Ordinary Meeting of Council

Date: Friday 20th November 2020

Late Reports:

- ✶ **Item CEO5** **Application for Freehold Title for Lot 28 on WI51**
- ✶ **Item DWO2** **Preliminary Designs – Caretaker's Cottage**
- ✶ **Item DWO5** **Boulia Drinking Water Quality Management Plan**

BOULIA SHIRE COUNCIL

Report for Ordinary Meeting held on 20th November 2020

TITLE:	Application for Freehold Title for Lot 28 on WI51	**DOC REF:** Item CEO5 LATE REPORT

REPORT BY:	Lynn Moore CHIEF EXECUTIVE OFFICER	**DATE:** 16/11/2020

CORPORATE PLAN REFERENCE:
Key Priority 2: Building and maintaining quality infrastructure
2.3: Well planned
2.3.4 Facilitate land and infrastructure development that meets the needs of the community and fits with the financial constraints of Council, key stakeholders including State and Federal governments

PURPOSE:
Council has received notification of the proposed change to ownership over Lot 28 WI51 from Leasehold to Freehold and any objections are to be received by 16th January 2021(File / Ref number: 2020/012679).

CONTENT:
The current use of the land (Lot 28 on WI51) is Grazing - USL. The attached Smartmap shows the subject land and the surrounding locality.

The application for conversion will be assessed in terms of Section 167(1) of the *Land Act 1994,* after considering the views of all interested parties.

Objections to the conversion application, and any views or requirements that may affect the future use of the land should be received **by close of business on 16 January 2021**. Any objection to the application requires a full explanation stating the reason for the objection which should be forwarded to the Department of Natural Resources Mines and Energy.

If a response is not received by the 16th January 2021 and no alternative arrangements have been made, it will be assumed that there are no objections or requirements in relation to this matter.

CONSULTATION: Nil

GOVERNANCE IMPLICATIONS: Nil

RECOMMENDATION:
That the application as described to convert LL Lot 28 on WI51 to freehold be supported.

ATTACHMENTS:
CEO 5.1 Lot 28 on WI51 map, CEO 5.2 DNRME Request, CEO 5.3 Smart Map

Chief Executive Officer	Ms Lynn Moore


107
SP301768
26
WI44
100
SP255329
Goodwood Road
Boulia
21
WI41
Max Foly Road
100
SP255329
Boulia Bedourie Road
107
SP301768
25
SP127205
28
WI51

Author: Tammy Starr
File / Ref number: 2020/012679
Directorate / Unit: State Land Asset Management
Phone: (07) 4447 9177

Queensland Government

Department of Natural Resources, Mines and Energy

16 November 2020

The Chief Executive Officer
Boulia Shire Council
18 Herbert Street
Boulia Qld 4829
Email: admin@boulia.qld.gov.au

Dear Sir/Madam

APPLICATION FOR CONVERSION TO FREEHOLD OF TL 213317 (LOT 28 ON PLAN WI51)

The department has received the above application. The current use of the land is Grazing - USL. The attached Smartmap shows the subject land and the surrounding locality.

The application for conversion will be assessed in terms of Section 167(1) of the *Land Act 1994,* after considering the views of all interested parties.

Objections to the conversion application, and any views or requirements that may affect the future use of the land should be received **by close of business on 16 January 2021**. If you offer an objection to the application, a full explanation stating the reason for the objection should be forwarded to this Office.

If you wish to provide a response but are unable to do so before the due date, please contact the author before the due date to arrange a more suitable timeframe. If a response is not received by the due date and no alternative arrangements have been made, it will be assumed you have no objections or requirements in relation to this matter.

If you wish to discuss this matter please contact Tammy Starr on (07) 4447 9177.

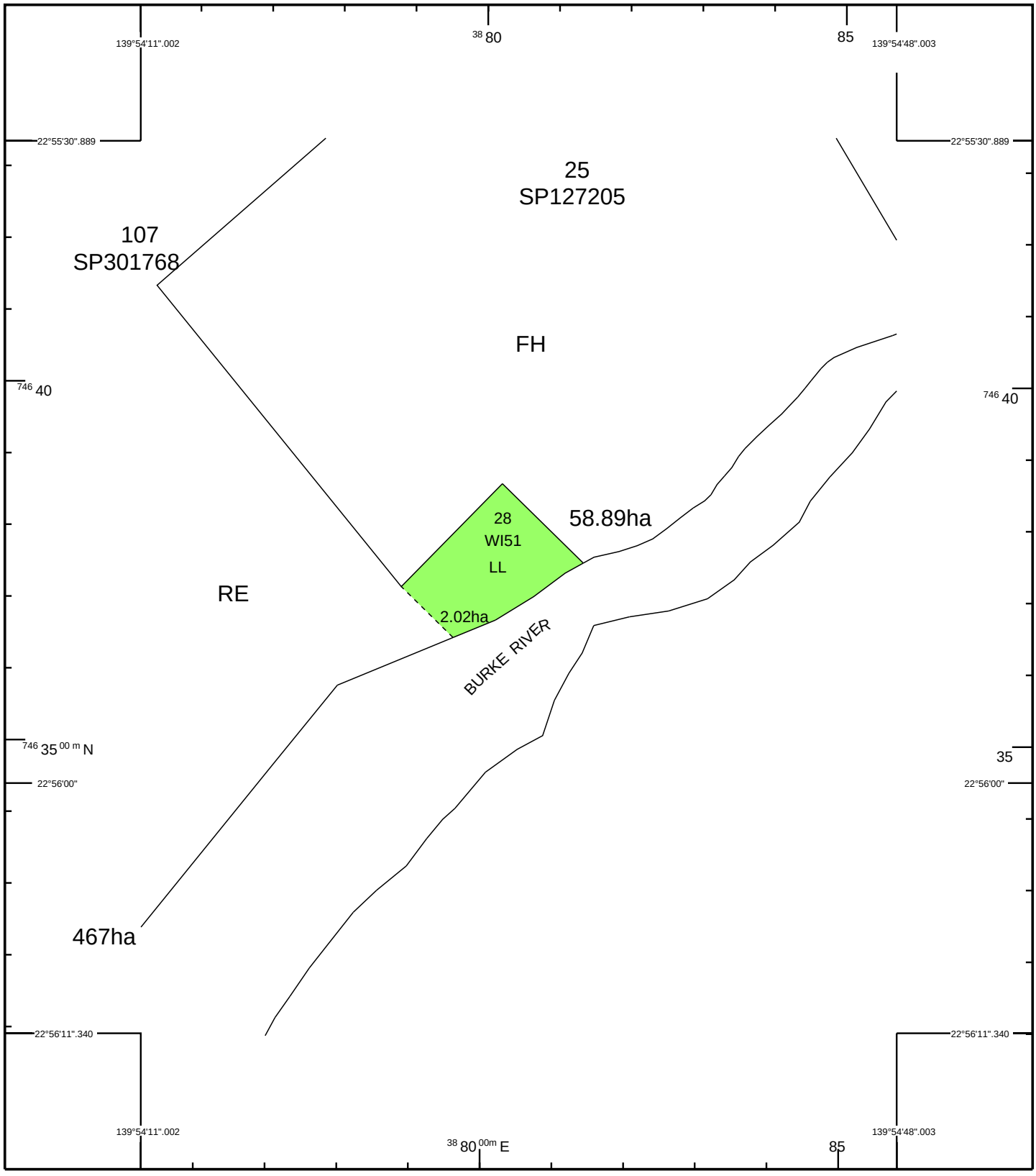
All future correspondence relative to this matter is to be referred to the contact Officer at the address below or by email to Townsville.SLAMS@dnrme.qld.gov.au. Any hard copy correspondence received will be electronically scanned and filed. For this reason, it is recommended that any attached plans, sketches or maps be no larger than A3-sized.

Please quote reference number 2020/012679 in any future correspondence.

Yours sincerely

Tammy Starr

Tammy Starr
Land Officer



STANDARD MAP NUMBER
6852-22423

0 151 303 454 606 758 m

HORIZONTAL DATUM:GDA94 ZONE:54 SCALE 1 : 7581

MAP WINDOW POSITION & NEAREST LOCATION

139°54'29".502
22°55'51".114
BOULIA
2.36 KM

GDA

SUBJECT PARCEL DESCRIPTION

DCDB

Lot/Plan	No Lot/Plan Selected.
Area/Volume	No Lot/Plan Selected.
Tenure	No Lot/Plan Selected.
Local Government	No Lot/Plan Selected.
Locality	No Lot/Plan Selected.
Segment/Parcel	No Lot/Plan Selected.

CLIENT SERVICE STANDARDS

PRINTED (dd/mm/yyyy) 16/11/2020
For additional information regarding this SmartMap see page 2.
Shading Rules have been applied.

DCDB 13/11/2020

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SmartMap

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Queensland Government

Additional Information Page

Shading Rules

 Lot Number = 28 and Plan Number = WI51

BOULIA SHIRE COUNCIL

Report for Ordinary Meeting held on 20th November 2020

TITLE:	Preliminary Designs – Caretaker's Cottage	**DOC REF:** Item DWO2 – LATE REPORT

REPORT BY:	Mr Harin Karra Director of Works and Operations	**DATE:** 16/11/2020

CORPORATE PLAN REFERENCE:
Key Priority 2: Building and maintaining quality infrastructure
- 2.2: Well serviced
  - 2.2.2 Provide and maintain well planned sustainable community assets to meet the needs of our community
- 2.3: Well planned
  - 2.3.4 Facilitate land and infrastructure development that meets the needs of the community and fits with the financial constraints of Council, key stakeholders including State and Federal governments

PURPOSE:
To consult with Council regarding preliminary designs for the new Racecourse Reserve Caretaker's Cottage.

CONTENT:
Council has been fortunate to receive funding under the Department of Local Government, Racing and Multicultural Affairs COVID-19 Works for Queensland program. This program has enabled Council to bring into fruition a number of projects that would otherwise not have been able to be completed without funding, one of which is the building of a new residential home on the Racecourse Reserve that will become the Caretaker's Cottage.

In accordance with discussions had in previous meetings of Council, the site of the new building on the reserve has been chosen and Council is now in a position to consider the layout of the home. Attached to this report are preliminary designs for review.

It is important to note that these designs are preliminary only – the next step of this project will be for Council to call for tenders for the building's construction, therefore pending what plans are submitted by tenderers in this process, the design may be subject to change.

CONSULTATION: Nil

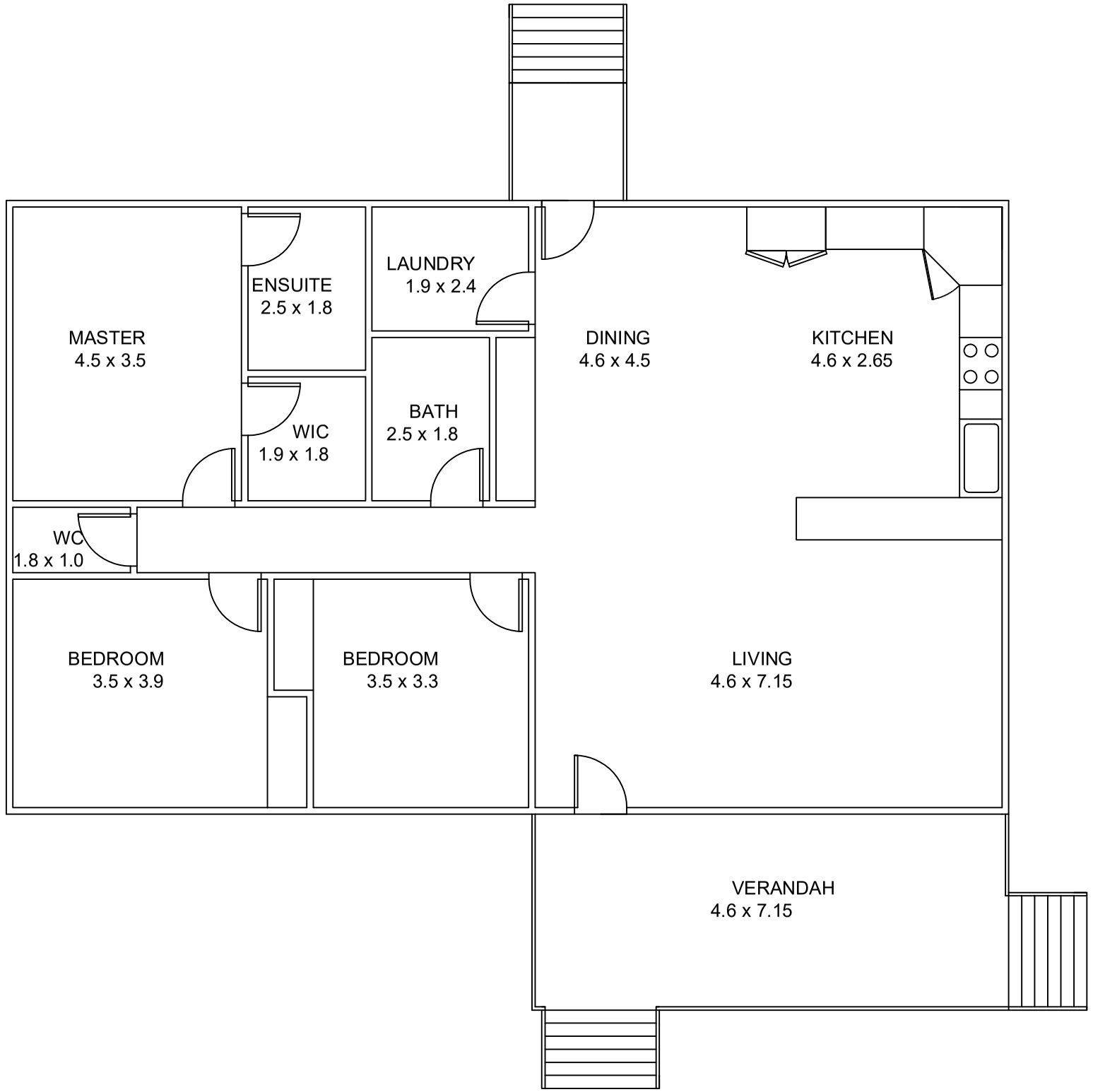
GOVERNANCE IMPLICATIONS:
Project is a part of the COVID-19 Works for Queensland funding budget.

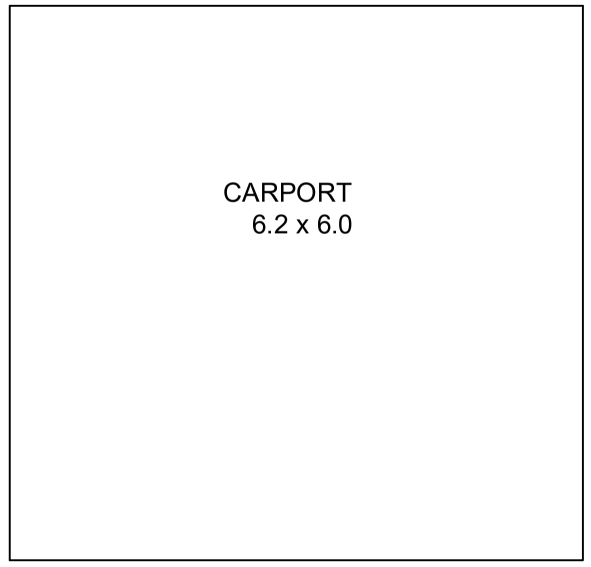
RECOMMENDATION:
That Council receive the Preliminary Designs – Caretaker's Cottage report for information.

ATTACHMENTS: Proposed floorplans

Reviewed and Approved by Chief Executive Officer	Ms Lynn Moore

RODEOGROUNDS 3 BEDROOM HOUSE FLOOR PLAN





AREAS
INTERNAL AREA: 139.4m2
DECK AREA: 25m2
CARPORT: 37.2m2

		Date:	Project: RODEOGROUNDS HOUSE	Paper Size: A3
		Drawn: H.J.K	Title: 3 BEDROOM FLOORPLAN	Scale:
		Approved:		Revision No. 1
		Date:	Sub- Job:	Sheet No.

RODEOGROUNDS 3 BEDROOM HOUSE FLOOR PLAN

			Date:	Project: RODEOGROUNDS HOUSE	Paper Size: A3
			Drawn: H.J.K	Title: 3 BEDROOM FLOORPLAN	Scale:
			Approved:		Revision No. 1
			Date:	Sub- Job:	Sheet No.

BOULIA SHIRE COUNCIL

Report for Ordinary Meeting held on 20th November 2020

TITLE:	Boulia Drinking Water Quality Management Plan	**DOC REF:** Item DWO5 LATE REPORT

REPORT BY:	Mr Harin Karra Director of Works and Operations	**DATE:** 17/11/2020

CORPORATE PLAN REFERENCE:
Key Priority 2: Building and maintaining quality infrastructure
2.2: Well serviced
2.2.1 Provide sustainable and environmentally sound water, sewerage and waste services for the communities within the Shire

PURPOSE:
To seek Council endorsement of the amended Boulia Drinking Water Quality Management Plan, as approved by the Department of Natural Resources, Mines and Energy.

CONTENT:
As a small Drinking Water Service Provider, Council has a variety of obligations it must adhere to under numerous acts. One of these obligations is the requirement to have an approved Drinking Water Quality Management Plan (DWQMP) as per the *Water Supply (Safety and Reliability) Act 2008*/*Water Supply (Safety and Reliability) Regulation 2011*.

Once a DWQMP is established, a number of differing audit and report types are then required to be completed at specified intervals.

Earlier this year, Council submitted an application to the Department of Natural Resources, Mines and Energy (the Regulator), for approval of amendments to the DWQMP which included changes to the following sections of the plan:

- Details of infrastructure for providing the service;
- Identify hazards and hazardous events;
- Assessment of risks;
- Risk management measures;
- Risk management improvement program.

Following negotiations between relevant Council and Regulator officers and subsequent alterations to the DWQMP, the final revised version - Version 22 October 2020, was approved with four standard conditions, noting that Council will need to focus on managing the turbidity of the drinking water it supplies in the short and medium term.

Standard Conditions	
1. Water Quality Criteria	Water quality criteria (as defined in Schedule 3 of the *Water Supply (Safety and Reliability) Act 2008*) for drinking water, means all of the following: (i) the standards for the quality of drinking water prescribed in a regulation under the *Public Health Act 2005*; (ii) the criteria stated in a guideline, if any, made by the Regulator about the quality of drinking water; (iii) the criteria for the quality of drinking water stated in a condition applying to a Drinking Water Quality Management Plan. For the purpose of (iii), the following applies: All parameters that have health guideline values in the most current version of the Australian Drinking Water Guideline are deemed to be water quality criteria that apply, to this Drinking Water Quality Management Plan. Parameters with only aesthetic guideline values are NOT considered water quality criteria and are not required to be reported under this condition. You must implement the verification monitoring program as detailed in the approved amended Drinking Water Quality Management Plan and report any non-compliance with the water quality criteria for the parameters monitored, in accordance with Section 102 of the *Water Supply (Safety and Reliability) Act 2008*. Additionally, if during the course of this monitoring or other activity, you become aware of a detection of a parameter in the drinking water supply that exceeds a health guideline value set in the Australian Drinking Water Guideline, that is not part of the verification monitoring

	program, you must notify this detection to the Regulator in accordance with Section 102 of the *Water Supply (Safety and Reliability) Act 2008*.
2. Additional reporting requirements (a) events; and (b) where a parameter has no water quality criteria	The following additional reporting requirements apply to the approved amended Drinking Water Quality Management Plan. These additional reporting requirements relate to: (a) Event(s), and (b) Where a parameter has no water quality criteria. An event is deemed to be anything that has happened to you or your service which has escalated beyond your ability to control and you believe or are concerned that public health may be adversely impacted as a result. A parameter with no water quality criteria is deemed to be any parameter with ▪ no standards prescribed in the *Public Health Regulation 2005* ▪ no criteria prescribed in the Water Quality and Reporting Guideline for a Drinking Water Service issued by the Regulator; and ▪ no guideline value in the most current version of the Australian Drinking Water Guidelines. Parameters with aesthetic guideline value only in the most current version of the Australian Drinking Water Guidelines are NOT considered parameters with no water quality criteria and are not required to be reported under this condition. The detection of a parameter with no water quality criteria must be reported to the Regulator if you believe this parameter cannot be managed under your approved amended Drinking Water Quality Management Plan and you believe, or are concerned, that public health may be impacted. You must immediately report these additional reporting requirements to the Regulator and then follow up this initial report within 24 hours, by submitting a *Notification of a drinking water event or detection of a parameter with no water quality criteria* form. The condition is imposed to verify that events and detections of a parameter that have no water quality criteria are appropriately managed to ensure the final water quality minimises any impact on public health. This condition will cease to apply upon commencement of the 'prescribed incidents' regulation as detailed in section 102A (4) of the *Water Supply (Safety and Reliability) Act 2008*.
3. Research projects and additional reporting requirements	If you are involved in any water quality research activity and become aware of the detection of or detect a parameter that must be reported as: ▪ non-compliance with water quality criteria as per Section 102 of the Water Supply (Safety and Reliability) Act 2008 ▪ an event or ▪ a parameter with no water quality criteria you must immediately report it to the Regulator, then follow up this initial report in writing within 24 hours of the initial report, unless you have sought and obtained formal acknowledgement of the research activity by the Regulator. Where you are operating under a research activity that has been formally acknowledged by the Regulator, detections of parameters arising from this research activity must be reported as detailed in the formal acknowledgement.
4. Financial outlays	The State of Queensland accepts no liability for any financial outlay incurred by complying with the approved amended Drinking Water Quality Management Plan and the conditions in this approval.

CONSULTATION: George Bourne and Associates (GBA)

GOVERNANCE IMPLICATIONS:
As a small Drinking Water Service Provider, Council has a variety of obligations it must adhere to under numerous acts.

RECOMMENDATION:
That the Boulia Drinking Water Quality Management Plan, version 22 October 2020, be endorsed by Council.

ATTACHMENT: Boulia Drinking Water Quality Management Plan

Reviewed and Approved by Chief Executive Officer	Ms Lynn Moore

BOULIA DRINKING WATER QUALITY MANAGEMENT PLAN

Service Provider ID 18

GBA CONSULTING ENGINEERS

Document Control

Date	Description	Author
22/05/2013	Internal review	Patrick J Cullivan/ Alvin Feeney
23/05/2013	Council	Endorse
04/11/2013	Approved	Alvin Feeney
23/02/2017	Issue for Review	William Green
02/03/2017	Approved	William Green
26/02/2020	Issue for Review	William Green
21/07/2020	Updated for Review by Client	William Green
04/08/2020	Released to Client	Stuart Bourne
19/10/2020	Amended with Regulator Comments	William Green
22/10/2020	Released to Client	Stuart Bourne

GBA Project/Doc ID no. **190234 / 338431**

Contact for enquiries and proposed changes

If you have any questions regarding this document or if you have a suggestion for improvements, please contact George Bourne and Associates.

Phone 07 4651 5177
Email admin@gbaengineers.com.au

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1 REGISTERED SERVICE DETAILS

Boulia Shire Council (BSC) is located in Western Queensland and comprises the towns of Boulia and Urandangie covering an area of 61,176 km^2. Figure 1.1 shows the location of the Boulia Shire relative to major Queensland centres.

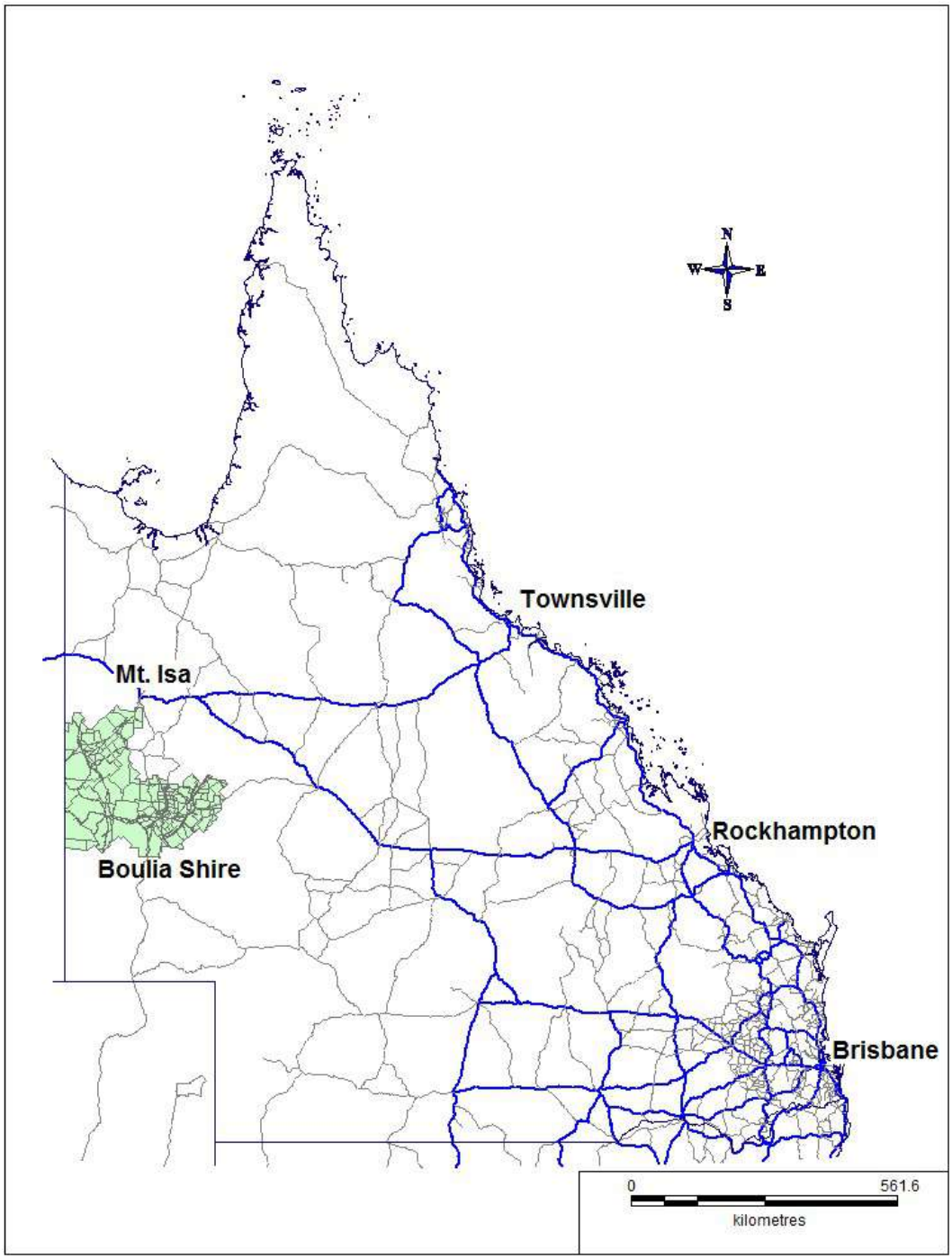


Figure 1.1 Boulia Shire Location Map

BSC is the drinking water service provider (SPID 18) for the following two drinking water supply schemes in the region (Figure 1.2 below).

- **Boulia Water Supply Scheme**
  Boulia is located approximately 360km west of Winton, 382km north of Birdsville and 295km south of Mt Isa.
- **Urandangie Water Supply Scheme**
  Urandangie is located 30km form the Northern Territory border, 160km southwest of Mt Isa and 220km northwest of Boulia.

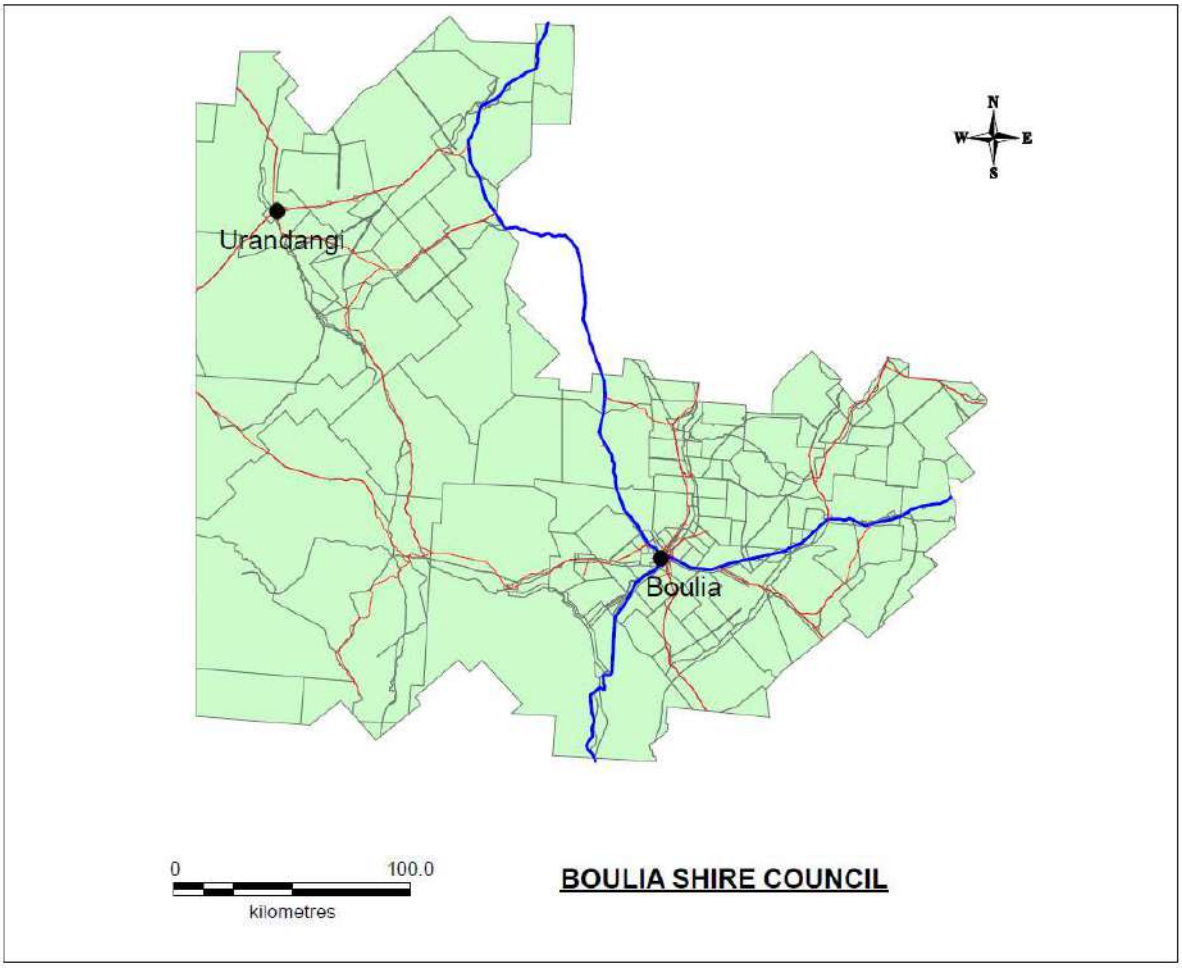


Figure 1.2 Boulia Shire Council

BSC is a small Drinking Water Service Provider (DWSP) as defined in the Water Supply (Safety and Reliability) Act 2008 and provides drinking water for an approximate population of 274 with a total demand of approximately 831 kL/d. BSC may be referred to as the DWSP throughout this document.

Council's office is located in Boulia. Council's mailing address is:

Boulia Shire Council
18 Herbert Street Boulia
BOULIA QLD 4829

The Council contact in relation to this plan is:

Harin Karra
Director of Works
Phone: 07 4746 3188
Email: dwo@boulia.qld.gov.au

1.1 Approval Application Form

Refer to APPENDIX A
DRINKING WATER QUALITY MANAGEMENT PLAN APPROVAL APPLICATION.

1.2 Further information

Table 1.1 below lists the drinking water schemes, identifies the operational responsibilities for each scheme and details the current and future population and demand for each scheme.

Table 1.1 Listing of Drinking Water Schemes

Scheme Name	Operator (organisation)	Current (2016)			Future (2026)[1]		
		Population Served	Connections	Demand kL/d	Population Served	Connections	Demand kL/d
Boulia Water Supply Scheme	Boulia Shire Council	280	119	770	274	117	755
Urandangie Water Supply Scheme		25	19	61	25	19	69
Total		305	138	831	299	136	824

1.3 Regulatory and Formal Requirements

The following table lists the regulatory requirements the DWSP is required to meet with regard to the management of drinking water.

