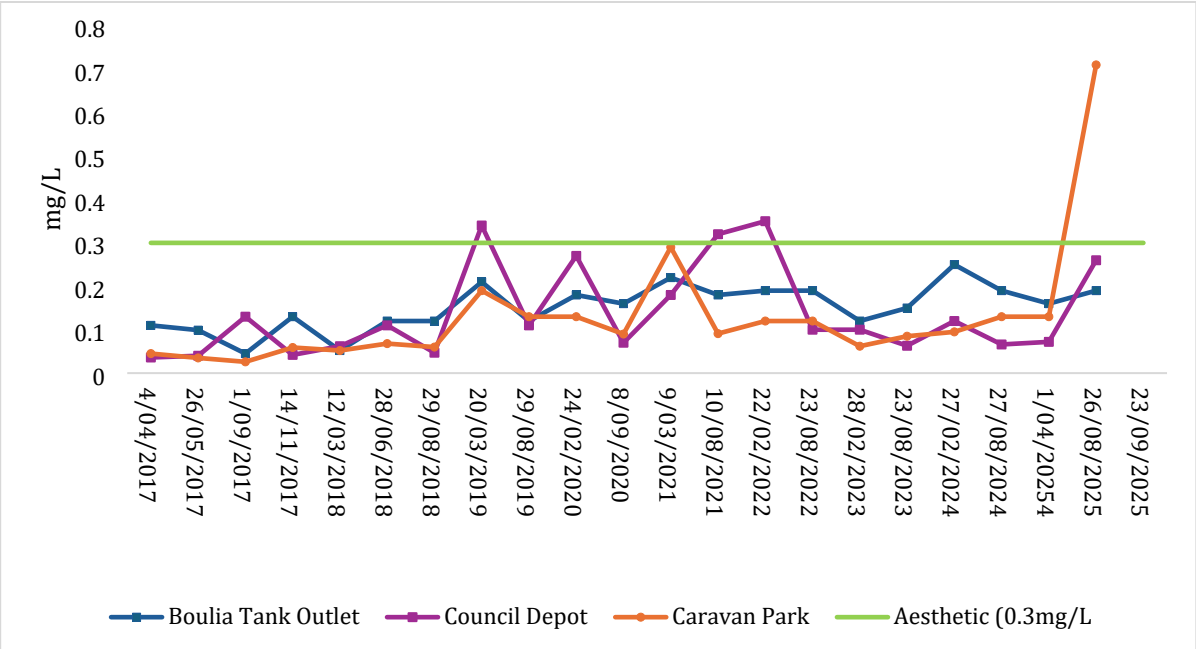


Figure 7: Iron trends for Boulia's distribution system (2017-2025).

