

**WINTON SHIRE COUNCIL**



# **DRINKING WATER QUALITY MANAGEMENT PLAN**

**Service Provider ID 131**

## Document Control

Prepared by:				Approved by:	
Rev	Name	Review / Release	Comment	Signature/Name	Date
A	P.J. Cullivan / C. Smith	Draft	Draft		13/02/2013
B	P.J. Cullivan / C. Smith	Review	For Council Review		28/06/2013
C	P.J. Cullivan / C. Smith	Review	For Council Review incorporating Council's amendments		02/07/2013
D	P.J. Cullivan / C. Smith	Review	Issue for review by OWSR		04/07/2013
1	C. Smith		Final Amendments		09/09/2013
2	W. Green	Release	Report updated and reformatted.		12/10/2018
2A	W. Green	Review	Report forwarded to Council for review after minor amendments		26/10/2018
3	W. Green	Release	Report issued for approval by OWSR	Keith Luckhurst	30/10/2018
4	W. Green	Release	Report reviewed and amended following Regulators Comments	Keith Luckhurst	22/01/2019
5	L. Alcorn	Review	Issue for review by OWSR	Adopted by Council CEO Ricki Bruhn	21/05/2020

### Contact for enquiries and proposed changes

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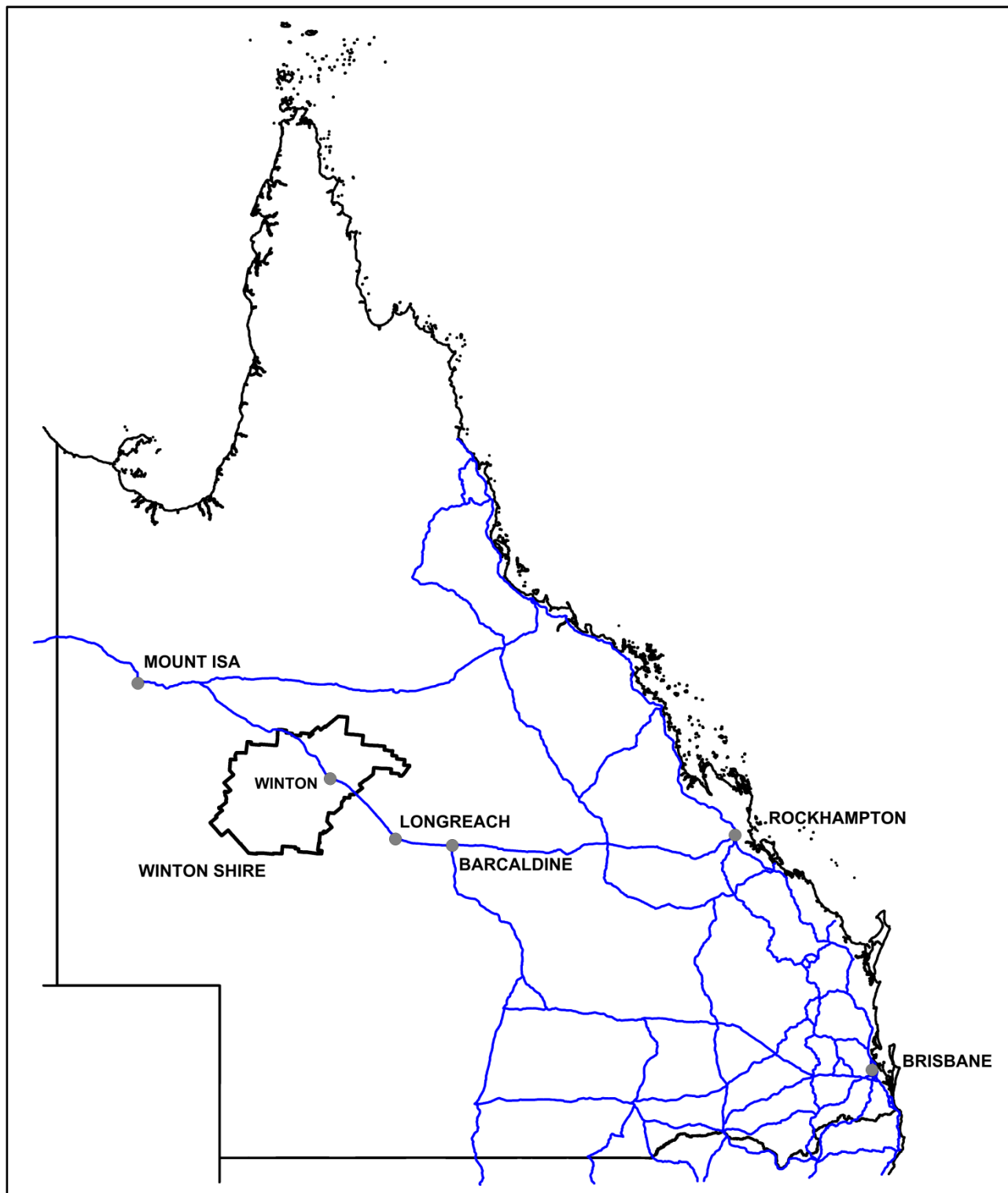
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## **Abbreviations and Acronyms**

WSC	Winton Shire Council
DWSP	Drinking Water Service Provider
THM	Trihalomethane
E.Coli	Escherichia Coli
GAB	Great Artesian Basin
RMIP	Risk Management Improvement Program
PLC	Programmed Logic Controller
NTU	Nephelometric Turbidity Unit
HU	Hazen Unit
DWQMP	Drinking Water Quality Management Plan
ADWG	Australian Drinking Water Guidelines
SCADA	Systems Control and Data Acquisition

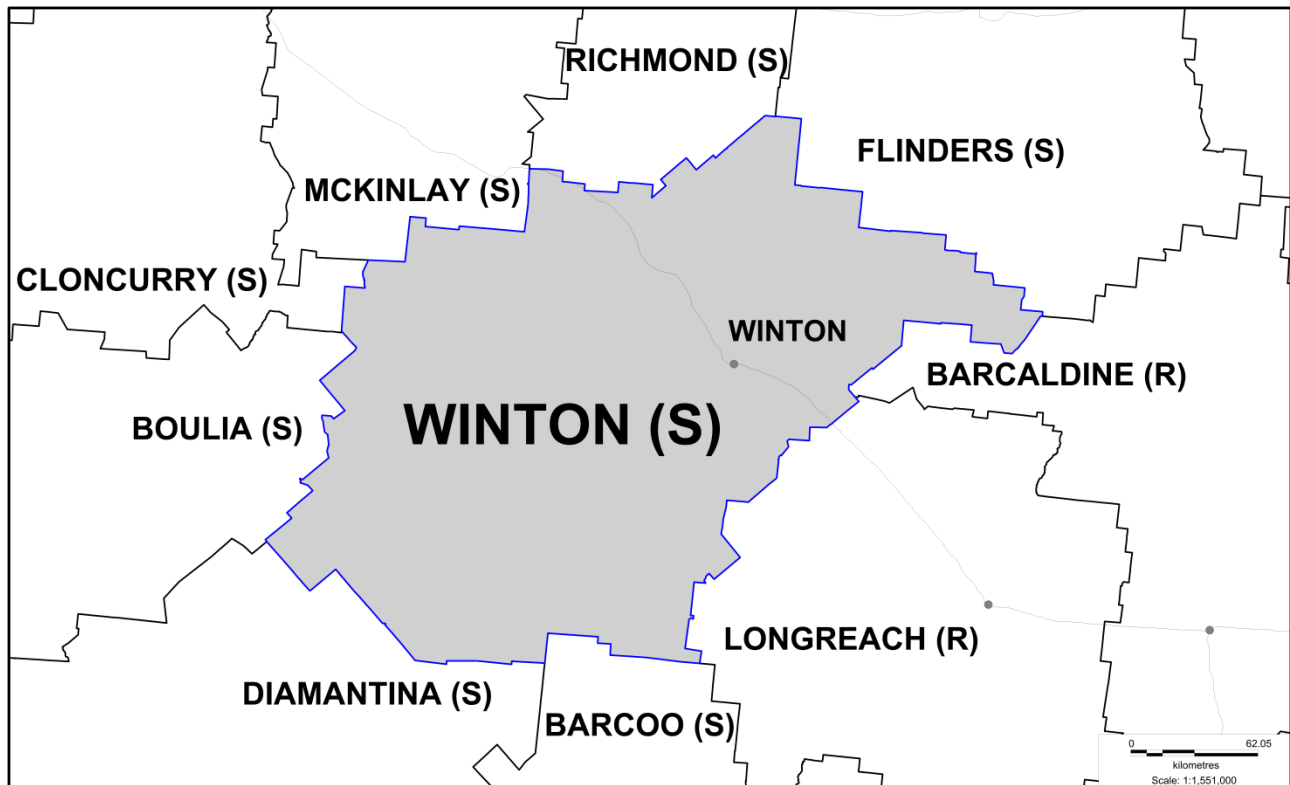
## 1 REGISTERED SERVICE DETAILS

Winton Shire Council (WSC) covers an area of approximately 54,000 km<sup>2</sup>. The town of Winton, the Shire's administrative centre, is located in Central Western Queensland on the Landsborough Highway, 178 kilometres north-west of Longreach and 470 kilometres south-east of Mount Isa. It is approximately 1,500 kilometres from Brisbane. Figure 1.1 shows WSC's location relative to the state of Queensland.



**Figure 1.1 Winton Shire Location Map**

WSC is the drinking water service provider (SPID 131) for the water supply scheme. WSC is a small<sup>1</sup> Drinking Water Service Provider (DWSP) as defined in the Water Supply (Safety and Reliability) Act 2008 and provides drinking water for an approximate resident population of 825 with a total demand of currently 1.85 ML/d. WSC shall be referred to as the DWSP throughout this document. Figure 1.2 shows the location of Winton within the Shire and the surrounding local government areas.



**Figure 1.2 Winton Shire Council and bordering shires**

## 1.1 Approval Application Form

Refer to Appendix A for approval application form.

## 1.2 Scheme Details

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 List of Drinking Water Schemes**

Scheme Name	Communities Served	Operator	Shire Population 2018
Winton	Winton	Winton Shire Council	1157
Total			1157

Estimated fall in population from 2016 – 2031 is expected to be -0.5 per cent per annum (pa). For projecting population for the ten-year period (2016-2026) in Table 1.2 Queensland Government

<sup>1</sup> a service provider with 1000 or less connections to a registered service

Statisticians Office population projection of -0.5 per cent pa was used. The estimated daily demand for Winton has not been adjusted in accordance with population decline, this is due to Councils efforts to enhance the amenity within the town, providing additional water to parks and gardens as well as for the significant and ever increasing influx of visitors during tourist season.

**Table 1.2 Current and Future Population and Demand**

Year	Population Served (not including visitors)	Connections	Average Demand (ML/d)
2016	831	663	1.93
2020	825	658	1.85 (current)
2026	790	630	1.93
2031	771	615	1.93



## **2 LEGISLATIVE CONTEXT**

The Water Supply (Safety and Reliability) Act 2008 (the Act) commenced on 1st July 2008. The purpose of the Act is to provide for the safety and reliability of water supply throughout Queensland.

The Act includes provisions relating to the management of drinking water quality, aimed at protecting public health. This outcome is achieved primarily through regulatory framework for drinking water quality which requires drinking water service providers to:

- Undertake monitoring and reporting on drinking water quality
- Have an approved drinking water quality management plan

Drinking Water Service Providers are also required to comply with other state and Commonwealth legislation. Requirements of Water Supply (Safety and Reliability) Act 2008 do not negate the requirements of other legislation unless where expressly stated. The provider is responsible for obtaining any necessary approvals under other Acts to ensure the compliant operation of the service. Other State and Commonwealth legislation relating to the operations of a water service may include:

- Water Legislation Act 2016
- Public Health Act 2005
- Public Health Regulations 2005
- Plumbing and Drainage Act 2002
- Planning Act 2016
- Environmental Protection Act 1994
- Water Act 2000
- Trade Practices Act 1974
- WHS Act 2011

### **3 DETAILS OF INFRASTRUCTURE FOR PROVIDING THE SERVICE**

WSC is the DWSP for one water supply scheme. The infrastructure for providing the service is detailed in section 3.1 Water Supply Scheme below.

For Winton's water supply scheme, artesian bore water at a temperature of approximately 85°C passes through heat exchangers in order to reduce the water temperature to a lower 44°C.

Water is untreated (other than cooling) and artesian bore water is reticulated to the community.

Any water not meeting the demand of the town is pumped into the elevated reservoir, from which it discharges during periods of high demand.

#### **3.1 Water Supply Scheme**

##### **3.1.1 WATER SOURCE**

Winton water supply scheme is comprised of one free flowing artesian bore (Bore No. 4, Table 3.2 below refers) delivering water to heat exchangers (Alpha Laval Plate Exchangers, model M15-BFG8) to cool water from 85°C to a temperature of 44°C. Three back-up bores exist (Bores No. 1, 2 and 3). The oldest, Town Bore No. 1, was first used in 1895. Prior to Bore No. 4 being constructed in 2005, Bores 1, 2 and 3 supplied the town of Winton with water. When Bore No. 4 came online with the new water pump station in December 2007, the supply of water from Bores 1, 2 and 3 was closed off. These bores are still connected to the new pump station via pipe work, however their supply is isolated with valves. The bores were left connected to the main inlet supply for the pump station for use in emergency situations only i.e. for water supply security in the event that something happened to Bore No.4 the valves could be opened on all three bores and a supply provided to town.

In the event of the loss of use of Bore No. 4, it would be important to open up a flushing valve before the pump station and run the water through the pipes from all three bores for a minimum of 2 hours to ensure that all standing water from inside the pipes was flushed from them before pumping any into the town reticulation system.

Since the new pump station was commissioned in December 2007, there has never been a need for water from Bore 1, 2 or 3 to be pumped into town and Council does not foresee a situation where it may need to happen. Bore 4 should continue to function and provide water for the town of Winton for at least the next 60 to 70 years (provided that pressures in the Great Artesian Basin do not drop). Council considers that it would be an extreme event under which there was a need to open up the valves and let Bores 1, 2 or 3 supply the town of Winton with water.

Currently Bore No. 2 is shut off completely at the bore head and has not been opened for many years. Bore No. 3 is open, but not in use. Bore No.1 is currently open and provides water to a turkey's nest which supplies water to cattle on the town common, and a dam near the Winton Showgrounds that is then a source of non-potable water for road works etc. via a stand pipe. Bore No. 1 also supplies top up water to the cooling dams that supply cooling water for the heat exchangers in the new pump station. None of the water from any of the Bores 1, 2 or 3 is supplied as potable water to the reticulation system of Winton.

In terms of water quality and mineral content, all four bores provide water which is considered to be the same. All bores are within 300 metres of each other and bored to the same aquifer.

### 3.1.2 HEAT EXCHANGER AND PUMP STATION

Pumps have sufficient pumping capacity to boost flow from the bores through the heat exchangers, maintain pressure through the network, and head in the elevated reservoir. The heat exchange effect is achieved by pumping water from the southern cooling pond through the heat exchange unit in the opposite direction to the flow of hot bore water through the unit. These storage ponds are fed from Town Bore No. 1 for replenishing cooling pond water lost to evaporation, and also for road works construction.

The two heat exchangers (one being duty and the other available as back up, swapped monthly) are constructed and operate under pressure in a way that there is an extremely low / negligible risk that water from the cooling water system would infiltrate the town bore water supply.

The pump station is controlled by a computerised system (Programmed Logic Controller – PLC) and essentially the level of water in the elevated water tower dictates the duty cycle that the pumps are operating in at any given time.