Table 1.2 Regulatory and Formal Requirements

Requirement	Council obligations and how they relate to the DWQMP
Water Supply (Safety and Reliability) Act 2008 Water Supply (Safety and Reliability) Regulation 2011	Council registered as a service provider, given powers to do certain things (e.g. disconnect customers, restrictions). Required to have an approved DWQMP and comply with the DWQMP. Required to report and respond to drinking water incidents.
Public Health Act 2005 Public Health Regulation 2005	Sets minimum sampling frequencies for E. coli as a provider. Council must not provide unsafe water.

[1] A population decline of -.2% per annum has been applied for Boulia in accordance with 2016 census data. Current population for Urandangie remains static with no foreseeable annual growth predicted due to the remoteness of the region.

Requirement	Council obligations and how they relate to the DWQMP
Disaster Management Act 2003	Council is required to have a disaster management plan. This plan links to the Emergency Plan in this document.
Work Health and Safety Act 2011	Council must ensure safe work practices, including in the provision of drinking water.
Plumbing and Drainage Act (2002)	Council must ensure that water infrastructure work is at a particular standard.
Qld Plumbing and Wastewater Code (QPW code)	The code defines how drinking water infrastructure can be constructed.

2 DETAILS OF INFRASTRUCTURE FOR PROVIDING THE SERVICE

BSC is the DWSP for two water supply schemes. The infrastructure for providing the service is detailed in the sections outlined below:

- 2.1 Boulia Water Supply Scheme
- 2.2 Urandangie Water Supply Scheme

For both water supply schemes, bore water is pumped into ground level reservoirs and then either elevated reservoirs or directly into reticulation. A chlorine gas disinfection system has been commissioned in Boulia which self regulates chlorine dosage rates based on water usage, in Urandangie chlorine tablets are added to the ground level reservoir.

2.1 Boulia Water Supply Scheme

Boulia water supply scheme is comprised of five sub-artesian bores. Water is pumped on demand from the bores into a 1,140kL ground level reservoir and a 26m high 314kL elevated reservoir. The raw water lines are directed into a manifold which combines the raw water before entering the ground level reservoir.

A Chlorine gas disinfection system is positioned between the combined raw water manifold and the ground water reservoir, a small percentage of the combined raw water line is diverted through the chlorine gas disinfection system. The chlorination process consists of a single chlorinator unit, which shares a common gas inlet and has a one duty dosing stream. Chlorine gas flows from the chlorine gas cylinder into the vacuum regulator where its pressure is reduced to less than atmospheric. It is drawn through the transfer pipework into the chlorinator by the vacuum produced at the injector. The level of chlorine dosage (kg/hr) is set and controlled by the chlorine residual analyser/controller (upstream of the reservoir) mounted on the chlorine dosing panel. The desired chlorine feed rate is calculated by the analyser controller via an analogue 4-20mA flow pacing signal sent from the mains flowmeter (multiple bore pump supply line), and chlorine residual reading. This analyser/controller determines the actual gas feed rate of the V-notch plug. A display mounted on the side of the chlorinator indicates the flow meter reading.

Chlorinated water is then pumped from the reservoirs directly into reticulation. 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.

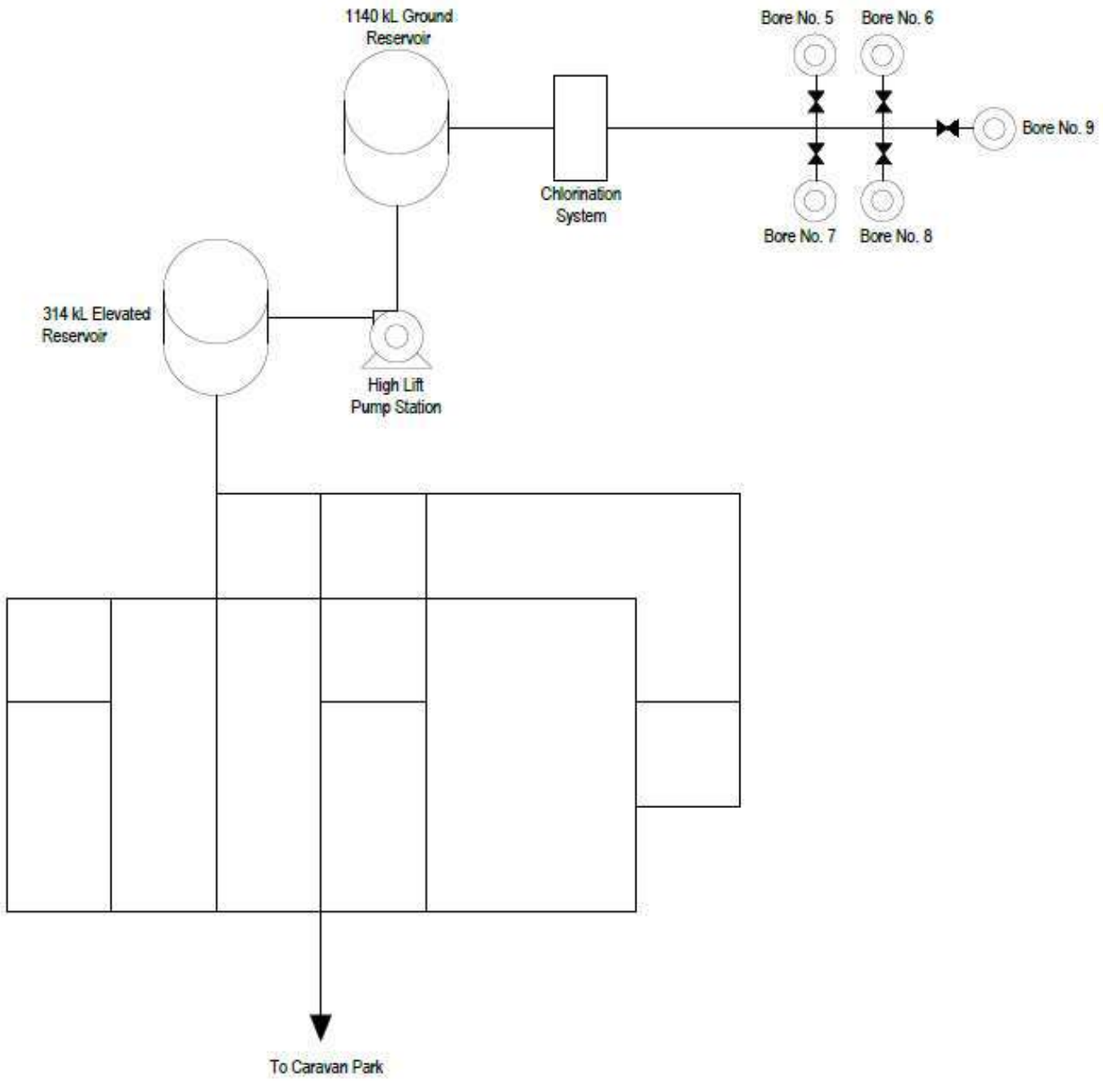
During power outages a back-up generator can be used to power pumps and the control system.

2.1.1 Schematic

Figure 2.1 below shows a schematic of the Boulia Water Supply Scheme. Refer to APPENDIX B for water supply layouts.

PRELIMINARY
FOR COMMENT
12 February 2020 at 10:27

Boulia Water Distribution Schematic



BORE INFORMATION	
BORE NO.	DATA
No. 5 Town Bore RN 93060	Constructed 1995 Depth 84.5m SWL 21.3m (1995) 5L/S (1995)
No. 6 Town Bore RN 118071	Constructed 2003 Depth 82m SWL 31.1m (2003) 5L/S (2003)
No. 7 Town Bore RN 146260	Constructed 2010 Depth 82m SWL 39m 2L/S
No. 9 Town Bore RN 146261	Constructed 2010 Depth 84m SWL 27m 4L/S
Backup Bore: No. 8 Town Bore RN146262	Constructed 2010 Depth 83m SWL 25m 3L/S

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2012-050-02/02
11/02/2020

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Figure 2.1 Boulia Service Schematic Layout

2.1.2 Source, Treatment and Distribution Details

Table 2.1 provides the following information for Boulia's infrastructure:

- Source details;
- Distribution and reticulation.

Table 2.1 Boulia Infrastructure Details

Component		Boulia Water Supply Scheme
Sources	Name	Boulia Town Bore No. 5 (Clinic)
	Type	Sub-artesian Bore (RN 93060)
	% of supply	Varies according to program
	Reliability	Does not run dry
	Water quality issues	Refer to 3.1.1 Water Quality Information
	Name	Boulia Town Bore No. 6 (Airport)
	Type	Sub-artesian Bore (RN 118071)
	% of supply	Varies according to program
	Reliability	Does not run dry
	Water quality issues	Refer to 3.1.1 Water Quality Information
	Name	Boulia Town Bore No. 7 (Powerhouse)
	Type	Sub- artesian Bore (RN 146260)
	% of supply	Varies according to program
	Reliability	Does not run dry
	Water quality issues	Refer to 3.1.1 Water Quality Information
	Name	Boulia Town Bore No. 9 (Washdown Bay)
	Type	Sub-artesian Bore (RN 146261)
	% of supply	Varies according to program
	Reliability	Does not run dry
	Water quality issues	Refer to 3.1.1 Water Quality Information
Backup Source	Name	Boulia Town Bore No. 8 (SES)
	Type	Sub-artesian Bore (RN 146282)
	% of supply	0% unless water shortage
	Reliability	Does not run dry
	Water quality issues	High turbidity
Sourcing Infrastructure	Type	Artesian Bores
	Description	Town Bore No. 5 is located at the northern end of Wills Street. Town Bore No.6 is located at the western end of Herbert Street. Town Bore No. 7 is located on the corner of Herbert Street and Hamilton Street. Town Bore No 8 is located is located on the corner of Templeton St and Burke St. Town Bore No 9 Is located on Diamantina St adjacent to washdown bay. Town Bore No.5, Town Bore No.6, Town Bore No.7, Town bore No 8 and Town Bore 9 are 84.5m, 82m, 82m, 83 and 78 m deep

Component		Boulia Water Supply Scheme
		respectively and yield 5 l/s, 5l/s, 2l/s, 3l/s and 4l/s respectively. All online bores are pumped into the ground level reservoir and then pumped into reticulation or the elevated reservoir. Refer to Appendix C for bore construction details.
Are there any sources that **do not** undergo treatment prior to supply?	All bores flow to the ground level reservoir water treatment consists of disinfection only.	
Are there any sources that **do not** undergo disinfection prior to supply?	Chlorine gas disinfection occurs prior to source water entering the ground level reservoir.	
Disinfection	Location	Combined source water line
	Type	Chlorine Gas
	Dose rate	.04-.34kg/hr
	Target residual levels	> .2mg/L <1mg/L
	Duty/standby	Single duty
	Alarms	The chlorination system has audible alarm and remote monitoring alarms. The remote terminal unit sends operators SMS notifications of alarms that require immediate operator attention. Alarms include: • Weight scale 1 low inventory alarm • Chlorine analyser (reservoir upstream) low chlorine residual alarm • Mains flow meter fault/error alarm • Booster pump inlet low flow alarm • Chlorine shutdown system leak detector alarm
	Auto shut-off arrangements	In the event of a chlorine gas leak detectors are hard wired to shutdown
	Pipe material Age range Approx. % of total length	Poly 9-29 65%
	Pipe material Age range Approx. % of total length	Rural Poly 5 28%
	Pipe material Age range Approx. % of total length	uPVC 64 6%
	Pipe material Age range Approx. % of total length	Blue Brute 16-21 1%

Component		Boulia Water Supply Scheme
	Areas where potential long detention periods could be expected	None
	Areas where low water pressure (e.g. < 12 m) could be expected during peak or other demand periods)	None
Reservoirs	**Ground Level**	
	Name	Boulia Ground Level Reservoir
	Capacity (ML)	1.140
	Roofed	Yes
	Vermin-proof	Yes
	Runoff directed off roof	Yes
	Construction materials	Concrete tank, aluminium roof
	Elevated	
	Name	Boulia Elevated Reservoir
	Capacity (ML)	0.314
	Roofed	Yes
	Vermin-proof	Yes
	Runoff directed off roof	Yes
	Construction materials	Galvanised steel
Water quality responsibility changes	Entire water supply scheme	Boulia Shire Council

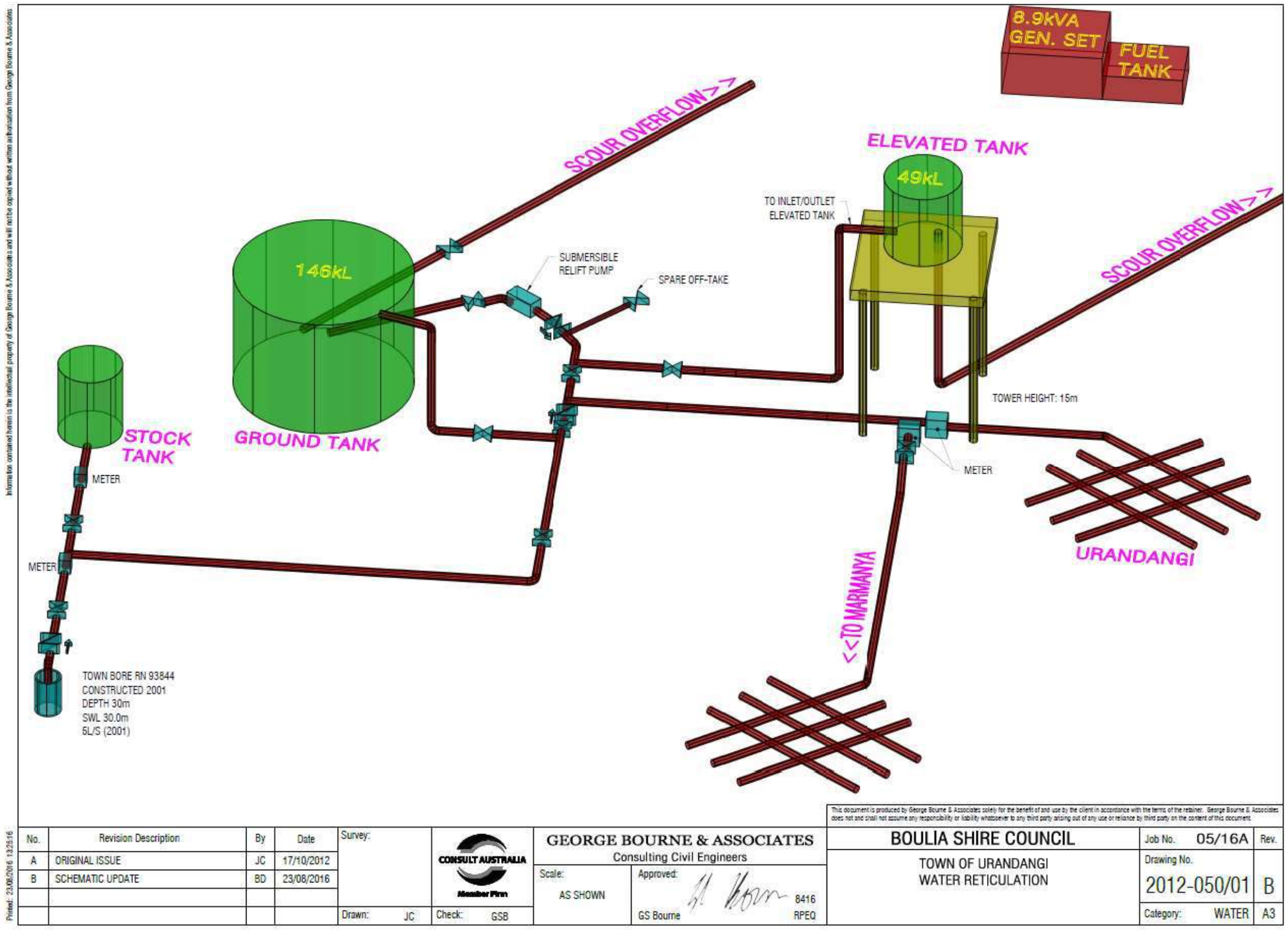
2.2 Urandangie Water Supply Scheme

Urandangie water supply scheme is comprised of one sub-artesian bore which pumps water to a 146kL ground reservoir and a 16m high 49kL elevated reservoir. Water is then fed from the reservoirs directly into reticulation. The water supplied into reticulation is treated with chlorine tablets. 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 bore pumps and control system is powered by a solar array. Urandangie also provides water supply to Marmanya which is an Indigenous settlement on a private property 3km north east of Urandangie. Marmanya is not subject to routine Council inspections.

During power outages a back-up generator can be used to power pumps and the control system.

2.2.1 Schematic

Figure 2.2 below shows a schematic of the Urandangie Water Supply Scheme. Refer to APPENDIX B for water supply layouts superimposed on aerial photos.



No.	Revision Description	By	Date
A	ORIGINAL ISSUE	JC	17/10/2012
B	SCHEMATIC UPDATE	BD	23/08/2016

Survey:
Drawn: JC
Check: GSB

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Member Firm

GEORGE BOURNE & ASSOCIATES
Consulting Civil Engineers

Scale: AS SHOWN
Approved: GS Bourne 8416 RPEQ

BOULIA SHIRE COUNCIL
TOWN OF URANDANGI
WATER RETICULATION

Job No. 05/16A
Drawing No. 2012-050/01
Rev. B
Category: WATER
A3

Printed: 23/08/2016 13:25:16

Figure 2.2 Urandangie Service Schematic Layout

2.2.2 Source, Treatment and Distribution Details

Table 2.2 provides the following information for Urandangie's infrastructure:

- Source details;
- Distribution and reticulation.

Table 2.2 Urandangie Infrastructure Details

Component		**Urandangie Water Supply Scheme**
Source	Name	Urandangie Town Bore No.1
	Type	Sub Artesian Bore (RN 93844)
	% of supply	100%
	Reliability	Does not run dry
	Water quality issues	Refer to 3.2.1 Water Quality Information
Sourcing Infrastructure	Type	Sub Artesian Bore
	Description	The Urandangie town bore is located on the corner of Collins Street and Margaret Street. The bore is 30m deep. The bore currently yields 5 l/s. Refer to appendix C for bore construction details.
Are there any sources that **do not** undergo treatment prior to supply?	Ground level reservoir treated manually with chlorine tablets.	
Are there any sources that **do not** undergo disinfection prior to supply?	No	
Disinfection	Location	Ground level reservoir
	Type	Chlorination
	Dose rate	3 tablets per week
	Target residual levels	N/A
	Duty/standby	N/A
	Alarms	None
	Auto shut-off arrangements	N/A
Distribution and Reticulation System	Pipe material	uPVC
	Age range	17
	Approx. % of total length	10.8%
	Pipe material	Poly
	Age range	17
	Approx. % of total length	89.2%
	Areas where potential long detention periods could be expected	None

Component		Urandangie Water Supply Scheme
	Areas where low water pressure (e.g. < 12 m) could be expected during peak or other demand periods)	None
Reservoirs	**Ground Level**	
	Name	Urandangie Ground Level Reservoir
	Capacity (ML)	0.146
	Roofed	Yes
	Vermin-proof	Yes
	Runoff directed off roof	Yes
	Construction materials	Concrete base, galvanised steel tank
	Elevated	
	Name	Urandangie Elevated reservoir
	Capacity (ML)	0.049
	Roofed	Yes
	Vermin-proof	Yes
	Runoff directed off roof	Yes
	Construction materials	Galvanised steel
Water quality responsibility changes	Entire water supply scheme	Boulia Shire Council

2.3 Key Stakeholders

Table 2.3 below outlines the relevant stakeholders for BSC water supply schemes in Boulia and Urandangie.

Table 2.3 Boulia Shire Council Stakeholders

Organisation	Contact Name and Details	Relevance to management of drinking water quality	How the stakeholder is engaged in the DWQMP
Boulia Shire Council	Lynn Moore Chief Executive Officer P: (07) 4746 3188 E:ceo@boulia.qld.gov.au	Small Drinking Water Service Provider	Small Drinking Water Service Provider
Boulia Hospital	P: (07) 3274 9070	Sensitive User	Sensitive User
Boulia Primary School	P: (07) 4746 3151	Sensitive User	Sensitive User
Urandangie Primary School	(07) 4748 3101	Sensitive User	Sensitive User
SGS	P: (07) 3859 3000	Water Analysis Authority	Chemical Analysis/ Reporting Water Quality
George Bourne & Associates	P: (07) 4651 5177	Consultancy Services	Preparation of DWQMP

3 IDENTIFY HAZARDS AND HAZARDOUS EVENTS

3.1 Boulia Water Quality and Catchment Characteristics

Boulia water supply is composed of five artesian bores which is treated with chlorine gas prior to distribution.

3.1.1 Water Quality Information

Water quality information for Boulia includes the following:

(a) Summary
(b) Interpretation

3.1.1 (a) Summary

Table 3.1 below summarises the available reticulated water quality for the Boulia water supply scheme.

Figure 3.1 to Figure 3.11 shows trends of the main characteristics contained in Table 3.1.

The responsibility for obtaining the water samples rests with the DWSP and samples are collected by the Water Operator. Samples are sent to SGS laboratories Brisbane for analysis. The DWSP also samples and analyses drinking water.

Table 3.1 Boulia Reticulated Water

Boulia Water Supply		Start Date	24/03/2015		End Date:	27/11/2019					
Characteristic	**Units**	**No. of Samples**	**Summary of Results**					**Guideline Value**			
			Maximum Value	**Average Value**	**Minimum Value**	**Std Dev**	**95th Percentile**	**Health**	**Exceedances**	**Aesthetic**	**Exceedances**
Conductivity	uS/cm	296.00	1500.00	1362.69	1296.00	31.17	1400.00				
pH		275.00	8.43	7.71	6.67	0.29	8.11			≥6.5 & ≤ 8.5	0
Total Dissolved Solids	mg/L	69.00	970.00	757.88	690.00	41.16	810.00			600	69
True Colour	Hazen	82.00	57.00	18.85	1.00	9.15	35.90			15	49
Turbidity	NTU	521.00	31.00	7.94	0.00	3.37	13.00			5	432
Sodium	mg/L	29.00	290.00	191.38	170.00	33.50	270.00			180	20
Potassium	mg/L	10.00	12.00	10.66	9.67	0.69	11.55				
Magnesium	mg/L	134.00	170.00	42.49	1.00	21.42	61.70				
Chlorine Total	mg/L	93.00	0.07	0.03	0.00	0.02	0.05	5	0		
Chlorine Free	mg/L	340.00	0.87	0.06	0.00	0.09	0.16				
Chloride	mg/L	61.00	230.00	202.62	190.00	10.39	230.00			250	0
Fluoride	mg/L	71.00	1.20	1.04	0.80	0.12	1.20	1.5	0		
Nitrate	mg/L	5.00	1.00	0.41	0.01	0.48	1.00	50	0		
Sulphate	mg/L	78.00	140.00	103.79	78.00	9.59	120.00	500	0	250	0
Iron	µg/L	312.00	1730.00	193.63	0.01	154.90	330.00			300	24
Manganese	µg/L	134.00	170.00	42.49	1.00	21.42	61.70	500	0	100	2
Zinc	µg/L	8.00	20.00	6.06	2.50	5.84	16.50			3000	0
Aluminium	µg/L	28.00	50.00	8.77	2.50	12.70	42.65			200	0
Uranium	µg/L	15.00	0.50	0.50	0.50	0.00	0.50	17	0		
Selenium	µg/L	15.00	2.00	0.67	0.50	0.39	1.30			10	0
Boron	µg/L	9.00	290.00	260.00	240.00	16.33	286.00	400	0		
Copper	µg/L	37.00	30.00	7.32	0.50	8.18	22.00	2000	0	1000	0
E.coli	MPN	272.00	2.00	0.01	0.00	0.12	0.00	0.1	1		

Aesthetic Guideline Exceedance
Health Guideline Exceedance

Figure 3.1 Boulia – Conductivity (µS/cm)