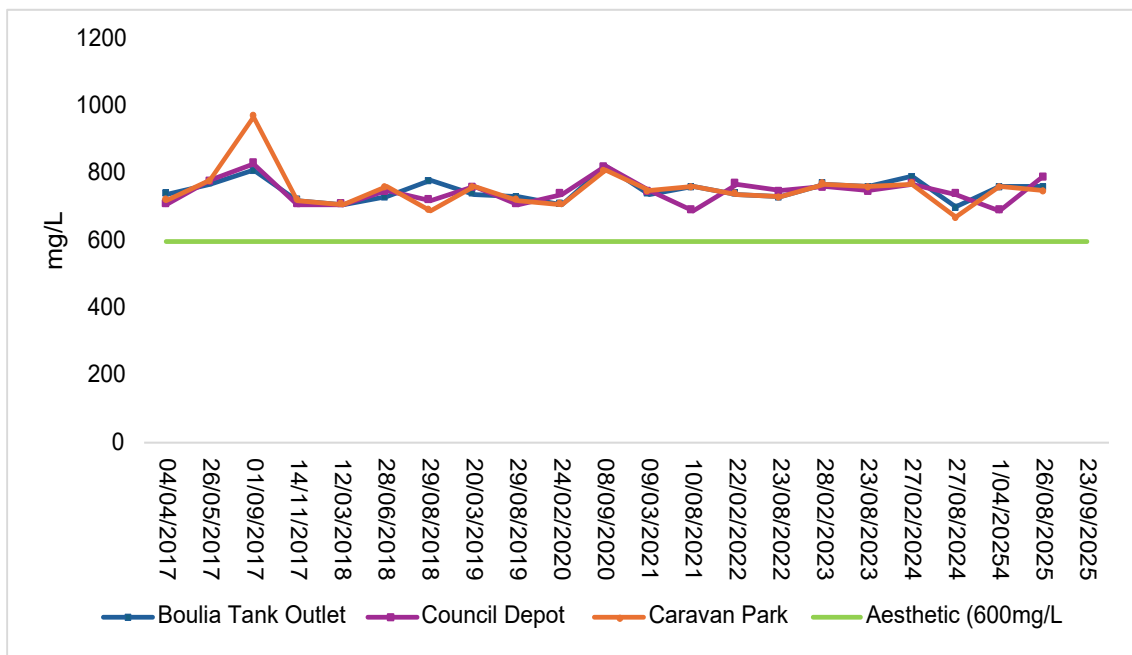


Figure 8: TDS trends for Boulia's distribution system (2017-2025).

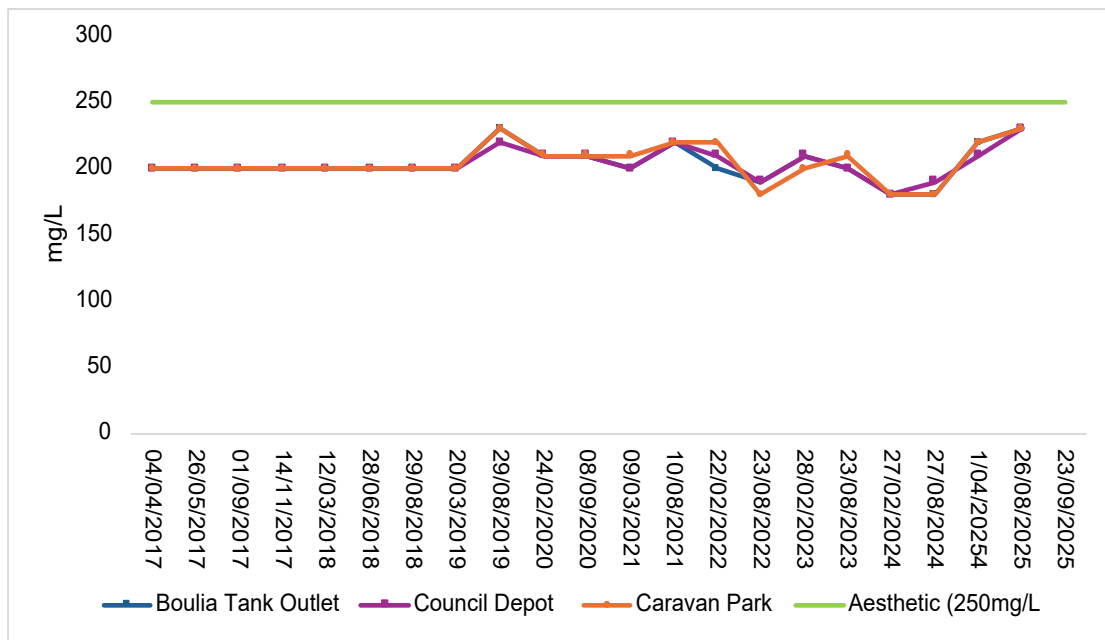


Figure 9: Chloride trends for Boulia's distribution system (2017-2025).