Computerised systems can be vulnerable to determined cyber aggressors, thus potentially compromising the ability for the WSC to provide clean and safe water. The WSC is currently in the process of upgrading the current computerised system to a more secure SCADA system which will allow the WSC to install firewalls and stay apprised of threats and breaches.

Table 3.1 below provides information on the cooling water pump duty cycles that can operate at the pump station.

**Table 3.1 Pump Station Duty Cycles**

Duty Condition	Cooling Water Flow Rate (average) L/s	Hot (Bore) Water Flow Rate (average) L/s
Duty 1 (Free flow)	50	17
Duty 2	65	58

The duties of the pump station are as follows:

**Duty 1 (Free Flow)** – this duty occurs when the level in the elevated water reservoir is between 85% and 100% full. Free flow conditions mean that the water from Bore No. 4 is free flowing through the pumps at the pump station under the bores own pressure and is being cooled by one cooling water pump i.e. no hot water pumps are operating (the water is not being pumped into town) and only one cooling water pump is operating.

**Duty 2** – this duty occurs when the water level in the elevated reservoir drops to 85% and is filled to 98%. Duty 2 conditions mean that two hot water pumps are running and pumping water through the heat exchangers and into town and two cooling water pumps are running and cooling the hot bore water as it passes through the heat exchanger.

There is not a dedicated rising main between the water pump station and the water tower. The water from the pump station is simply pumped into the reticulated water mains and what water is in the system that exceeds the current demand is pushed up into the water tower.

A typical cycle would be:

1. Water level in the water tower is 100% and the water pump station is completely shut off i.e. there are no hot water pumps running and no cooling water pumps running and no water from Bore No. 4 is being supplied to town.
2. Demand increases and the level of water in the water tower starts dropping until it gets to 98%. The transponder in the water tower sends a message to the pump station and the PLC opens the main control valve and starts one cooling water pump so that Duty 1 commences. If the free flow duty exceeds the current demand for water, then the water level in the water tower rises until it reaches 100%. Once the 100% level is reached the transponder in the water tower sends a signal to the pump station and the PLC shuts the main control valve, thus preventing all water from bore No. 4 entering the pump station or town. The PLC also shuts off the cooling water pump. If the water demand from town keeps increasing, then the water level in the tower will continue to drop until such time as the water level reaches 85%.
3. When the water level in the water tower reaches 85%, the transponder sends a message to the water pump station and the PLC starts up two hot water pumps and another cooling water pump so that two cooling water pumps are now circulating cooling water through the heat exchangers. Duty 2 is now in operation. Provided that the demand for water does not exceed the amount being pumped into town, the water level in the water tower will continue to rise until it reaches 98%, when the free flow duty will take over. If demand from town exceeds the amount of water being pumped into town, then the water level in the water tower will continue to fall until such time as the demand eases and excess water above the level of demand is available to be pushed up and into the water tower.

Two cooling ponds are part of the water pump station infrastructure, these are for the holding of water that is used to cool the bore water by the heat exchangers. The cooling water is circulated by the cooling water pumps, normally from the southern dam through the heat exchanger then back to the northern dam. The two dams are connected via a balance pipe so that there is complete circulation of the water between the two dams. The two cooling dams are enclosed by a 1.5m high security fence and it is therefore impossible for any stock to access the water in the dams. Water for roadworks is available via a stand pipe from a storage dam near the showgrounds. this water is supplied with water from Bore No.1. This storage dam is connected to the southern cooling dam as a top-up water source in case of a supply failure directly from Bore 1.

During power outages, water can be supplied to the town via the elevated reservoir. A dedicated 125kw standby (fully fuelled) diesel generator is located at the water station to operate the facility in the event of a power failure. In the event of a power failure the standby generator has the capacity to power the supply system in duty two mode, providing full supply to the distribution system. A full tank of diesel fuel will run the generator for at least four hours in duty two mode, and at normal demand levels for eight hours before refuelling is required. The generator is currently manually started but in the future it will be automated with the electricity supply coming from the Geothermal Plant.

### **3.1.3 ELEVATED RESERVOIR**

The elevated reservoir was built in 1952 and is located on Werna Street. The reservoir has a capacity of 0.45ML. The elevated reservoir provides a water supply head of up to 20m, storage to buffer peak hour demand and emergency storage for firefighting and allows supply to be maintained in case of power failure on the pump system at the heat exchangers.

### **3.1.4 DISTRIBUTION SYSTEM**

Water is distributed from the bore and elevated reservoir through the reticulation system to residents. The reticulation consists of pipes ranging from 50mm to 200mm diameter. The principal delivery main (200mm) is located along Manifold Street and Elderslie Street.

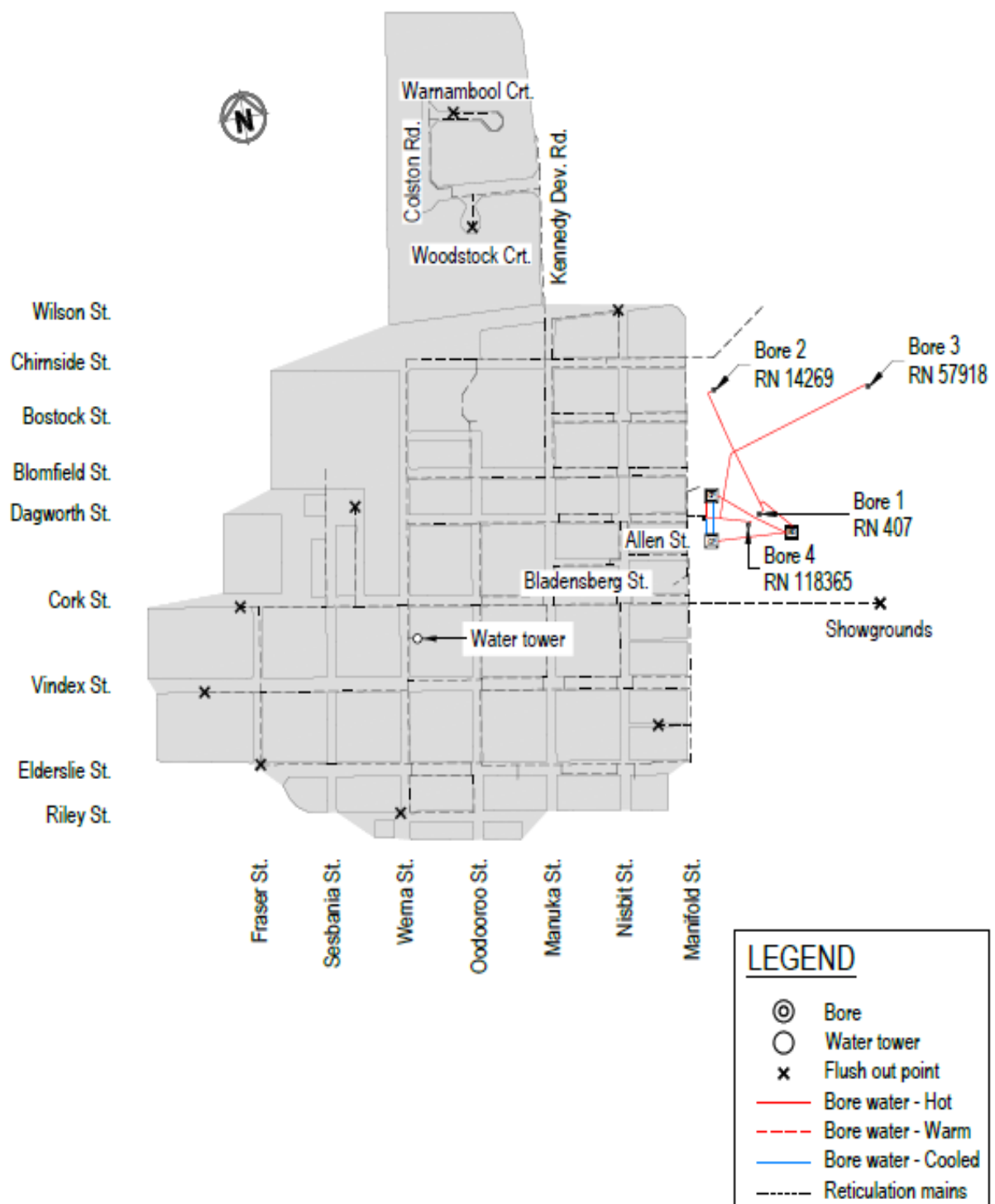
The water reticulation system of pipes and dual check valves (backflow prevention devices) is a completely closed network and does not allow any contaminated water or other material to ingress the closed network. Extreme care is taken when maintenance, repair or replacement works are carried out at locations in the network to ensure that the piped water is not contaminated in any way.

The quality of the bore water has been routinely tested since 2008. It has a sulphurous odour, which at times residents and tourists (in particular) find objectionable. The mineral content may affect soil permeability with constant use and the chemical content is not conducive for irrigating sensitive plants.

### **3.1.5 SCHEMATIC**

Figure 3.1 shows a schematic of the Winton water supply scheme. Figure 3.2 shows a schematic of the Winton heat exchangers.

Refer to Appendix B for water supply layouts superimposed on aerial photos.



180126-SK1/02

Winton DWQMP Review: Location of infrastructure

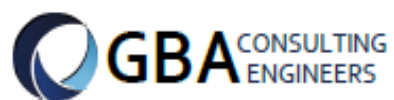
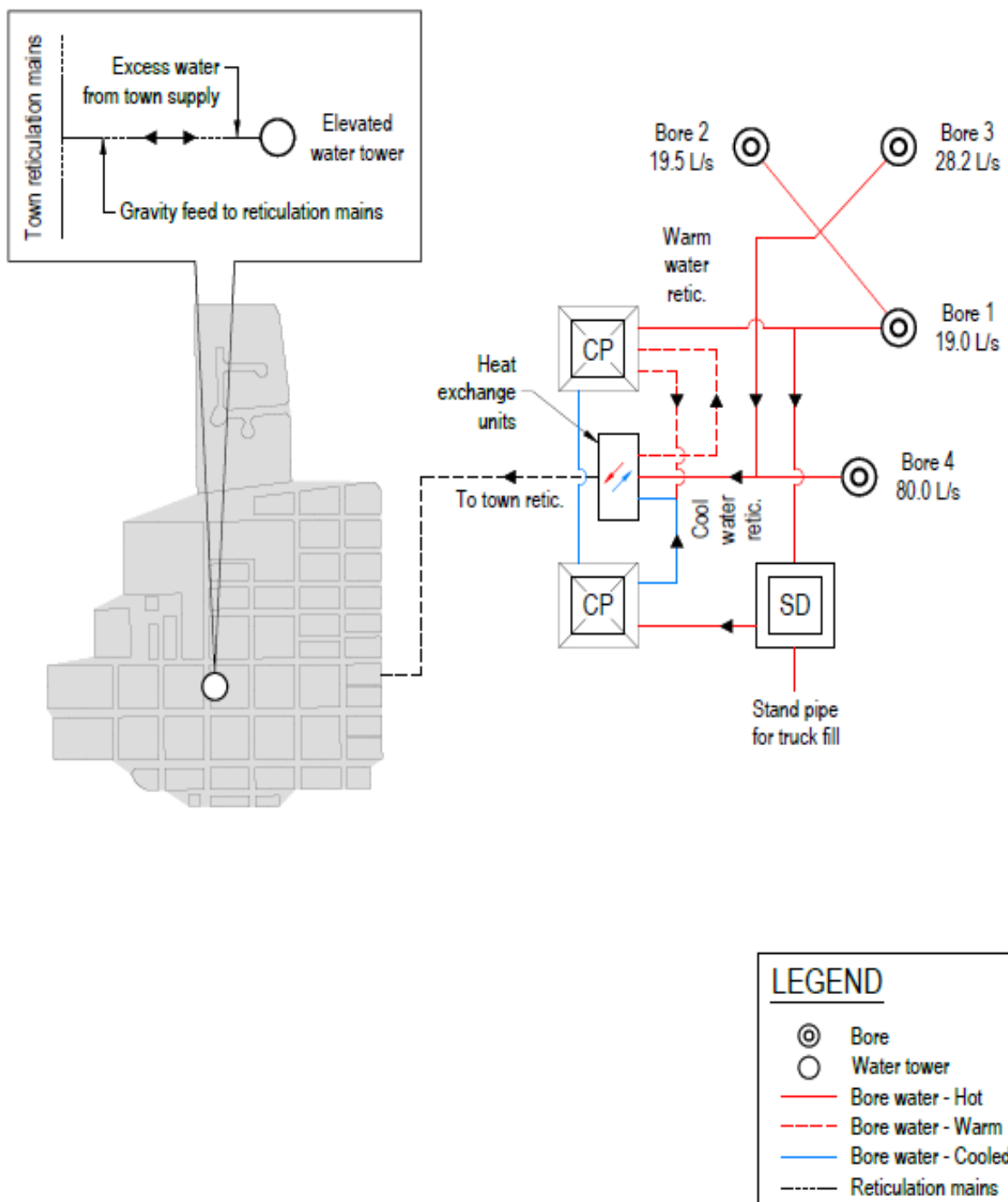


Figure 3.1 Service Schematic Layout



180126-SK1/01  
Winton DWQMP Review: Schematic



Figure 3.2 Heat Exchanger Plant Schematic

### 3.1.6 SOURCE, TREATMENT AND DISTRIBUTION DETAILS

Table 3.2 provides the following information for Winton's infrastructure:

- Source details;
- Heat exchangers; and
- Distribution and reticulation.

**Table 3.2 Winton Infrastructure Details**

Component	Winton Water Supply Scheme	
Source and Sourcing Infrastructure	Name	Town Bore No.1
	Type	Artesian Bore (RN 407)
	% of supply	0%
	Depth	1220
	Temperature	85°C
	Static Pressure	34 m
	Predominant Bore Size	127 mm
	Flow	19 L/s
	Reliability	Poor
	Water quality issues	Utilised for water for cooling ponds and for road construction.
	Name	Town Bore No.2
	Type	Artesian Bore (RN 14269)
	% of supply	0%
	Depth	1224
	Temperature	79°C
	Static Pressure	26 m
	Predominant Bore Size	203 mm
	Flow	11 L/s
	Reliability	Poor
	Reliability	Poor (Backup supply)
	Water quality issues	Some physical and chemical characteristics do not comply with the Australian Drinking Water Guidelines aesthetic limits. Refer to section 3.
	Name	Town Bore No.3
	Type	Artesian Bore (RN 51918)
	% of supply	0%
	Depth	1222



Component	Winton Water Supply Scheme	
	Temperature	85°C
	Static Pressure	32 m
	Predominant Bore Size	168 mm
	Flow	30 L/s
	Reliability	Poor
	Reliability	Moderate (Backup supply)
	Water quality issues	Some physical and chemical characteristics do not comply with the Australian Drinking Water Guidelines aesthetic limits. Refer to section 3.
	Name	Town Bore No.4
	TypeName	Artesian Bore (RN 118368) Town Bore No.4
	% of supplyType	100%Artesian Bore (RN 118368)
	Depth% of supply	1325100%
	TemperatureDepth	85°C1325
	Static PressureTemperature	30 m85°C
	Predominant Bore SizeStatic Pressure	203 mm30 m
	FlowPredominant Bore Size	77 L/s203 mm
	ReliabilityFlow	Good77 L/s
	Water quality issuesReliability	Some physical and chemical characteristics do not comply with the Australian Drinking Water Guidelines aesthetic limits. Refer to section 3. Good
	Water quality issues	Some physical and chemical characteristics do not comply with the Australian Drinking Water Guidelines aesthetic limits. Refer to section 3.
Are there any sources that <b>do not</b> undergo treatment prior to supply?	Yes. 100% of the sources do not undergo treatment prior to supply.	
Heat Exchangers	Name	2 x Alfa Laval Plate Heat Exchanger
	Process	Plate heat exchangers are made up of a series of assembled, corrugated plates. Between the plates there are two channels with a cool and a hot medium. These pass on each side of the plates and in opposite direction to each other.