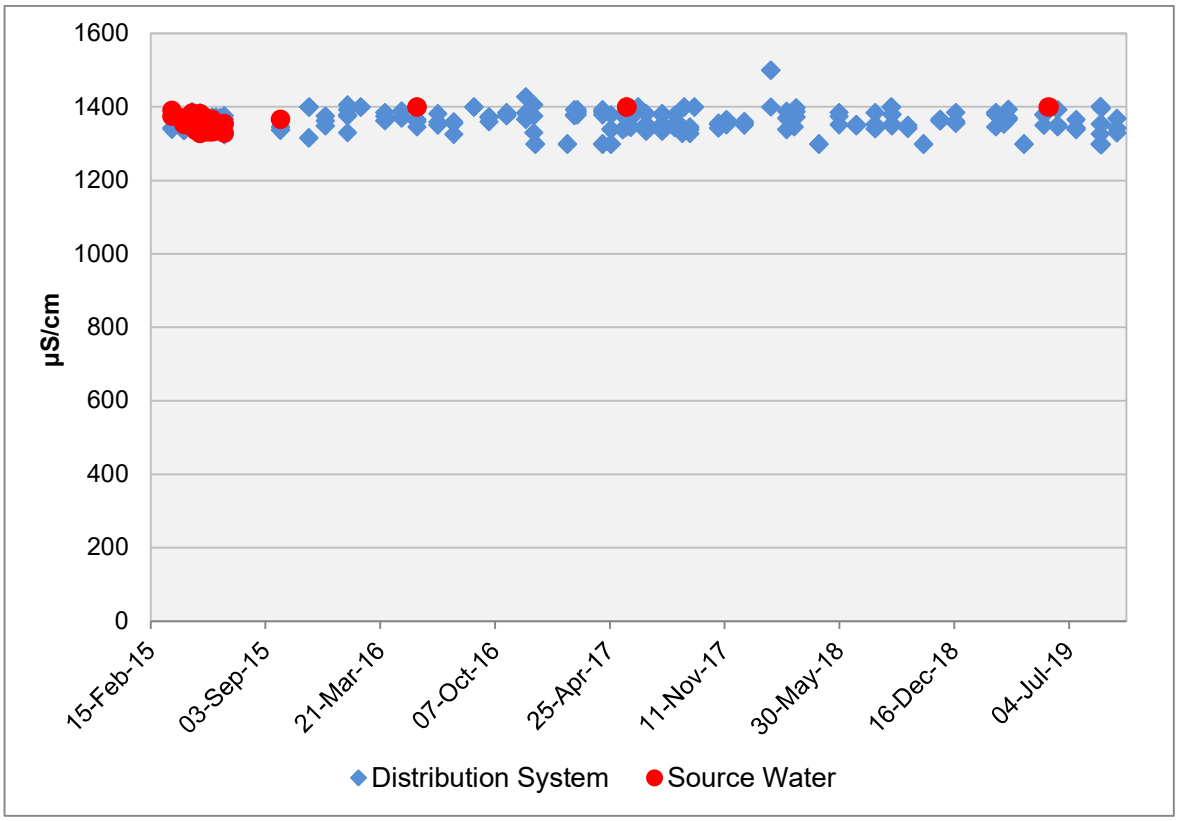


Figure 3.2 Boulia – pH at 25°C

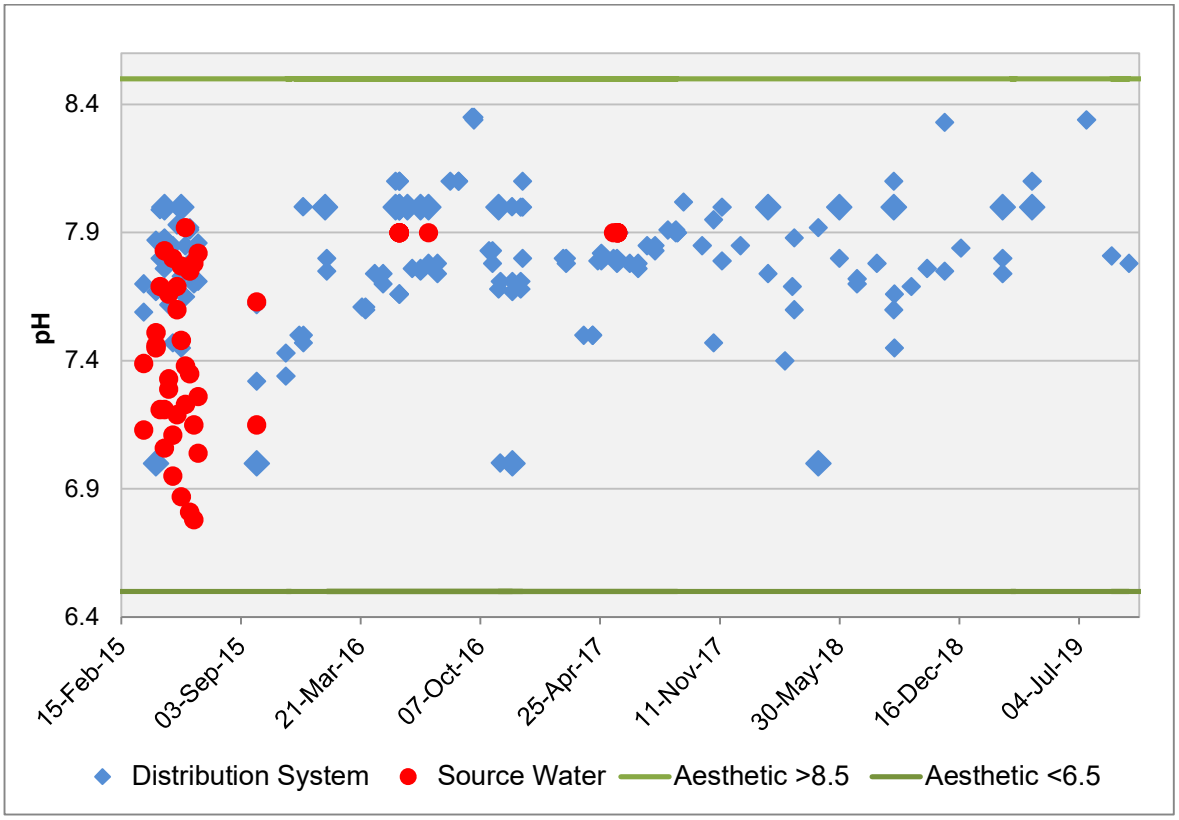


Figure 3.3 Total Dissolved Solids

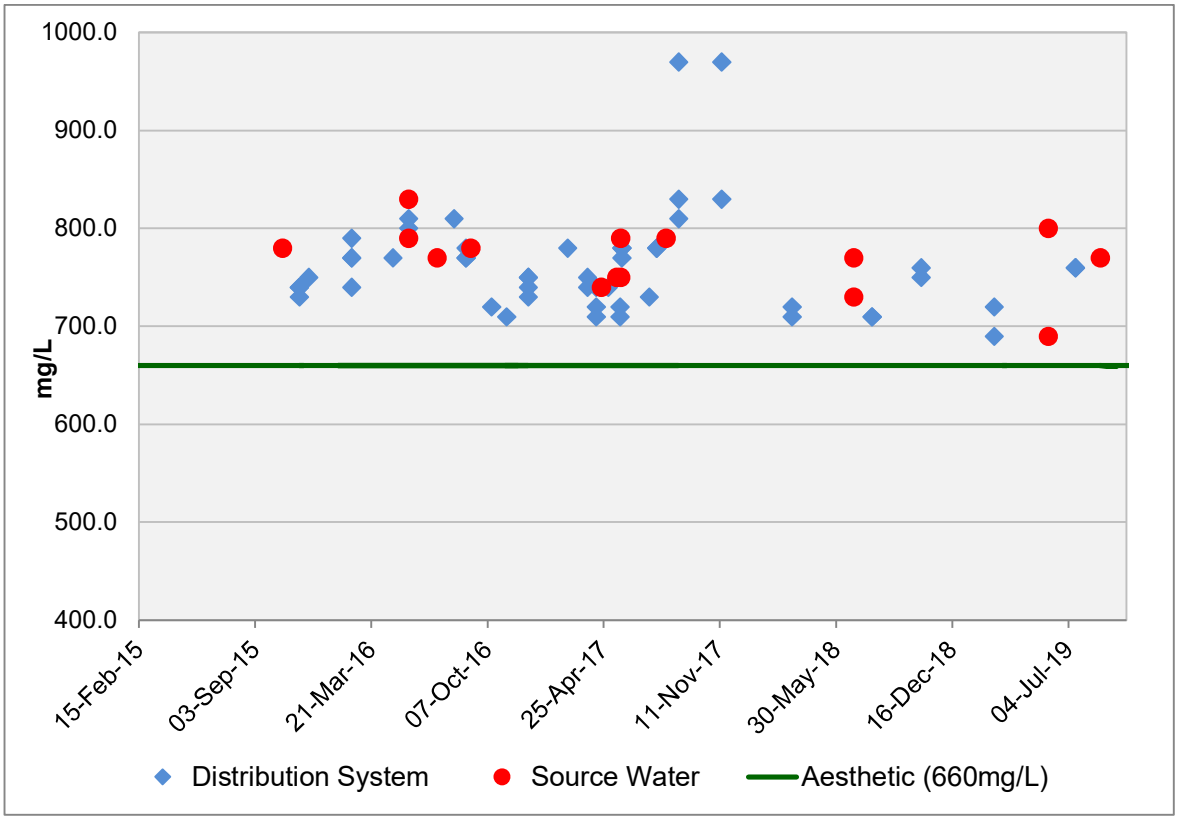


Figure 3.4 Boulia – True Colour

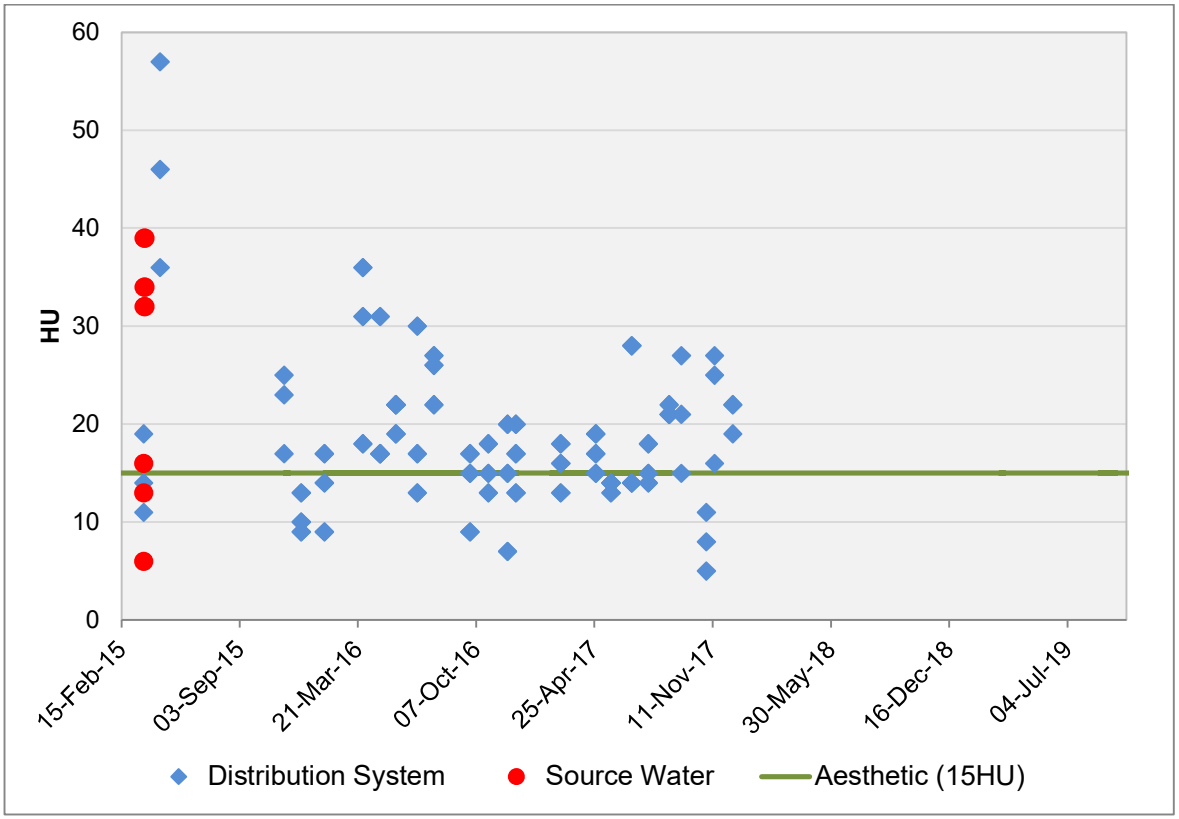


Figure 3.5 Boulia – Turbidity

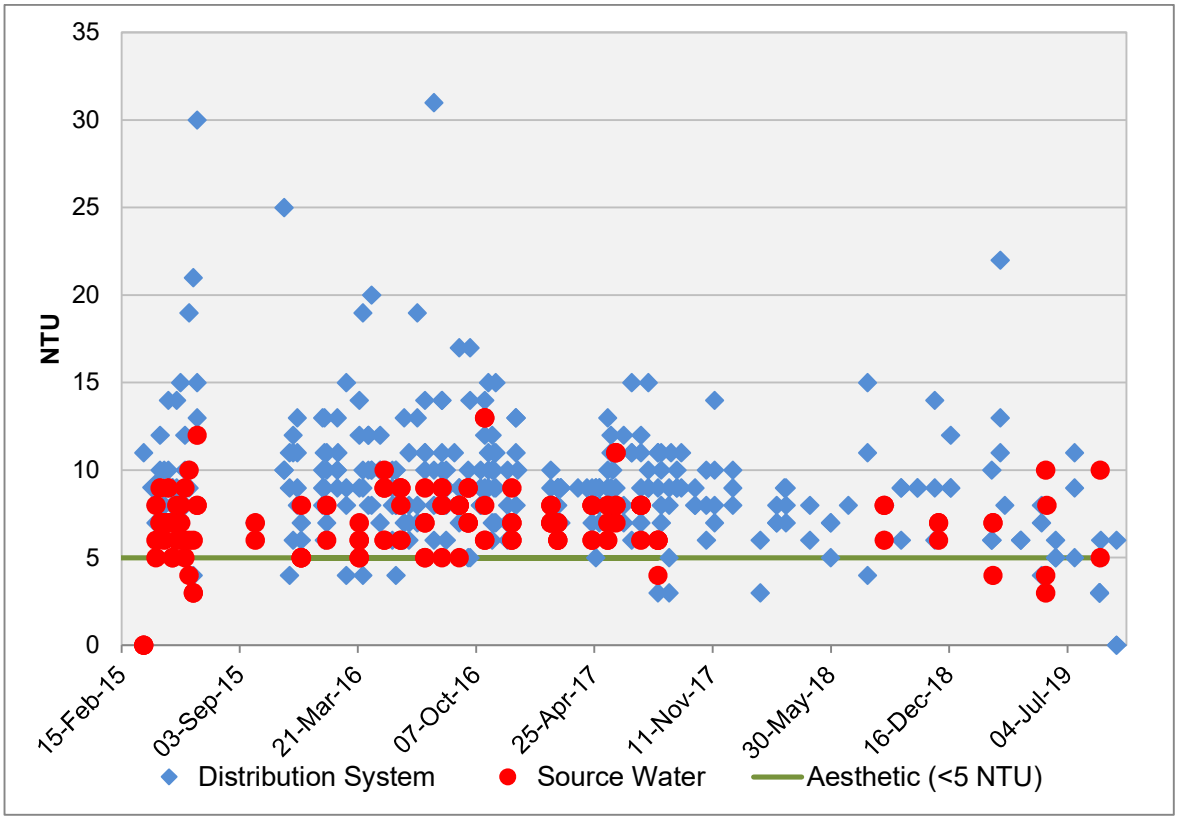


Figure 3.6 Boulia – Sodium

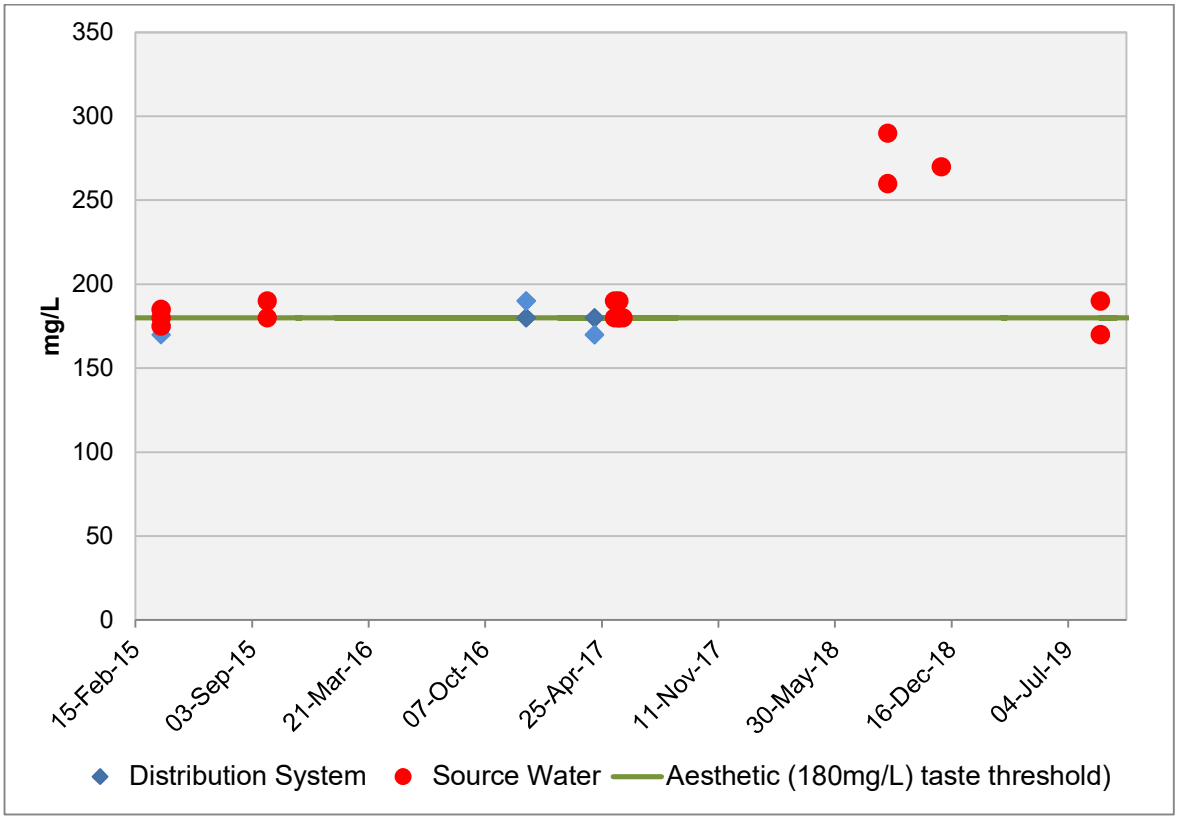


Figure 3.7 Boulia - Chloride

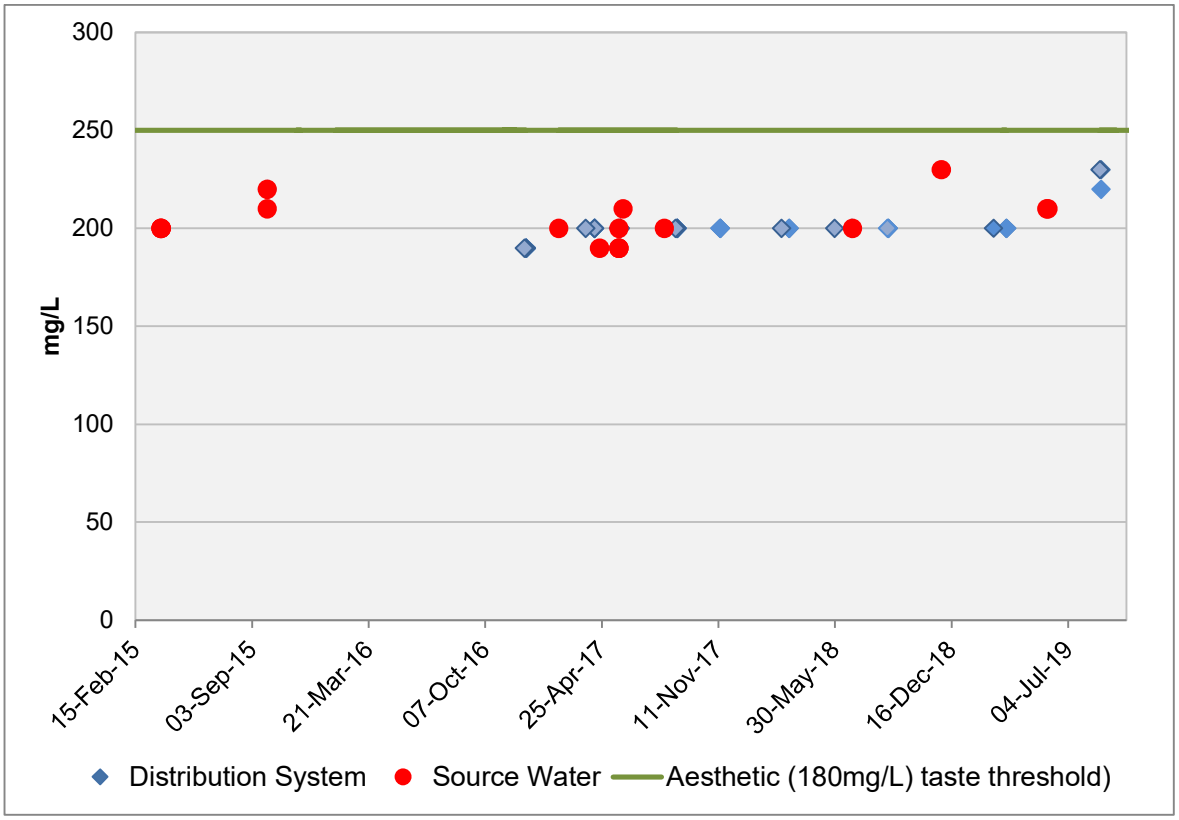


Figure 3.8 Boulia – Fluoride

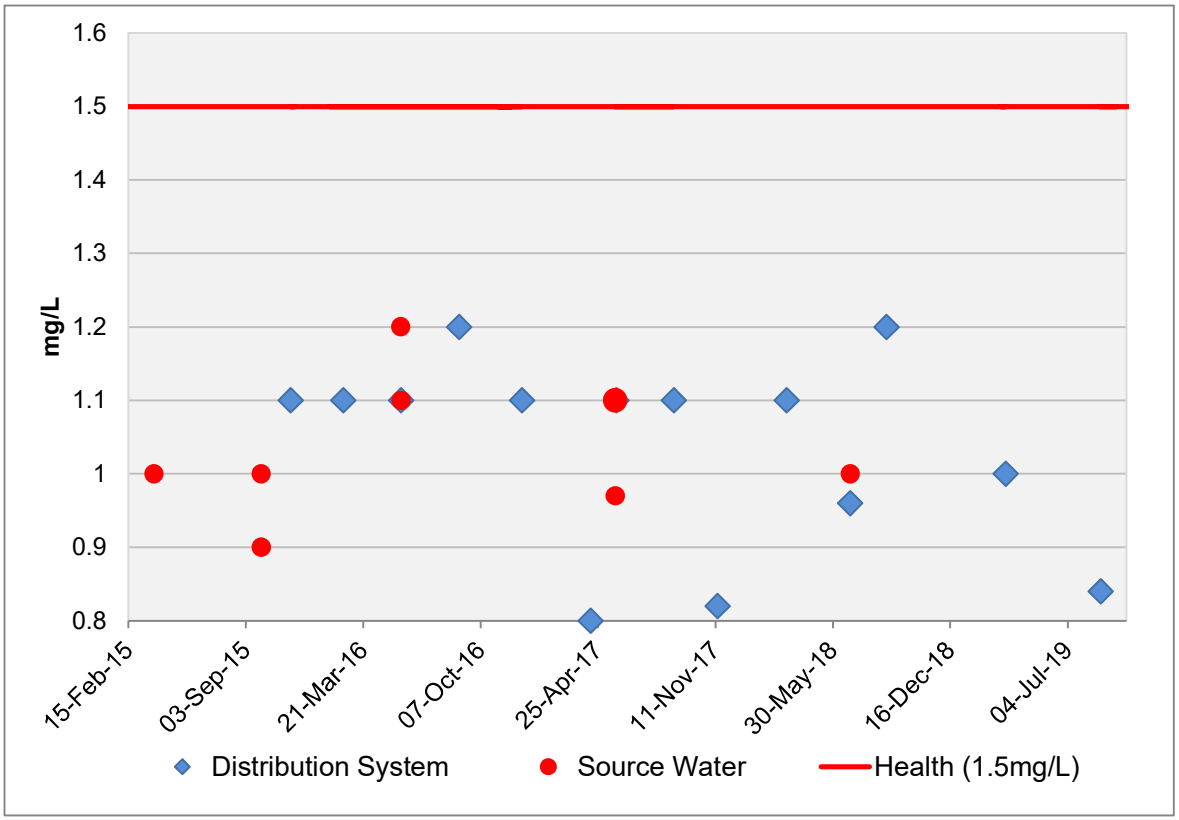


Figure 3.9 Boulia – Total Iron

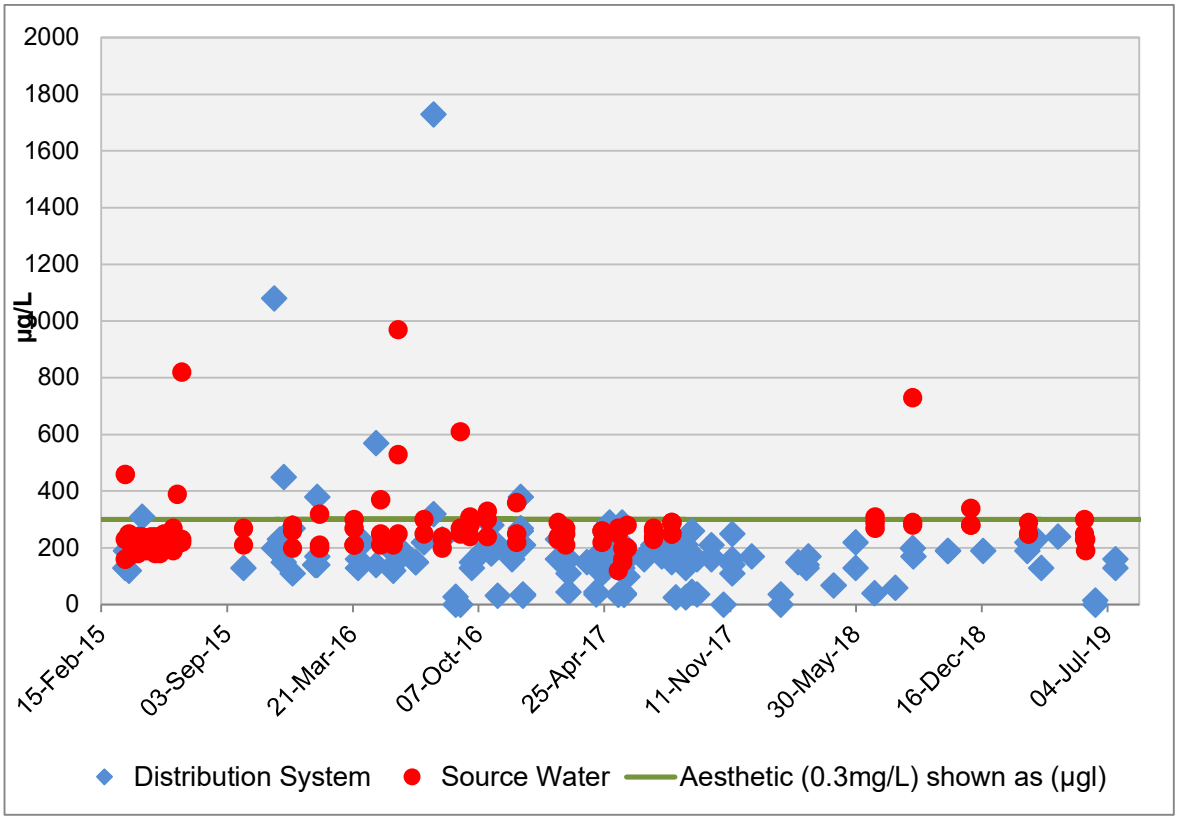


Figure 3.10 Boulia – Total Manganese

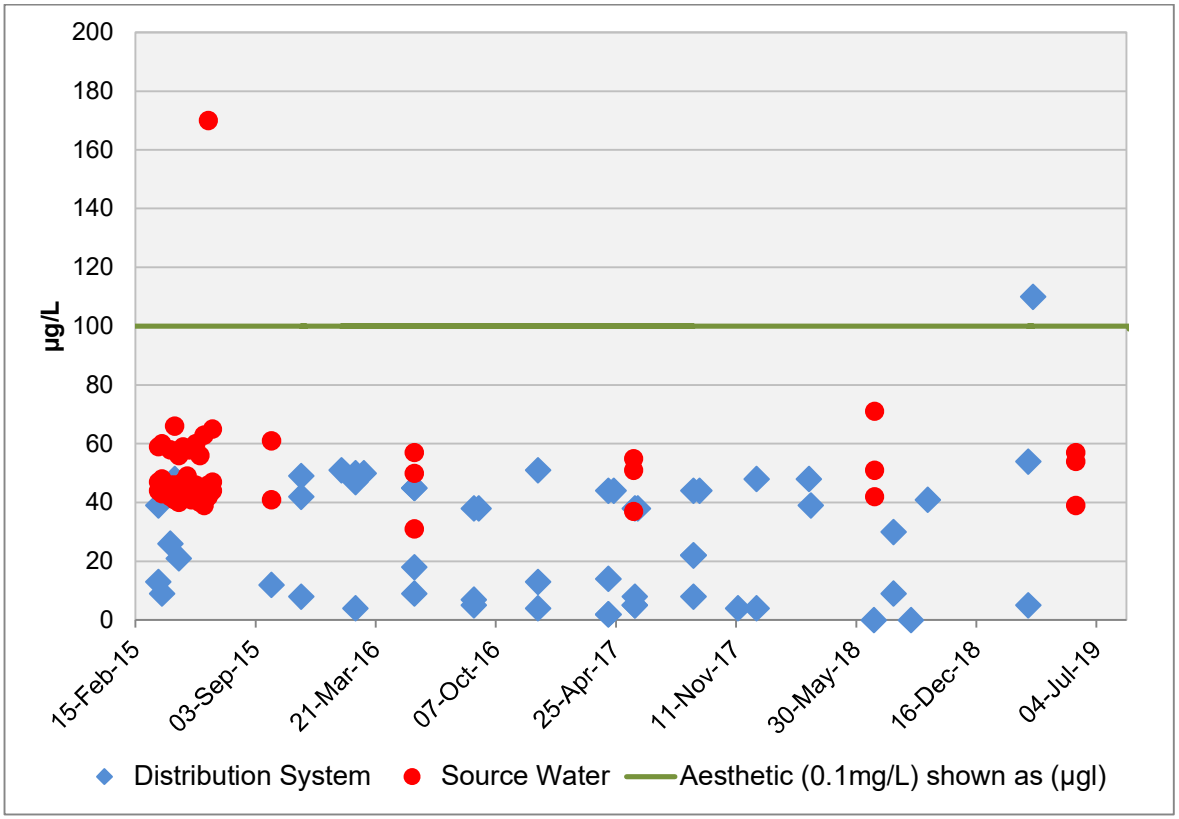


Figure 3.11 Boulia – Aluminium

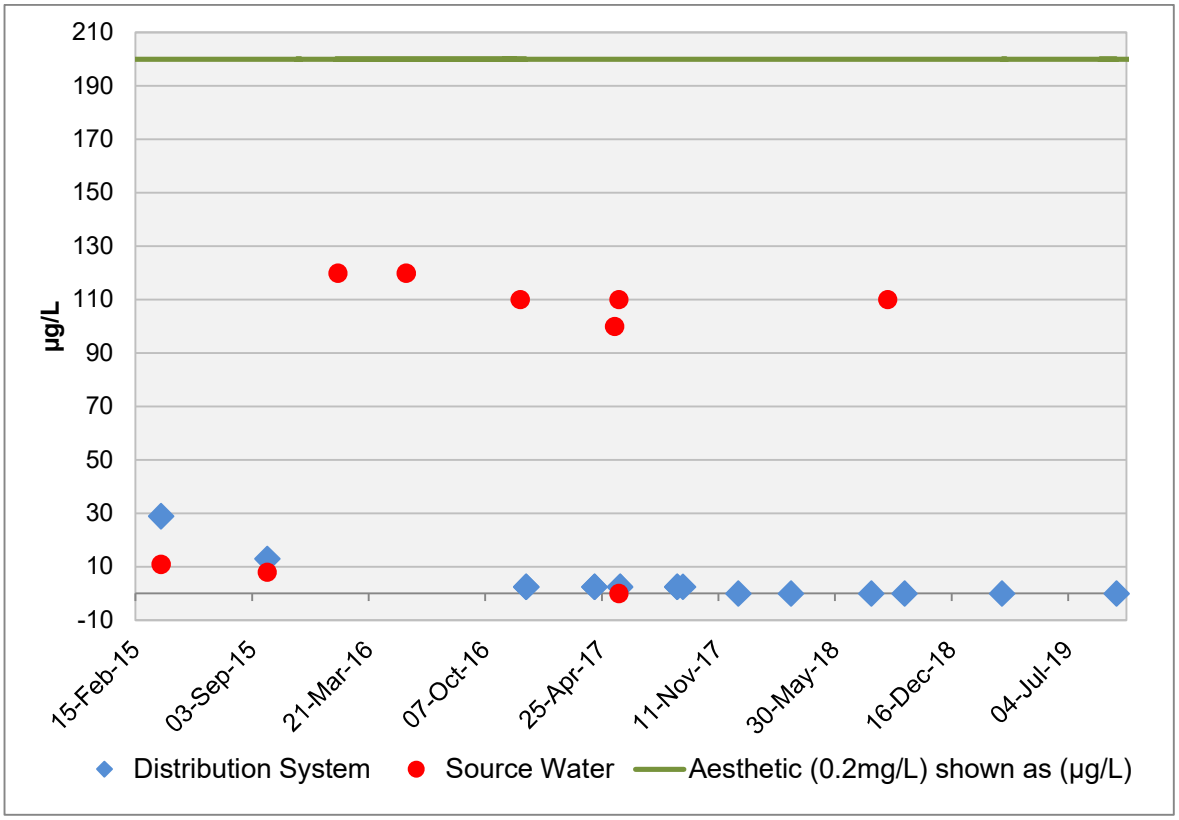


Figure 3.12 Boulia – E. coli

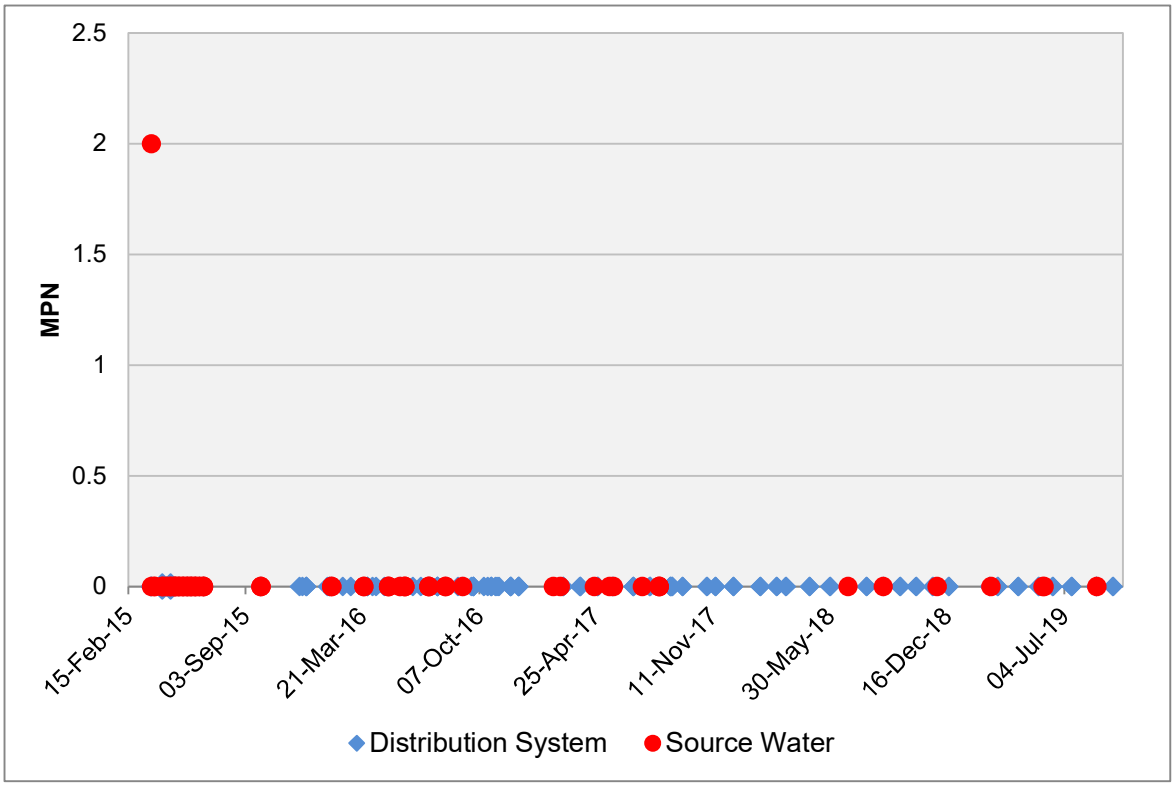
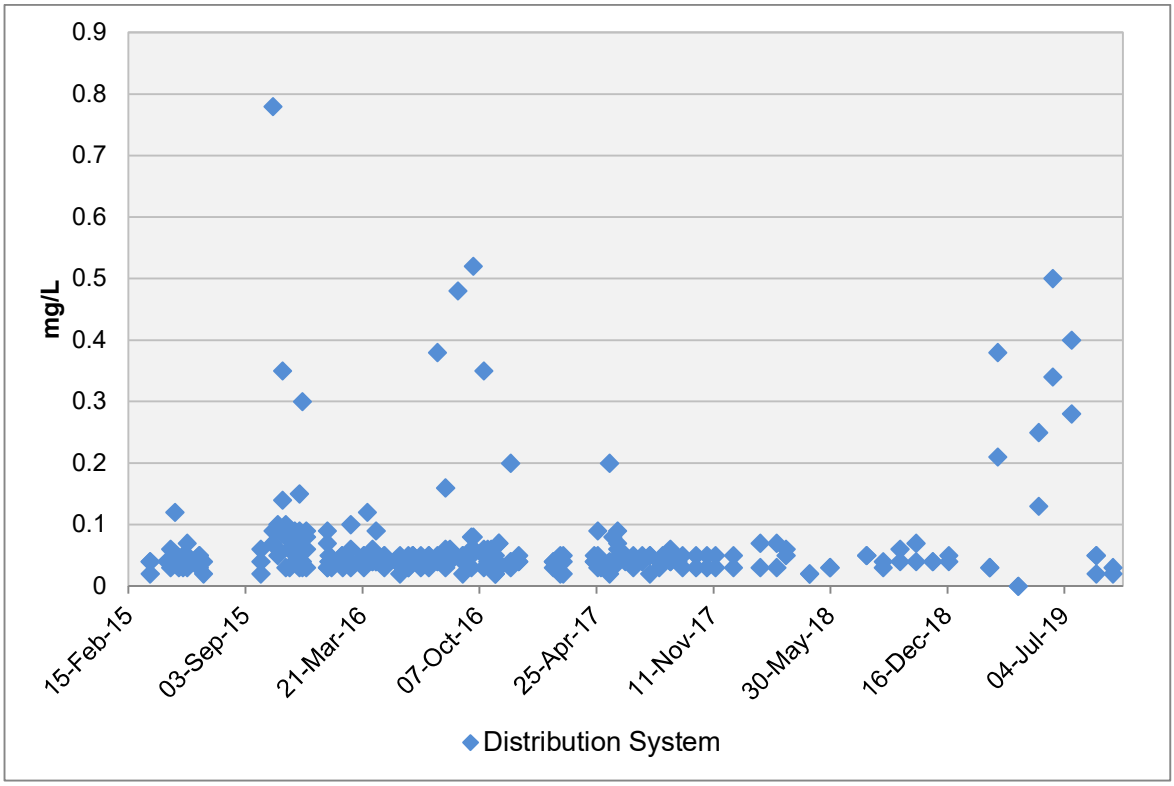


Figure 3.13 Boulia – Free chlorine



3.1.1 (b) Interpretation

Table 3.1 above Identified ADWG value exceedances.