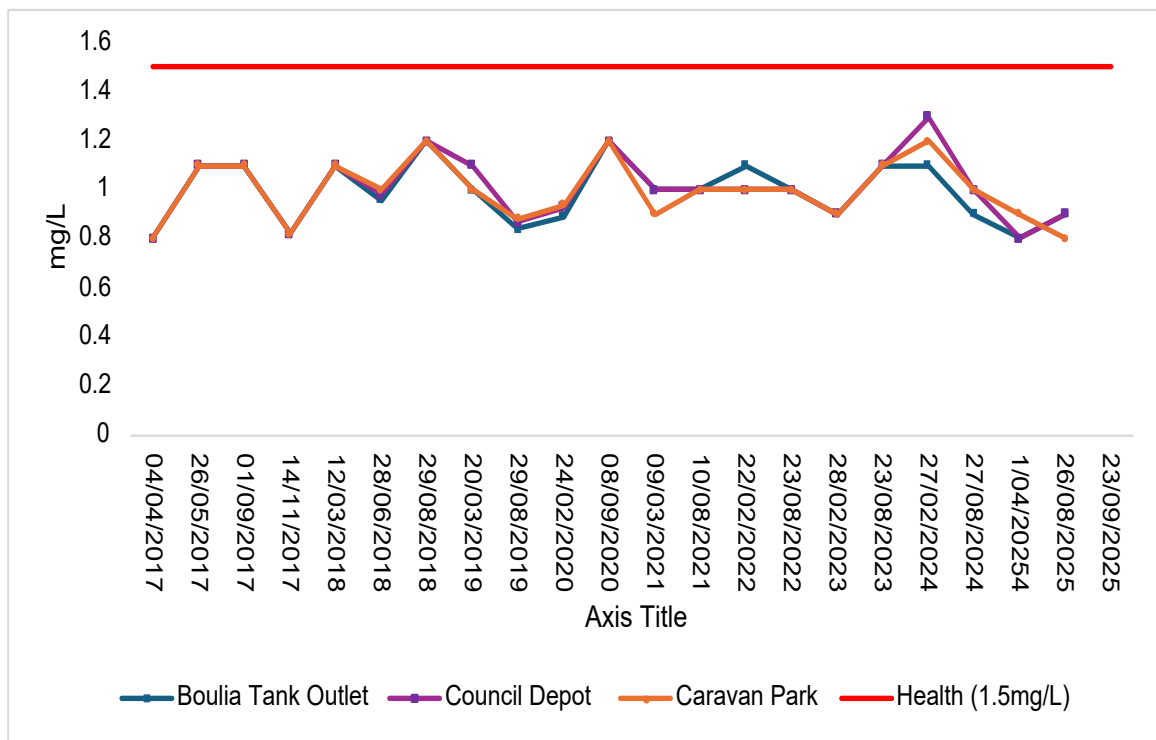


Figure 10: Fluoride trends for Boulia's distribution system (2017-2025).