Component	Winton Water Supply Scheme	
	Heat Exchanged	9710kw
	Design Conditions	60L/s Hot Side, 85°C in to 44°C out
		80L/s Cool Side, 40°C in to 59°C out
	Water sourced from and %	100%
	% of average day demand provided	100%
	% of scheme supply	100%
	Distribution area supplied	Entire distribution
Are there any sources that <b>do not</b> undergo disinfection prior to supply?	Yes. 100% of the sources do not undergo disinfection prior to supply.	
Reservoir	Elevated	Yes
	Name	Werna St
	Capacity (ML)	0.45ML
	Roofed	Yes
	Vermin-proof	Yes, Runoff directed off roof
	Construction materials	Reinforced Concrete
Distribution and Reticulation System	Pipe material	AC
	Age range	1983 - 2014
	Length	5637m
	Approx. % of total length	16.0%
	Pipe material	DI
	Age range	1983 - 2014
	Length	5211m
	Approx. % of total length	16.0%
	Pipe material	CI
	Age range	1955 - 1955
	Length	105m
	Approx. % of total length	0.3%
	Pipe material	GI
	Age range	1978 - 1978
	Length	500m

Component	Winton Water Supply Scheme	
	Approx. % of total length	1.0%
	Pipe material	BB
	Age range	1955 - 2007
	Length	1385m
	Approx. % of total length	4.0%
	Pipe material	Poly
	Age range	1965 - 2011
	Length	17330m
	Approx. % of total length	50.0%
	Pipe material	PVC
	Age range	2009 - 2018
	Length	2118m
	Approx. % of total length	6.0%
	Pipe material	UPVC
	Age range	2003 - 2018
	Length	210m
	Approx. % of total length	1.0%
	Areas where potential long detention periods could be expected	Western end of Cork Street Western end of Wilson Street Western side of Elderslie Street Western end of Vindex Street Warnambool Court Woodstock Court End of Ramsay Street (Refer to Appendix B for Regular Flushing Point Locations Map)
	Areas where low water pressure (e.g. < 12 m) could be expected during peak or other demand periods)	None
Water quality responsibility changes	Entire water supply scheme	Winton Shire Council

### 3.1.7 WINTON GEOTHERMAL POWER PLANT

The Winton Geothermal Power Plant is located east of Manifold Street near Bore No. 4, and was commissioned in late 2019. The Geothermal Power Plant provides a sustainable and renewable energy source by converting the thermal energy in the town water supply into electricity.

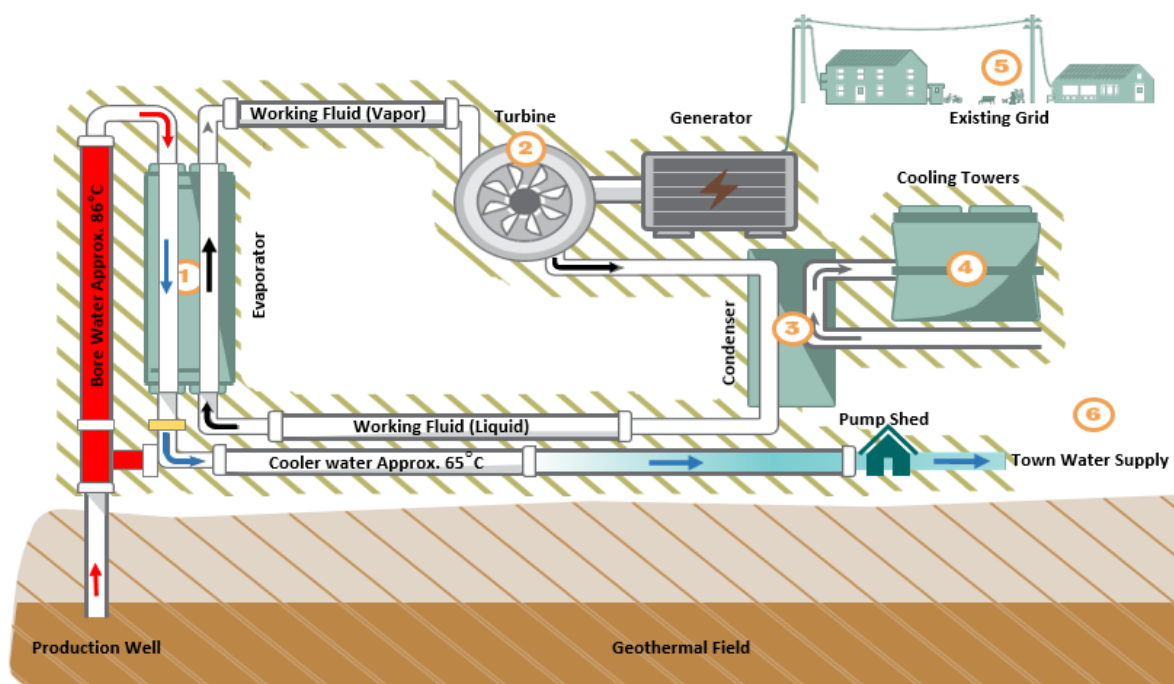
The plant system, known as the Organic Rankine Cycle, works by transferring the heat in the water to a working fluid which evaporates at low temperature. The evaporated gas spins a turbine to generate electricity before being condensed by cooling towers.

Water from Bore No. 4 (town water supply) is used to power the plant. The water passes through the evaporator as shown in *Figure 3.3 Winton Geothermal Plant Overview*, before continuing to the Council's water supply system (pumping station and reticulation network).

**The town bore water is not altered in any way, apart from cooling by approximately 20°C.**

The risk of contamination of the town water by the working fluid is extremely low. The evaporator where the heat exchange takes place is a completely closed (brazed) structure and the plant and equipment has a failsafe system that will detect the most minute presence of the working fluid.

#### Winton Geothermal Power Plant Overview



Pressure/flow sensor

1. **Evaporator:** Heat Transfer to working fluid
2. **Generator:** Gas spins the turbine to generate electricity
3. **Condenser:** Gas cool down to liquid
4. **Cooling Tower:** Ensures cooling water at required temperature
5. **Electricity Distribution:** Exports electricity to Ergon Network
6. **Town Water Supply:** To the pump station for further heat exchange and then distribution

**Figure 3.3 Winton Geothermal Power Plant Overview**

## 3.2 Key Stakeholders

Table 3.3 below outlines the relevant stakeholders for the water supply scheme in Winton.

**Table 3.3 Winton Shire Council Stakeholders**

Organisation	How the Stakeholder is Engaged in The DWQMP	Contact Name and Details	Relevance to Management of Drinking Water Quality
Winton Shire Council	Small Drinking Water Service Provider	WSC Chief Executive Officer Phone: (07) 4657 2666 Email: ceo@winton.qld.gov.au	Small Drinking Water Service Provider
Winton Shire Council	Small Drinking Water Service Provider	Director of Works Phone: (07) 4657 2666 Email: dow@winton.qld.gov.au	Small Drinking Water Service Provider
George Bourne & Associates Consulting Engineers	External Consultancy Service	Keith Luckhurst, Senior Engineer Phone: (07) 4651 5177 Email: kluckhurst@gbassoc.com.au	Infrastructure design & Operations Preparation of Schematic Diagrams
Ergon Energy	Power Supplier	Rowan Gillies, Area Manager Phone: 0427961852 Faults, Phone: 13 22 96	Power supplier heat exchange and supply system
QLD Government Forensic and Scientific Services	Water Analysis Provider	Bruce Gray, Supervising Scientist Phone: (07) 3096 2822 bruce.gray@health.qld.gov.au	Water Analysis
QLD Health Public Health Unit (Central QLD)	Public Health	Phone: (07) 4920 6989 Email: FSS@health.qld.gov.au	Public Health
Aged Care	Sensitive User	Phone: (07) 4920 6989 Email: FSS@health.qld.gov.au	Sensitive user
Winton Child Care Centre (Little Swaggies)	Sensitive User	Phone: (07) 4657 1522 Email: littleswaggies@winton.qld.gov.au	Sensitive user

Organisation	How the Stakeholder is Engaged in The DWQMP	Contact Name and Details	Relevance to Management of Drinking Water Quality
St Patricks Primary School	Sensitive User	Phone: (07) 4657 1652 Email: wntn@tsv.catholic.edu.au	Sensitive user
Winton State School	Sensitive User	Phone: (07) 4657 1522 Email: the.principal@wintonss.eq.edu.au	Sensitive user

## **4 IDENTIFY HAZARDS AND HAZARDOUS EVENTS**

### **4.1 Water Quality and Catchment Characteristics**

The water supply is composed of one deep artesian bore, which is not treated prior to reticulation. The source water quantity is generally sufficient to reticulate to the town.

#### **4.1.1 WATER QUALITY INFORMATION**

Water quality information for Winton includes the following:

- (a) Summary
- (b) Interpolation

##### **4.1.1.1 Summary**

Table 4.1 below summarises the available reticulated water quality for the Winton water supply scheme. The water quality data provided below has been updated from the 2013 version of the DWQMP and will be updated every five years (given the stability of the water supply) unless otherwise directed. For some parameters no additional data has been collected since the original investigation. Therefore, not all analyte testing has been replicated over the same timeframes, resulting in disparity between testing replications of some analytes. In the table and figures below water quality data may be as recent as September 2018, whereas other data sets for specific analytes will only have data up until late 2012 when the original DWQMP compliance testing was undertaken.

Figure 4.1 to Figure 4.18 below shows trends of the main characteristics contained in Table 4.1.

The responsibility for obtaining the water samples rests with the DWSP and samples are collected by the Water & Sewerage Section monthly. Samples are sent to Queensland Health Scientific Services for analysis. The DWSP also samples and analyses drinking water for E. coli and Coliforms using its own testing facilities, if and when the need arises.

**Table 4.1 Winton Reticulated Water**

Winton Water Supply		Start Date	15/03/2011		End Date:	01/09/2018					
Characteristic	Units	No. of Samples	Summary of Results					Guideline Value			
			Maximum Value	Average Value	Minimum Value	Std Dev	95 <sup>th</sup> Percentile	Health	Exceedances	Aesthetic	Exceedances
Conductivity	uS/cm	93	484.00	464.56	450.00	9.80	482.00				
pH		424	8.37	7.75	7.29	0.16	8.03			≥6.5 & ≤ 8.5	0
Total Hardness	mg/L as CaCO <sub>3</sub>	93	46.00	31.38	21.00	2.60	33.40				
Temporary Hardness	mg/L as CaCo <sub>3</sub>	93	46.00	31.38	21.00	2.60	33.40			200	0
Alkalinity	mg/L CaCo <sub>3</sub>	93	1183.00	196.19	181.00	102.91	190.00				
Residual Alkalinity	meq/L	93	3.30	3.07	2.80	0.08	3.20				
Silica	mg/L	93	54.00	51.32	42.00	1.53	54.00			80	0
Total Dissolved Ions	mg/L	93	384.00	367.86	272.00	11.00	377.40				
Total Dissolved Solids	mg/L	93	317.00	306.22	298.00	3.04	311.00			600	0
True Colour	Hazen	93	19.00	2.92	0.90	2.92	8.00			15	2
Turbidity	NTU	424	38.00	1.21	0.00	2.50	1.00			5	4
pH (Saturation)*		93	8.20	8.10	7.90	0.03	8.10				
Saturation Index		93	0.10	-0.31	-0.70	0.15	-0.04				
Mole Ratio		93	2.10	1.77	1.30	0.14	2.00				
Sodium Absorption Ratio		93	7.20	6.57	5.40	0.27	6.94				



Winton Water Supply		Start Date	15/03/2011		End Date:	01/09/2018					
Characteristic	Units	No. of Samples	Summary of Results					Guideline Value			
			Maximum Value	Average Value	Minimum Value	Std Dev	95 <sup>th</sup> Percentile	Health	Exceedances	Aesthetic	Exceedances
Figure of Merit		93	0.30	0.20	0.10	0.01	0.20				
Sodium	mg/L	93	89.00	84.59	82.00	1.89	88.00			180	0
Potassium	mg/L	93	13.00	12.01	11.00	0.27	12.00				
Calcium	mg/L	93	18.00	12.29	11.00	0.80	13.00				
Magnesium	mg/L	93	2.30	0.26	0.10	0.34	0.40				
Hydrogen	mg/L	93	0.00	0.00	0.00	0.00	0.00				
Bicarbonate	mg/L	93	233.00	224.45	219.00	2.94	230.00				
Carbonate	mg/L	93	2.40	0.86	0.40	0.32	1.44				
Hydroxide	mg/L	93	0.00	0.00	0.00	0.00	0.00				
Chloride	mg/L	93	34.00	28.84	28.00	0.95	30.00			250	0
Fluoride	mg/L	424	0.43	0.30	0.20	0.04	0.36	1.5	0		
Nitrate	mg/L	423	0.90	0.50	0.05	0.05	0.50	50	0		
Sulphate	mg/L	424	9.70	5.33	4.00	0.61	6.00	500	0	250	0
Iron	mg/L	424	0.56	0.08	0.01	0.05	0.14			0.3	2
Manganese	mg/L	424	0.19	0.07	0.01	0.01	0.08	0.5	0	0.1	2
Zinc	mg/L	424	1.40	0.04	0.01	0.13	0.11			3	0
Aluminium	mg/L	423	0.07	0.05	0.05	0.00	0.05			0.2	0
Boron	mg/L	424	0.10	0.07	0.05	0.01	0.07	4	0		
Copper	mg/L	424.00	29.00	0.11	0.03	1.41	0.04	2	1	1	1

Winton Water Supply		Start Date	15/03/2011		End Date:	01/09/2018					
Characteristic	Units	No. of Samples	Summary of Results					Guideline Value			
			Maximum Value	Average Value	Minimum Value	Std Dev	95 <sup>th</sup> Percentile	Health	Exceedances	Aesthetic	Exceedances
Coliforms	mpn/100ml	903	208.00	3.74	0.00	22.80	22.00	0	0		
E. coli	mpn/100ml	898	23.00	.17	0.00	1.59	0.00	0	7	0	