No health characteristics were detected showing exceedances.

The following aesthetic characteristics were detected (underlined show exceedances):

- pH
- Silica
- **Total Dissolved Solids**
- **True Colour**
- **Turbidity**
- **Sodium**
- Chloride
- Sulphate
- **Iron**
- **Manganese**
- Aluminium

Figure 3.3 provides a trend for the analysis of Total Dissolved Solids; there are 74 exceedances since November 2009. The aesthetic guideline value is 600 mg/l. A maximum value of 970 mg/l, average value of 758 mg/l and a 95th percentile of 810 mg/l have been determined. For total dissolved solids no health based guideline is considered necessary.

Figure 3.4 identifies True Colour trends for Boulia; from 86 values 49 exceed the aesthetic threshold of the ADWG. The aesthetic guideline value is 15Hu. A maximum value of 57Hu, average value of 18Hu and a 95th percentile of 36Hu have been determined. For true colour no health guideline has been deemed necessary.

Figure 3.5 provides values for test results for Turbidity of Boulia's drinking water. These results indicate levels above ADWG aesthetic thresholds. Of the 525 values recorded 432 have exceeded aesthetic thresholds, a maximum value of 31NTU has been recorded with an average score of 7.89.

Figure 3.6 identifies Sodium concentration values for Boulia's drinking water. From the 33 recorded values there are 20 exceedances. The aesthetic guideline value for sodium is 180mg/l. A maximum value of 290mg/l, average value of 199mg/l and a 95th percentile of 270mg/l have been determined. For Sodium no health guideline is stipulated.

Figure 3.9 provides values for iron levels in Boulia's water supply and distribution system from the 315 recorded values 24 exceeded the ADWG aesthetic threshold. The average recorded value is 191µg/L and the 95th percentile reading for iron was 330µg/L. The relatively high concentrations of iron in Boulia's water has caused significant issues regarding water quality which is discussed further in section 4 Assessment of Risks.

Figure 3.10 shows two values exceeding the aesthetic threshold level for Total Manganese. This exceedance does not reflect other values for this characteristic. Due to the unprecedented nature of these exceedances Total Manganese levels are not considered to be a major concern.

Chlorination

Prior to the implementation of Boulia's DWQMP the potential hazards associated with Boulia's drinking water scheme were not fully appreciated. However, since formal systems analysis and risk evaluation processes have been undertaken the risk profile has become more apparent. In 2014 the Outback Regional water Alliance implemented specialist reviews of the members systems, where it was identified that there was a significant risk of biological contamination of the drinking water. The identification of these risks led to the implementation of a basic disinfection system in 2014, suspending chlorine tablets

in the ground level reservoir. This measure was temporary until sufficient funding could be obtained to install a more conventional chlorine dosing system. As detailed in the preceding water quality summary, the utilisation of chlorine tablets in the reservoir was not providing free chlorine concentrations capable of achieving consistent disinfection, which is indicated in table 3.1 by the low average concentration of .06mg/L over the 2015-2019 period. In late 2019 BSC commissioned an automated chlorine gas disinfection plant, the commissioning of this plant will provide greater disinfection of drinking water in Boulia's distribution system.

3.1.2 Catchment Characteristics

Boulia Shire is located in the Channel Country of Central West Queensland and is 61,176 square kilometres in area. The Shire is bordered by the Northern Territory to the West, the Diamantina Shire to the South, Winton to the East, and Mount Isa and Cloncurry to the North.

The bulk of the Shire consists of flat channel type country. The area forms part of the Lake Eyre catchment area where the Georgina River system is the most prominent river system which flows through the area and is regularly subjected to flooding. Rainfall and floodwaters from the North flows down and can cause flooding without any rainfall occurring locally. The generally flat terrain is particularly suited to grazing.

The average annual rainfall for Boulia is 263.2mm[2] with the majority of the rain falling between late November and late March. The mean maximum temperature is 31.8°C.

The Georgina River and Eyre Creek system drains an area of approximately 210,000km2. It rises to the north west of Mt Isa with three main tributaries, the Buckle, Sander and Ranken Rivers. The latter two have their headwaters in the Northern Territory. Further inflow enters the system from numerous creeks and rivers, the two main tributaries being the Burke and Hamilton Rivers. The Burke River drains the area to the north of Boulia and enters the Georgina River about 20km upstream of Marion Downs, whilst the Hamilton rises to the north-east of Boulia and enters the main Georgina below Marion Downs. Towns located within the catchment include Urandangie, Dajarra, Boulia and Bedourie.

Very little rainfall is needed to bring the country to a standstill. Following flood rains, the main channel fills fairly quickly and then spreads out into the neighbouring channels and watercourses for kilometres on either side. In the event of severe flooding, the Georgina can vary in width in the upper reaches from 15-20km, and in the lower reaches it is estimated in some sections to be 25-30km wide.

The major waterway is the Burke River which passes the southern end of the township of Boulia. This river often floods during the wet season resulting in the roads to the south of the township being regularly cut. Despite this amount of water during the wet season for the rest of the year there is little rainfall in the area and the volume drops considerably until there is no water and the river dries up. The Georgina River is located to the West of Boulia and also plays a significant role in providing water for livestock and cutting access in times of flood. (Boulia LDMP 2011).

The Great Artesian Basin (GAB) covers approximately one-fifth of the Australian continent and contains 8.7 x 106 GL of groundwater in the Jurassic sandstone aquifers. It is the largest groundwater and artesian basin in the world. The basin is located under mostly arid and semi-arid landscapes to the west of the Great Dividing Range. The GAB supports a wide array of activities such as pastoral, agriculture and mining as well as the rural communities, cultural and tourism activities. The GAB is recharged by rainfall and stream flow infiltrating into the exposed sandstone on the edges of the basin. Figure 3.7 shows the recharge, discharge and flow of the GAB.

Currently there are five water source bores in Boulia, including one Backup source (Bore No 8.). Town Bore No. 5 (RN 93060), Town Bore No. 6 (RN 118071), Town Bore No. 7 (RN 146260), Town Bore No. 8 (RN 146262) and Town Bore No 9. (RN 146261)

[2] Climate statistics for Boulia – Bureau of Meteorology

All bores are pumped into the ground level reservoir and then pumped into reticulation or the elevated reservoir. Appendix B shows the bore locations and water reticulation layout. Appendix C contains a copy of the bore card reports obtained from Department of Natural Resources Mines and Energy.

Boulia sewerage collection scheme is comprised of 150mm diameter relined and 225mm diameter asbestos cement reticulation mains, two pump stations, an Imhoff tank and effluent storage lagoons. The sewerage reticulation system has a total pipeline length of 7,010m.

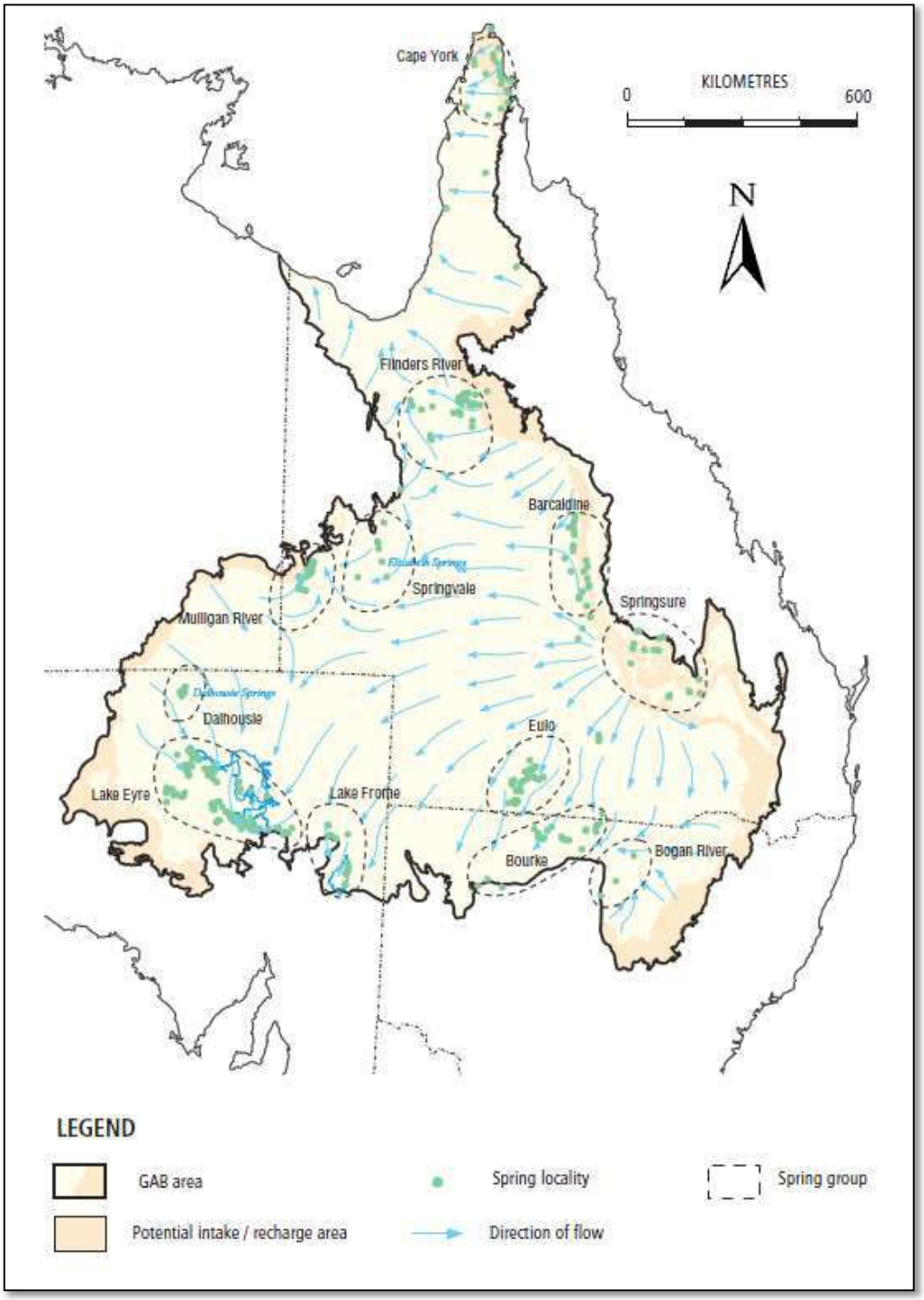


Figure 3.14 GAB Recharge, Discharge and Flow[3]

[3] Great Artesian Basin, Resource Study Summary, Great Artesian Basin Consultative Council

3.1.3 Hazard Identification

The hazards and hazardous events and their sources that adversely affect water quality are documented in Table 3.2 below and include those affecting:

- Catchment
- Sourcing infrastructure
- Disinfection process
- Distribution system
- Whole of System

3.1.3 (a) Identifying and Documenting Hazards and Hazardous Events

The hazards and hazardous events were identified using data contained in the plan and following site visits and a risk assessment workshop which was conducted on 07 December 2017;

- Section 2.1 Boulia Water Supply Scheme
- Section 3.1.1 Water Quality Information
- Section 3.1.2 Catchment Characteristics

Table 3.2 Boulia Hazard Identification, Risk Assessment and Uncertainty

Scheme Component / Sub-component	Hazardous Event	Hazard	Maximum risk			Existing Preventive Measures / Barriers.	Residual risk			Uncertainty	Comments/ Proposed Further Risk Reduction Actions
			Consequence	Likelihood	Risk level		Consequence	Likelihood	Risk level		
Bore	Ingress contaminated run-off	Biological	Major	Possible	High 12	Automated Disinfection System	Major	Rare	Medium 5	Estimate	Acceptable risk Bore headworks sealed in 2019
	Hazard that arises from the natural geological processes in the aquifer.	Chemical/Biological	Major	Possible	High 12	Automated Disinfection System Verification and operational monitoring	Major	Rare	Medium 5	Reliable	Acceptable risk
	High Turbidity	Chemical/Biological	Major	Possible	High 12	Disinfection Verification monitoring	Major	Rare	Medium 5	Reliable	Acceptable risk
	Power Outage	Physical	Major	Possible	High 12	Elevated reservoir and back-up generator	Insignificant	Rare	Low 1	Confident	Acceptable risk
Disinfection System	Chlorine dosing equipment failure or underdosing	Bacteria/ Virus (Source Water)	Major	Possible	High 12	Target Dose 1.5mg/L Low residual alarm	Major	Rare	Medium 5	Estimate	Acceptable risk
	Turbidity impact disinfection effectiveness	Bacteria/ Virus (Source Water)	Major	Likely	High 16	Oxidisation through chlorine gas disinfection Operational Monitoring Target Dose 1.5mg/L	Minor	Possible	Medium 6	Estimate	Acceptable risk
	Chlorine overdosing	chemical	Major	Possible	High 12	Target Dose 1.5mg/L High Residual Alarm	Moderate	Rare	Low 3	Estimate	Acceptable risk
	Disinfection by-products (Degradation of chemicals)	Chlorate THM's	Major	Possible	High 12	Chlorine gas system Verification Monitoring Automated chlorine monitoring	Moderate	Unlikely	Medium 6	Estimate	Acceptable risk
	System Malfunction	Lack of expertise/ knowledge of system	Major	Possible	High 12	System Telemetry Operations Manual	Major	Possible	High 12	Estimate	**B1**. Provide required training for staff to manage Disinfection System

Scheme Component / Sub-component	Hazardous Event	Hazard	Maximum risk			Existing Preventive Measures / Barriers.	Residual risk			Uncertainty	Comments/ Proposed Further Risk Reduction Actions
			Consequence	Likelihood	Risk level		Consequence	Likelihood	Risk level		
Sourcing Infrastructure	Vermin barrier not secured/ Degraded	Biological	Major	Unlikely	High 12	Low residual alarm Renewal of vermin barrier protection Regular inspections	Moderate	Rare	Low 3	Confident	Acceptable risk
	Accidental or intentional contamination	Chemical/Biological	Major	Unlikely	High 12	Renewal of vermin barrier protection Security fencing O & M procedures in place	Major	Rare	Medium 5	Confident	Acceptable risk
	Flood Event	Biological	Major	Unlikely	High 12	O & M Procedures in place Back up bore water source (Bore # 8) Boil water alert	Major	Rare	Medium 5	Reliable	Acceptable risk
	Iron oxidisation/precipitation	Biological/Physical	Major	Possible	High 12	Disinfection Regular Air Scouring	Major	Unlikely	Medium 8	Reliable	**B4.** Engineering Modifications – improved turbidity
	Cross contamination/Backflow	Biological	Major	Possible	High 12	Disinfection	Major	Unlikely	Medium 8	Reliable	**B2.** Install non return valves at high risk locations, town common stables, STP
	Unable to locate assets	Outdated records	Major	Possible	High 12	Asset register Reticulation drawings	Major	Unlikely	Medium 8	Reliable	**B3.** Update live drawings to reflect rising main manifold
	Reticulation maintenance and repair	Biological	Major	Possible	High 12	O & M Procedures in place	Major	Rare	Medium 5	Reliable	Acceptable risk

Scheme Component / Sub-component	Hazardous Event	Hazard	Maximum risk			Existing Preventive Measures / Barriers.	Residual risk			Uncertainty	Comments/ Proposed Further Risk Reduction Actions
			Consequence	Likelihood	Risk level		Consequence	Likelihood	Risk level		
Whole of System	Flights carrying water samples delayed/cancelled	Chemical/Biological	Major	Unlikely	High 10	Collect new samples and schedule testing for next available flight	Moderate	Rare	Low 3	Estimate	Acceptable risk
	Local trained staff unavailable to sample water	Chemical/Biological	Major	Possible	High 12	Samples to be collected by external parties	Major	Rare	Medium 5	Confident	Acceptable risk
	Shortage of supply of essential materials for treatment purposes due to weather/flooding	Biological	Major	Possible	High 12	Store sufficient materials to allow for distributions to freight	Major	Rare	Medium 5	Confident	Acceptable risk
	Cyber security breach	Cyber security threat	Major	Possible	High 12	Council data stored on document management system with high grade security protection User authentication Restricted admin privileges Backup systems in place	Major	Unlikely	Medium 8	Estimate	**B5** Cyber security risk not fully understood. Specialist assessment to be undertaken through regional water alliance

3.1.3 (b) Hazard Identification (and Risk Assessment) Team

The personnel responsible for the hazard identification and risk assessment process, their roles and responsibilities are detailed in the Table below.

Table 3.3 Hazard Identification and Risk Assessment Team

Typical job title for key personnel	What role did each person play on the team?	What expertise and system knowledge did the person bring?
Director of Works & Operations	Identify time or budgetary constraints, assess and identify improvement actions	Experience managing water schemes. Forecast budgeting and delivering projects.
Foreman Utilities and Services	Identifying hazards risks	Detailed knowledge of individual schemes
Licensed Plumber	Identifying hazards risks	Detailed knowledge of individual schemes
Water Operator	Identifying hazards risks	Understanding of water quality and associated risks.
Engineer (Consultant)	Management of DWQMP Process, Risk Assessment Procedure & Chairing Risk Assessment Workshop	High level knowledge, risk assessment and general engineering experience in the management of the systems.

3.2 Urandangie Water Quality and Catchment Characteristics

Urandangie water supply is composed of a single sub-artesian bore at the southern end of town which is partially treated prior to reticulation; treatment consists of manual chlorination by adding chlorine tablets on a weekly basis.

3.2.1 Water Quality Information

Water quality information for Urandangie includes the following:

(a) Summary
(b) Interpretation

3.2.1 (a) Summary

Table 3.4 below summarises the available reticulated water quality for the Urandangie water supply scheme.

Figure 3.15 to Figure 3.29 shows trends of the main characteristics contained in Table 3.4.

The responsibility for obtaining the water samples rests with the DWSP and samples are collected by the Water Operator. Samples are sent to SGS laboratories Brisbane for analysis. The DWSP also samples and analyses drinking water for E. coli.

Table 3.4 Urandangie Reticulated Water

Urandangie Water Supply		Start Date:	24/03/2015		End Date:	27/11/2019				
Characteristic	**Units**	**No. of Samples**	**Summary of Results**					**Guideline Value**			
			Maximum Value	**Average Value**	**Minimum Value**	**Std Dev**	**95th Percentile**	**Health**	**Exceedances**	**Aesthetic**	**Exceedances**
Conductivity	uS/cm	122.00	2200.00	1969.60	400.00	164.72	2100.00				
pH		108.00	8.35	7.76	6.80	0.26	8.27			≥6.5 & ≤ 8.5	0
Total Dissolved Solids	mg/L	31.00	2400.00	1270.00	270.00	281.87	1400.00			600	30
True Colour	Hazen	39.00	32.00	16.36	4.00	5.32	23.30			15	24
Turbidity	NTU	93.00	18.00	5.16	0.00	2.56	8.00			5	41
Sodium	mg/L	11.00	280.00	201.36	185.00	25.77	245.00			180	11
Potassium	mg/L	4.00	21.00	21.00	21.00	0.00	21.00				
Chlorine Total	mg/L	11.00	0.55	0.24	0.04	0.16	0.49	5	0		
Chlorine Free	mg/L	83.00	1.44	0.26	0.00	0.27	0.63				
Magnesium	mg/L	33.00	120.00	91.14	0.50	41.45	120.00				
Chloride	mg/L	24.00	380.00	343.88	13.00	70.27	378.50			250	23
Fluoride	mg/L	35.00	2.70	1.90	0.16	0.38	2.33	1.5	34		
Nitrate	mg/L	4.00	0.05	0.03	0.01	0.02	0.05	50	0		
Sulphate	mg/L	35.00	200.00	183.23	13.00	32.48	200.00	500	0	250	0
Iron	µg/L	21.00	150.00	12.93	0.20	31.07	20.00			300	0
Manganese	µg/L	29.00	27.00	1.83	0.50	4.84	3.80	500	0	100	0
Zinc	µg/L	4.00	290.00	143.50	13.00	115.00	279.50			3000	0
Aluminium	µg/L	16.00	12.00	4.66	2.00	3.25	11.25			200	0
Uranium	µg/L	35.00	17.00	12.91	1.00	2.38	14.30	17	0		
Selenium	µg/L	31.00	4.00	2.81	2.00	0.64	4.00			10	0
Boron	µg/L	4.00	450.00	427.50	410.00	17.85	448.50	4000	0		
Copper	µg/L	21.00	54.00	10.43	0.50	12.88	38.00	2000	0	1000	0
Lead	µg/L	24.00	15.00	2.60	0.50	4.14	12.85	10	3		
E.coli	MPN	92.00	0.00	0.00	0.00	0.00	0.00	0.1	0		