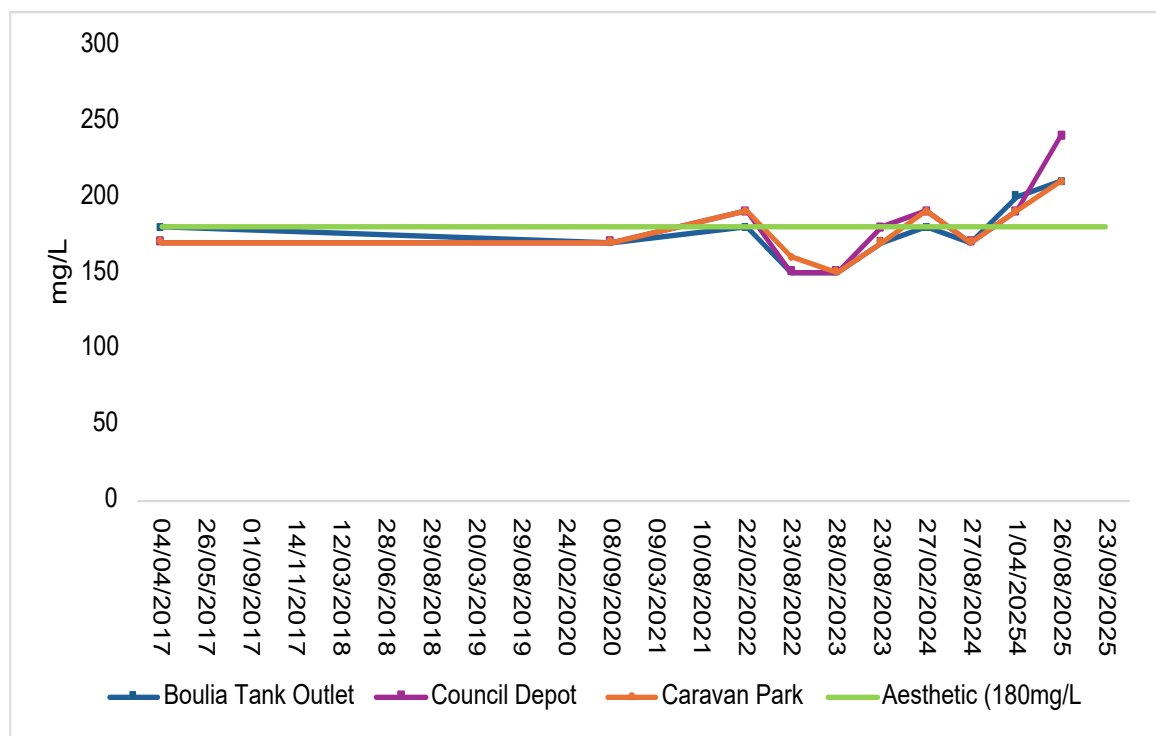


Figure 11: Sodium trends for Boulia's distribution system (2017-2025).