Aesthetic Guideline Exceedance

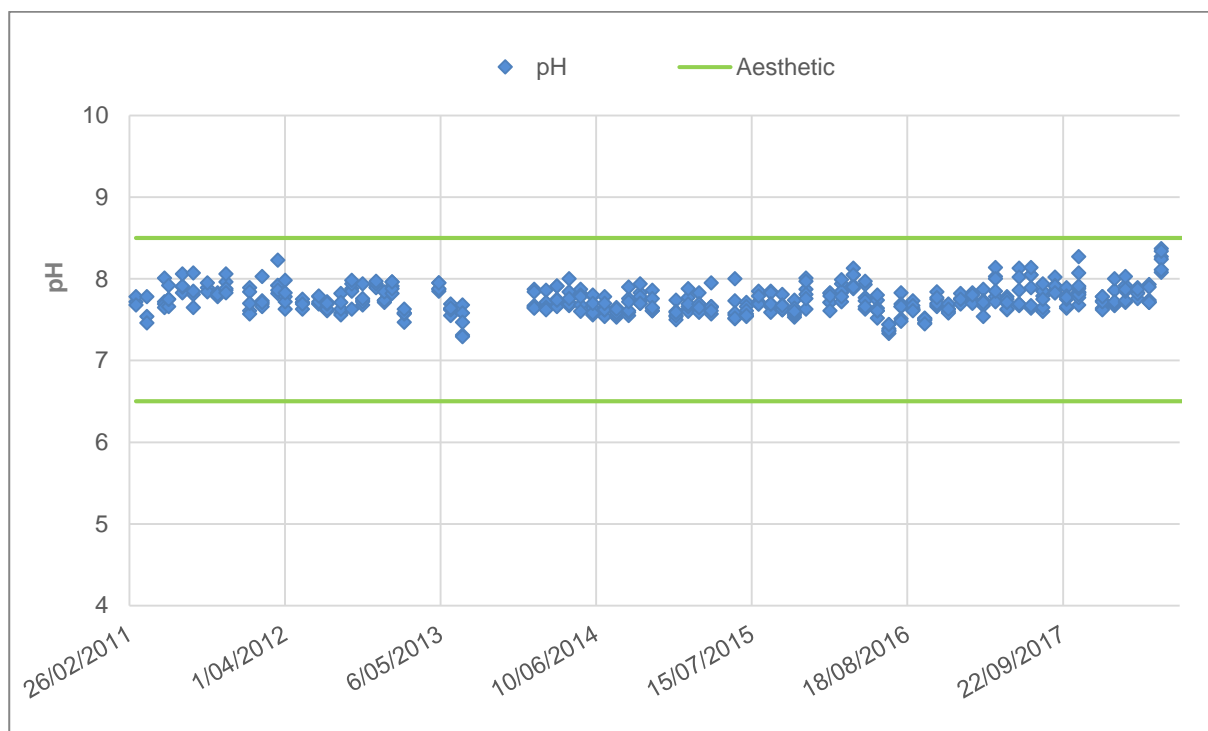
Health Guideline Exceedance

#### **4.1.1.2 Water Quality Complaints**

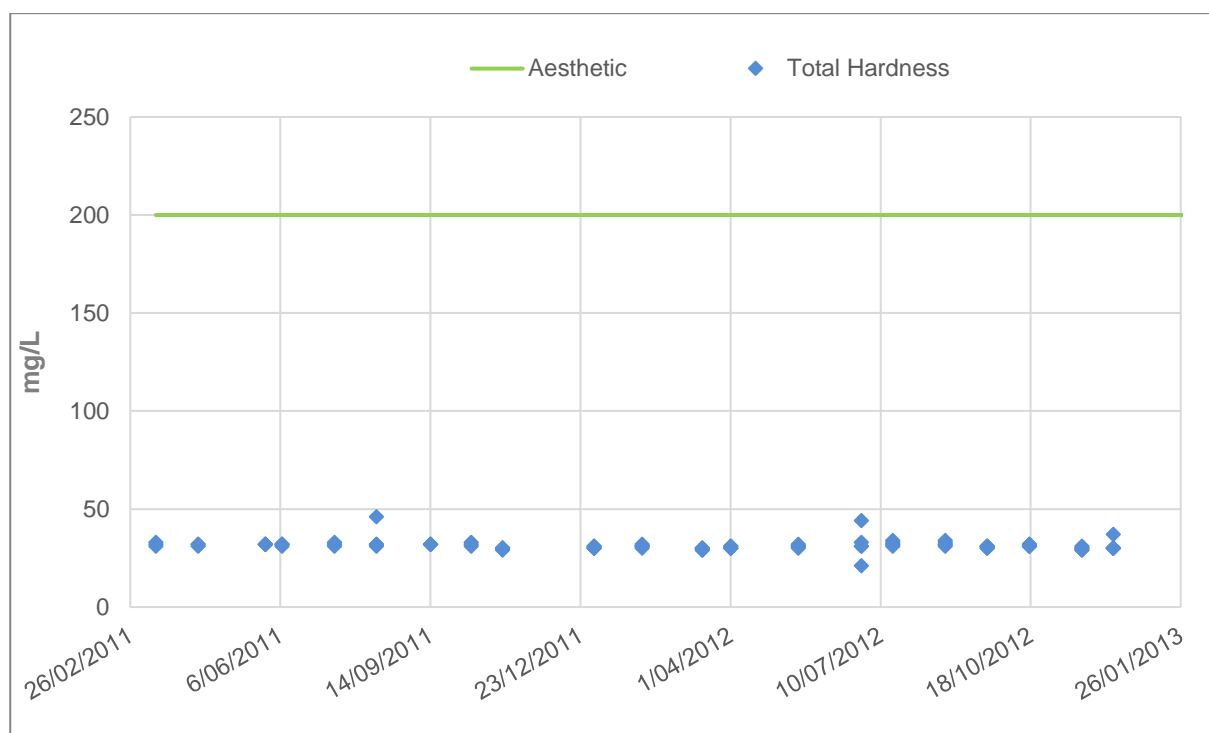
The DWSP has formalised complaints management system. Accurate data on the number of complaints and the reasons for these complaints are compiled in a formal register.

The majority of complaints received by Council regarding the water in Winton is about the temperature of the water. Many residences on the eastern side of town do not have hot water systems and the residents rely on the water supplied to be warm enough to shower in, particularly during the winter months. During the summer months, however, the water may be warmer than desirable (e.g. the resident wants to have a cold shower). In these circumstances it is necessary to have a “cold water tank” – and even then the ambient temperature requires a large capacity cooling water tank/s to achieve a slightly cooler temperature.

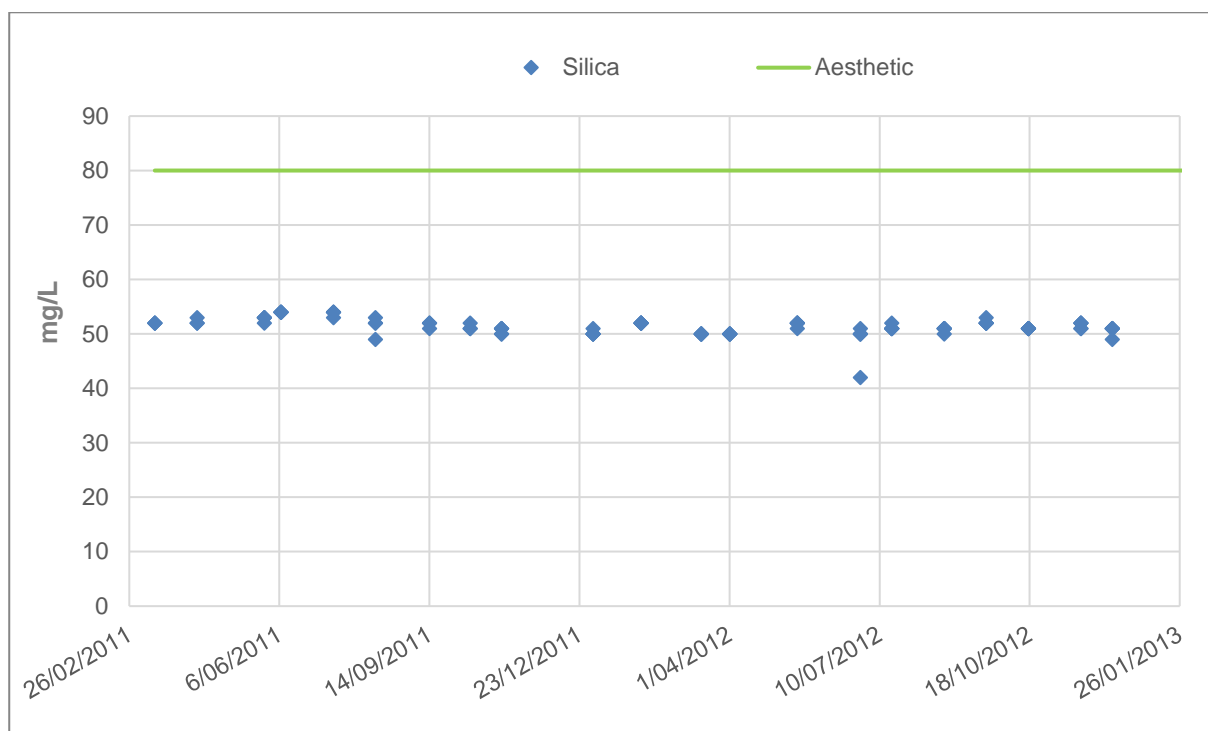
Tourists also tend to complain about the smell of the bore water. These are general comments rather than complaints though and are common in areas where the source of potable water is from an artesian bore.



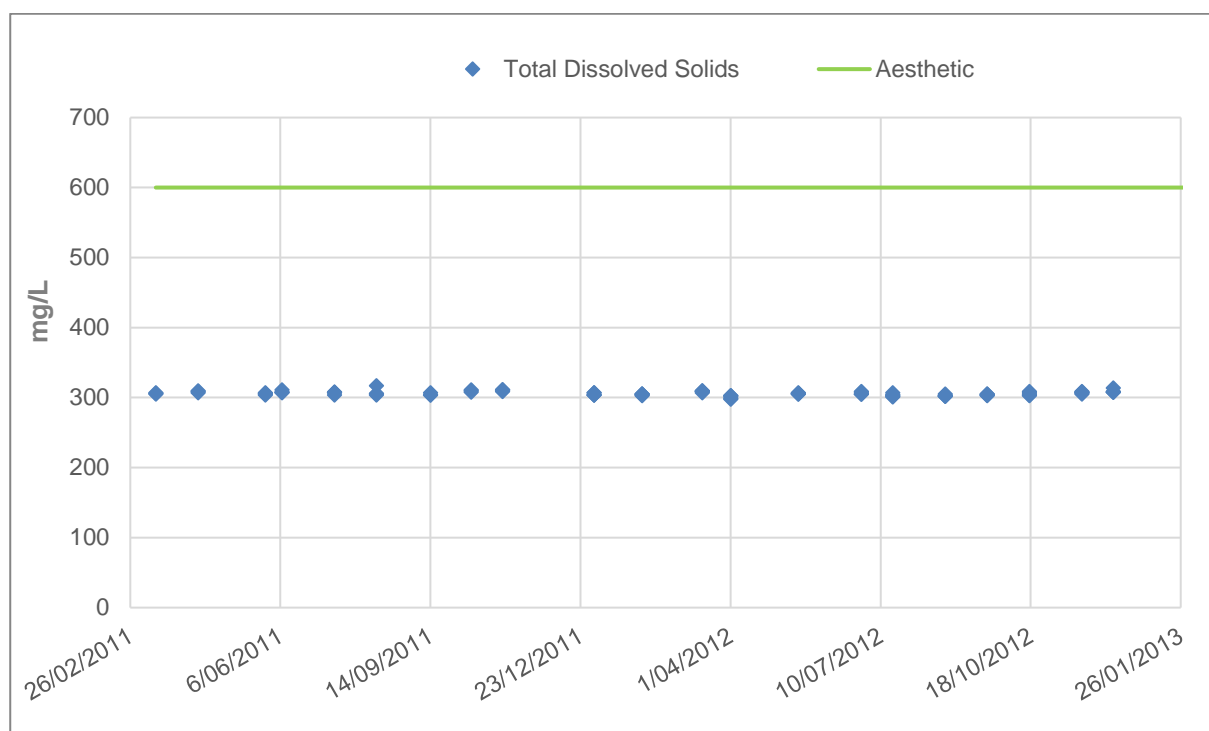
**Figure 4.1 Winton Reticulated - pH at 23°C**



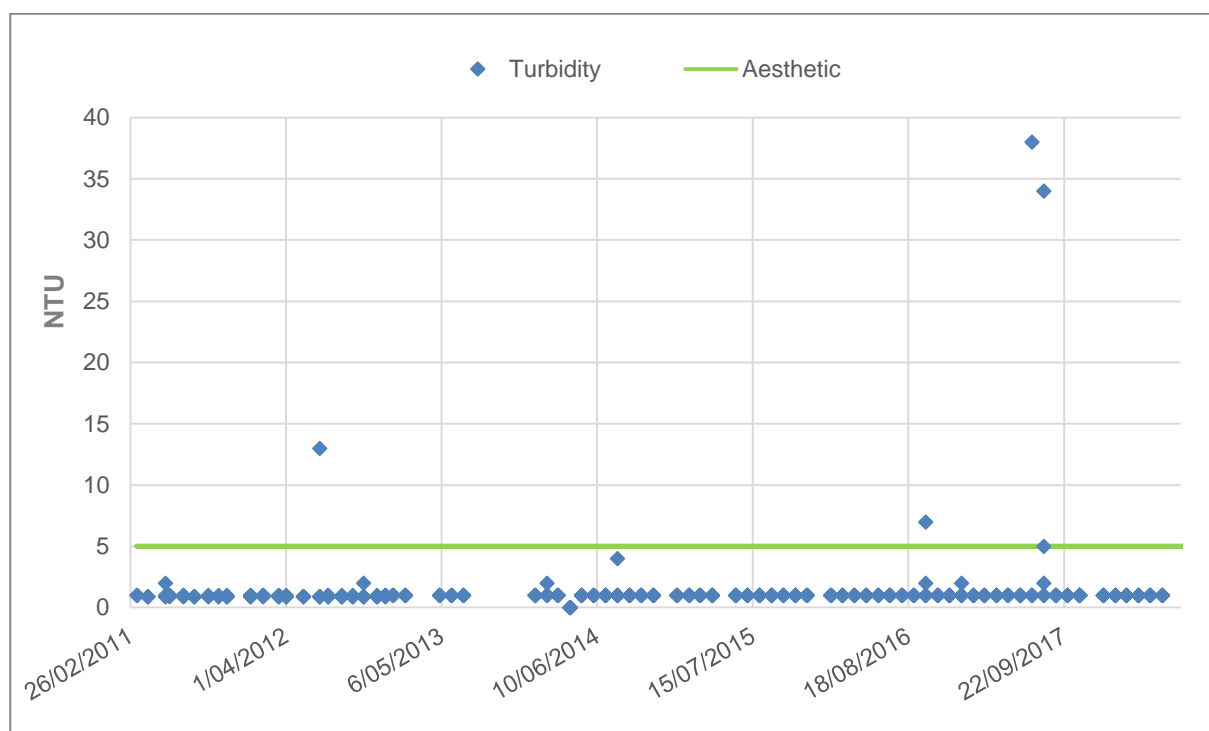
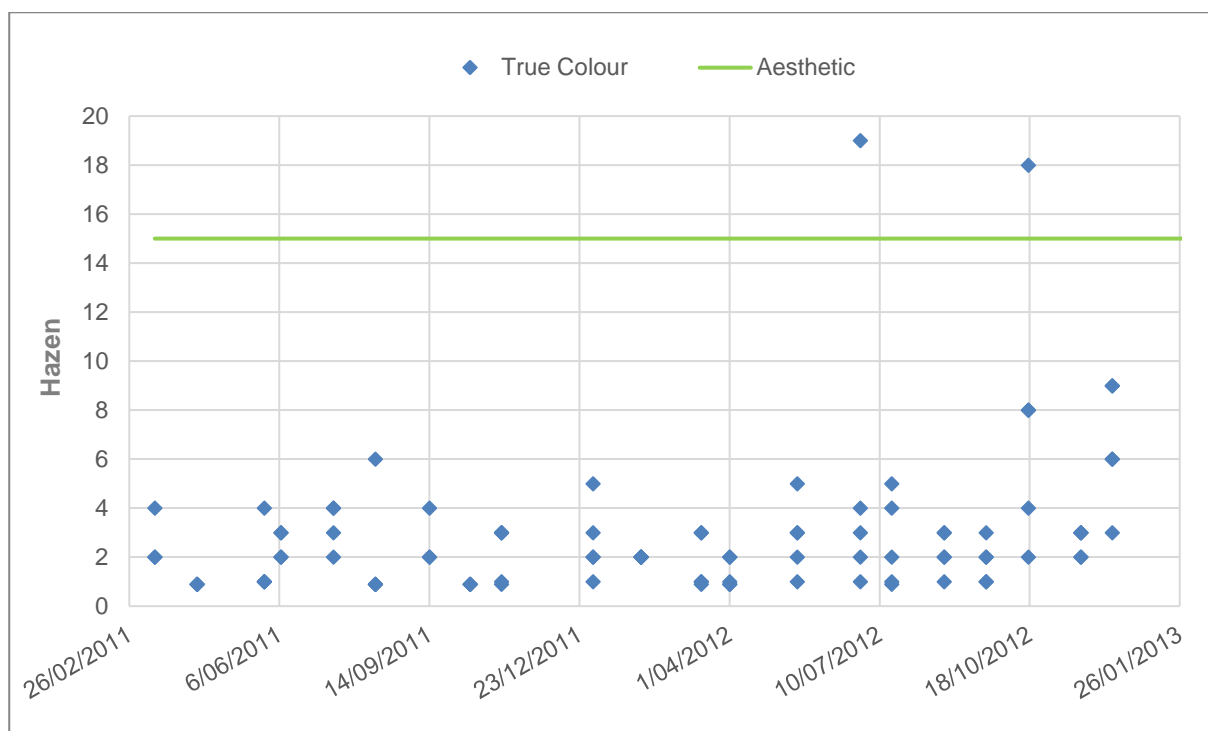
**Figure 4.2 Winton Reticulated - Total Hardness**