Aesthetic Guideline Exceedance

Health Guideline Exceedance

Figure 3.15 Urandangie – Conductivity

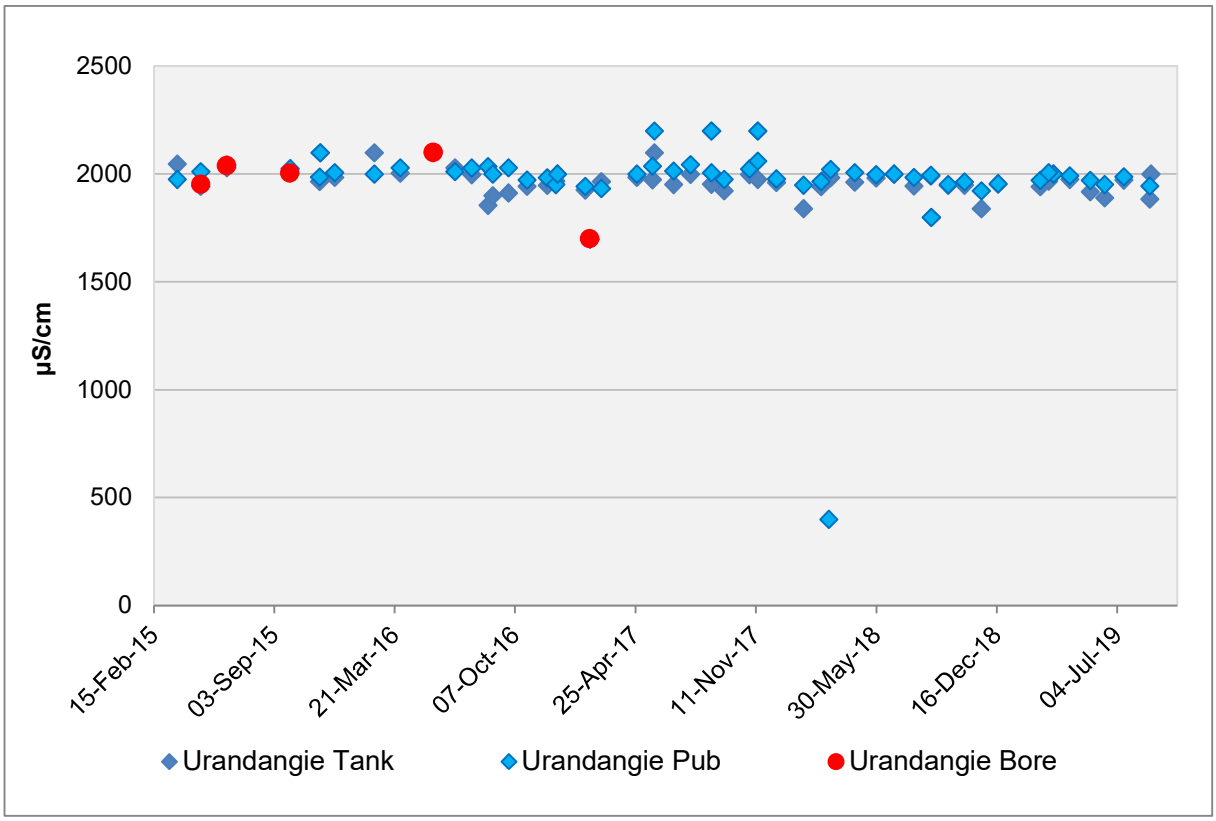


Figure 3.16 Urandangie – pH @ 230C

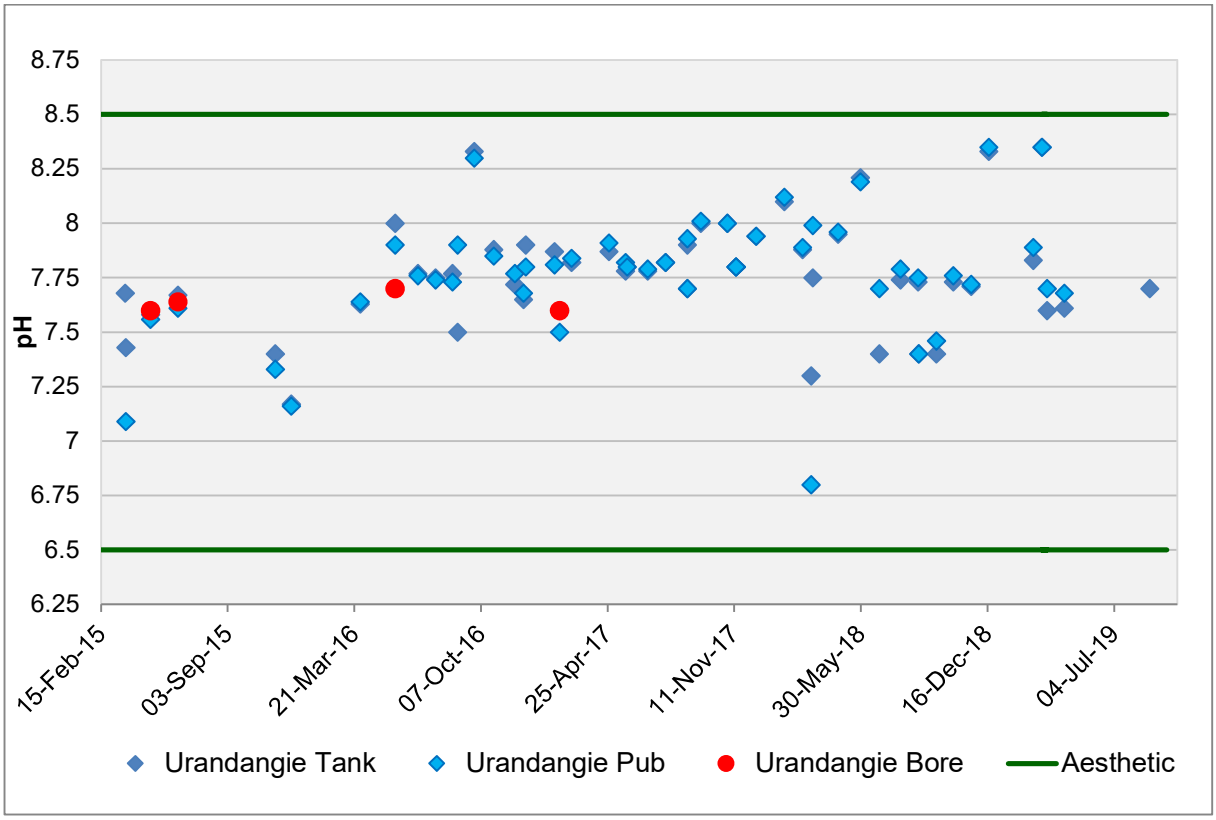


Figure 3.17 Urandangie – Total Dissolved Solids

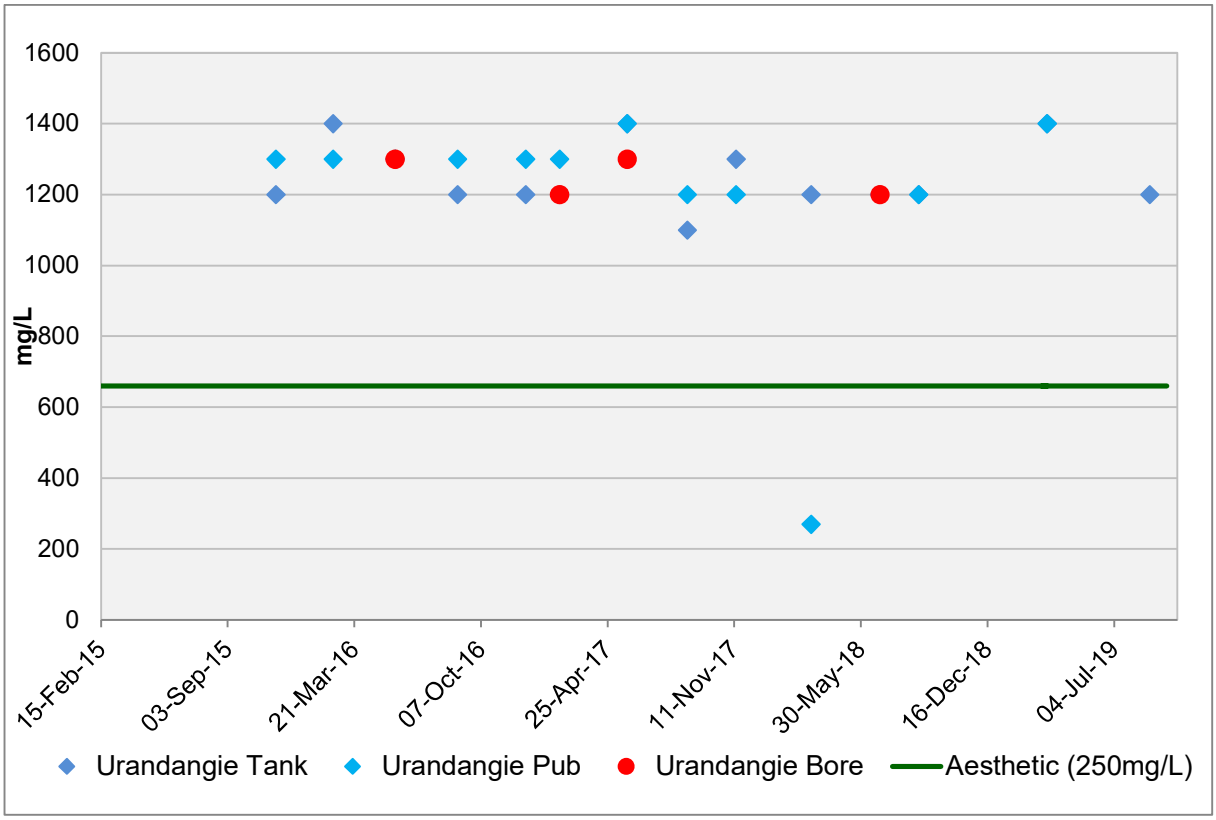


Figure 3.18 Urandangie – True Colour

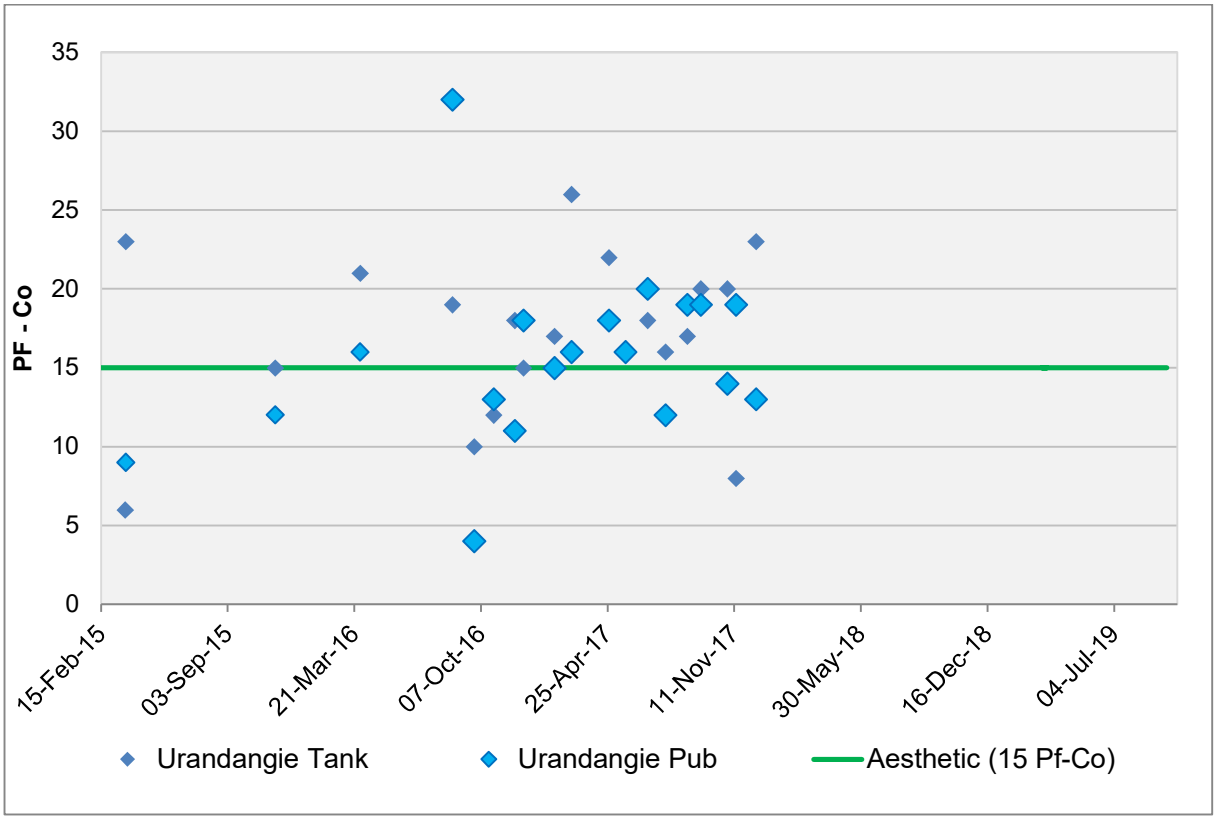


Figure 3.19 Urandangie – Turbidity

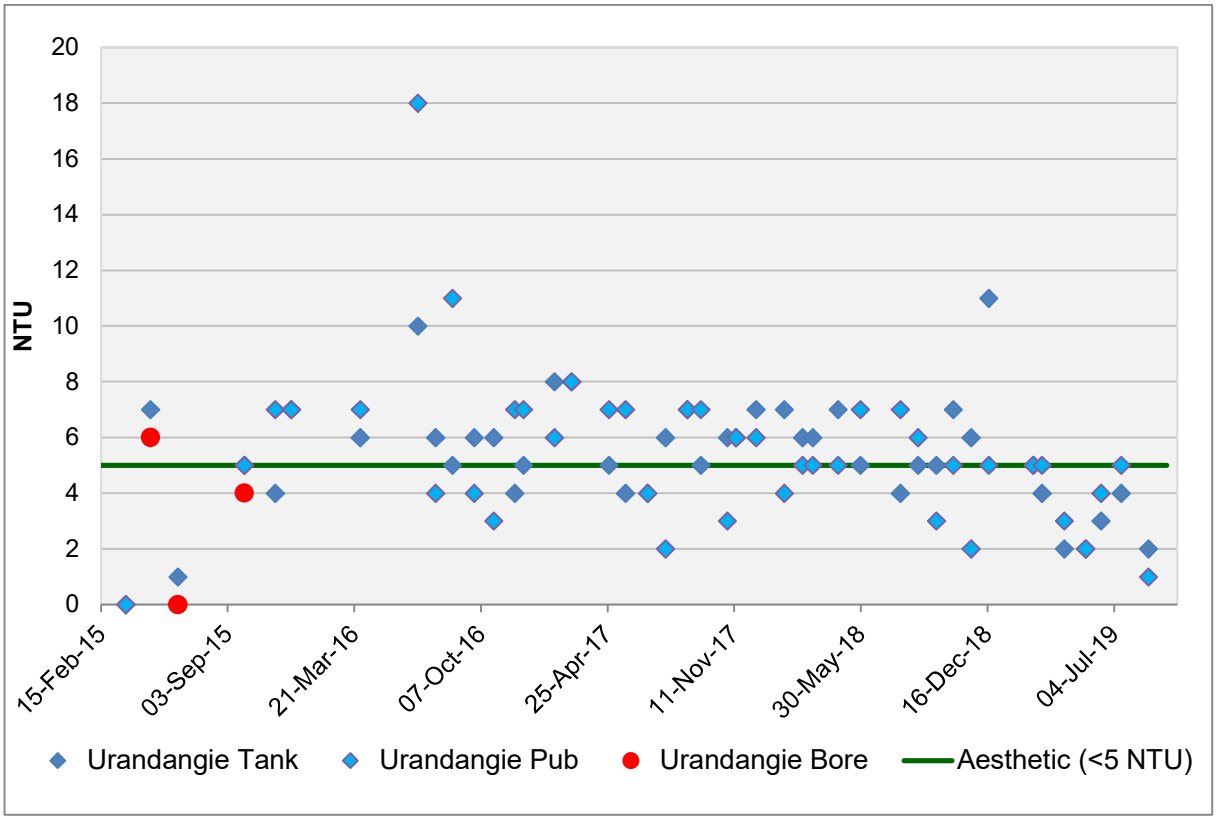


Figure 3.20 Urandangie – Sodium

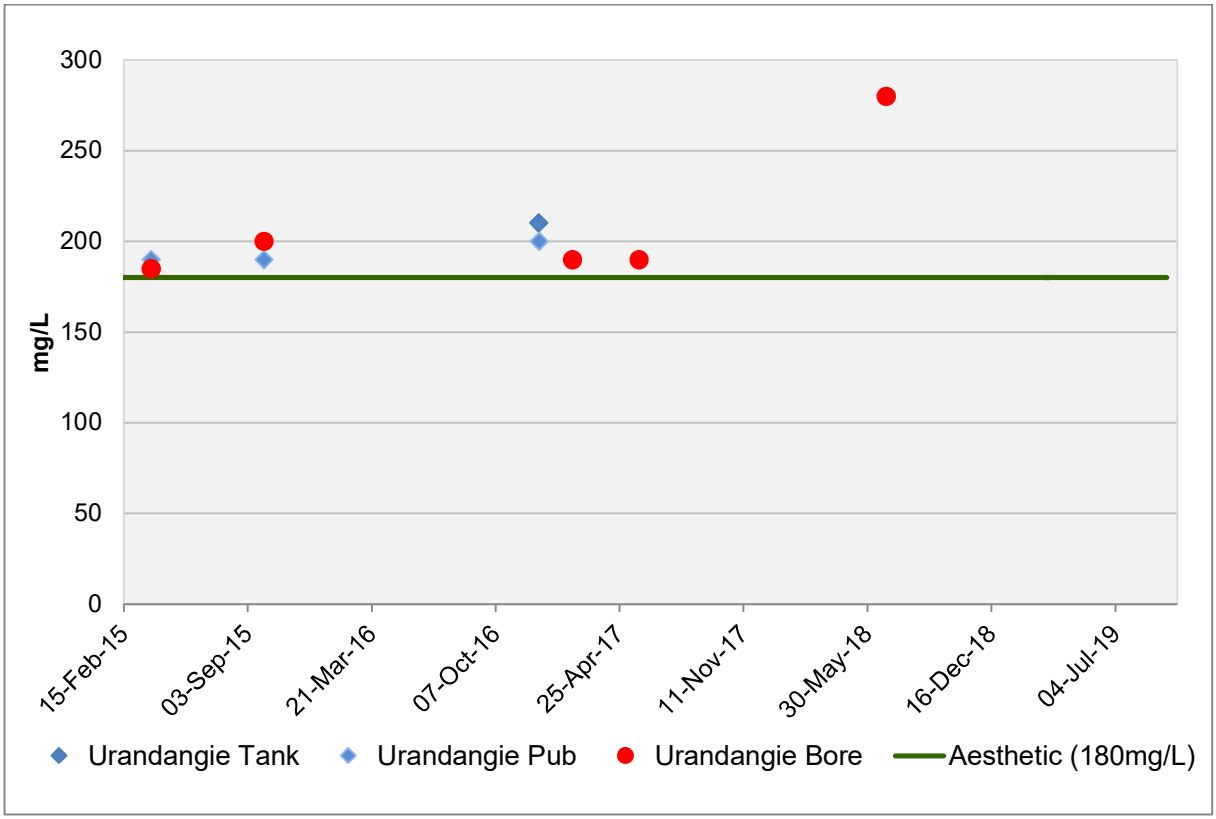


Figure 3.21 Urandangie – Chloride

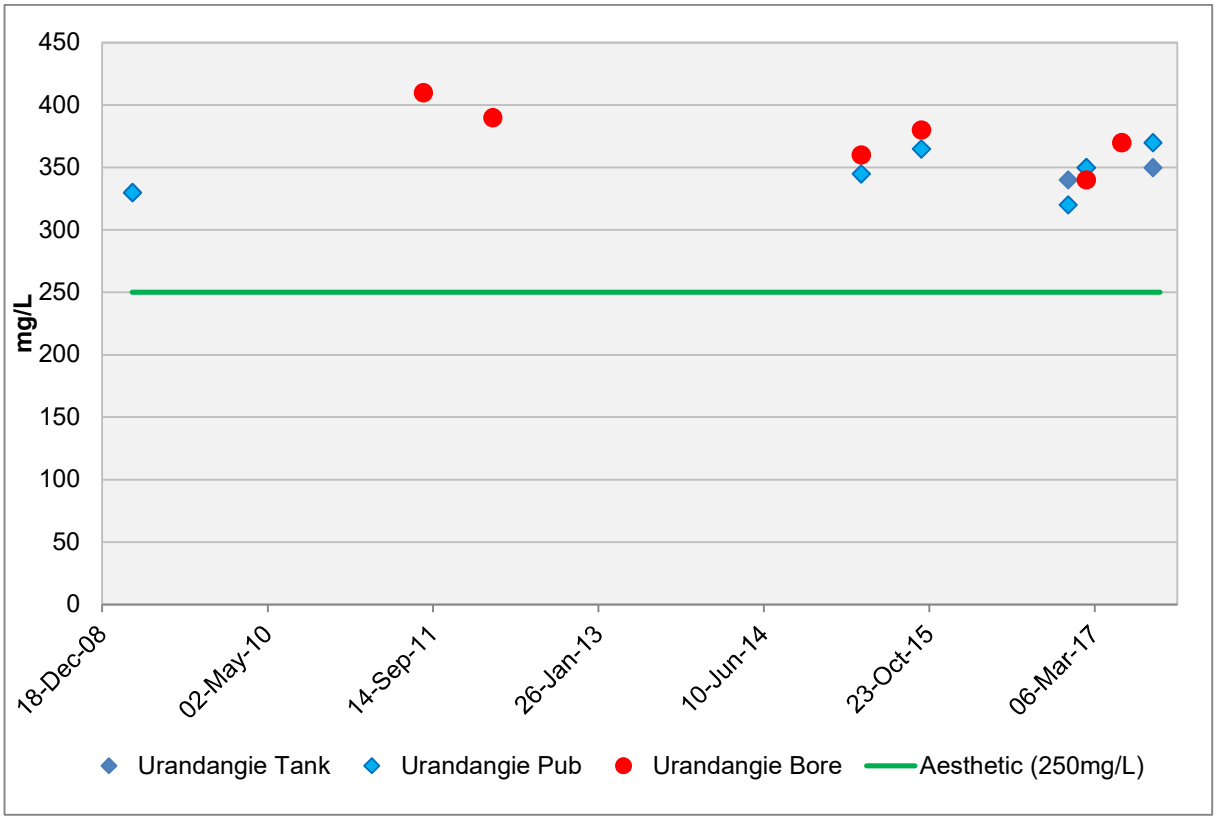


Figure 3.22 Urandangie – Fluoride

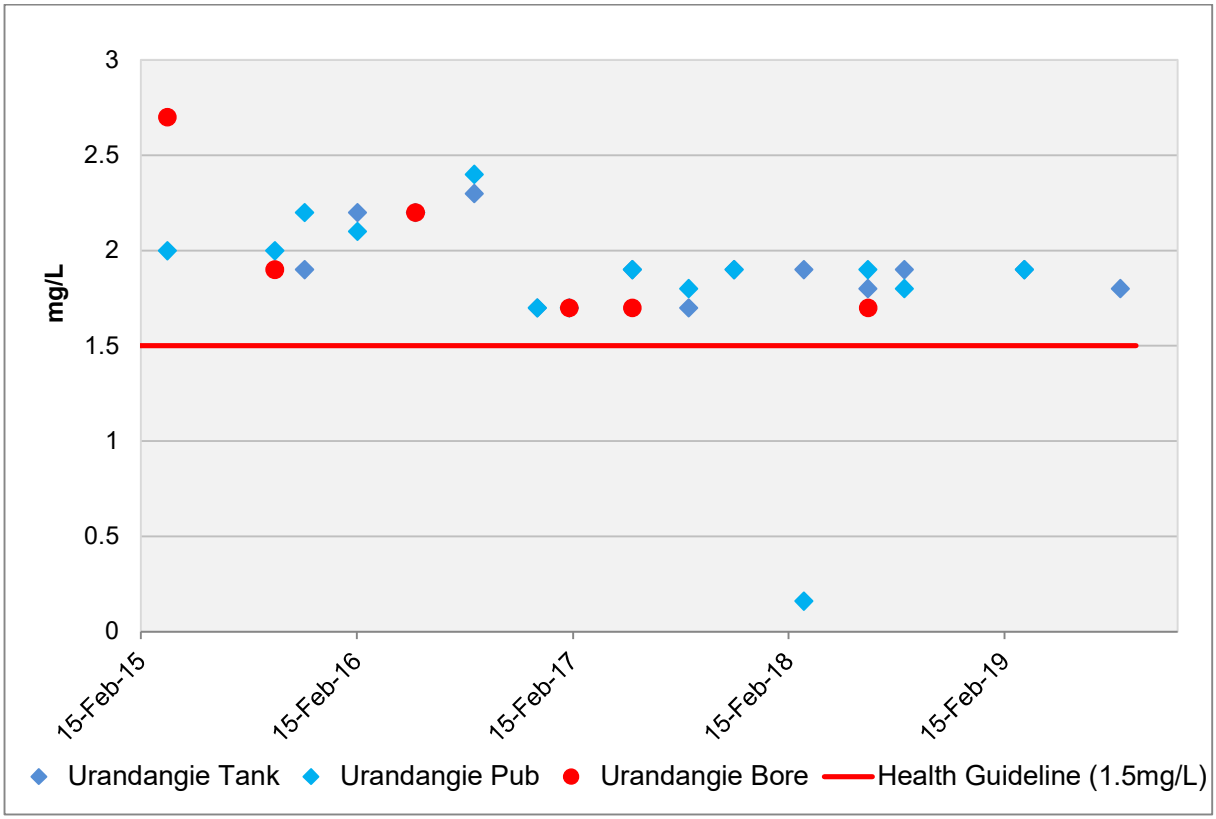


Figure 3.23 Urandangie – Iron (25°C)