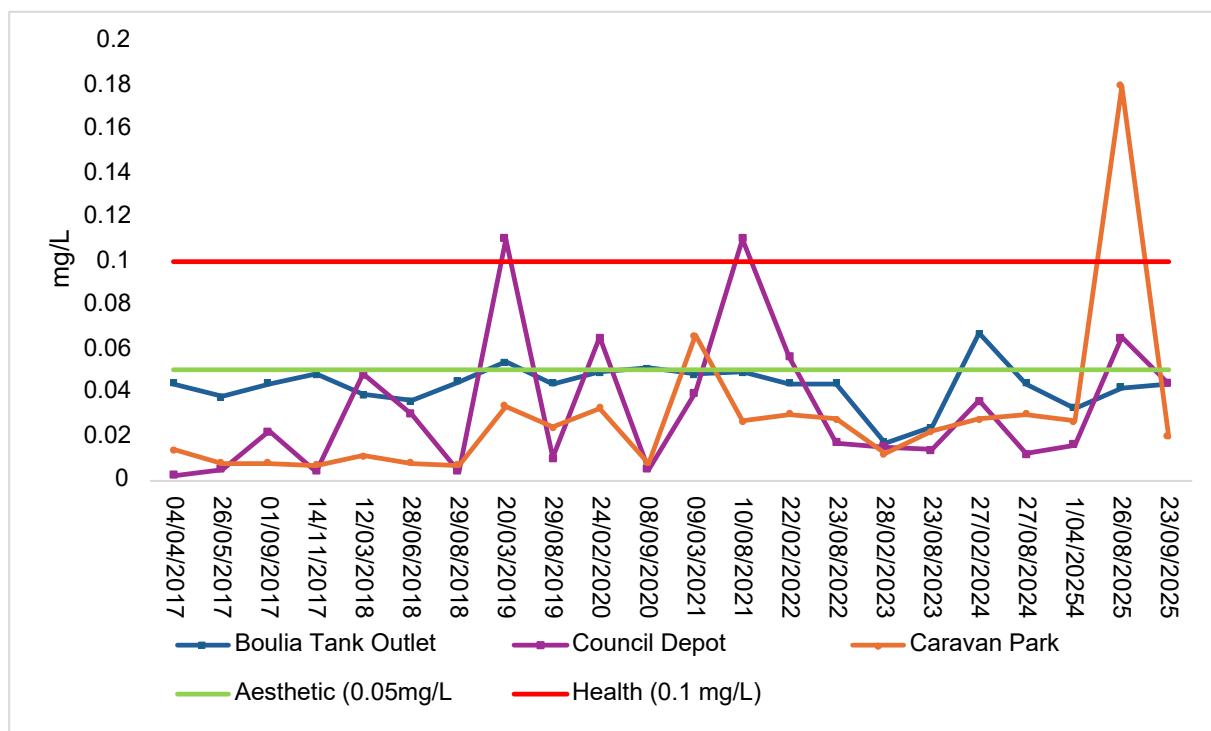


Figure 12: Manganese trends for Boulia's distribution system (2017-2025). Note that exceedances were not reported as they occurred under old 2024 ADWG health values and were therefore, not considered reportable incidents at the time.

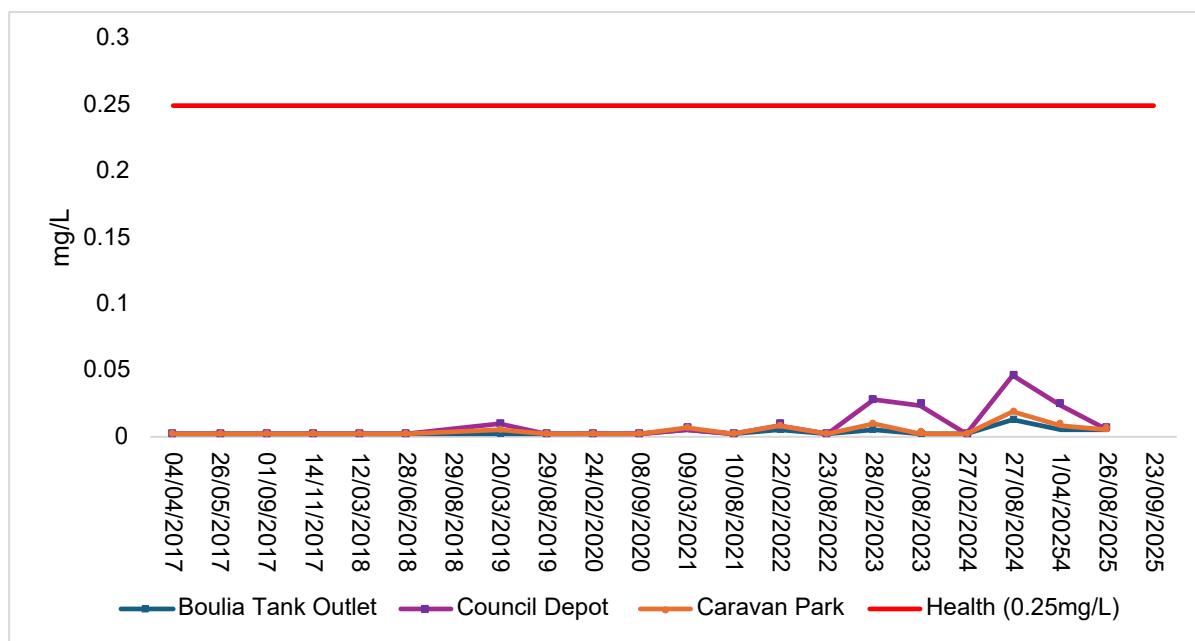


Figure 13: THM trends for Boulia's distribution system (2017-2025).