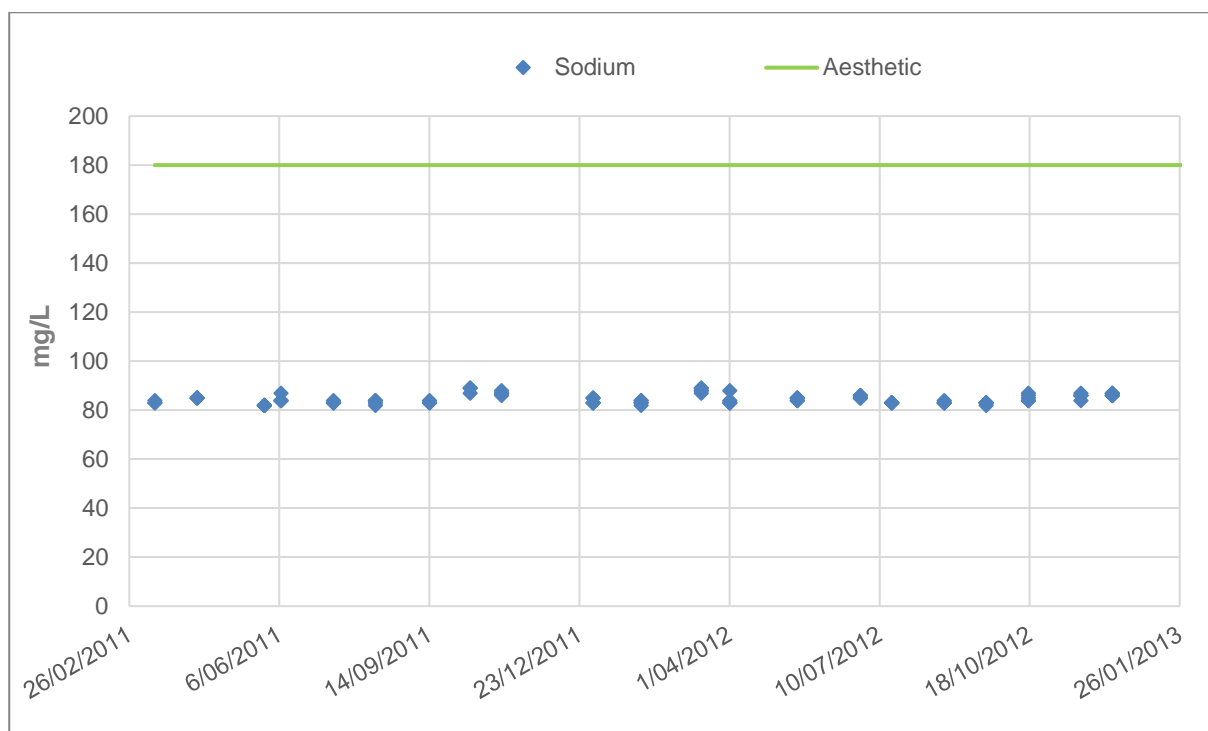


**Figure 4.3 Winton Reticulated – Silica**

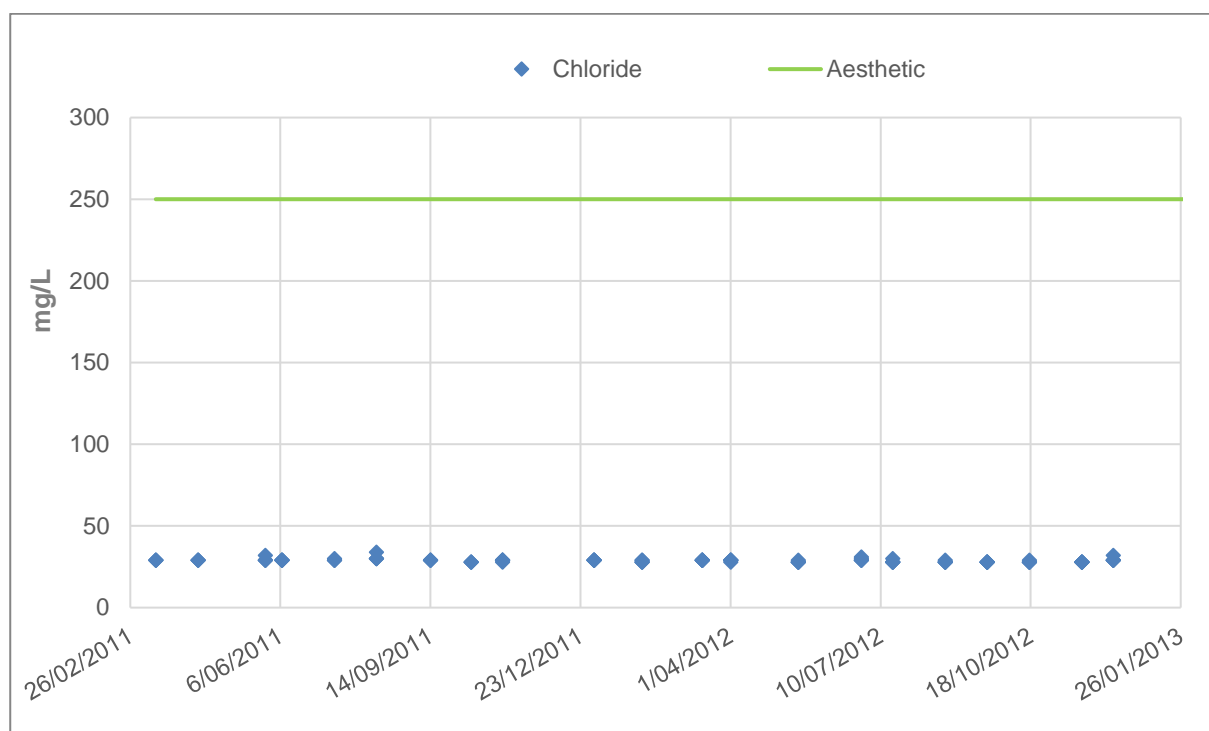


**Figure 4.4 Winton Reticulated - Total Dissolved Solids**

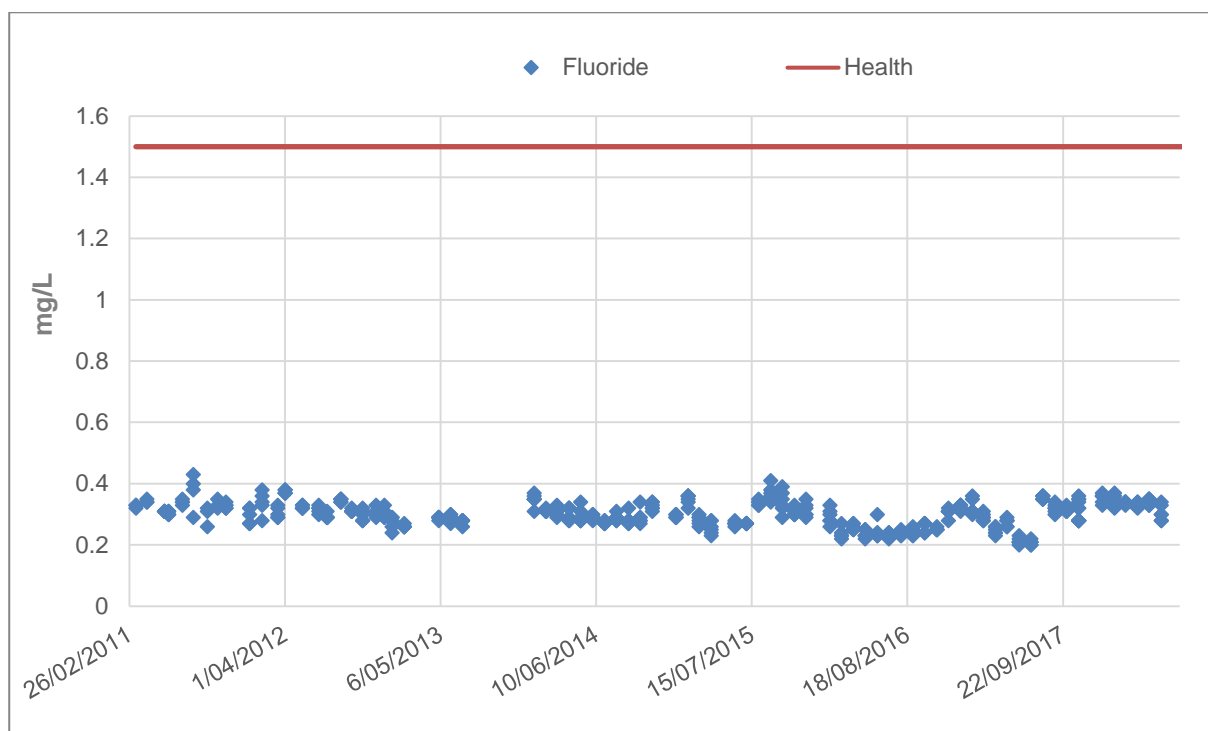




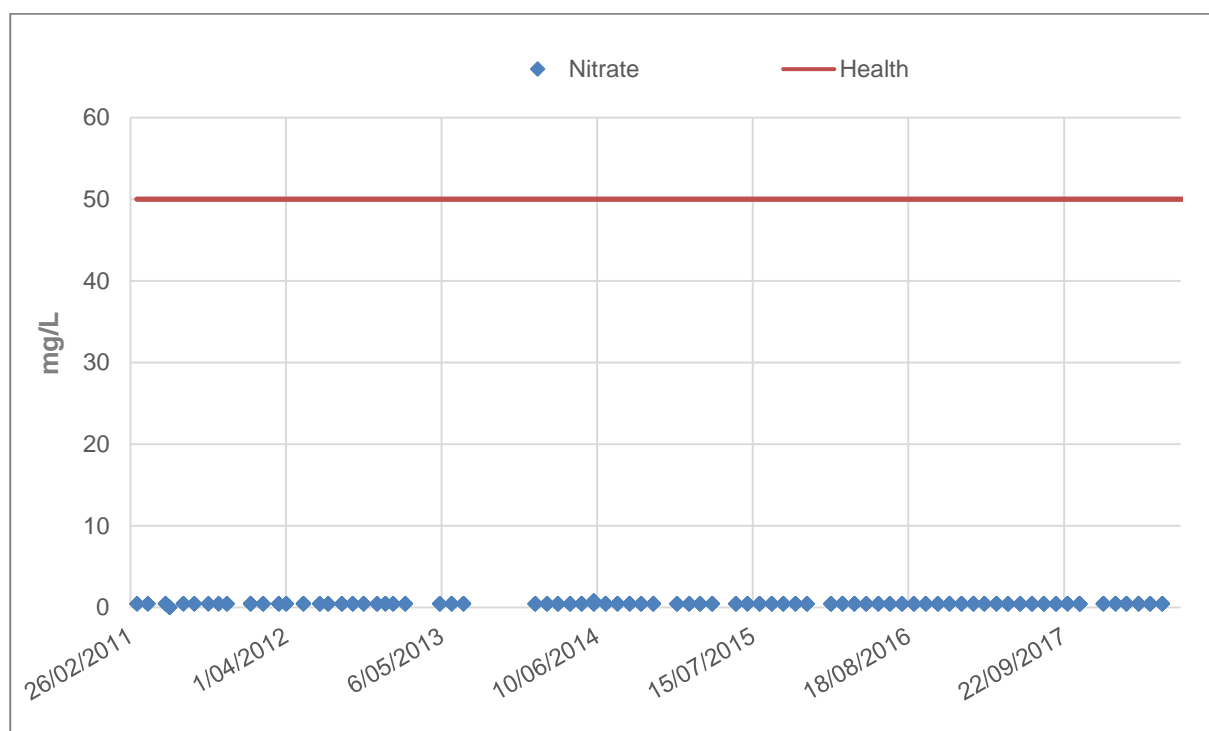
**Figure 4.7 Winton Reticulated – Sodium**