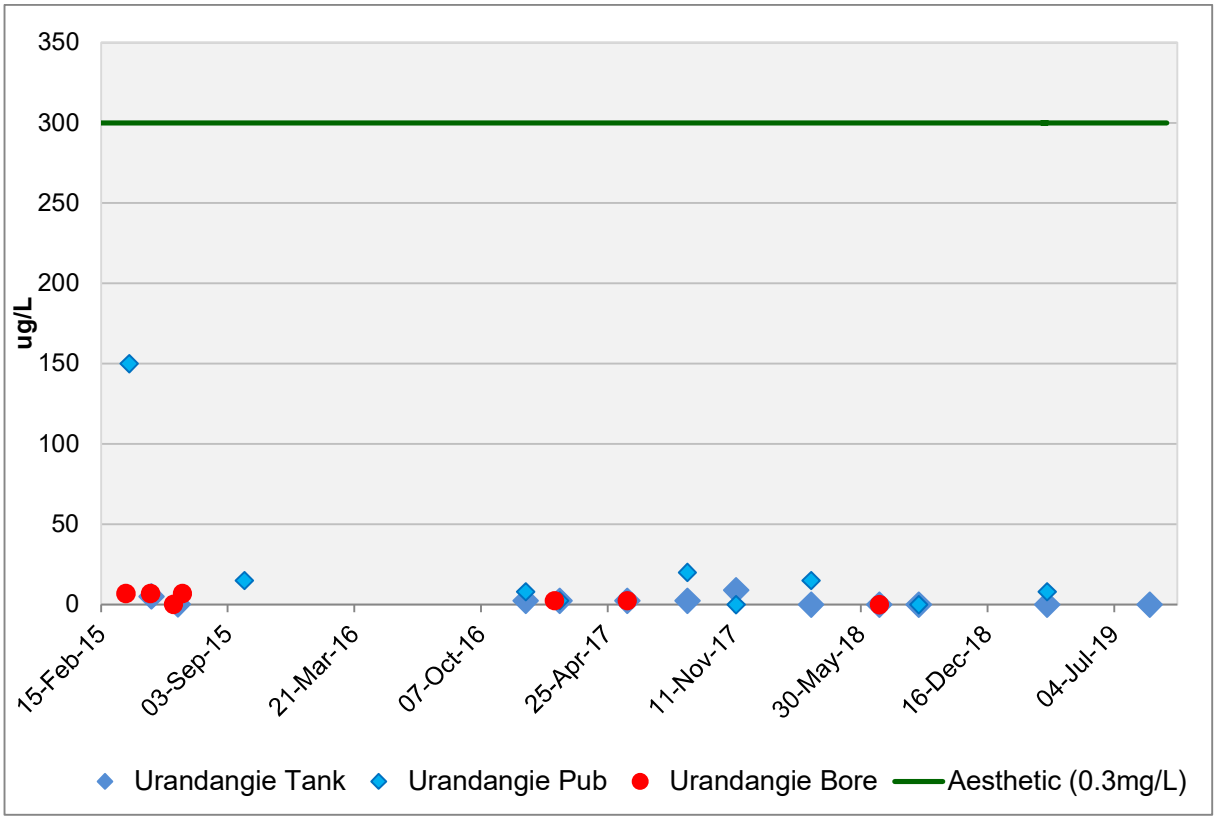


Figure 3.24 Urandangie – Manganese

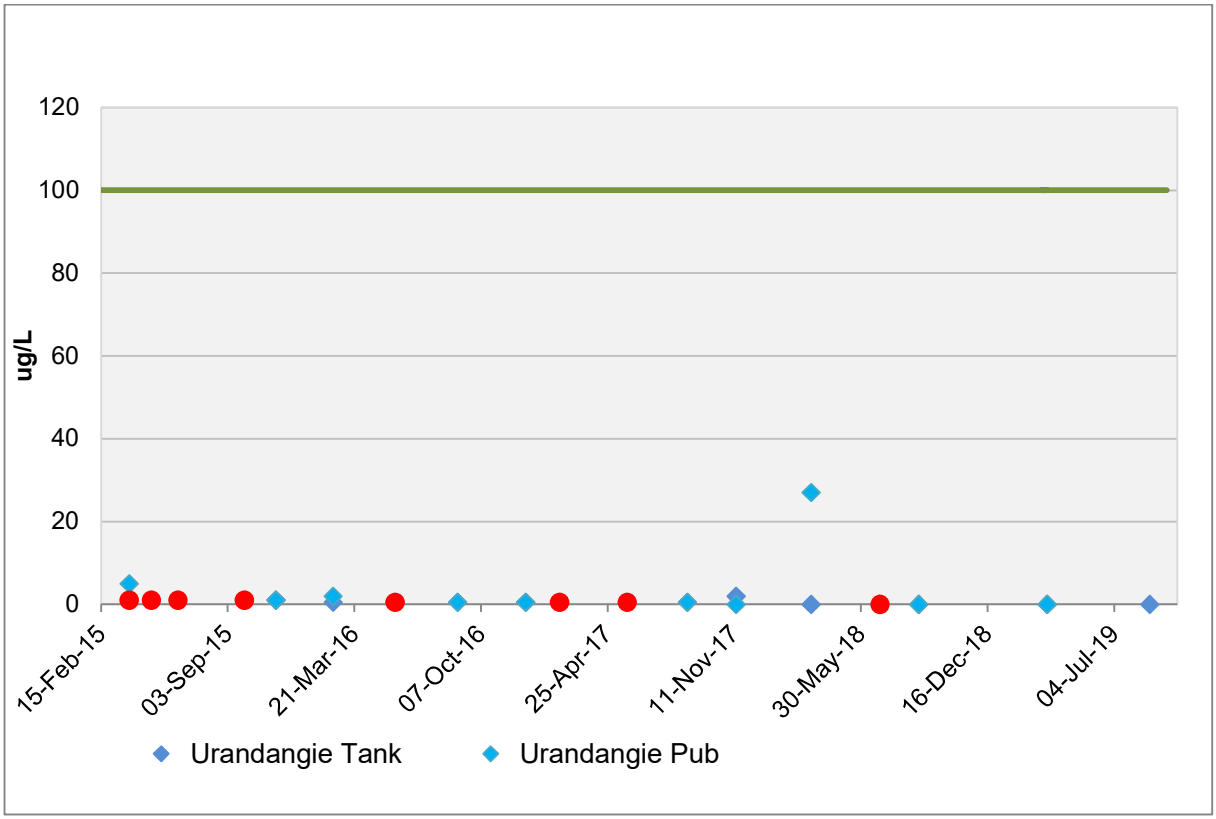


Figure 3.25 Urandangie – Aluminium

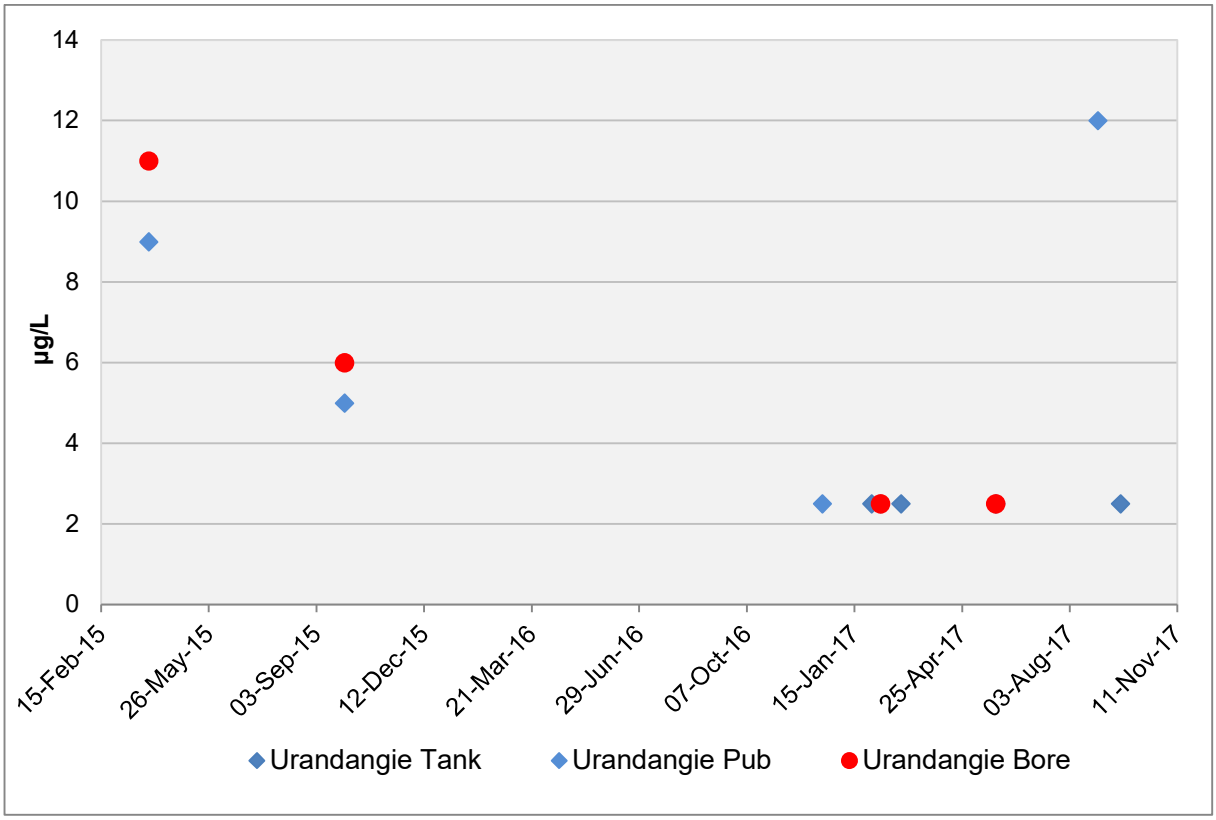


Figure 3.26 Urandangie – Uranium

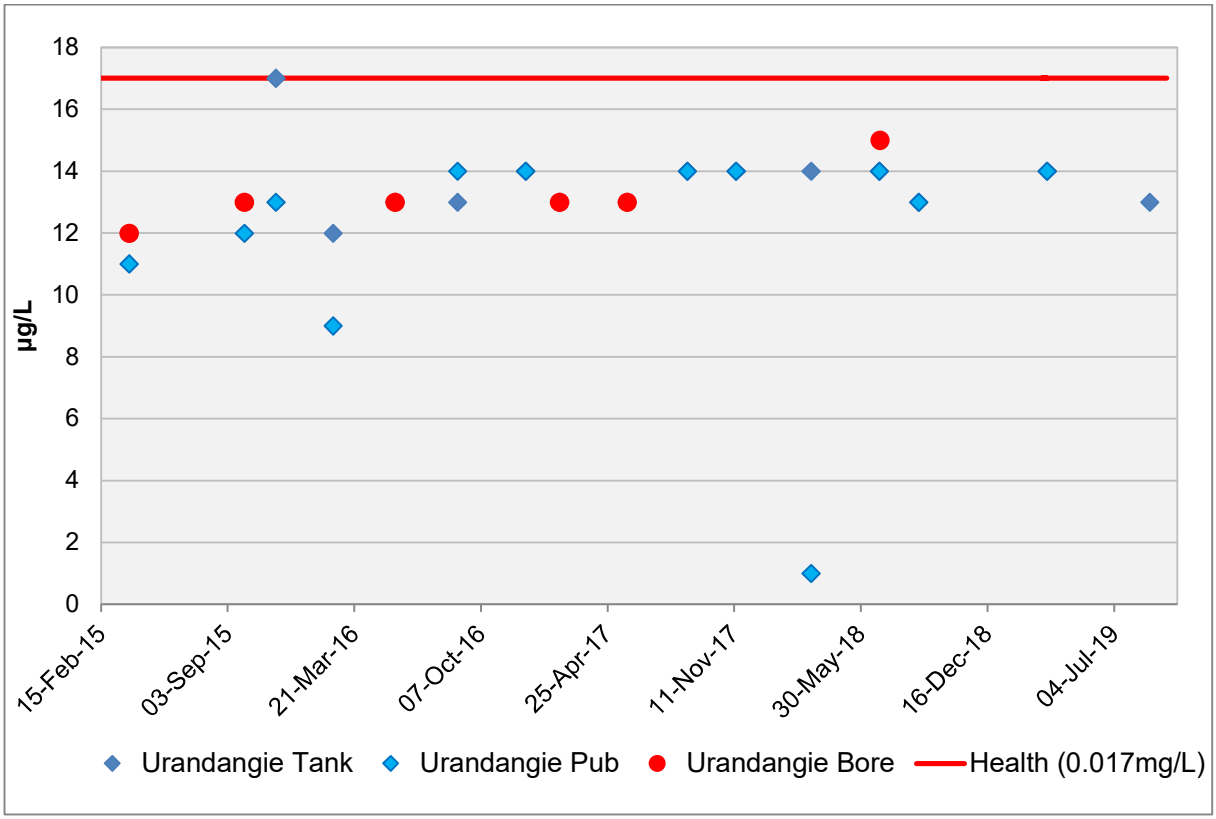


Figure 3.27 Urandangie – Selenium

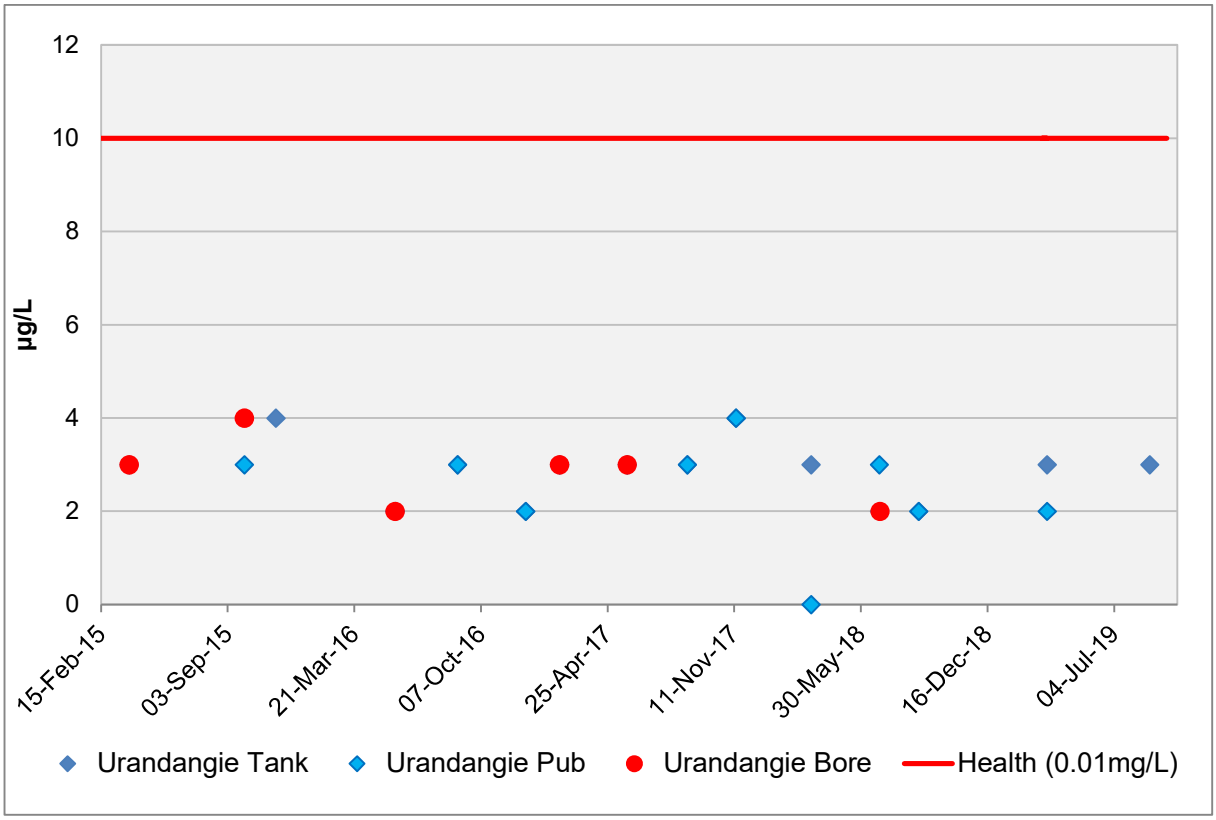


Figure 3.28 Urandangie - Lead

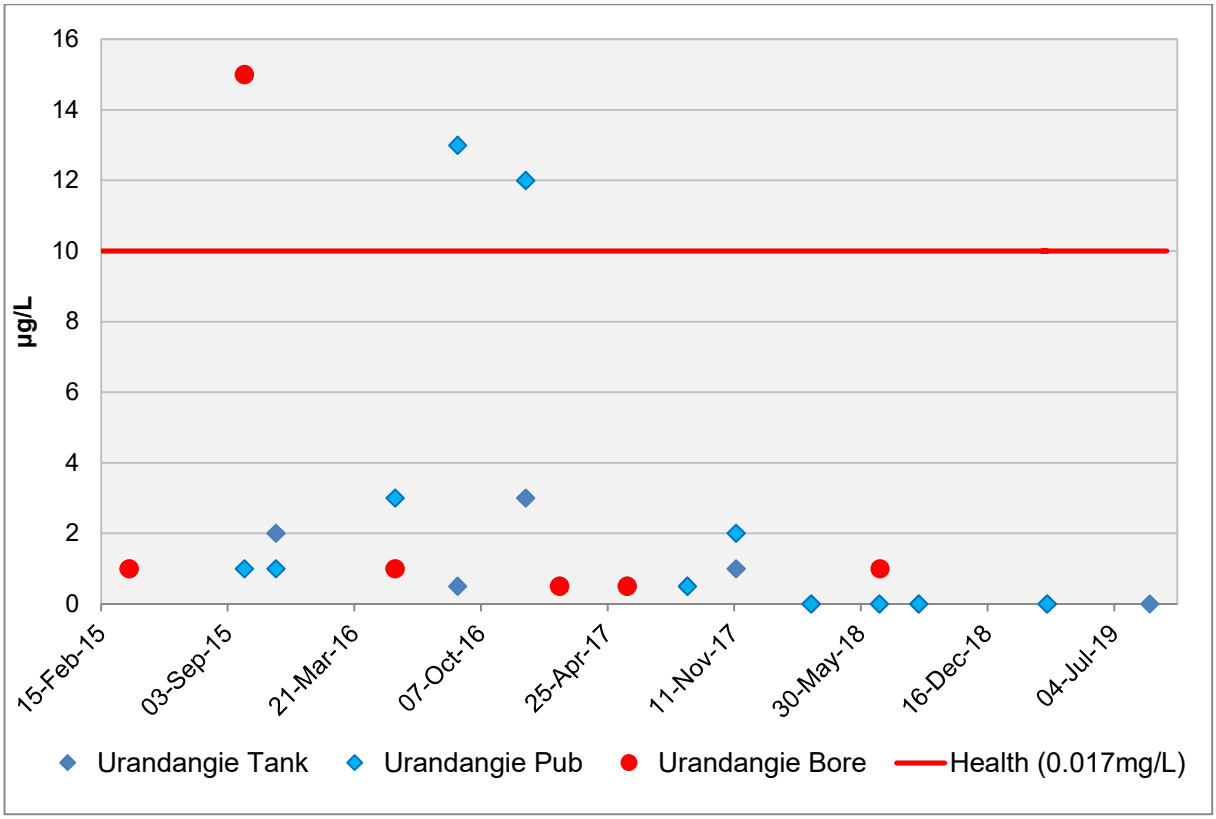
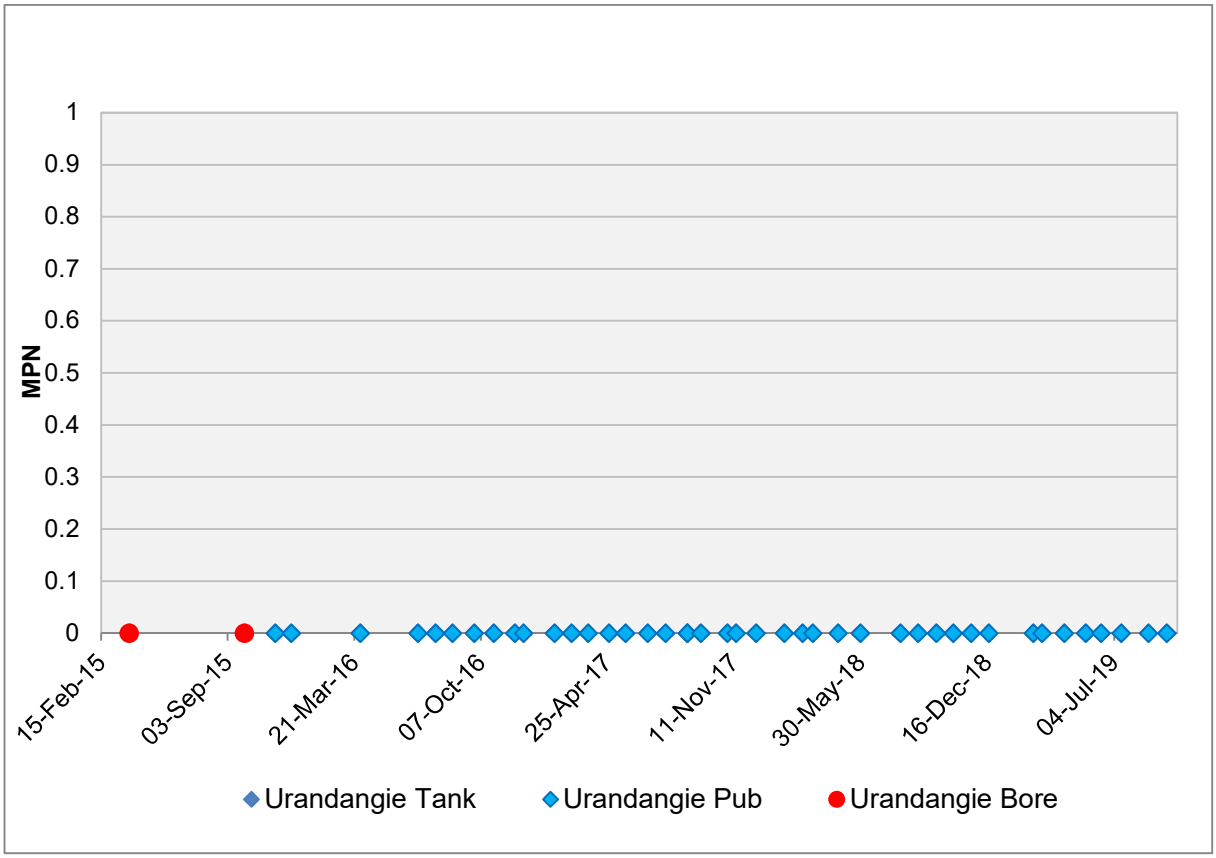


Figure 3.29 Urandangie – E.coli



3.2.1 (b) Interpretation

The following aesthetic characteristics were detected (Underlined show exceedances):

- pH
- Silica
- **Total Dissolved Solids**
- **Colour**
- **Turbidity**
- **Sodium**
- **Chloride**
- Sulphate
- Iron
- Manganese
- Aluminium

Figure 3.17 provides a trend for the analysis of Total Dissolved Solids; there are 32 exceedances of the aesthetic guideline value of 600 mg/l. A maximum value of 2400 mg/l, average value of 1270 mg/l and a 95th percentile of 1400 mg/l have been determined. For Total Dissolved Solids no health based guideline is considered necessary.

Figure 3.18 Provides True Colour values for Urandangie's drinking water. This characteristic has 24 exceedances of the ADWG aesthetic guideline value of 15Hu from 41 monitoring events. No health based guideline is considered necessary. A maximum value of 32 Hu, average value of 16Hu and a 95th percentile of 24Hu have been determined.

Figure 3.19 provides values for Turbidity: there are 41 exceedances from a total of 97 tested samples. The aesthetic guideline value is 5 NTU. For Turbidity no health based guideline is considered necessary. A maximum value of 18 NTU, average value of 4.97 NTU and a 95th percentile of 8 NTU have been determined.

Figure 3.20 provides values for Sodium; there are 14 exceedances. The aesthetic guideline value is 180 mg/l. For sodium no health based guideline is considered necessary. A maximum value of 280 mg/l, average value of 201 mg/l and a 95th percentile of 235 mg/l have been determined. Sodium values >180 mg/l cause taste issues.

Figure 3.21 provides values for Chloride: there are 16 exceedances. The aesthetic guideline value is 250 mg/L. For Chloride no health based guideline is considered necessary. A maximum value of 410 mg/L, average value of 346 mg/L and a 95th percentile of 386.5mg/L have been determined.

The following health characteristics were detected (Underlined shows exceedances):

- **Fluoride**
- Nitrate
- Sulphate
- Boron
- Chlorate
- Selenium
- Uranium
- **Lead**

Figure 3.22 provides a trend for the analysis of Fluoride; of 39 samples taken 36 exceed ADWG health threshold. The health guideline value is 1.5 mg/l. A maximum value of 2.7 mg/l, average value of 1.88mg/l and a 95th percentile of 2.31 mg/l have been determined. Fluoride values > 1.5 mg/l can cause dental fluorosis while values > 4 mg/l can cause skeletal fluorosis.

Figure 3.26 provides a trend for the analysis of Uranium; of the 24 samples taken there are no exceedances however values are regularly recorded close to ADWG health guidelines and therefore requires close monitoring. The health limit is based on animal studies and includes chemical toxicity as well as possible radiological effects. Conventional treatment processes do not effectively remove Uranium from water supplies.

Figure 3.28 provides a trend for the Lead values; 26 values were recorded over the sampling period, of the 26 values 4 have exceeded the ADWG health guideline of 10µg/L. A maximum value of 15µg/L was recorded, average value of 3.06µg/L and a 95th percentile of 12.90µg/L have been determined. High levels of lead can have serious effects on health, as high levels can severely affect the body's central nervous system. Due to the high variability in recorded lead concentrations it is likely that values exceeding the ADWG health limits are due to contamination, most likely from lead sources in the domestic water lines such as solders, galvanising or brass fittings.

3.2.2 Catchment Characteristics

Urandangie is located in the Channel Country of Western Queensland. The average annual rainfall for Urandangie is 302.8mm[4] with the majority of the rain falling between December and March. The mean maximum temperature is 32.4°C. Urandangie has a current population of 25 permanent residents and has a current demand of 61 kL/day.

Refer to section 3.1.2 for details of major river catchment characteristics.

Currently there is one sub-artesian bore in Urandangie. Urandangie Town Bore No.1 (RN93844). Figure 3.14 shows the recharge, discharge and flow of the GAB.

The town bore is located on the corner of Collins Street and Margaret Street. The bore is 30m deep and yields 5 l/s.

The bore water is pumped into a ground level reservoir and then pumped into reticulation or the elevated reservoir. Appendix B shows the bore locations and water reticulation layout. Appendix C contains a copy of the bore card reports obtained from Department of Natural Resources & Mines.

There is no sewerage system for Urandangie. Sewerage treatment is provided by grease traps, septic tanks and effluent soakage trenches.

3.2.3 Hazard Identification

The hazards and hazardous events and their sources that adversely affect water quality are documented in Table 3.5 below and include those affecting:

- Catchment
- Sourcing infrastructure
- Disinfection process
- Distribution system
- Whole of System

[4] Climate statistics for Urandangie – Bureau of Meteorology

3.2.3 (a) Identifying and Documenting Hazards And Hazardous Events

The hazards and hazardous events were identified using data contained in the plan and following site visits and a risk assessment workshop which was conducted in December 2019;

- Section 2.2 Urandangie Water Supply Scheme
- Section 3.2.1 Water Quality Information
- Section 3.2.2 Catchment Characteristics

Table 3.5 Urandangie Hazard Identification, Risk Assessment and Uncertainty

Scheme Component / Sub-component	Hazardous Event	Hazard	Maximum risk			Existing Preventive Measures / Barriers.	Residual risk			Uncertainty	Comments/ Proposed Further Risk Reduction Actions
			Consequence	Likelihood	Risk level		Consequence	Likelihood	Risk level		
Bore	Contamination of bore	Biological	Major	Possible	High 12	Disinfection Operational monitoring of infrastructure	Major	Rare	Medium 5	Reliable	**U1** Seal Bores
	Hazard that arises from the natural geological processes in the aquifer.	Chemical/Biological	Major	Possible	High 12	Distribute health fact sheet to community Verification monitoring	Moderate	Possible	Medium 9	Estimate	**U2** Implement annual community education program informing the community of risks and management strategies associated with elevated fluoride concentrations in drinking water **U6** Undertake a desktop analysis of alternate source water locations with improved water quality
	High Turbidity	Chemical/Biological	Major	Possible	High 12	Disinfection Verification monitoring	Major	Rare	Medium 5	Reliable	Acceptable risk
	Bore Failure	Physical	Major	Possible	High 12	Operational monitoring of bore headworks and pump operation Routine CCTV inspection at 5-year interval	Major	Rare	Medium 5	Reliable	Acceptable risk
	Power Outage	Physical	Major	Possible	High 12	Elevated reservoir and back-up generator	Moderate	Rare	Low 3	Confident	Acceptable risk
Sourcing Infrastructure	Equipment Failure/ Leaking Tank	Ageing Infrastructure	Major	Likely	High 16	Operational Monitoring	Major	Possible	High 12	Reliable	**U3** Address leaking elevated reservoir
	Vermin barrier not secured/degraded	Biological	Major	Possible	High 12	Security fencing Vermin barrier protection Hatches secured Vermin barrier inspection O & M procedures in place	Moderate	Rare	Low 3	Confident	Acceptable risk
	Accidental or intentional contamination	Chemical/Biological	Major	Possible	High 12	Security fencing Vermin barrier protection Hatches secured Vermin barrier inspection O & M procedures in place	Major	Rare	Medium 5	Confident	Acceptable risk
	Flood Event	Biological	Major	Possible	High 12	O & M procedures in place Boil water alert	Major	Rare	Medium 5	Confident	Acceptable Risk

Scheme Component / Sub-component	Hazardous Event	Hazard	Maximum risk			Existing Preventive Measures / Barriers.	Residual risk			Uncertainty	Comments/ Proposed Further Risk Reduction Actions
			Consequence	Likelihood	Risk level		Consequence	Likelihood	Risk level		
Disinfection Process	Over Chlorination	Chemical	Major	Unlikely	Medium 8	O & M procedures in place	Moderate	Rare	Low 3	Reliable	Residual risk continue to monitor
	Under Chlorination	Biological	Major	Possible	High 12		Major	Rare	Medium 5	Reliable	
Distribution System	Reticulation maintenance and repair	Biological	Major	Possible	High 12	O & M procedures in place	Major	Rare	Medium 6	Reliable	Acceptable risk
Whole of System	Flights carrying water samples delayed/cancelled	Chemical/Biological	Major	Unlikely	Medium 8	Collect new samples and schedule for next available flight	Moderate	Rare	Low 3	Estimate	Acceptable risk
	Contamination of water samples	Chemical/Biological	Moderate	Possible	Medium 9	Water sampling procedures Inhouse water training	Moderate	Rare	Low 3	Reliable	Acceptable risk
	Widespread flooding causing road closures and inability to undertake water sampling and testing	Chemical/Biological	Major	Possible	High 12	Monitor weather patterns. Schedule monthly sampling for early in the month, providing a greater window for sampling	Major	Unlikely	Medium 8	Reliable	Acceptable risk
	Equipment failure	Ageing Infrastructure	Major	Likely	High 16	Operational Monitoring	Major	Possible	High 12	Reliable	**U4** Update live drawings to accurately reflect current infrastructure status
	Local trained staff unavailable to sample water due to illness/weather	Chemical/Biological	Major	Possible	High 12	Samples to be collected by external parties	Major	Rare	Medium 5	Confident	Acceptable risk
	Shortage of supply of essential materials for treatment purposes due to weather	Biological	Major	Possible	High 12	Ensure storage of sufficient materials to allow for disruptions to freight	Major	Rare	Medium 5	Confident	Acceptable risk
	Cyber security breach	Cyber security threat	Major	Possible	High 12	Council data stored on document management system with high grade security protection User authentication Restricted admin privileges Backup systems in place	Major	Possible	Medium 8	Estimate	**U5** Cyber security risk not fully understood. Specialist assessment to be undertaken through regional water alliance

3.2.3 (b) Hazard Identification (and Risk Assessment) Team

The personnel responsible for the hazard identification and risk assessment process, their roles and responsibilities are detailed in the Table below.

Table 3.6 Hazard Identification and Risk Assessment Team

Typical job title for key personnel	What role did each person play on the team?	What expertise and system knowledge did the person bring?
Director of Works & Operations	Identify time or budgetary constraints, assess and identify improvement actions	Experience managing water schemes. Forecast budgeting and project delivery.
Foreman Utilities and Services	Identifying hazards risks	Detailed knowledge of individual schemes
Licensed Plumber	Identifying hazards risks	Detailed knowledge of individual schemes
Water Operator	Identifying hazards risks	Understanding of water quality and associated risks.
Engineer (Consultant)	Management of DWQMP Process, Risk Assessment Procedure & Chairing Risk Assessment Workshop	High level knowledge, risk assessment and general engineering experience in the management of the systems.

4 ASSESSMENT OF RISKS

The plan details the risk assessment methodology used for the scheme in Section 4.1 below. Section 4.2 explains how the risks were assessed. Section 4.3 tabulates the relevant stakeholders in the risk assessment process.

4.1 Methodology

The methodology adopted for the risk assessment is described below. The methodology is based on the methodology explained in the document "Drinking Water Quality Management Plan Guideline" (September 2010).

Table 4.1 below shows the qualitative measures of likelihood that was adopted in the risk assessment.

Table 4.1 Measures of Likelihood Utilised in the Risk Assessment

Likelihood	Descriptors
Rare	Occurs less than or equal to once every 5 years
Unlikely	Occurs more often than once every 5 years and up to once per year
Possible	Occurs more often than once per year and up to once a month (12/yr.)
Likely	Occurs more often than once per month (12/yr.) and up to once per week (52/yr.)
Almost Certain	Occurs more often than once per week (52/yr.)

Table 4.2 below shows the qualitative measures of consequence that was adopted in the risk assessment.

Table 4.2 Measures of Consequences Utilised in the Risk Assessment

Consequence	Descriptors
Insignificant	Isolated exceedance of aesthetic parameter with little or no disruption to normal operation
Minor	Potential local aesthetic, isolated exceedance of chronic health parameter
Moderate	Potential widespread aesthetic impact or repeated breach of chronic health parameter
Major	Potential acute health impact, no declared outbreak expected
Catastrophic	Potential acute health impact, declared outbreak expected

Table 4.3 below shows the degrees of uncertainty adopted for the risk assessment. Some of the risks assessed for all the Water Supply Schemes remain an estimate or uncertain.

Table 4.3 Degrees of Uncertainty

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.

Level of Uncertainty	Definition
Confident	There is 5 years of continuous monitoring data, which has been collated and assessed, with at least weekly monitoring or for the duration of seasonal events; or There is a 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.

Table 4.4 below shows the risk analysis matrix utilised, detailing the various levels of risk that was adopted in the risk assessment.

Table 4.4 Risk Analysis Matrix – Level of Risk

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)

Table 4.5 Defined Acceptable Risk Levels

Low	acceptable	manage for continuous improvement
Medium	acceptable	Implement short term measures, longer term risk reduction measures may be implemented within a reasonable timeframe
High	unacceptable	Implement short term measures immediately, longer term risk reduction measures need to be a priority
Extreme	unacceptable	Implement short term measures immediately, implementation of longer term risk reduction measures given top priority

Table 4.5 above details the acceptable risk levels for the water supply schemes.

4.1.1 DWQMP Review and Risk Assessment Workshop

The DWQMP risk assessment was conducted in association with the DWQMP regular review in collaboration between GBA engineering staff and BSC management and operational staff. The collaboration process between GBA and BSC included a review of the DWQMP audit by both parties and a workshop, discussing potential risks in the Boulia and Urandangie drinking water schemes. Table 4.6 below identifies the DWQMP Review and Risk Assessment Team.

Table 4.6 Stakeholders – Risk Assessment

Stakeholder	Contact Name and Details	Rationale for engagement and how engagement occurred
Boulia Shire Council	Harin Kara Director of Works & Operations P: (07) 4746 3188	Manager of infrastructure and projects Experience managing water schemes. Risk assessment
	Ronnie Calliope Foreman Utilities and Services P: (07) 4746 3188	Detailed knowledge of water infrastructure. Risk assessment
	Mari Gunderson Water Operator P: (07) 4746 3188	Undertakes operational and verification monitoring, understanding of water quality and associated risks. Risk assessment
	Brent Krause Licensed Plumber P: (07) 4746 3188	Detailed knowledge of water infrastructure. Risk assessment
Consultants	Stuart Bourne Engineer P: (07) 4651 5177 E: gbourne@gbassoc.com.au	Manage Engineering Services for Boulia Shire Council[5] Review and Endorse DWQMP. Risk Assessment
	William Green Environmental Scientist P (07) 4651 2177 E wgreen@gbassoc.com.au	Review and amendment of DWQMP. Risk Assessment

[5] BSC engages a civil engineering consultancy (George Bourne and Associates) to manage Engineering Services.

4.2 Assessment of Risk

Details of the risk assessment results for each scheme's identified hazards and hazardous events include:

- Maximum risk level or equivalent process (i.e. without existing barriers in place, e.g. no treatment and/or disinfection);
- Existing preventive measures including multiple barriers (i.e. treatment process steps)
- Residual risk level (i.e. with existing barriers in place for example, treatment and/or disinfection); and any uncertainties.

The following sections will discuss each of these dot points in further detail.

4.2.1 Assessment of Maximum Risk

For all hazards, maximum risk (e.g. the risk from an uncontrolled hazard) was first assessed. Where there was insufficient data or information to complete a reliable assessment, this was highlighted as an uncertainty and discussed further in the Risk Management Improvement Program in Section 5.4 below.

4.2.2 Existing Preventative Measures/Barriers

All existing preventative measures are listed in the Risk Assessment. Existing preventative measures include all actions, barriers or measures currently in place to reduce the maximum risk. They include active measures that protect raw water quality prior to treatment and measures to protect treated water quality.

4.2.3 Residual Risk

The residual risk is determined once existing preventive measures have been applied. Residual risk is the level of risk a particular hazard is assessed as posing to the safety of the drinking water once the existing preventative measure/s have been applied.

Residual risk is determined using the same methodology (e.g. likelihood and consequence descriptors) as the initial maximum risk assessment; however changes to the assessed likelihood (or consequence) should result in a lower resultant risk level.

5 MANAGING RISKS

Boulia and Urandangie raw water requires disinfection prior to reticulation and both schemes undergo similar disinfection under different processes, with Boulia commissioning a new automated chlorine gas disinfection system and Urandangie utilising a manual application of chlorine to the reservoir.

Managing risks are discussed in the following sections below:

- 5.1 Risk Management Measures
- 5.2 Operation and Maintenance Procedures
- 5.3 Management of Incidents and Emergencies
- 5.4 Risk Management Improvement Program
- 5.5 Information Management

5.1 Risk Management Measures

Existing and proposed preventative risk management measures are detailed in 5.1.1 for Boulia and 5.1.2 below for Urandangie.

5.1.1 Boulia Existing and Proposed Preventative Measures

Table 5.1 below provide details of the existing and proposed preventative measures for Boulia. Proposed measures are included in the Risk Management Improvement Program (RMIP) in Table 5.6 below.

Table 5.1 Boulia Existing and Proposed Preventative Measures

Scheme Component / Sub-component	Hazard	Hazardous event/s	What is/are the existing preventative measure/s?	Which risk factor/s does the existing preventative measure/s impact on	How effective is/are the existing preventative measure/s & on what basis has this been determined?	Is the level of residual risk acceptable	Proposed measures to reach an acceptable level of residual risk	Responsible Organisations
Bore	Biological	Ingress contaminated run-off	Automated Disinfection System	Likelihood	Effective - Initial results are achieving effective disinfection	Yes – medium risk		Boulia Shire Council
	Chemical/Biological	Hazard that arises from the natural geological processes in the aquifer – High Iron concentrations and turbidity.	Automated Disinfection System Verification Monitoring	Likelihood	Moderately effective residual risk persists	Yes – medium risk		
	Physical	Power Outage	Elevated reservoir Back-up generator	Likelihood	Effective	Yes – low risk		
Disinfection Process	Bacteria/ Virus (Source Water)	Chlorine dosing equipment failure or under dosing	Target Dose 1.5mg/L Low residual alarm	Likelihood	Effective	Yes – Medium risk		
	Bacteria/ Virus (Source Water)	Turbidity impact disinfection effectiveness	Oxidisation through chlorine gas disinfection Operational Monitoring Target Dose 1.5mg/L	Likelihood/Consequence	Effective	Yes – Medium risk		
	chemical	Chlorine overdosing	Target Dose 1.5mg/L High Residual Alarm	Likelihood/Consequence	Effective	Yes - Low Risk		
	Chlorate THM's	Disinfection by-products (Degradation of chemicals)	Chlorine gas system Verification Monitoring Automated chlorine monitoring	Likelihood/Consequence	Effective - Initial results show low levels of disinfection by-products	Yes – Medium risk		
	Lack of expertise/ knowledge of system	System Malfunction	System Telemetry Operations Manual	Likelihood	Residual risk resides - System shutdowns have occurred in the initial commissioning stages of the plant.	No – High Risk	**B1.** Provide required training for staff to manage Disinfection System	

Scheme Component / Sub-component	Hazard	Hazardous event/s	What is/are the existing preventative measure/s?	Which risk factor/s does the existing preventative measure/s impact on	How effective is/are the existing preventative measure/s & on what basis has this been determined?	Is the level of residual risk acceptable	Proposed measures to reach an acceptable level of residual risk	Responsible Organisations
Sourcing infrastructure	Biological	Vermin barrier not secured/Degraded	Low residual alarm Renewal of vermin barrier protection Regular inspections	Likelihood	Effective	Yes – low risk		
	Chemical/Biological	Accidental or intentional contamination	Renewal of vermin barrier protection Security fencing O & M procedures in place	Likelihood	Effective	Yes – medium risk		
	Biological	Flood event	O & M Procedures Back up bore water source (Bore # 8) Boil water alert	Likelihood	Effective	Yes – Medium risk		
Distribution System	Biological/Physical	Iron oxidisation/precipitation	Regular Air scouring Disinfection	Likelihood	Effective however residual risk resides	Yes – medium risk	**B4.** Engineering Modifications – improved turbidity	
	Biological	Cross contamination/Backflow	Disinfection	Likelihood	Temporary control, does not provide continuous mitigation	No – high Risk	**B2.** Install non return valves at high risk locations, town common, STP	
	Outdated records	Unable to locate assets	Asset register Reticulation drawings	Likelihood	Moderately effective _ live drawings of water assets require updating	Yes – medium risk	**B3.** Update live drawings to reflect rising main and manifold	
	Biological	Reticulation maintenance and repair	O & M Procedures in place	Likelihood	Effective	Yes – medium risk		

Scheme Component / Sub-component	Hazard	Hazardous event/s	What is/are the existing preventative measure/s?	Which risk factor/s does the existing preventative measure/s impact on	How effective is/are the existing preventative measure/s & on what basis has this been determined?	Is the level of residual risk acceptable	Proposed measures to reach an acceptable level of residual risk	Responsible Organisations
Whole of System	Chemical/Biological	Flights for transportation water samples delayed/cancelled	Collect new samples and schedule testing for next available flight	Likelihood/Consequence	Effective however risk cannot be completely controlled	Yes – low risk		
	Chemical/Biological	Local trained staff unavailable to sample water	Samples to be collected by consultant engineers	Likelihood	Effective	Yes – medium risk		
	Biological	Shortage of supply of essential materials for treatment purposes due to weather	Consultant Engineers provide relief by use of light aircraft	Likelihood	Effective	Yes – medium risk		
	Cyber security threat	Cyber security breach	Council data stored on Info expert system with high grade security protection. Backup systems in place	Likelihood	Residual risk resides - cyber security risk is not fully understood.	Yes – medium risk	**B5.** Cyber security risk not fully understood. Specialist assessment to be undertaken through regional water alliance.	

5.1.2 Urandangie Existing and Proposed Preventative Measures

Table 5.2 below provide details of the existing and proposed preventative measures for Urandangie. Proposed measures are included in the RMIP in Table 5.7 below.

Table 5.2 Urandangie Existing and Proposed Preventative Measures

Scheme Component / Sub-component	Hazard	Hazardous event/s	What is/are the existing preventative measure/s?	Which risk factor/s does the existing preventative measure/s impact on	How effective is/are the existing preventative measure/s & on what basis has this been determined?	Is the level of residual risk acceptable	Proposed measures to reach an acceptable level of residual risk	Responsible Organisations
Bore	Biological	Contamination of bore	Disinfection Operational Monitoring	Likelihood	Effective	Yes – medium risk	**U1.** Seal bore heads to reduce contamination risk	Boulia Shire Council
	Chemical/Biological	Hazards that arise from the natural geological process in the aquifer	Distribute fluoride facts sheet to community informing them of potential health risks	Likelihood	Moderately effective – residual risk resides	Yes – medium risk	**U2.** Implement annual community education program informing the community of risks and management strategies associated with elevated fluoride concentrations in drinking water. **U6.** Undertake a desktop analysis of alternate source water locations with improved water quality.	
			Verification Monitoring					
	Turbidity		Water disinfection Verification Monitoring	Likelihood	Effective	Yes – medium risk		
	Physical	Power Outage	Elevated reservoir and back-up generator	Likelihood/Consequence	Effective	Yes – low risk		
		Bore Failure	Operational monitoring of bore headworks and pump operation Routine CCTV inspection at 5-year interval	Likelihood/Consequence	Effective	Yes – low risk		
Sourcing infrastructure	Ageing Infrastructure	Equipment Failure/ Leaking Tank	Operational Monitoring	Likelihood	Residual risk resides	No - high Risk	**U3.** Address leaking elevated reservoir, line reservoir or Install new reservoir.	
	Biological	Vermin barrier not secured	Security fencing	Likelihood/Consequence	Effective	Yes – medium risk		
			Vermin barrier protection					
			Hatches secured					
			Vermin barrier inspection					
			O & M procedures in place					
	Chemical/Biological	Accidental or intentional contamination	Security fencing	Likelihood	Effective	Yes – medium risk		
			Vermin barrier protection					

Scheme Component / Sub-component	Hazard	Hazardous event/s	What is/are the existing preventative measure/s?	Which risk factor/s does the existing preventative measure/s impact on	How effective is/are the existing preventative measure/s & on what basis has this been determined?	Is the level of residual risk acceptable	Proposed measures to reach an acceptable level of residual risk	Responsible Organisations
			Hatches secured					
			Vermin barrier inspection					
			O & M procedures in place					
	Biological	Flood event	O & M Procedures	Likelihood	Effective	Yes – medium risk		
			Boil water alert					
Disinfection Process	Chemical	Over Chlorination	Manual Disinfection	Likelihood/Consequence	Effective	Yes – low risk	Residual risk continue to monitor residual levels	
			O & M Procedures					
	Biological	Under Chlorination	Manual Disinfection	Likelihood	Moderately effective – residual risk resides	Yes – medium risk		
			O & M Procedures					
Distribution System	Biological	Reticulation maintenance and repair	O & M Procedures	Likelihood	Effective however residual risk resides	Yes – medium risk		
Whole of System	Chemical/Biological	Flights for transportation water samples delayed/cancelled	Collect new samples and schedule testing for next available flight	Likelihood/Consequence	Effective however risk cannot be controlled	Yes – medium risk		
	Chemical/Biological	Contamination of water samples	Water sampling procedures Inhouse water training	Likelihood	Effective, ongoing training is necessary	Yes – low risk		
	Chemical/Biological	Widespread flooding causing road closures and inability to undertake water sampling and testing	Monitor weather patterns	Likelihood	Moderately effective – residual risk resides	Yes – medium risk		
			Schedule monthly sampling for early in the month, providing a greater window for sampling					
	Equipment failure	Ageing Infrastructure	Operational Monitoring	Likelihood	Residual risk resides	No - high risk	**U4.** Update live drawings to accurately reflect current infrastructure status	
	Chemical/Biological	Local trained staff unavailable to sample water	Samples to be collected by consultant engineers	Likelihood	Effective	Yes – medium risk		
	Biological	Shortage of supply of essential materials for treatment purposes due to weather	Consultant Engineers provide relief by use of light aircraft	Likelihood	Effective	Yes – medium risk		

Scheme Component / Sub-component	Hazard	Hazardous event/s	What is/are the existing preventative measure/s?	Which risk factor/s does the existing preventative measure/s impact on	How effective is/are the existing preventative measure/s & on what basis has this been determined?	Is the level of residual risk acceptable	Proposed measures to reach an acceptable level of residual risk	Responsible Organisations
	Cyber security threat	Cyber security breach	Council data stored on Info expert system with high grade security protection. Backup systems in place	Likelihood	Residual risk resides - cyber security risk is not fully understood.	Yes – medium risk	**U5.** Cyber security risk not fully understood. Specialist assessment to be undertaken through regional water alliance	

5.2 Operation and Maintenance Procedures

During the initial risk assessment in 2012 it was identified that a large number of procedures were non-existent. Since 2012 Operational and Maintenance Procedures have been developed as part of the DWQMP review process. The procedures provide operational personnel with the necessary information to implement safe work practices in order to optimise drinking water quality.