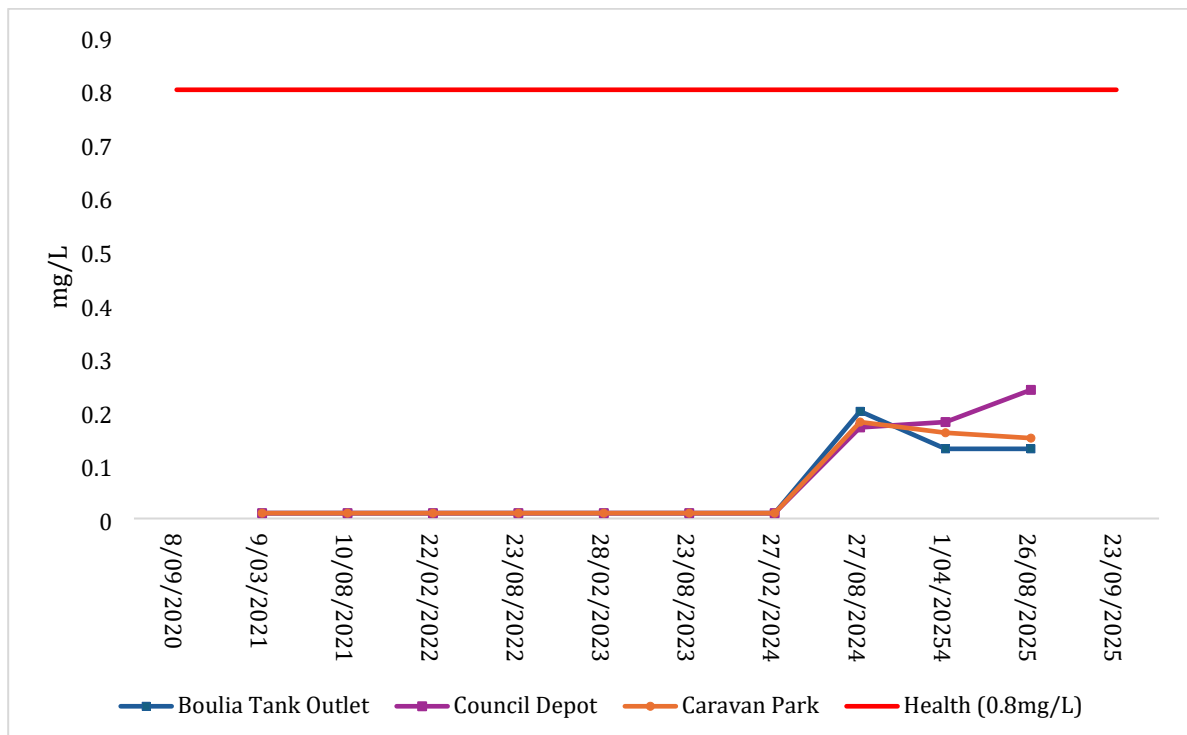


Figure 14: Chlorate trends for Boulia's distribution system (2017-2025).