**Figure 4.8 Winton Reticulated – Chloride**

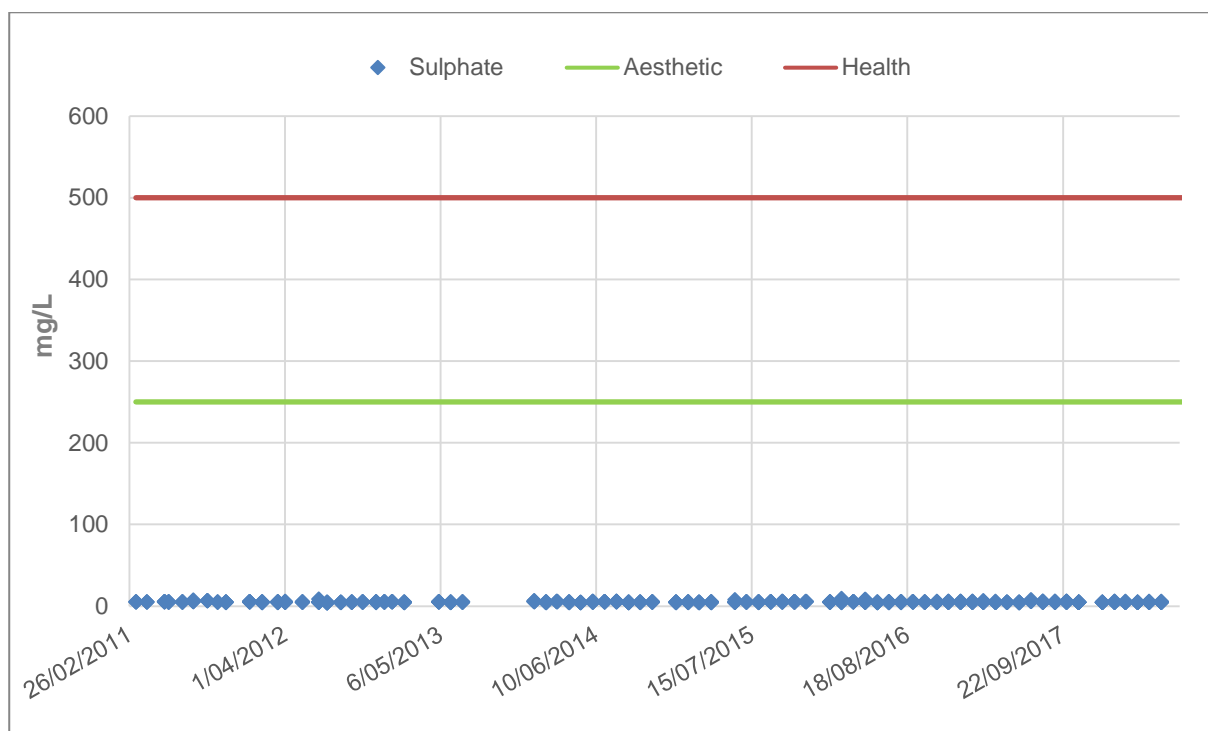


**Figure 4.9 Winton Reticulated – Fluoride**

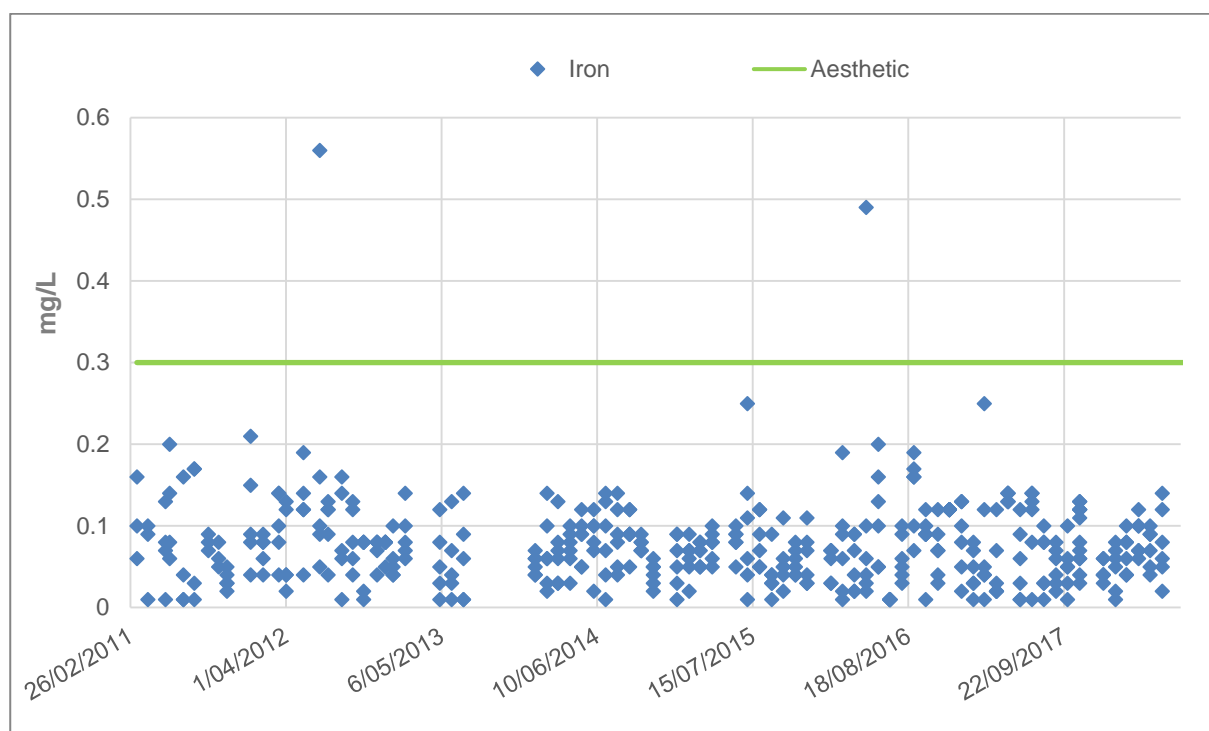


**Figure 4.10 Winton Reticulated – Nitrate**

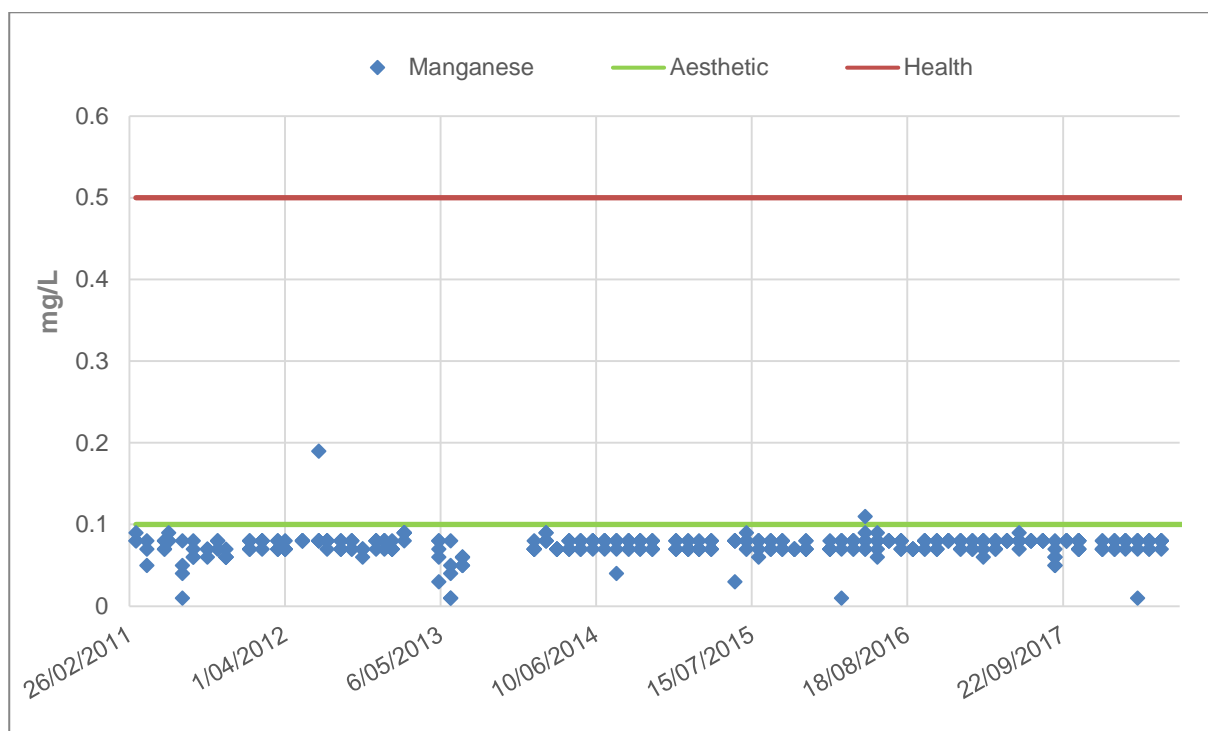




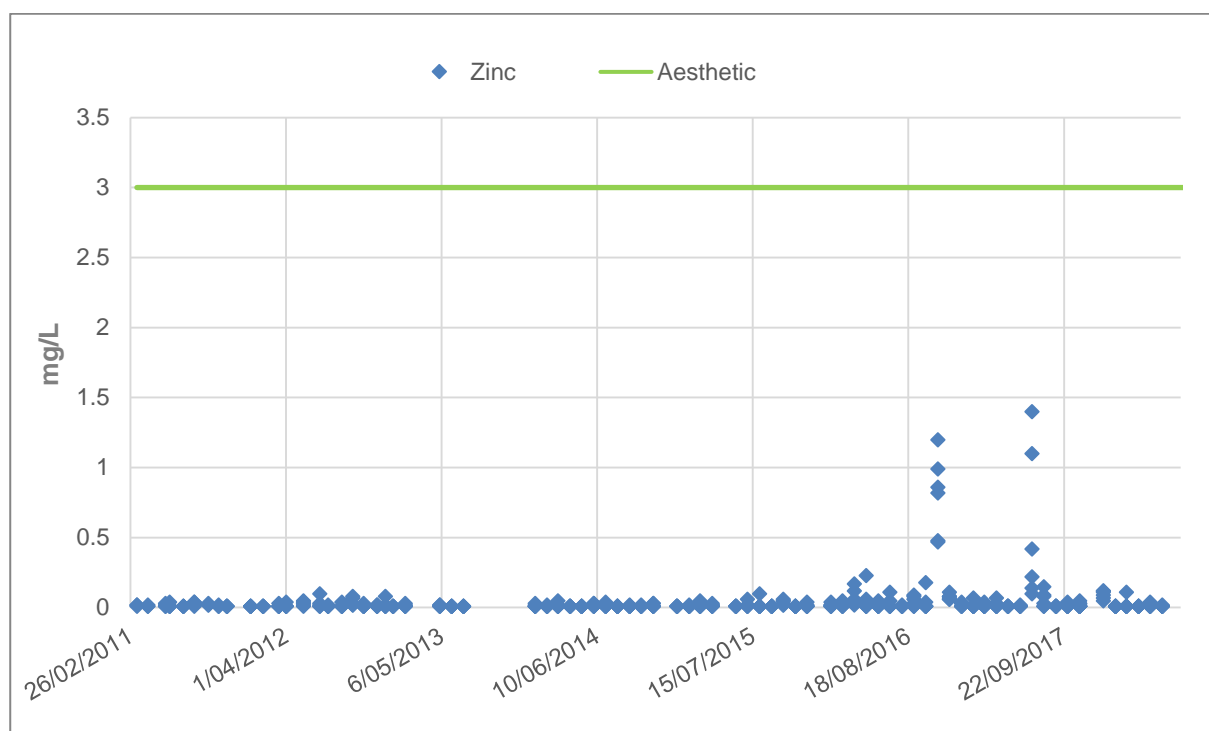
**Figure 4.11 Winton Reticulated – Sulphate**



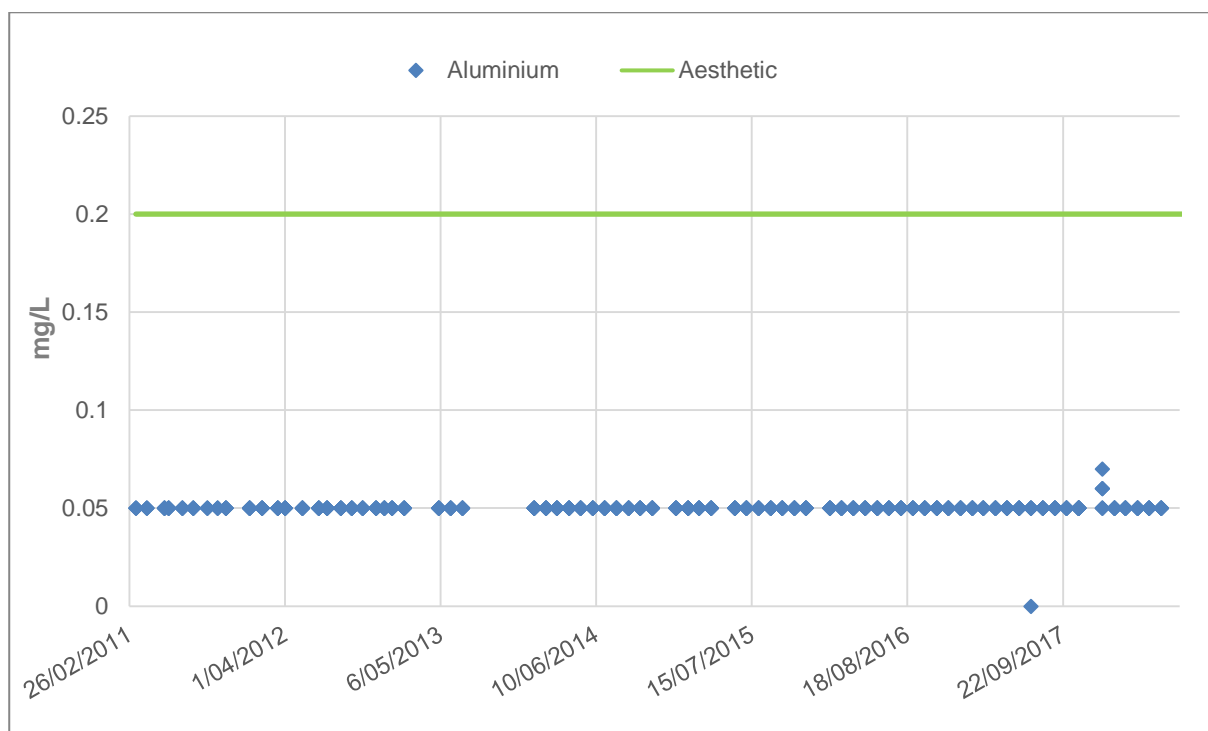
**Figure 4.12 Winton Reticulated – Iron**



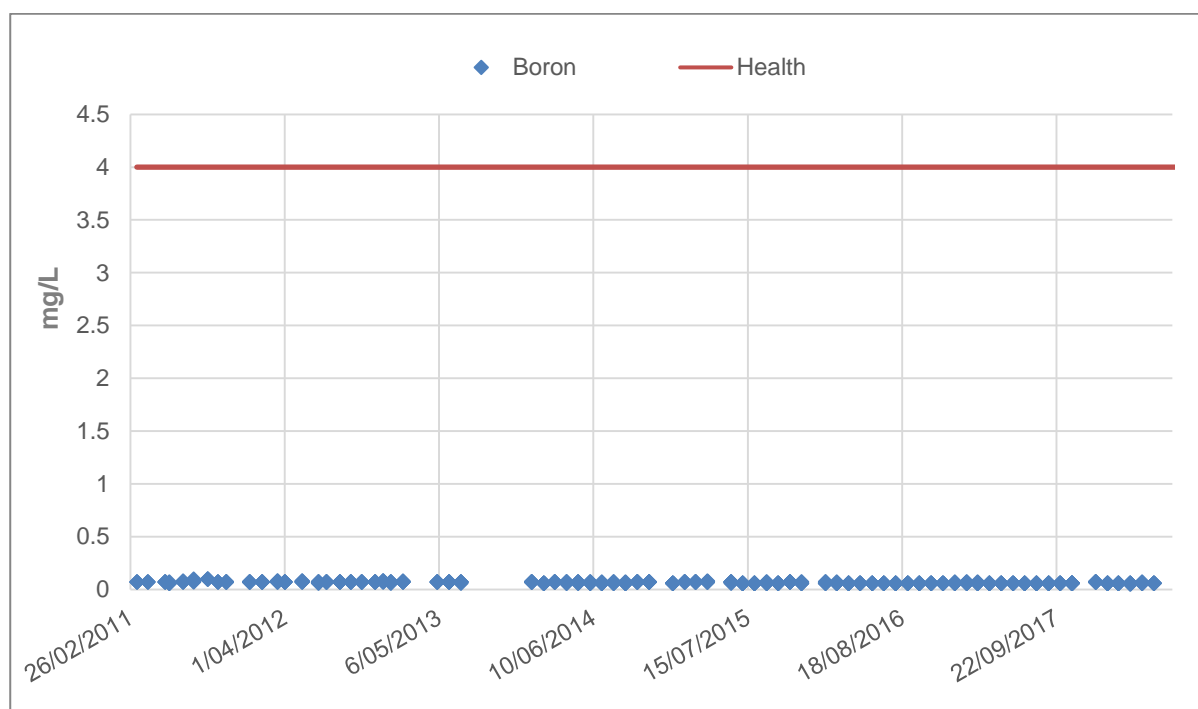
**Figure 4.13 Winton Reticulated – Manganese**