Procedures adopted and currently in use include:

- DWQMP Operating Procedure – Boulia & Urandangie
- Operational Monitoring Procedure
- Water Sampling Procedure
- Safe Work Method Statement – Maintenance and repair of water infrastructure

In accordance with Councils quality management systems, procedures are given a procedure number, title, revision date, process used for maintaining the documented procedure, and the process for implementing the procedure.

5.3 Management of Incidents and Emergencies

Table 5.3 shows the different levels of incidents for the entire drinking water service. There are five levels of incidents and emergencies ranging from Level 5 (most severe) to Level 1 (least severe). Boulia Shire Council has developed a Local Disaster Management Plan (current version dated 20/05/2019). Level 5 incidents and emergencies should be handled under the Boulia Shire Council Local Disaster Management Plan and are likely to be the result or cause of other emergencies which are covered under the plan.

Table 5.4 details how incidents and emergencies are managed relevant to drinking water quality. Table 5.5 details the emergency contact details for and protocols to be followed when a particular emergency or incident occurs. All other contact details for incident and emergency management are included in Boulia Shire Councils Local Disaster Management Plan.

5.3.1 Evaluation and Response to High Turbidity Values

As identified in section 3 of the Plan elevated turbidity values are associated with the source water in Boulia and to a lesser extent Urandangie, with average turbidity values of 7.9 and 5.1 NTU respectively. As identified in section 5.6 below Council currently does not have the capacity to treat the water to reduce the turbidity to the recommended turbidity values. Given that the health risks associated with high turbidity values in drinking water are not directly associated with the turbidity but the increased likelihood of biological contamination, Council's main strategy to manage the health risks associated with elevated turbidity in the drinking water is to disinfect the drinking water prior to distribution.

Given that elevated turbidity is an inherent characteristic of the source water for the Boulia scheme and to a lesser extent the Urandangie scheme and there is a high level of confidence that the health risks can be managed through the disinfection of the drinking water, the detection of turbidity values in exceedance of ADWG aesthetic values will not in all cases be considered a reportable incident.

An incident in relation to typically elevated turbidity values would be raised in circumstances where the risk to public health is deemed to be unacceptable.

These circumstances include a combination of the following:

1. **An event:** An incident will be raised where turbidity values have been determined to be uncharacteristically high, and pose a risk to public health. Based on historical data values (approximate 95th percentile values) exceeding 15 NTU for Boulia and 10 NTU for Urandangie would represent an event; and

2. **Low chlorine residuals are detected:** If low chlorine residual levels below .1mg/l are detected an incident should be raised as the health risk associated with turbidity is not managed.

Table 5.3 Incident / Emergency Levels

Incident / Emergency level	Description of level
Level 5	• Widespread outbreak of waterborne disease • Declared disaster • Supply unable to be maintained • Gross exceedances of ADWG health guideline values for a chemical parameter (> five times the ADWG health guideline limit).
Level 4	• High level of E. coli (> 5 CFU/ 100 mL) or any pathogens detected in reticulation • Failure of infrastructure (severe or emergency level supply restrictions required to ensure continuity of supply) • Major cyber security breach resulting in interference of the operation of the water supply scheme water supply scheme.
Level 3	• Detection of 1-5 CFU/100 mL E. coli in reticulation • Failure of infrastructure (ability to supply water compromised – short term water restrictions may be required) • Minor exceedances of ADWG health guideline value for chemical parameter (determined value is close to guideline value).
Level 2	• Failure of infrastructure or source supply (water quality or supply unlikely to be compromised) • Exceedances of ADWG aesthetic guideline (customer complaints possible) • Cyber security breach resulting in interference of the operation of the water supply scheme water supply scheme.
Level 1	• Exceedances of operational limit managed through operational and maintenance procedures

Table 5.4 Management of Incidents and Emergencies

Level	Incident or emergency	Summary of actions to be taken (with documented procedure listed)	Position/s responsible for Action/s
5	Disaster levels - Implement Boulia Shire Council Local Disaster Management Plan Report to the Drinking Water Incident Hotline by phone and written incident report to DEWS		
4	High level of E. coli (> 5 CFU/ 100 mL) or any pathogens detected in reticulation	1. Alert Chief Executive Officer	1. Water Operator
		2. Determine potentially affected area, isolate if possible. Issue Boil Water alert. Escalate emergency further if situation worsens.	2. Water Operator
		3. Report detection to Drinking Water Incident Hotline by phone (Immediately by phone, written incident report – Part 1 incident form - within 24 hours)	3. Water Operator
		4. Resample for E. coli and disinfectant residual in potentially affected infrastructure	4. Water Operator
		5. Undertake comprehensive contamination investigation	5. Director of Works
		6. Undertake necessary corrective actions	6. As appropriate
		7. Upon resolution, provide written report to regulator (Part 2 incident form) and Chief Executive Officer	7. Water Operator
		8. Non-compliance will be raised and will require signing off by the Chief Executive Officer after corrective actions have taken place.	8. Water Operator / Chief Executive Officer

Level	Incident or emergency	Summary of actions to be taken (with documented procedure listed)	Position/s responsible for Action/s
4	Failure of infrastructure including Major cyber security breach, where electronic water supply infrastructure operation could be compromised, such as security breach of SCADA system. (severe or emergency level supply restrictions required to ensure continuity of supply)	1. Alert Chief Executive Officer and IT support services/infrastructure providers where major cyber security breach has occurred. 2. Determine reason for failure, isolate if possible. Consider options to recommence supply. 3. Report detection to Drinking Water Incident Hotline by phone (Immediately by phone, written incident report – Part 1 incident form - within 24 hours) 4. Undertake comprehensive failure investigation 5. Undertake necessary corrective actions to recommence supply and provide an estimate of when the supply can be recommenced 6. Implement severe or emergency level supply restrictions. Consider escalating to a Level 5 incident. Notify the public. 7. Upon resolution, provide written report to regulator (Part 2 incident form). Provide written report to the Chief Executive Officer 8. Non-compliance will be raised and will require signing off by the Water Operator and the Chief Executive Officer after corrective actions have taken place.	1. Water Operator 2. Water Operator 3. Water Operator / Consulting Engineer 4. Water Operator 5. Director of Works 6. Water Operator / Chief Executive Officer 7. Water Operator 8. Water Operator / Chief Executive Officer

Level	Incident or emergency	Summary of actions to be taken (with documented procedure listed)	Position/s responsible for Action/s
3	Detection of 1-5 CFU/100mL E.coli in reticulation	1. Alert Chief Executive Officer	1. Water Operator
		2. Determine potentially affected area, isolate if possible. Consider Boil Water alert. Escalate emergency further if situation worsens.	2. Water Operator
		3. Report detection to Drinking Water Incident Hotline by phone (Immediately by phone, written incident report – Part 1 incident form - within 24 hours)	3. Water Operator
		4. Resample for E. coli and disinfectant residual in potentially affected infrastructure	4. Water Operator
		5. Undertake comprehensive contamination investigation	5. Director of Works
		6. Undertake necessary corrective actions	6. As appropriate
		7. Upon resolution, provide written report to regulator (Part 2 incident form)	7. Water Operator
		8. Non-compliance will be raised and will require signing off by the Water Operator and the Chief Executive Officer after corrective actions have taken place.	8. Water Operator / Chief Executive Officer

Level	Incident or emergency	Summary of actions to be taken (with documented procedure listed)	Position/s responsible for Action/s
3	Minor exceedances of ADWG health guideline value for chemical parameter (determined value is close to guideline value).	1. Alert Chief Executive Officer	1. Water Operator
		2. Determine potentially affected area, isolate if possible (i.e. individual bore). Consider Water alert. Escalate emergency further if situation worsens.	2. Water Operator
		3. Report detection to Drinking Water Incident Hotline by phone (Immediately by phone, written incident report – Part 1 incident form - within 24 hours)	3. Water Operator
		4. Resample for detected health parameter for all bores and combined bores (if possible)	4. Water Operator
		5. Undertake comprehensive contamination investigation	5. Water Operator
		6. Undertake necessary corrective actions	6. Water Operator
		7. Upon resolution, provide written report to regulator (Part 2 incident form). Provide Report to Chief Executive Officer also.	7. Water Operator
		8. Non-compliance will be raised and will require signing off by the Water Officer and the Chief Executive Officer after corrective actions have taken place.	8. Water Operator / Chief Executive Officer

Level	Incident or emergency	Summary of actions to be taken (with documented procedure listed)	Position/s responsible for Action/s
3	Failure of infrastructure (ability to supply water compromised – short term water restrictions may be required)	1. Alert Chief Executive Officer. 2. Determine reason for failure, isolate if possible. Consider options to recommence supply. 3. Undertake comprehensive failure investigation 4. Undertake necessary corrective actions to recommence supply and provide an estimate of when the supply can be recommenced 5. Implement Short Term Water restrictions if required 6. Provide written report to the Chief Executive Officer 7. Non-compliance to be raised and will require signing off by the Water Operator and the Chief Executive Officer after corrective actions have taken place.	1. Water Operator 2. Water Operator 3. Water Operator 4. As appropriate 5. Water Operator 6. Director of Works 7. Water Operator / Chief Executive Officer
2	Failure of infrastructure, including minor cyber security breach, such as computer virus or security breach on council server.(supply unlikely to be compromised)	1. Alert Director of Works 2. Monitor the situation to provide warning if supply may be compromised – initiate appropriate action if so Rectify the problem 3. CEO to alert IT support services/infrastructure providers if cyber security breach has occurred. 4. Inform Director of works of malfunction, communicate ongoing issues and improvement actions.	1. Water Operator 2. Water Operator 3. Water Operator 4. Water Operator

Level	Incident or emergency	Summary of actions to be taken (with documented procedure listed)	Position/s responsible for Action/s
	Abnormal exceedance of ADWG aesthetic guideline (customer complaints possible).	5. Determine potentially affected area, isolate if possible (i.e. individual bore). Consider Water alert. 6. Resample for detected aesthetic parameter for all bores and combined bores (if possible) 7. Aesthetic exceedances posing a potential health concern for customers, represent a reportable event. Report detection to Drinking Water Incident Hotline by phone (Immediately by phone, and written incident report – Part 1 incident form - within 24 hours) 8. Undertake contamination investigation 9. Undertake necessary corrective actions	5. Water Operator 6. Water Operator 7. Director of Works
1	Exceedances of operational limit managed through operational and maintenance procedures	1. Implement corrective actions immediately if simple malfunction 2. Rectify exceedance and bring parameter within operational limits. Parameter shall be corrected same day. 3. Inform Director of works of exceedance, communicate ongoing issues and improvement actions to Director of Works.	1. Water Operator 2. Water Operator / Chief Executive Officer 3. Water Operator / Director of Works

Table 5.5 Emergency Contact Details and Protocols

Description of Incident/ Emergency	Level	Business Unit / Organisation	Contact person(s) details	Communication protocols
All	5	Refer to Boulia Shire Council Local Disaster Management Plan		
All	Levels 3-5	Boulia Shire Council	Chief Executive Officer Lynn Moore Herbert Street, Boulia QLD 4829 Phone 07 4746 3188 ceo@boulia.qld.gov.au	Phone Email Written Reports
	Levels 1 - 2	Boulia Shire Council	Director of Works Harin Karra Herbert Street, Boulia QLD 4829 Phone 07 4746 3188 dwo@boulia.qld.gov.au	Phone Email Written Reports
	All levels	Boulia Shire Council	Water Operator Boulia QLD 4829 Phone 07 4746 3188	Phone Email Written Reports
All in Table 5.4	5, 4, 3, 2 Where outlined in Table 5.4	Drinking Water Incident Hotline: 1300 596 709 Email: drinkingwater.reporting@dews.qld.gov.au		Phone Written Report by email
All health related	5, 4, 3	Central Queensland Public Health Unit 82-86 Bolsover Street Rockhampton Queensland 4700 Ph: 0749206989 F: 0749206865 Firstname_Lastname@health.qld.gov.au		Phone Written Email

Description of Incident/ Emergency	Level	Business Unit / Organisation	Contact person(s) details	Communication protocols
For all other contacts and contact numbers refer to the Boulia Shire Council Local Disaster Management Plan including media, police, state agencies, health etc.				

5.4 Risk Management Improvement Program

Unacceptable residual risks or risks identified in the plan have been included in the Risk Management Improvement Program (RMIP) below for Boulia and Urandangie in 5.4.1.

The RMIP also include improvements to parts of the plan where deficiencies in information or uncertainties exist. Priorities of the improvements and target dates for completion have also been included.

5.4.1 Boulia and Urandangie RMIP

Table 5.6 and 5.7 below outline the proposed RMIP to be implemented for Boulia and Urandangie.

Table 5.6 Boulia Risk Management Improvement Program

Code	Improvement	Scheme Component/Sub-component	Hazardous event	Priority	Action(s)			Estimated Cost ($)	Target date/s	Responsibility
					Interim	Short-term	Long-term			
B1	Provide required training for staff to manage Disinfection System	Disinfection System	System Malfunction	High	Identify additional training requirements	Have necessary training completed		$50,000	Interim: June 2021 Short term: December 2021	Director of Works
B2	Install non return valves at high risk locations, town common stables, STP	Distribution system	Cross contamination/Backflow	High	Identify all high risk areas such as stock watering points, low use areas and potential contaminant sites	Install non-return valves at strategic locations		$50,000	Interim: June 2021 Short term: December 2021	
B3	Update live drawings to reflect rising main manifold	Distribution system	Unable to locate assets	High	N.A	Update live drawing to reflect rising main manifold		$10,000	Short-term: June 2021	
B4	Reduce Turbidity Levels	Bore Sourcing infrastructure Sourcing infrastructure	Harbour pathogens Reduced disinfection capacity Discolouration	High	N.A	Engineering Modifications: Oxidisation Optimisation investigate improvement options conduct feasibility study	Implementation of improvement options	$500,000	December 2021 Long term: December 2022	
B5	Cyber security risk not fully understood, particularly with respect to the Remote Terminal Unit operating at the disinfection system. Specialist assessment to be undertaken through regional water alliance	Whole of System	Cyber security breach	High	N.A	Cyber Security risk assessment to be undertaken by specialist		$20,000	Short-term: Dec-21	

Table 5.7 Urandangie Risk Management Improvement Program

Code	Improvement	Scheme Component / Sub-component	Hazardous event	Priority	Action(s)			Estimated Cost ($)	Target date/s	Responsibility
					Interim	Short-term	Long-term			
U1	Seal Bores	Bores	Contamination of source water	High	Determine bore seal design and cost	Seal Bores	N.A.	$10,000	Interim: June 21 Short term: June 22	Chief Executive Officer
U2	Continue to inform community of potential impacts of elevated Fluoride levels	Bore Sourcing Infrastructure	Hazard that arises from the natural geological processes in the aquifer	Medium	N.A.	Identify potential health professionals which could provide informative education program tailored toward the needs of the community residents.	Program an annual educational program to provide ongoing information delivery to the residents of Urandangie.	$5,000	Short-term: June-21	
U3	Address leaking elevated reservoir, line reservoir or Install new reservoir	Sourcing Infrastructure	Equipment Failure/ Leaking Tank	High	Assess and price options for fixing or renewal	Repair or install new tank	N.A.	$100,000	Interim: June - 21 Short-term: June - 22	
U4	Update live drawings to accurately reflect current infrastructure status	Whole of system	Equipment Failure	High	N.A.	Update Urandangie water infrastructure drawings	N.A.	$10,000	Short-term: June - 22	
U5	Cyber security risk not fully understood. Specialist assessment to be undertaken through regional water alliance	Whole of system	Equipment Failure	High	N.A.	Cyber Security risk assessment to be undertaken by specialist	N.A.	$20,000	Short-term: June - 22	
U6	Undertake a desktop analysis of alternate source water locations with improved water quality	Source	Hazard that arises from the natural geological processes in the aquifer.	Medium	N.A	Undertake desktop assessment of potential alternate water sources	N.A	$10,000	Short-term: June - 22	

5.5 Information Management

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 with operational monitoring water quality data detailing maintenance issues or identified hazards.

In order to monitor water quality in the Boulia and Urandangie schemes regular water analysis is conducted in alignment with the Operational and Verification Monitoring Program outlined in Tables 5.10 - 5.14 below. The Water Operator is responsible for organising water quality analysis to be undertaken. The Water Operator collects samples from the sampling points in the systems and for in-house testing conducts analysis in the council depot, results are then recorded and filed chronologically by date on the council server, test results are also sent to GBA Consulting Engineers who update data records and file sample record sheets. For external testing the laboratory delivers sampling equipment on scheduled dates, after the samples are taken a chain of custody certificate is signed and the samples are put on a flight to Brisbane and couriered to the lab. External water quality results are received by GBA Consulting Engineers who manage the water quality data which is stored in electronic format in a chronological order to ensure information is accessible, accurate and up to date. Water quality data is maintained in electronic format in a spreadsheet to maintain a single record of all water quality data. The spreadsheet is maintained with trends graph to provide visual guides depicting trends over time.

Infrastructure and asset records are managed by GBA Consulting Engineers who maintain reticulation plans.

5.6 Management of Sub-optimal Drinking Water Quality parameters

Ongoing monitoring undertaken by BSC in accordance with the Verification and Operational Monitoring Programs detailed in the DWQMP have identified sub-optimal physical and chemical properties associated with the source water in Boulia and Urandangie. Due to budget and resource limitations improvements have been made as funds and resources permit, focusing on low value/ high impact solutions.

Within the BSC drinking water schemes specific water quality parameters have been identified as a potential risk to health which are not within ADWG recommended parameters, these parameters include:

- Turbidity within the Boulia distribution scheme; and
- Fluoride within the Urandangi's scheme

Since the implementation of BSC's DWQMP Council has implemented a range of improvement strategies to provide safe drinking water to its customers. These include:

Boulia:

- Identifying the highest turbidity bore in the bore field supplying Boulia and turning this bore off (for use in Emergency situations only)
- Diverting all source water into a common manifold to allow dosing/ treatment
- Install a chlorine disinfection system after the manifold to disinfect and also oxidize iron
- Aerate the source water into the Ground level reservoir to increase the precipitation of iron
- Regular cleaning of the ground level reservoir to remove oxidized iron/ minerals
- Investigation of alternate source water (improved quality through a deeper aquifer)

Urandangie:

- Distribution of fact sheets regarding high fluoride levels in the source water

In terms of managing the sub-optimal levels of Turbidity and Fluoride in the relevant schemes. Council have attempted to identify alternate water sources for improved water quality in Boulia. A recent investigation into alternate water aquifers (preferably an artesian supply) with improved water quality identified that the likelihood of striking significantly higher quality aquifers in the vicinity of the supply schemes was unlikely.

The high turbidity levels within Boulia's sub-artesian water source are an inherent characteristic of the water within the aquifer which have been determined to be caused by elevated iron concentrations, which become oxidised and form precipitates in the drinking water. The presence of iron and the subsequent elevated turbidity do not directly create a risk to public health, their presence in high concentration however can increase the likelihood of biological contamination, providing a suitable habitat for proliferation. As such addressing the biological risks associated with the water supply scheme has become a high priority for BSC.

The implementation of an automated disinfection system in Boulia in 2019 has been a major advancement in terms of managing risks associated with water quality, by greatly reducing the likelihood of biological contamination of the water supply. A chlorine gas disinfection system was chosen as the preferred disinfection method for Boulia, as the chlorine gas system had the added benefit of increasing the oxidization of the iron, with the potential to increase the precipitation of iron from the water prior to reaching the reticulation system.

In Boulia the provision of a quality disinfection system has been Councils priority, in order to manage the risk of pathogenic impacts to customers health. Further treatment such as filtration is currently financially unviable due to the very limited rates base and highly competitive government grant circumstances. A conventional treatment facility is likely to cost several million dollars and require additional specialist technical staff which have proven to be very difficult to attract and retain in Boulia.

Elevated Fluoride levels associated with Urandangie's source water pose a potential health risk to the local residents, where high fluoride levels in the body can lead to health issues such as dental or even skeletal fluorosis in extreme cases. An advanced water treatment system (such as reverse osmosis) to reduce the fluoride concentrations in Urandangie's water is not considered to be financially viable for the same reasons as mentioned above. Councils management strategy at this stage is to ensure an effective community education program is in place.

6 OPERATIONAL AND VERIFICATION MONITORING PROGRAMS

Details of the operational monitoring programs are tabulated below for Boulia and Urandangie in Table 6.1 and 6.2 below.

Details of the verification monitoring programs for Boulia and Urandangie are tabulated in Tables 6.3 – 6.7.

6.1 Operational Monitoring

6.1.1 Boulia and Urandangie Operational Monitoring

Operational monitoring for Boulia and Urandangie water supply schemes are provided in tables 6.1 and 6.2 below.

The persons responsible for operational monitoring, and associated actions include the Chief Executive Officer, Director of Works & Operations and the Water Operator. The Water Operator is responsible for conducting operational monitoring.

The Water Operator will be required to log all maintenance issues in a monthly report and a copy of this shall be sent to the Director of Works & Operations. While the Water Operator will be encouraged to maintain informal lines of communication, formal communications shall also be required so as to enable a means for improved record keeping. Maintenance monitoring shall include but not limited to visual inspections to ensure that access to bore sites is restricted.

Table 6.1 Boulia Operational Monitoring Parameters

Location in System	Parameter	Sampling			Target limit	Action if target limit exceeded	Critical limit	Action if critical limit exceeded	Positions Responsible for Monitoring
		Frequency	Method	Location					
				Boulia					
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	< 0.2 mg/L >5mg/L	Recalibrate chlorine monitor Check and clean sensors If low: Manually dose into reservoir	Water Operator
Bores, System Wide	General Maintenance	Weekly	Visual inspection	Bore 5 (Hospital) Bore 6 (Airport) Bore 7 (Powerhouse) Bore 8 (SES, Backup bore) Bore 9 (Washdown Bay) Reservoir Reticulation	N/A	N/A	N/A	On a weekly basis the Water Operator is required to visually inspect the scheme for maintenance issues. A copy of the maintenance register is sent to the Director of Works on Monthly Basis with operational monitoring data. 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

Table 6.2 Urandangie Operational Monitoring Parameters

Location in System	Parameter	Sampling			Target limit	Action if target limit exceeded	Critical limit	Action if critical limit exceeded	Positions Responsible
		Frequency	Method	Location					
				Urandangie					
Bores, System Wide	General Maintenance	Weekly	Visual inspection	Bore Reservoir Reticulation	N/A	N/A	N/A	On a weekly basis the Water Operator is required to visually inspect the scheme for maintenance issues. A copy of the maintenance register is sent to the Director of Works on Monthly Basis with operational monitoring data. 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

6.2 Verification Monitoring

6.2.1 Boulia and Urandangie Verification Monitoring

The verification monitoring programs have been developed and modified in response to historical data analysis, the analysis of historical water quality data has been undertaken by an independent specialist to provide advice on potential hazards within the schemes and appropriate monitoring to detect potential contaminants.

Boulia has five shallow artesian bores with raw water quality requiring treatment (disinfection) prior to reticulation. Urandangie has 1 sub-artesian bore with raw water quality requiring treatment (disinfection) prior to reticulation. Table 6.2 and 6.3 below tabulates the parameters to be monitored, monitoring locations and frequency of monitoring.

For Boulia and Urandangie microbial, physical and inorganic verification monitoring will be conducted at designated points in the reticulation system. These points will include public buildings to facilitate access. Water treatment chemicals and disinfection by-products will be sampled at a tap located at the ground level reservoir.

Water sampling in Urandangie requires staff to travel over 300km which maybe impassable for prolonged periods during the wet season, it is therefore imperative for BSC to monitor weather and road conditions and take advantage of desirable conditions when possible, particularly in the wet season. Only having one mid-week flight out of Boulia which can have water samples to the testing laboratory within recommended timeframes can cause difficulties for laboratory analysis of samples as flights can be cancelled or postponed on occasions. Where adverse weather conditions cause variation to scheduled monitoring programs BSC will endeavour to make alternate arrangements to meet verification monitoring requirements.

6.2.2 Verification Monitoring Frequency Urandangie

Typically, in a drinking water scheme where the ADWG health guideline values are frequently exceeded such as Urandangie where routine verification monitoring over a significant timeframe has identified the presence of elevated Fluoride levels in the source water, verification monitoring would be undertaken on a more frequent basis than the 6 monthly basis specified in the verification monitoring program.

Verification monitoring undertaken on a six-monthly basis has been deemed to be suitable for the Urandangie scheme based on the historical data which identifies the fluoride concentrations to be within a consistent range, where additional verification monitoring would provide little value.

Table 6.3 Boulia Inhouse Verification Monitoring Program – Source Water

Characteristic	Parameter	Sampling			Positions Responsible
		Frequency	Method	Location	
				Boulia	
Microbial quality	E. coli	Bi annually	Grab sample	Bore 5 (Hospital) Bore 6 (Airport) Bore 7 (Powerhouse) Bore 8 (SES, Backup bore) Bore 9 (Washdown Bay)	**Overall Responsibility:** Chief Executive Officer **Implementation, review and actions:** Manager of Engineering Services **Operations:** Water Operator
Physical	Turbidity	Bi annually	Grab sample		
Inorganic	Iron	Bi annually	Grab sample		
Inorganic	Free chlorine	Continuous	Online meter	Combined raw water line downstream of treatment plant	

Table 6.4 Boulia Inhouse Verification Monitoring Program – Distribution System

Characteristic	Parameter	Sampling			Positions Responsible
		Frequency	Method	Location	
				Boulia	
Microbial quality	E. coli	Monthly	Grab sample	GLR Outlet Caravan Park Council Depot Others as necessary if adverse results	**Overall Responsibility:** Chief Executive Officer **Implementation, review and actions:** Manager of Engineering Services **Operations:** Water Operator
Inorganic	Free chlorine	Weekly	Grab sample		
Physical	Turbidity	Monthly	Grab sample		
Physical	pH	Monthly	Grab sample		
Physical	Conductivity	Monthly	Grab sample		

* Note Turbidity values in Boulia greater than 20NTU represent an event

Table 6.5 Urandangie Inhouse Verification Monitoring Program

Characteristic	Parameter	Sampling			Positions Responsible
		Frequency	Method	Location	
				Urandangie	
Microbial quality	E. coli	Monthly	Grab sample	From two of the following locations; Urandangie Tank Urandangie Bore Urandangie Pub Urandangie Hall Others as necessary if adverse results	**Overall Responsibility:** Chief Executive Officer **Implementation, review and actions:** Manager of Engineering Services **Operations:** Water Operator
Inorganic	Free chlorine	Monthly	Grab sample		
Physical	Turbidity	Monthly	Grab sample		
	pH	Monthly	Grab sample		
	Conductivity	Monthly	Grab sample		

* Note Turbidity values in Urandangie greater than 10NTU represent an event

Table 6.6 Boulia and Urandangie Outsourced Verification Monitoring Program – Distribution System

Characteristic	Parameter	ADWG &/or Regulation Value	Associated Hazard	Sampling Locations		Analysing Authority	Response to Exceedances	Positions Responsible
				Boulia	Urandangie			
Microbial quality	E.coli*	Nil detect	Bacteria	All locations including: Tap located at ground level reservoir, Council Depot & Caravan Park	Tap located at ground level reservoir & one of the following locations in the distribution system: Tap located at Urandangie Pub or tap at Urandangie Hall	SGS Environmental Services Australia PTY LTD	Refer to incident management Plan, Acceptable risk continue to monitor for exceedances or complete incident reporting forms for exceedance of health guidelines	**Overall Responsibility:** Chief Executive Officer
	Total Coliforms	*Nil detect*						
Physical	Conductivity	N/A	*Hazard that arises from the natural geological processes in the aquifer.*					**Implementation, review and actions:** Manager of Engineering Services **Operations:** Water Operator
	True Colour	N/A						
	Dissolved Organic Carbon	N/A						
	Dissolved Oxygen	> 85% - Aesthetic						
	pH	pH 6.5 - 8.5						
	Total Dissolved Solids	N/A						
	Turbidity	5 NTU - Aesthetic						
Inorganics	Chlorate	N/A						
	Chloride	250mg/L - Aesthetic						
	Fluoride	1.5mg/L - Health						
	Lead	0.010mg/L - Health						
	Nitrate	50mg/L - Health						
	Nitrite	3mg/L - Health						
	Sodium	180mg/L - Aesthetic						
	Uranium	0.017mg/L - Health						
	Total Iron	0.3mg/L - Aesthetic						
	Soluble Iron	N/A						
	Total Manganese	0.5mg/L - Health						
	Soluble Manganese	N/A						
	Trihalomethanes	.25mg/L - Health						
Testing Frequency for verification monitoring in the distribution system is to be conducted on a biannual basis, once in the wet season and dry season.								

Table 6.7 Boulia and Urandangie Outsourced Verification Monitoring Program – Source Water

Characteristic	Parameter	ADWG &/or Regulation Value	Associated Hazard	Sampling Locations		Analysing Authority	Response to Exceedances	Positions Responsible
				Boulia	Urandangie			
Microbial quality	E.coli*	Nil detect	Bacteria	All locations including: Bore 5 Bore 6 Bore 7 Bore 8 Bore 9	Town Bore	SGS Environmental Services Australia PTY LTD	Refer to incident management Plan, Acceptable risk continue to monitor for exceedances or complete incident reporting forms for exceedance of health guidelines	**Overall Responsibility:** Chief Executive Officer **Implementation, review and actions:** Manager of Engineering Services **Operations:** Water Operator
	Total Coliforms	*Nil detect*						
Physical	Conductivity	N/A	*Hazard that arises from the natural geological processes in the aquifer.*					
	Dissolved Organic Carbon	N/A						
	Dissolved Oxygen	> 85% - Aesthetic						
	pH	pH 6.5–8.5						
	Total Dissolved Solids	N/A						
	Turbidity	5 NTU - Aesthetic						
Inorganics	Chlorate	N/A						
	Chloride	250mg/L - Aesthetic						
	Fluoride	1.5mg/L - Health						
	Lead	0.010mg/L - Health						
	Nitrate	50mg/L - Health						
	Nitrite	3mg/L - Health						
	Selenium	0.010mg/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	0.5mg/L - Health						
	Soluble Manganese	N/A						
	Uranium	0.017mg/L - Health						
Testing Frequency for verification monitoring of the source water is to be conducted on an annual basis.								

APPENDIX A

DRINKING WATER QUALITY MANAGEMENT PLAN APPROVAL APPLICATION

Drinking Water Quality Management Plan Approval Application

Queensland Government

Water Supply (Safety and Reliability) Act 2008, section 95

Privacy Disclaimer: Collection of information provided in this approved form and any attachments is authorised under the *Water Supply (Safety and Reliability) Act 2008* and is being used for the purpose of applying to the Office of the Water Supply Regulator for approval of a drinking water quality management plan. The Department of Environment and Resource Management will endeavour to maintain any confidentiality of information relating to your form. However, consideration of your form may involve consultation and if so, details of your form may be disclosed to third parties. This information will not otherwise be disclosed outside of the department unless required or authorised by law (for example as under the *Right to Information Act 2009*).

Note: This is an approved form under the *Water Supply (Safety and Reliability) Act 2008*, to be used by the drinking water service provider, to apply to the regulator for approval of a drinking water quality management plan (DWQMP).

Before submitting this approved form, please be fully aware of your rights and obligations under the *Water Supply (Safety and Reliability) Act 2008*.

1. Drinking Water Service Provider Details

Drinking water service provider	SPID
Boulia Shire Council	18

2. Contact Details

Principal Contact

Family name	Given name(s)	Position
Corbin	Vince	CEO

Postal address

Herbert Street

Boulia, QLD Postcode 4829

Telephone number	Fax number	Mobile number
(07) 4746 3188	(07) 4746 3136	

Email address

ceo@boulia.qld.gov.au

3. Drinking Water Scheme Details

Please **list** the drinking water scheme(s) to which this plan applies

Boulia Water Supply Scheme
Urandangi Water Supply Scheme

(If space provided is insufficient, additional information may be attached)

4. Relevant Documents

List below all supporting documentation attached to this application that form part of the DWQMP. Where a document applies to a specific scheme or schemes please state this (e.g. scheme name).