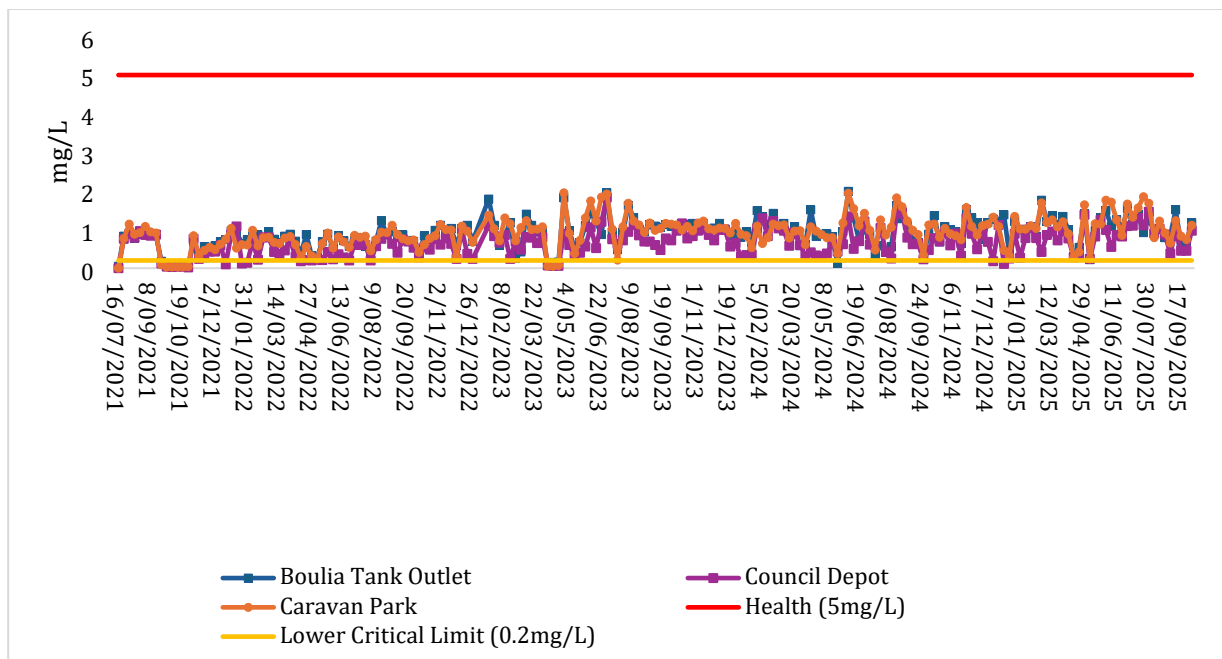


Figure 15: Free Chlorine trends for Boulia's distribution system (2021-2025).

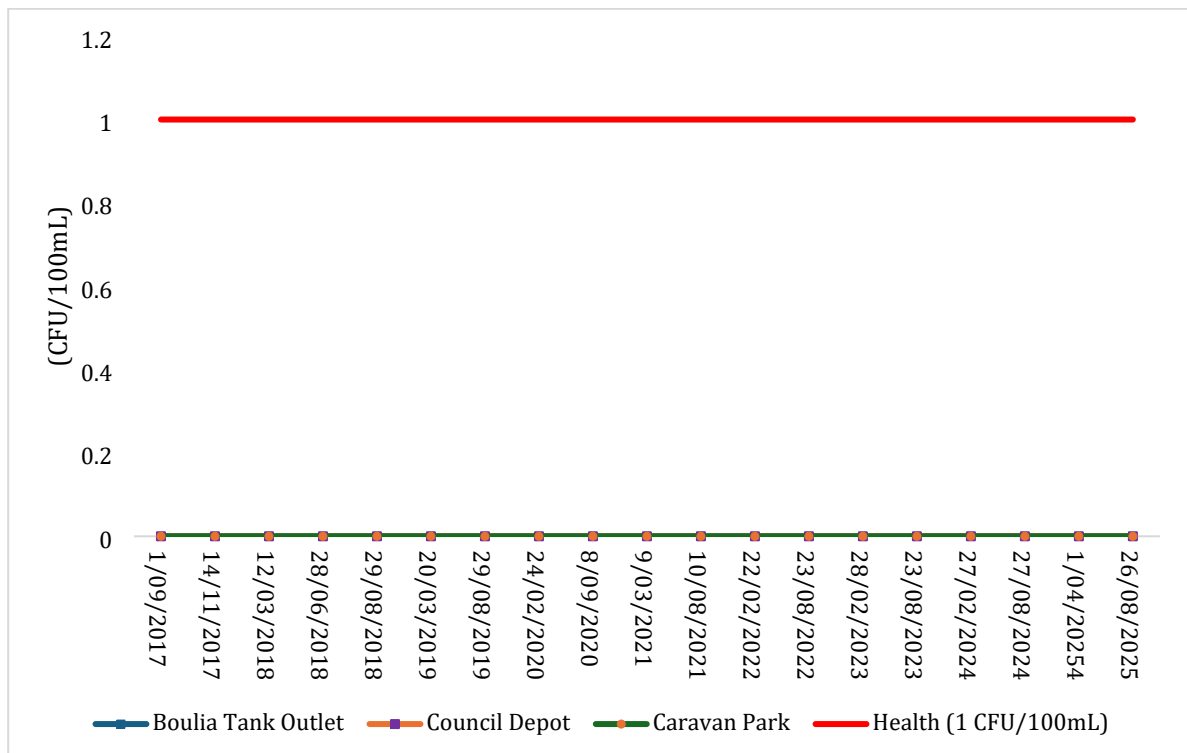


Figure 16: *E. coli* trends for Boulia's distribution system (2017-2025).