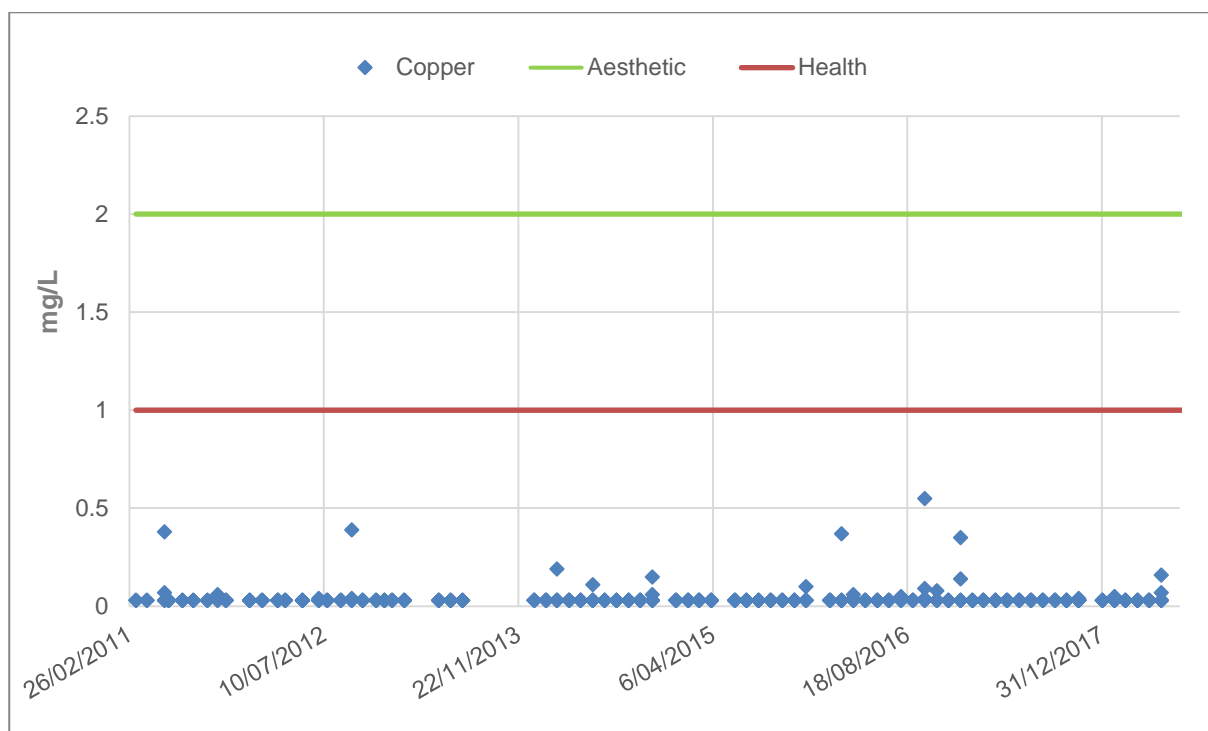
**Figure 4.14 Winton Reticulated – Zinc**



**Figure 4.15 Winton Reticulated – Aluminium**



**Figure 4.16 Winton Reticulated – Boron**



#### 4.1.1.3 Interpretation

Table 4.1 above shows aesthetic guideline value exceedances<sup>2</sup> for pH, colour, turbidity, sodium, iron, manganese and aluminium in the water.

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

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

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

- Fluoride
- Nitrate
- Sulphate
- Boron
- Chlorate
- **E. coli**

Figure 4.5 provides a trend for the analysis of true colour, there were two exceedances. The aesthetic guideline value is 15 HU. For total colour no health based guideline value is considered necessary. Ninety three samples have acceptable true colour (<15 HU). Up to 25 HU is acceptable where turbidity is low, while 15 HU is just noticeable in a glass. The slight discolouration of Winton's water supply is most likely due to the presence of metals such as Iron and Manganese. The slight discolouration of water does not directly impact upon health, however changes in the colour of water can indicate that water quality is reduced.

Figure 4.6 provides a trend for the analysis of turbidity, there were four exceedances. The aesthetic guideline value is 5 NTU. For turbidity there is insufficient data to set a guideline value based on health considerations. The consumption of turbid water may not necessarily be a health risk, but may constitute a health risk if the suspended particles harbour microorganisms capable of causing health problems. A maximum value of 38 NTU, average value of 1.21 NTU and a 95th percentile of 1NTU have been determined. Four hundred and twenty samples analysed have a water quality which is acceptable (<5 NTU) based on an aesthetic threshold.

Figure 4.12 provides a trend for the analysis of iron; there is two exceedances. A maximum value of .56mg/L, average value of 0.08mg/L and a 95th percentile value of 0.14mg/L have been determined. The aesthetic guideline value is 0.3 mg/L. For iron no health based guideline value is considered

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<sup>2</sup> As per the Australian Drinking Water Guidelines (2011)

necessary. All except for two samples analysed (<0.3mg/l) have a water quality which is acceptable based on a taste threshold.

Figure 4.13 provides a trend for the analysis of Manganese; there are two exceedances. A maximum value of .19mg/l, average value of 0.07mg/l and a 95th percentile value of 0.08mg/l have been determined. The aesthetic guideline value is 0.1 mg/l. For Manganese no health based guideline value is considered necessary. All except for two samples analysed have a water quality which is acceptable (<0.1mg/l) based on a taste threshold. Manganese can impact on water quality by imparting an undesirable taste above .1mg/L. Even at low concentrations of .002 mg/L, manganese will form a coating on pipes, which can slough off a black ooze.

Of the eight hundred and ninety-eight (898) samples analysed for E. coli there have been seven (7) occurrences where E. coli colonies were detected (Figure 4.18). Of the seven positive E.coli detections identified in the available data, six occurred between December 2010 and March 2012, with one detection occurring more recently, in September 2016. This data indicates that E. coli detections are less frequent in recent times. As identified in Figure 4.18 the data ranges from December 2010 to September 2018, with no data represented between January 2013 and July 2015. The gap in data between 2013 and 2015 is due to Council adopting new software (info eXpert) in 2015, electronic or hardcopy files between the completion of the DWQMP and the adoption of the new system could not be located.

#### **4.1.2 WATER QUALITY INCIDENT**

In April 2012 Winton experienced several water samples that tested positive to salmonella. Over several lots of samples it was determined that the problem could be isolated to the water tower (elevated reservoir). Winton Shire Council worked in conjunction with the Queensland Health Department to monitor the situation and meetings were held regularly as well as correspondence exchanged about the course of action that was to be taken.

The course of action undertaken, involved taking the water tower offline and supplying water to the town's reticulation system solely from the water pump station. A contractor was organised to clean the water tower. Cleaning of the tank involved accessing the inside of the water tower and high pressure blasting the interior walls. Following the cleaning of the inside of the tower, the tower was refilled with water, super chlorinated and then left sitting for a period of 2 days before being dumped to waste. To remove the chlorine residual the tower was filled again with water and then emptied to waste. Finally, the water tower was filled with water and then samples were taken from the water tap at the base of the tower. The samples taken, recorded no trace of salmonella and the water tower was placed back online.

#### **4.1.3 CATCHMENT CHARACTERISTICS**

Winton is located in Central Western Queensland on the Landsborough highway, 180km northwest of Longreach, 472km south-east of Mount Isa and approximately 1,353 kilometres from Brisbane City, covering 53,935 square kilometres and boasting a population of around 1,200 people. The town lies adjacent to the confluence of Jessamine Creek, Western River, Mills Creek and Mistake Creek, which are tributaries of the Diamantina River.

Winton Township is situated on gently undulating terrain typical of the rolling plains country predominant in the Shire. The local soil type is highly expansive black soil. Winton Shire is home to diverse landscapes consisting of rolling Mitchell Grass Downs which are contrasted suddenly by mesa formations comprising of starkly beautiful red earth and spinifex country. Another distinct

landform type is the Channel Country consisting of areas of braided river channels which form wide floodplains after significant rainfalls within the catchment of the Diamantina River.

#### 4.1.4 LOCAL ECONOMY

Winton is located in the prominent Central Western Queensland beef and wool producing area.

Whilst cattle and sheep grazing are the main industries, road infrastructure construction and maintenance also contributes significantly to provide a stable employment base for the area. Tourism is also a significant industry within the area having famous attractions with the area home to some of Australia's best dinosaur discoveries on display at Australian Age of Dinosaur Museum and Lark Quarry dinosaur stampede site. A Waltzing Matilda Centre is located in Winton dedicated to the song written by Banjo Patterson whilst staying in the district. Other tourist attractions include National parks, self-drive tours and opal fossicking.

#### 4.1.5 CLIMATE

The reported long-term average annual rainfall for Winton is 411.7 mm with the majority of rain falling between late December and late March with little or no rainfall at any other time. The mean maximum temperature is 32.1°C. Temperatures consistently exceed the 40°C mark during the warmer months of October through to March and unofficial temperatures of between 40°C and 45°C are regularly observed during the hottest periods in December and January. The mean daily evaporation is 7.5mm. Climate statistics at Winton Post Office are summarised in Table 4.2 below.

**Table 4.2 Summary Climate Statistics at Winton Post Office (Site Number: 037051)**

Statistic	Annual
Mean maximum temperature (Degrees C) for years 1938 to 2012	32.1
Mean minimum temperature (Degrees C) for years 1938 to 2012	16.6
Mean rainfall (mm) for years 1884 to 2012	411.7
Decile 5 (median) monthly rainfall (mm) for years 1884 to 2012	367.3
Mean number of days of rain $\geq$ 1mm for years 1884 to 2012	31.5
Mean daily evaporation (mm) for years 1977 to 2012	7.5

#### 4.1.6 POPULATION STATISTICS

The current resident population for Winton is 825 with 658 service connections. The projected population change for the fifteen-year period (2016-2031) as indicated in Table 1.2 is based on the Queensland Governments Statistics Office population projection of -0.5 per cent pa decline in population.

However, social events occurring in Winton have a significant impact on the actual town population from time to time. The major social events for Winton including patronage numbers as follows:

- "Film Festival" - 1000 to 2000 visitors
- "Outback Festival" - 2000 to 3000 visitors (every second year)
- "Way Out West Fest" - 3000 visitors

Other major social events include all major inter town sporting activities, rodeos, arts venues, camp draft events, town show and horse racing. Winton Shire offers a number of "in town" and "out of

town” tourist attractions including the “Opalton” opal mining area and the popular “Waltzing Matilda Centre” in town and Lark Quarry.

Considering the resident population of Winton, tourist numbers place a relatively significant demand on the town water supply and sewerage systems, particularly during the cooler months from March through to October when tourist numbers are highest – the grey nomad invasion; as well as at school holiday times when the Australian Age of Dinosaurs, Lark Quarry and Dinosaur trail are very popular attractions boosting the town population.

#### **4.1.7 PREDOMINANT LAND USE**

The figure in Appendix C1 shows the current WSC planning scheme zoning map. The predominant land use in the Shire is rural. The town of Winton is divided into commercial, industrial, mixed use, open space and recreational, rural residential and urban zones. The bores are located in the open space and recreational zone. Cattle and sheep grazing are predominant rural land use in Winton Shire.

Current mining activity is limited to extraction of gypsum (Figure C.2 in Appendix C refers) south-west of Winton, and small-scale opal mining over a broad arc extending from northwest of Winton to south of Blackall. The Bladensburg key resource area and Windermere areas contain significant gravel and binding soil resources respectively, which are necessary for district road construction and maintenance. The region has significant potential for hot rock geothermal energy associated with high heat-producing granites beneath the sedimentary basins. Seven geothermal exploration permits have been lodged over a 4200 square kilometre area south-west of Winton. The Figure in Appendix C.3 shows current mining leases and permits and shows current exploratory permits. It is not expected that mining activities will have a significant effect on the bore water supply.

#### **4.1.8 GREAT ARTESIAN BASIN BORES**

Currently there are four artesian bores in Winton, the oldest being Town Bore No. 1, which is over 100 years old. The four bores are located to the east of Manifold Street. Bores 1, 2 and 3 are maintained for back up. Bore No. 4 is 1336 m deep and has a free flow yield of 42.5 L/s. Appendix B shows the bore locations and water reticulation layout on an aerial photo of the town.

The Great Artesian Basin (GAB) covers approximately one-fifth of the Australian continent and contains  $8.7 \times 10^6$  GL of groundwater in the Jurassic sandstone aquifers. It comprises the Eromanga, Surat and Carpentaria sedimentary basins and parts of the Bowen and Galilee Basins. The GAB 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.

The Eromanga basin consists of a conformable, almost horizontal bedded sequence of Early Jurassic to Late Cretaceous sedimentary rocks. The sequence comprises continental quartz-rich sandstone, siltstone and mudstone units formed within a shallow marine setting during the Early Cretaceous. These rocks conformably overlie sandstone-dominated formations deposited in lacustrine and fluvial environments of the Late Cretaceous (Habermehl, 1980).

The most significant groundwater systems in the GAB occur in the Late Jurassic to Early Cretaceous aquifer sequence, collectively termed the Cadna-owie–Hooray Aquifer. The Cadna-owie–Hooray Aquifer extends across the entire GAB, although its thickness and hydraulic properties may vary.



This important groundwater-bearing unit is a composite of several aquifers that hydraulically interconnect over basement highs, and merge in the western Eromanga Basin (Radke et al., 2000).

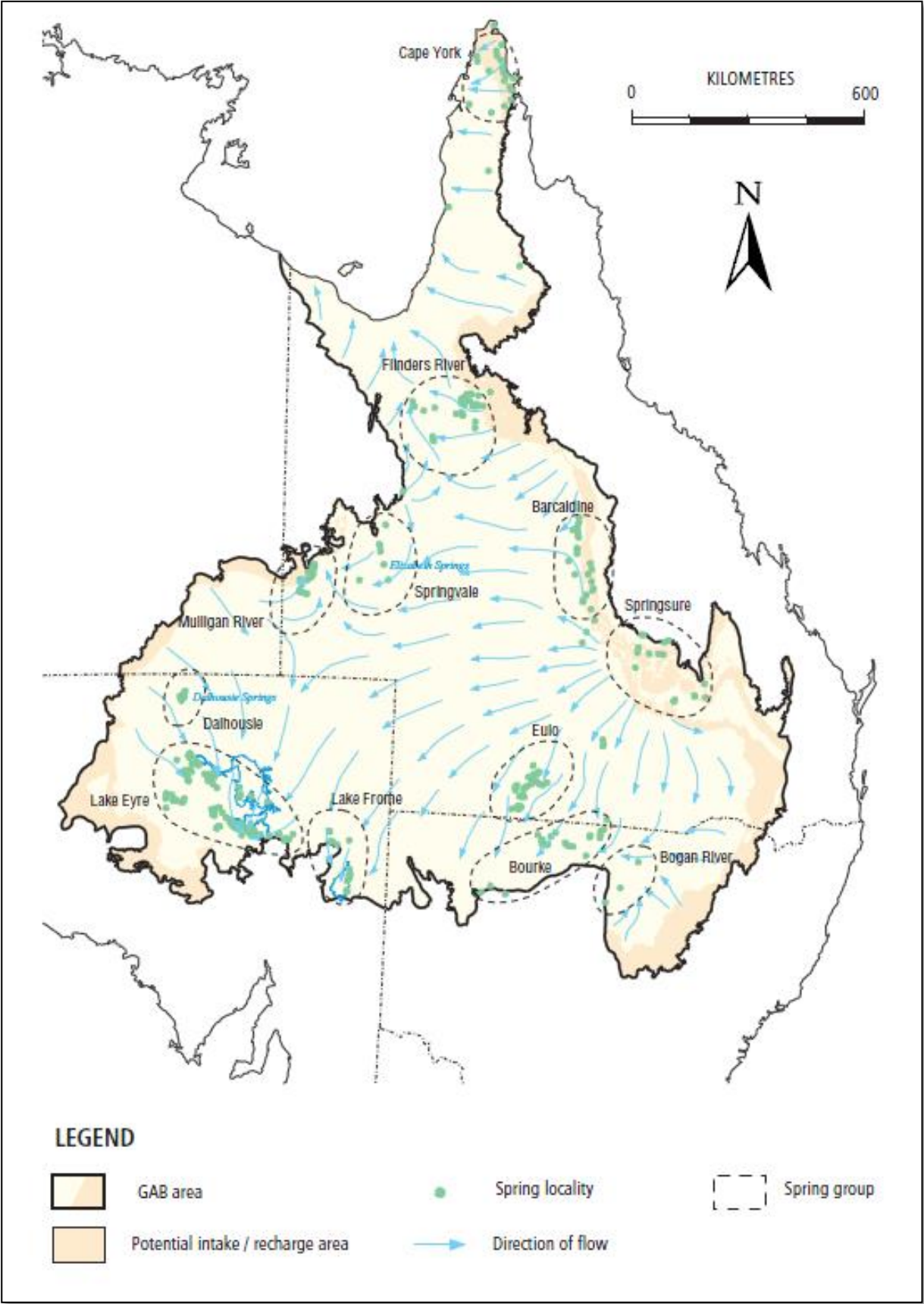


Figure 4.19 GAB Recharge, Discharge and Flow

Specific to Winton, the geology of the area is part of the sedimentary Great Artesian Basin. The formations consist of thick bands of Cretaceous age sediments overlying Jurassic age formations. The formations are listed in the table below. While the Cretaceous formations do supply low yields of water, the supply and quality is generally unsuitable for domestic water supply.