	Document Name(s)
1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	

(If space provided is insufficient, additional information may be attached)

5. Declaration

I/we declare and warrant that I/we have all the necessary and appropriate authority on behalf of the drinking water service provider to declare the information in this approved form, including any attachments or supporting information provided, are true and accurate to the best of my/our knowledge.

Family name: Corbin	Given name(s): Vince	
Position: CEO	Signature:	Date (dd/mm/yyyy): 13/11/2012
Family name:	Given name(s):	
Position:	Signature:	Date (dd/mm/yyyy): / /

6. Submission

Please complete and sign the form and send one (1) printed copy of all relevant materials, along with all materials saved on to CD (or equivalent electronic device) to:

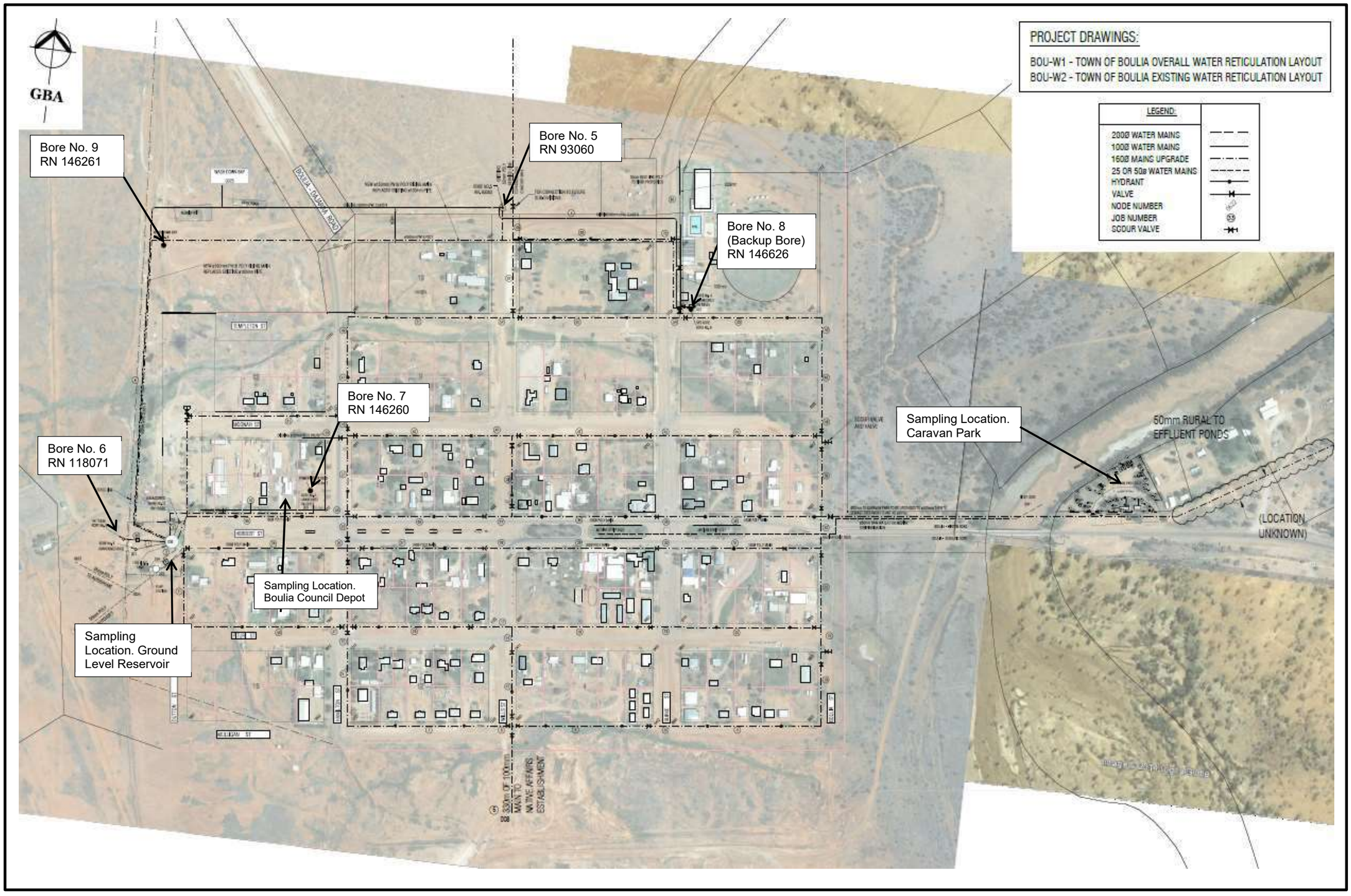
Director
Water Industry Asset Management and Standards
Office of the Water Supply Regulator
Department of Environment and Resource Management
GPO Box 2454
Brisbane Qld 4001

APPENDIX B

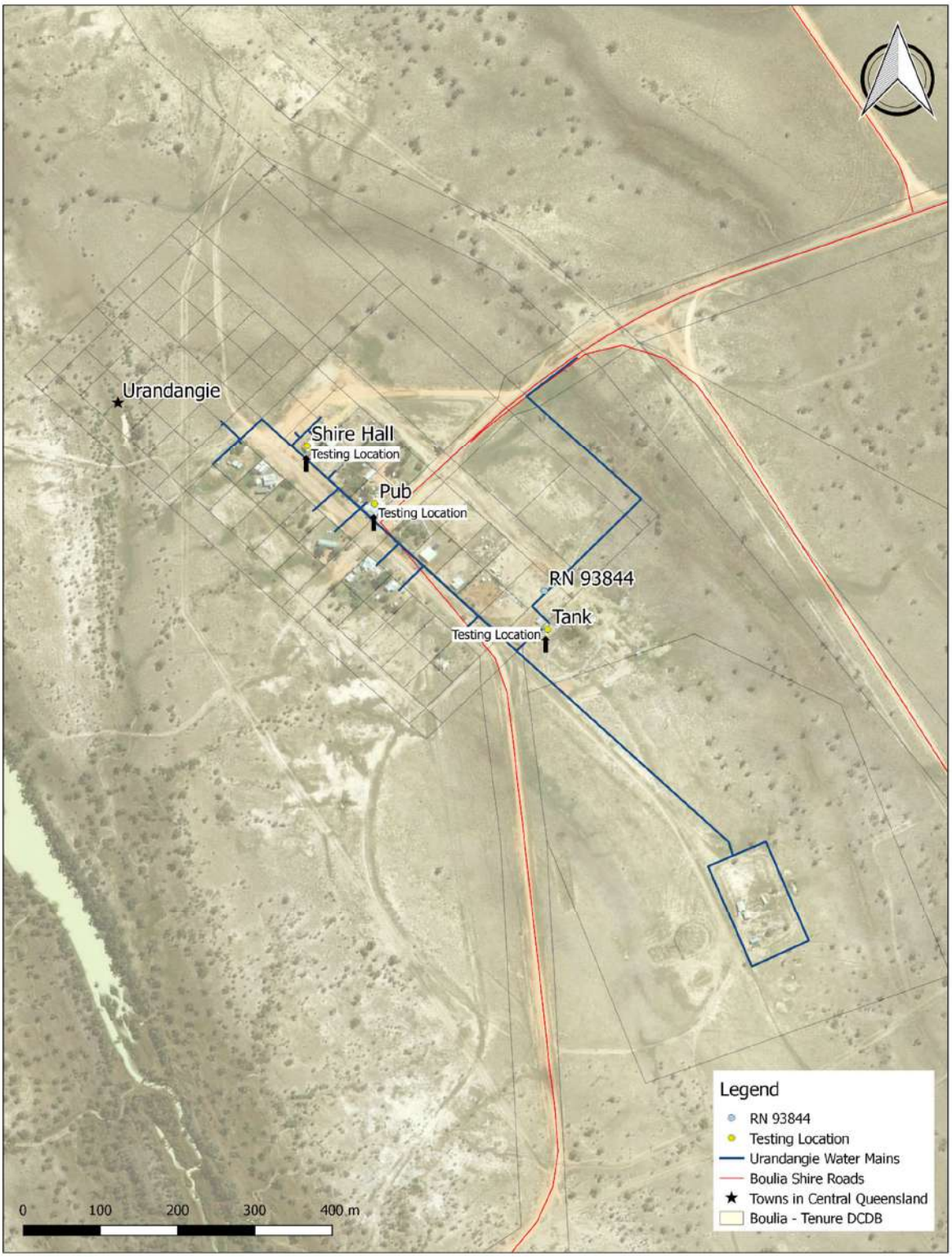
WATER SUPPLY LAYOUTS SUPERIMPOSED ON AERIAL PHOTOS

1. Boulia Water Supply Scheme
2. Urandangie Water Supply Scheme

1. Boulia Water Supply Scheme



2. Urandangie Water Supply Scheme



Boulia Shire Council
Urandangie Water Supply

APPENDIX C

BORE WATER REPORT CARDS

REG NUMBER 93060

REGISTRATION DETAILS

		BASIN	0012	LATITUDE	22-54-26	MAP-SCALE	
OFFICE	Longreach	SUB-AREA		LONGITUDE	139-54-33	MAP-SERIES	
DATE LOG RECD		SHIRE	900-BOULIA	EASTING	388116	MAP-NO	
D/O FILE NO.	028-405101-A	LOT	33	NORTHING	7466338	MAP NAME	
R/O FILE NO.	028-405101-A	PLAN	SP158998	ZONE	54	PROG SECTION	
H/O FILE NO.		ORIGINAL DESCRIPTION	PORTION 11	ACCURACY		PRES EQUIPMENT	NE
				GPS ACC			
GIS LAT	-22.9072065	PARISH NAME	639-BOULIA			ORIGINAL BORE NO	NO 5
GIS LNG	139.9090384	COUNTY	WILLS			BORE LINE	-
CHECKED	Y	PROPERTY NAME	BOULIA SHIRE COUNCIL				
		FIELD LOCATION				POLYGON	
						RN OF BORE REPLACE	
FACILITY TYPE	SF	DATE DRILLED	05/06/1995			DATA OWNER	
STATUS	EX	DRILLERS NAME				CONFIDENTIAL	N
ROLES		DRILL COMPANY					
		METHOD OF CONST.					

CASING DETAILS

PIPE	DATE	RECORD NUMBER	MATERIAL DESCRIPTION	MAT SIZE (mm)	SIZE DESC	OUTSIDE DIAM (mm)	TOP (m)	BOTTOM (m)
A	05/06/1995	1	Steel Casing (unspecified)	6.400	WT	273	0.00	36.00
A	05/06/1995	2	Plastic Casing (unspecified)	13.000	WT	219	0.00	84.50
A	05/06/1995	3	Perforated or Slotted Casing				78.00	84.50

STRATA LOG DETAILS

RECORD NUMBER	STRATA TOP (m)	STRATA BOT (m)	STRATA DESCRIPTION
1	0.00	4.00	CLAY
2	4.00	11.00	RED CLAY
3	11.00	14.00	WHITE CLAY *
4	14.00	17.00	YELLOW CLAY
5	17.00	23.00	PINK CLAY
6	23.00	37.00	YELLOW CLAY

REG NUMBER 93060

RECORD NUMBER	STRATA TOP (m)	STRATA BOT (m)	STRATA DESCRIPTION
7	37.00	39.00	PINKY BROWN CLAY
8	39.00	42.00	BROWN CLAY
9	42.00	43.00	GREY MUDSTONE
10	43.00	44.00	GREEN SANDY MUDSTONE *?
11	44.00	57.00	GREY MUDSTONE
12	57.00	77.00	SANDY GREY MUDSTONE
13	77.00	83.50	SANDSTONE *
14	83.50	84.50	HARD ROCK
15	999.00		W BALKE LONGREACH WELL DRILLING
16	1000.00		CABLE TOOL 05-06-1995
17	1001.00		PUMP TEST 24HR SUBMERSIBLE

AQUIFER DETAILS

**** NO RECORDS FOUND ****

WATER LEVEL DETAILS

PIPE	DATE	MEASURE (m)	N/R	RMK	LOG	PIPE	DATE	MEASURE (m)	N/R	RMK	LOG	PIPE	DATE	MEASURE (m)	N/R	RMK	LOG
A	05/06/1995	-21.30	R														

GROUNDWATER DATABASE

BORE CARD REPORT

REG NUMBER 118071

REGISTRATION DETAILS

		BASIN	0012	LATITUDE	22-54-43	MAP-SCALE	254
OFFICE	Longreach	SUB-AREA		LONGITUDE	139-54-15	MAP-SERIES	M
DATE LOG RECD	16/JUN/03	SHIRE	900-BOULIA	EASTING	387622	MAP-NO	SF 54-10
D/O FILE NO.	140/017/0003	LOT	33	NORTHING	7465801	MAP NAME	
R/O FILE NO.		PLAN	CP903938	ZONE	54	PROG SECTION	
H/O FILE NO.		ORIGINAL DESCRIPTION		ACCURACY	SKET	PRES EQUIPMENT	
				GPS ACC			
GIS LAT	-22.91202393	PARISH NAME	639-BOULIA			ORIGINAL BORE NO	TOWN BORE NO 6
GIS LNG	139.9041876	COUNTY	WILLS			BORE LINE	-
CHECKED	Y	PROPERTY NAME	BOULIA SHIRE COUNCIL				
		FIELD LOCATION	POSITION DESCRIPTION MAY NOT BE ACCURATE			POLYGON	
						RN OF BORE REPLACE	10928
FACILITY TYPE	SF	DATE DRILLED	21/04/2003			DATA OWNER	DNR
STATUS	EX	DRILLERS NAME	PHILLIPS, BARTON JOHN			CONFIDENTIAL	N
ROLES	WS	DRILL COMPANY					
		METHOD OF CONST.	ROTARY MUD				

CASING DETAILS

PIPE	DATE	RECORD NUMBER	MATERIAL DESCRIPTION	MAT SIZE (mm)	SIZE DESC	OUTSIDE DIAM (mm)	TOP (m)	BOTTOM (m)
A	21/04/2003	2	Acrylonitrile Butadiene Styrene	17.200	WT	219	0.00	82.00
A	21/04/2003	4	Grout			311	0.00	50.00
A	21/04/2003	5	Perforated or Slotted Casing				64.00	76.00
A	21/04/2003	6	Gravel Pack	3.000	GR	311	50.00	82.00
X	21/04/2003	1	Steel Casing (unspecified)	6.400	WT	324	0.00	6.00
X	21/04/2003	3	Grout			381	0.00	6.00

STRATA LOG DETAILS

RECORD NUMBER	STRATA TOP (m)	STRATA BOT (m)	STRATA DESCRIPTION
1	0.00	12.00	LIMESTONE, WHITE, HARD
2	12.00	37.00	CLAY, WHITE, CHALKY
3	37.00	64.00	SHALE, GREY, FIRM

REG NUMBER 118071

RECORD NUMBER	STRATA TOP (m)	STRATA BOT (m)	STRATA DESCRIPTION
4	64.00	82.00	SANDSTONE, GREY, FINE, FIRM

AQUIFER DETAILS

REC	TOP BED(M)	BOTTOM BED(M)	BED LITHOLOGY	DATE	SWL (m)	FLOW	QUALITY	YIELD (l/s)	CTR	CONDIT	FORMATION NAME
1	67.00		SDST	21/04/2003	-31.10	N	"POTABLE"	5.00	Y	PS	

WATER LEVEL DETAILS

**** NO RECORDS FOUND ****

REG NUMBER 146260

REGISTRATION DETAILS

		BASIN	0012	LATITUDE	22-54-41	MAP-SCALE	254
OFFICE	Longreach	SUB-AREA		LONGITUDE	139-54-24	MAP-SERIES	
DATE LOG RECD		SHIRE	900-BOULIA	EASTING	387866	MAP-NO	SF 54-10
D/O FILE NO.	140/017/0003	LOT	1	NORTHING	7465884	MAP NAME	
R/O FILE NO.		PLAN	SP107147	ZONE	54	PROG SECTION	
H/O FILE NO.		ORIGINAL DESCRIPTION		ACCURACY		PRES EQUIPMENT	
				GPS ACC			
GIS LAT	-22.91129	PARISH NAME	639-BOULIA			ORIGINAL BORE NO	POWER HOUSE
GIS LNG	139.9065728	COUNTY	WILLS			BORE LINE	-
CHECKED	Y	PROPERTY NAME					
		FIELD LOCATION				POLYGON	
						RN OF BORE REPLACED	
FACILITY TYPE	SF	DATE DRILLED	11/02/2010			DATA OWNER	DNR
STATUS	EX	DRILLERS NAME	HARGRAVE, TREVOR JOHN			CONFIDENTIAL	N
ROLES		DRILL COMPANY	Q.D.S.				
		METHOD OF CONST.	ROTARY MUD - PDC				

CASING DETAILS

PIPE	DATE	RECORD NUMBER	MATERIAL DESCRIPTION	MAT SIZE (mm)	SIZE DESC	OUTSIDE DIAM	TOP (m)	BOTTOM (m)
A	11/02/2010	1	Polyvinyl Chloride	11.600	WT	226	0.00	82.00
A	11/02/2010	2	Centraliser				12.00	36.00
A	11/02/2010	3	Perforated or Slotted Casing				64.00	82.00
X	11/02/2010	4	Grout			270	0.00	35.00

STRATA LOG DETAILS

RECORD NUMBER	STRATA TOP (m)	STRATA BOT (m)	STRATA DESCRIPTION
1	0.00	1.00	TOP SOIL
2	1.00	5.00	ROCK, WHITE
3	5.00	8.00	CLAY, WHITE
4	8.00	23.00	CLAY, YELLOW
5	23.00	65.00	SHALE

REG NUMBER 146260

RECORD NUMBER	STRATA TOP (m)	STRATA BOT (m)	STRATA DESCRIPTION
6	65.00	81.00	SANDSTONE
7	81.00	83.00	ROCK

STRATIGRAPHY DETAILS

**** NO RECORDS FOUND ****

AQUIFER DETAILS

REC	TOP BED(M)	BOTTOM BED(M)	BED LITHOLOGY	DATE	SWL (m)	FLOW	QUALITY	YIELD (l/s)	CTR	CONDIT	FORMATION NAME
1	65.00	81.00	SDST	11/02/2010	-39.00	N	POTABLE	2.00	Y	PS	HOORAY SANDSTONE

PUMP TEST DETAILS PART 1

**** NO RECORDS FOUND ****

PUMP TEST DETAILS PART 2

**** NO RECORDS FOUND ****

BORE CONDITION

**** NO RECORDS FOUND ****

ELEVATION DETAILS

**** NO RECORDS FOUND ****

WATER ANALYSIS PART1

**** NO RECORDS FOUND ****

WATER ANALYSIS PART 2

**** NO RECORDS FOUND ****

WATER LEVEL DETAILS

**** NO RECORDS FOUND ****

WIRE LINE LOG DETAILS

REG NUMBER 146260

**** NO RECORDS FOUND ****

FIELD MEASUREMENTS

PIPE	DATE	DEPTH (m)	COND (uS/cm)	pH	TEMP (C)	NO3 (mg/L)	DO (mg/L)	Eh (mV)	ALK	METH	SOURCE
A	11/02/2010	83.00	1376	6.5						PU	GB

SPECIAL WATER ANALYSIS

**** NO RECORDS FOUND ****

VALIDATION LOG - PART 1

**** NO RECORDS FOUND ****

VALIDATION LOG - PART 2

**** NO RECORDS FOUND ****

GENERAL NOTES

**** NO RECORDS FOUND ****

GROUNDWATER DATABASE

BORE CARD REPORT - PUBLISHABLE

REG NUMBER 146262

REGISTRATION DETAILS

		BASIN	0012	LATITUDE	22-54-30	MAP-SCALE	254
OFFICE	Longreach	SUB-AREA		LONGITUDE	139-54-43	MAP-SERIES	
DATE LOG RECD		SHIRE	900-BOULIA	EASTING	388402	MAP-NO	SF 54-10
D/O FILE NO.	140/017/0003	LOT	17	NORTHING	7466220	MAP NAME	
R/O FILE NO.		PLAN	B2674	ZONE	54	PROG SECTION	
H/O FILE NO.		ORIGINAL DESCRIPTION		ACCURACY		PRES EQUIPMENT	
				GPS ACC			
GIS LAT	-22.90829	PARISH NAME	639-BOULIA			ORIGINAL BORE NO	SES BORE NO. 4
GIS LNG	139.91182	COUNTY	WILLS			BORE LINE	-
CHECKED	Y	PROPERTY NAME					
		FIELD LOCATION				POLYGON	
						RN OF BORE REPLACED	
FACILITY TYPE	SF	DATE DRILLED	16/02/2010			DATA OWNER	DNR
STATUS	EX	DRILLERS NAME	HARGRAVE, TREVOR JOHN			CONFIDENTIAL	N
ROLES		DRILL COMPANY	Q.D.S.				
		METHOD OF CONST.	ROTARY MUD - PDC				

CASING DETAILS

PIPE	DATE	RECORD NUMBER	MATERIAL DESCRIPTION	MAT SIZE (mm)	SIZE DESC	OUTSIDE DIAM	TOP (m)	BOTTOM (m)
A	16/02/2010	1	Polyvinyl Chloride	11.600	WT	266	0.00	83.00
A	16/02/2010	2	Centraliser				8.00	36.00
A	16/02/2010	3	Perforated or Slotted Casing				65.00	83.00
X	16/02/2010	4	Grout			271	0.00	35.00

STRATA LOG DETAILS

RECORD NUMBER	STRATA TOP (m)	STRATA BOT (m)	STRATA DESCRIPTION
1	0.00	8.00	TOPSOIL
2	8.00	21.00	ROCK
3	21.00	31.00	CLAY, YELLOW
4	31.00	75.00	SHALE, GREY
5	75.00	81.00	SHALE, SANDY

REG NUMBER 146262

RECORD NUMBER	STRATA TOP (m)	STRATA BOT (m)	STRATA DESCRIPTION
6	81.00	88.00	LIMESTONE

STRATIGRAPHY DETAILS

**** NO RECORDS FOUND ****

AQUIFER DETAILS

REC	TOP BED(M)	BOTTOM BED(M)	BED LITHOLOGY	DATE	SWL (m)	FLOW	QUALITY	YIELD (l/s)	CTR	CONDIT	FORMATION NAME
1	75.00	81.00	SHLE SAND	16/02/2010	-25.00	N	POTABLE	3.00	Y	PS	HOORAY SANDSTONE

PUMP TEST DETAILS PART 1

**** NO RECORDS FOUND ****

PUMP TEST DETAILS PART 2

**** NO RECORDS FOUND ****

BORE CONDITION

**** NO RECORDS FOUND ****

ELEVATION DETAILS

**** NO RECORDS FOUND ****

WATER ANALYSIS PART1

**** NO RECORDS FOUND ****

WATER ANALYSIS PART 2

**** NO RECORDS FOUND ****

WATER LEVEL DETAILS

**** NO RECORDS FOUND ****

WIRE LINE LOG DETAILS

REG NUMBER 146262

**** NO RECORDS FOUND ****

FIELD MEASUREMENTS

PIPE	DATE	DEPTH (m)	COND (uS/cm)	pH	TEMP (C)	NO3 (mg/L)	DO (mg/L)	Eh (mV)	ALK	METH	SOURCE
A	16/02/2010	88.00	1408	6.5						PU	GB

SPECIAL WATER ANALYSIS

**** NO RECORDS FOUND ****

VALIDATION LOG - PART 1

**** NO RECORDS FOUND ****

VALIDATION LOG - PART 2

**** NO RECORDS FOUND ****

GENERAL NOTES

**** NO RECORDS FOUND ****

GROUNDWATER DATABASE

BORE REPORT

REG NUMBER 146261

REGISTRATION DETAILS

		BASIN	0012	**LATITUDE**	22-54-31	**MAP-SCALE**	254
OFFICE	Longreach	**SUB-AREA**		**LONGITUDE**	139-54-15	**MAP-SERIES**	
DATE LOG RECD		**SHIRE**	900-BOULIA	**EASTING**	387607	**MAP-NO**	SF 54-10
D/O FILE NO.	140/017/0003	**LOT**	D	**NORTHING**	7466193	**MAP NAME**	
R/O FILE NO.		**PLAN**	AP20052	**ZONE**	54	**PROG SECTION**	
H/O FILE NO.		**ORIGINAL DESCRIPTION**		**ACCURACY**		**PRES EQUIPMENT**	
				GPS ACC			
GIS LAT	-22.9084832	**PARISH NAME**	639-BOULIA			**ORIGINAL BORE NO**	INDUST/AC AREA
GIS LNG	139.9040676	**COUNTY**	WILLS			**BORE LINE**	-
CHECKED	Y						
						POLYGON	
						RN OF BORE REPLACED	
FACILITY TYPE	Sub-Artesian Facility	**DATE DRILLED**	13/02/2010			**DATA OWNER**	DNR
STATUS	Existing	**DRILLERS NAME**	HARGRAVE, TREVOR JOHN				
ROLES		**DRILL COMPANY**	Q.D.S.				
		METHOD OF CONST.	ROTARY MUD - PDC				

CASING DETAILS

PIPE	DATE	RECORD NUMBER	MATERIAL DESCRIPTION	MAT SIZE (mm)	SIZE DESC	OUTSIDE DIAM (mm)	TOP (m)	BOTTOM (m)
A	13/02/2010	1	Polyvinyl Chloride	11.600	WT	226	0.00	78.00
A	13/02/2010	2	Centraliser				12.00	36.00
A	13/02/2010	3	Perforated or Slotted Casing				60.00	78.00
X	13/02/2010	4	Grout			270	0.00	35.00

STRATA LOG DETAILS

RECORD NUMBER	STRATA TOP (m)	STRATA BOT (m)	STRATA DESCRIPTION
1	0.00	4.00	TOPSOIL
2	4.00	10.00	CLAY, YELLOW/WHITE
3	10.00	17.00	ROCK
4	17.00	29.00	CLAY, YELLOW
5	29.00	64.00	SHALE

BORE REPORT

REG NUMBER 146261

RECORD NUMBER	STRATA TOP (m)	STRATA BOT (m)	STRATA DESCRIPTION
6	64.00	78.00	LIMESTONE
7	78.00	84.00	GRANITE

STRATIGRAPHY DETAILS

**** NO RECORDS FOUND ****

AQUIFER DETAILS

REC	TOP BED(M)	BOTTOM BED(M)	BED LITHOLOGY	DATE	SWL (m)	FLOW	QUALITY	YIELD (l/s)	CTR	CONDIT	FORMATION NAME
1	64.00	78.00	LMST	13/02/2010	-27.00	N	POTAB;E	12.00	Y	PS	HOORAY SANDSTONE

PUMP TEST DETAILS PART 1

PIPE	DATE	REC NO.	RN OF PUMP-BORE	TOP (m)	BOTTOM (m)	DIST (m)	METH	TEST TYPES	PUMP TYPE	SUCTION SET (m)	Q PRIOR TO TEST (l/s)	DUR OF Q PR (min)	PRES ON ARRIV (m)	Q ON ARRIV (l/s)
A	13/02/2010	1	146261	64.00	78.00		PUM		AIR	54.00				

PUMP TEST DETAILS PART 2

PIPE	DATE	REC	TEST DUR (mins)	SWL (m)	RECOV. TIME (mins)	RESID. DD (m)	MAX DD or P RED (m)	Q at MAX DD (l/s)	TIME TO MAX DD (mins)	Max Q (l/s)	CALC STAT HD (m)	DESIGN YIELD (l/s)	DESIGN BP (m)	SUCT. SET (m)	TMSY (m2/DAY)	STOR
A	13/02/2010	1	390	-27.00				12.00						54.00		

BORE CONDITION

**** NO RECORDS FOUND ****

ELEVATION DETAILS

**** NO RECORDS FOUND ****

WATER ANALYSIS PART1

**** NO RECORDS FOUND ****

WATER ANALYSIS PART 2

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** **End of Report. Produced:** 06/07/2016 02:58:37 PM **

BORE CARD REPORT - PUBLISHABLE

REG NUMBER 93844

REGISTRATION DETAILS

		BASIN	0012	LATITUDE	21-36-38	MAP-SCALE	254
OFFICE	Longreach	SUB-AREA		LONGITUDE	138-19-08	MAP-SERIES	M
DATE LOG RECD		SHIRE	900-BOULIA	EASTING	222435	MAP-NO	54-5
D/O FILE NO.	455/007(28)	LOT	8	NORTHING	7607902	MAP NAME	
R/O FILE NO.		PLAN	CP684165	ZONE	54	PROG SECTION	
H/O FILE NO.		ORIGINAL DESCRIPTION		ACCURACY		PRES EQUIPMENT	
				GPS ACC			
GIS LAT	-21.610401715	PARISH NAME	4783-URANDANGI			ORIGINAL BORE NO	URANGANGIE TOWN BORE
GIS LNG	138.318941087	COUNTY	PITURIE			BORE LINE	-
CHECKED	Y	PROPERTY NAME					
		FIELD LOCATION				POLYGON	
						RN OF BORE REPLACED	5337
FACILITY TYPE	SF	DATE DRILLED	06/10/2001			DATA OWNER	
STATUS	EX	DRILLERS NAME	BRETT NORRIE			CONFIDENTIAL	
ROLES		DRILL COMPANY	NORRIE DRILLING SERVICES				
		METHOD OF CONST.	ROTARY AIR				

CASING DETAILS

PIPE	DATE	RECORD NUMBER	MATERIAL DESCRIPTION	MAT SIZE (mm)	SIZE DESC	OUTSIDE DIAM	TOP (m)	BOTTOM (m)
A	06/10/2001	1	Steel Casing (unspecified)	6.400	WT	319	0.00	6.00
A	06/10/2001	2	Polyvinyl Chloride			150	0.00	30.00
A	06/10/2001	3	Grout			319	0.00	6.00
A	06/10/2001	4	Perforated or Slotted Casing				24.00	30.00

STRATA LOG DETAILS

RECORD NUMBER	STRATA TOP (m)	STRATA BOT (m)	STRATA DESCRIPTION
1	0.00	1.00	BLACK SOIL
2	1.00	6.00	BROWN CLAY
3	6.00	10.00	GREY CLAY
4	10.00	12.00	WEATHERED QUARTZITE
5	12.00	13.00	GREY CLAY

REG NUMBER 93844

RECORD NUMBER	STRATA TOP (m)	STRATA BOT (m)	STRATA DESCRIPTION
6	13.00	30.00	LIMESTONE *

STRATIGRAPHY DETAILS

**** NO RECORDS FOUND ****

AQUIFER DETAILS

REC	TOP BED(M)	BOTTOM BED(M)	BED LITHOLOGY	DATE	SWL (m)	FLOW	QUALITY	YIELD (l/s)	CTR	CONDIT	FORMATION NAME
1	24.00	30.00	LMST			N	POTABLE	3.40	Y	VS	AUSTRAL DOWNS LIMESTONE

PUMP TEST DETAILS PART 1

**** NO RECORDS FOUND ****

PUMP TEST DETAILS PART 2

**** NO RECORDS FOUND ****

BORE CONDITION

**** NO RECORDS FOUND ****

ELEVATION DETAILS

**** NO RECORDS FOUND ****

WATER ANALYSIS PART1

**** NO RECORDS FOUND ****

WATER ANALYSIS PART 2

**** NO RECORDS FOUND ****

WATER LEVEL DETAILS

**** NO RECORDS FOUND ****

WIRE LINE LOG DETAILS

**** NO RECORDS FOUND ****

REG NUMBER 93844

FIELD MEASUREMENTS

**** NO RECORDS FOUND ****

SPECIAL WATER ANALYSIS

**** NO RECORDS FOUND ****

VALIDATION LOG - PART 1

**** NO RECORDS FOUND ****

VALIDATION LOG - PART 2

**** NO RECORDS FOUND ****

GENERAL NOTES

**** NO RECORDS FOUND ****

APPENDIX D

INFORMATION NOTICE DWQMP AMENDMENT APPROVAL

(insert amendment approval once received from OWSR)