The Jurassic age formations in the area appear to be relatively horizontal and thinly bedded. The primary formations, the Hooray and the Hutton formation appear to be less than 60 m thick.

**Table 4.3 Geological Formations**

<b>Formation Name</b>	<b>Age</b>
Winton Formation	Cretaceous
Mackunda Formation	Cretaceous
Allaru Mudstone	Cretaceous
Toolebuc Formation	Cretaceous
Wallumbilla Formation	Cretaceous
Cadna-owie Formation	Cretaceous
Wyandra Sandstone	Cretaceous
Hooray Sandstone	Jurassic
Westbourne Equivalent	Jurassic
Injune Creek Group	Jurassic
Westbourne Formation	Jurassic
Westbourne Shale	Jurassic
Adori Sandstone	Jurassic
Birkhead Formation	Jurassic
Hutton Sandstone	Jurassic
Basement	

#### **4.1.9 SEWERAGE SYSTEM**

The Winton sewerage system was commissioned in 1960. The reticulation system comprises a vitreous clay pipe reticulation system and two sewage pump stations. Considerable efforts have placed on the upgrade of the sewage reticulation lines in recent years, with all mains relined or replaced since 2008. The vast majority of the upgrades have been achieved through relining, whereby all accept one line which required replacement has been relined. Pump station No. 2 collects and pumps sewage to pump station No. 1 (via the gravity sewer mains, not a dedicated rising main) from where it is pumped to the sewage treatment works on the western side of town. The treatment plant comprises an Imhoff tank, four effluent holding lagoons, sludge drying beds and an artificial wetland.

## **4.2 Hazard Identification**

The hazards and hazardous events and their sources that adversely affect water quality are documented in Table 4.4 below and include those affecting:

- Catchment
- Sourcing infrastructure
- Heat exchangers
- Distribution system
- System wide

### **4.2.1 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 the 3 May 2013.

- Section 3.1 Water Supply Scheme
- Section 4.1.1 Water Quality Information
- Section 4.1.3 Catchment Characteristics

**Table 4.4 Hazard Identification, Risk Assessment and Uncertainty**

Scheme Component / Sub-component	Hazardous Event	Hazard	Maximum Risk[2]			Existing Preventive Measures / Barriers.	Residual risk			Uncertainty	Comments/ Proposed Further Risk Reduction Actions
			Consequence	Likelihood	Risk level		Consequence	Likelihood	Risk level		
Bore	Hazard that arises from the natural geological processes in the aquifer.	Iron	Minor	Unlikely	Low (4)	Operational and Verification Monitoring	Minor	Rare	Low (2)	Estimate	Acceptable risk, continue to monitor for exceedances
		Manganese	Minor	Unlikely	Low (4)	Operational and Verification Monitoring	Minor	Rare	Low (2)	Estimate	
		Turbidity	Minor	Unlikely	Low (4)	Operational and Verification Monitoring	Minor	Rare	Low (2)	Estimate	
Sourcing Infrastructure	Power Outage	Disruption to supply	Moderate	Unlikely	Medium (6)	Elevated reservoir (limited backup). Backup generator at pump station	Moderate	Rare	Low (3)	Confident	Acceptable Risk
	Flood Event	Loss of infrastructure	Catastrophic	Rare	Medium (6)	Critical Infrastructure constructed above flood event	Moderate	Rare	Low (3)	Uncertain	
	Maintenance and repair of water main	Bacteria	Moderate	Possible	Medium (9)	Continual upgrade of pipes that have outlasted their expected useful lives	Moderate	Rare	Low (3)	Uncertain	<b>W1.</b> Operational and Maintenance procedures. Develop maintenance and repair procedure  <b>W8.</b> Microbial Risk Mitigation Project.
	Accidental or intentional contamination	Harmful substances (not identified)	Catastrophic	Rare	Medium (6)	Fencing and locked gates Restricted Access to bore sites	Catastrophic	Rare	Medium (6)	Uncertain	
Cooling/Hot Water	Cooling system fails	Potential scolding	Catastrophic	Rare	Medium (6)	Monitoring Automated Alarms	Moderate	Rare	Low (3)	Uncertain	Acceptable Risk
Treatment Plant	Reticulated Water Untreated										
Disinfection Process	Reticulated Water Not Disinfected										

Scheme Component / Sub-component	Hazardous Event	Hazard	Maximum Risk[2]			Existing Preventive Measures / Barriers.	Residual risk			Uncertainty	Comments/ Proposed Further Risk Reduction Actions
			Consequence	Likelihood	Risk level		Consequence	Likelihood	Risk level		
Elevated reservoir	Contamination due to vermin such as birds, lizards, frogs and insects	Bacteria	Major	Likely	High (16)	Roofed reservoir. Vermin mesh on overflow pipe and vents. Gattic raised manhole with locked hatch. Cleaning of Elevated Reservoir once every 5 years Bacteriological testing	Major	Rare	Medium (5)	Uncertain	<p><b>W1.</b> Operational and Maintenance procedures. Develop elevated reservoir inspection procedure.</p> <p><b>W1.</b> Develop procedures for isolation</p> <p><b>W3.</b> Cleaning of Elevated Reservoir every 5 years</p> <p><b>W4.</b> Improve sampling and testing process, implementation of fortnightly in-house E.coli and Coliform testing.</p> <p><b>W8.</b> Microbial Risk Mitigation Project.</p>
Geothermal Power Plant	Redirection of town water supply through the geothermal power plant evaporator, before returning to the town water supply	Bacteria	Insignificant	Unlikely	Low (2)	Evaporator constructed of stainless steel. Evaporator is completely sealed. The water is not altered in any way apart from cooling	Major	Rare	Low (2)	Confident	<b>Acceptable Risk</b>
	Disruption to the town water supply	Maintenance/repairs & other down time of geothermal power plant	Insignificant	Unlikely	Low (2)	Bypass valve installed allowing water from Bore No. 4 to continue directly to the town water supply	Insignificant	Unlikely	Low (2)	Confident	<b>Acceptable Risk</b>
Distribution system	Reticulation, maintenance and repair	Bacteria	Major	Possible	High (12)	Upgrade of old degraded lines Qualified plumbers Work hygiene practices	Moderate	Unlikely	Medium (6)	Uncertain	<p><b>W1.</b> Operational and Maintenance procedures. Develop reticulation maintenance and repair procedure.</p> <p><b>W4.</b> Improve sampling and testing process, implementation of fortnightly in-house E.coli and Coliform testing.</p> <p><b>W8.</b> Microbial Risk Mitigation Project.</p>

Scheme Component / Sub-component	Hazardous Event	Hazard	Maximum Risk[2]			Existing Preventive Measures / Barriers.	Residual risk			Uncertainty	Comments/ Proposed Further Risk Reduction Actions
			Consequence	Likelihood	Risk level		Consequence	Likelihood	Risk level		
	Colonisation with opportunistic pathogens suited to warm water environment	Bacteria and protozoa (notably Naegleria and Legionella)	Major	Possible	High (12)	Asset replacement program Vermin proofing Regular flushing Disinfection and monitoring of health facilities by QLD Health	Major	Unlikely	Medium (8)	Estimate	<b>W1.</b> Operational and Maintenance procedures.  <b>W4.</b> Improve sampling and testing process, implementation of fortnightly in-house E.coli and Coliform testing.  <b>W8.</b> Microbial Risk Mitigation Project.
	Stagnant water	Bacteria	Major	Possible	High (12)	Identification of dead ends with higher risk Fortnightly flushing program	Moderate	Rare	Low (3)	Confident	<b>W1.</b> Operational and Maintenance procedures. Develop mains flushing procedure  <b>W8.</b> Microbial Risk Mitigation Project.
	Backflow	Bacteria	Major	Unlikely	Medium (8)	Installation of new metres with non-return valves Regular bacteriological tests	Major	Rare	Medium (5)	Estimate	<b>W5.</b> Renewal of water meters, models with non-return valves.  <b>W.</b> Microbial Risk Mitigation Project.
Whole of System	Flights carrying samples to lab delayed/cancelled	Logistical	Insignificant	Possible	Low (3)	Nil	Insignificant	Possible	Low (3)	Confident	Acceptable Risk
	No central water quality data file for trends analysis	Bacteria/ Chemical	Catastrophic	Possible	High (15)	Queensland Health lab analysis and notifications Analysis of lab reports	Catastrophic	Rare	Medium (6)	Confident	<b>W6.</b> Implementation of central water quality data system to allow for trends analysis.  <b>W8.</b> Microbial Risk Mitigation Project.
	Poor record keeping of complaints and subsequent actions	Bacteria	Major	Unlikely	Medium (8)	Diary entries Online complaints portal	Major	Rare	Medium (5)	Estimate	<b>W7.</b> Improve record keeping for maintenance records  <b>W8.</b> Microbial Risk Mitigation Project.
	Poor record keeping Maintenance	Bacteria	Major	Unlikely	Medium (8)	Diary entries Monthly reports	Major	Rare	Medium (5)	Estimate	
	Disruption to the town water supply due to cyber security threats	Cyber Aggressors - potential external cyber security threats and breaches	Moderate	Possible	Medium (9)	Ability to easily operate the system manually Non-wireless system	Moderate	Possible	Medium (9)	Confident	<b>W9.</b> Install a new Control System, Telemetry and SCADA System for town water – secure system management by WSC firewalls (palo alto)

#### 4.2.2 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 4.5 Hazard Identification and Risk Assessment Team**

<b>Typical job title for key personnel</b>	<b>What role did each person play on the team?</b>	<b>What expertise and system knowledge did the person bring?</b>
Director of Works / Engineer	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
Special Projects Officer	Author, Risk Assessment, Risk Assessment Workshop	Detailed knowledge of the system, water risk assessment
Water / Water & Sewerage Manager	Risk Assessment Workshop	Detailed knowledge of individual schemes, risk assessment
Works Administration / Technical Officer	Data management and systems processes	Knowledge of DWSP information Management Systems

## 5 ASSESSMENT OF RISKS

The plan details the risk assessment methodology used for the scheme in Section 5.1 below. Section 5.2 explains how the risks were assessed. Section 5.3 tabulates the relevant stakeholders in the risk assessment process.

### 5.1 Methodology

The methodology adopted for the risk assessment is described below. The methodology is based on the methodology exemplified in the document “Preparing a Drinking Water Quality Management Plan Guideline Supporting Information” (September 2010).

Table 5.1 below shows the qualitative measures of likelihood that were adopted in the risk assessment.

**Table 5.1 Measures of Likelihood Utilised in the Risk Assessment**

<b>Likelihood</b>	<b>Descriptors</b>
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 5.2 below shows the qualitative measures of consequence that were adopted in the risk assessment.

**Table 5.2 Measures of Consequences Utilised in the Risk Assessment**

<b>Consequence</b>	<b>Descriptors</b>
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 5.3 below shows the degrees of uncertainty adopted for the risk assessment. The degree of uncertainty for the scheme varies from confident to reliable for the Water Supply Scheme.

Table 5.4 below shows the risk analysis matrix utilised, detailing the various levels of risk that were adopted in the risk assessment.



**Table 5.3 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.
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 5.4 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 5.5 Defined Acceptable Risk Levels**

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

Table 5.5 details the acceptable risk levels for the water supply schemes.

## **5.2 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.

### **5.2.1 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 6.4 below.

### **5.2.2 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.

### **5.2.3 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.

## 5.3 Key Stakeholders

**Table 5.6 Stakeholders – Risk Assessment**

Stakeholder	Contact Name and Details	Rationale for engagement and how engagement occurred
Winton Shire Council	Geoff Hatwell Acting Director of Works P: (07) 4657 2666 E: <a href="mailto:dow@winton.qld.gov.au">dow@winton.qld.gov.au</a>	Responsible for directing Engineering Services for Winton Shire Council Site Visits & Risk Assessment Workshop Management of DWQMP Preparation
Winton Shire Council	Merv Sale, Water & Sewerage Manager P: 0427 570 110 E: <a href="mailto:mervs@winton.qld.gov.au">mervs@winton.qld.gov.au</a>	Site Visits & Risk Assessment Workshop
Winton Shire Council	Lynda Alcorn, Special Projects Officer P: 0457 148 593 E: <a href="mailto:lyndaa@winton.qld.gov.au">lyndaa@winton.qld.gov.au</a>	Author, Site Visits, Risk Assessment Workshop & Review of the DWQMP
Winton Shire Council	Tiffany Neilson, Works Administration P: (07) 4657 2666 E: <a href="mailto:tiffanyn@winton.qld.gov.au">tiffanyn@winton.qld.gov.au</a>	Risk Assessment Workshop

## **6 MANAGING RISKS**

Managing risks are discussed in the following sections below:

- 6.1 Risk Management Measures
- 6.2 Operation and Maintenance Procedures
- 6.3 Management of Incidents and Emergencies
- 6.4 Risk Management Improvement Program
- 6.5 Information Management
- 6.6 Community Awareness

### **6.1 Risk Management Measures**

Table 6.1 provides details of the existing and proposed preventative measures for Winton. Proposed measures are included in the Risk Management Improvement Program (RMIP) in Table 6.4.

Table 6.1 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?	Is the level of residual risk acceptable	Proposed measures to reach an acceptable level or residual risk	Responsible Organisations
Distribution System/Reservoir	Bacteria	Contamination of reservoir due to vermin such as birds, lizards and frogs	Roofed reservoir. Vermin mesh on overflow pipe and vents. Gattic raised manhole with locked hatch.	Likelihood Consequence	Effective however residual risk resides.	Yes – Medium Risk	<b>W1.</b> Operational and Maintenance procedures. Develop procedures for isolation <b>W3.</b> Cleaning of Elevated Reservoir every 5 years <b>W4.</b> Improve sampling and testing process, implementation of fortnightly in-house E.coli and Coliform testing. <b>W8</b> Microbial Risk Mitigation Project.	Winton Shire Council
	Bacteria	Reticulation, maintenance and repair	Upgrade of old degraded lines  Qualified plumbers	Likelihood	Effective	Yes – Low Risk	<b>W1.</b> Operational and Maintenance procedures. Develop reticulation maintenance and repair procedure. <b>W4.</b> Improve sampling and testing process, implementation of fortnightly in-house E.coli and Coliform testing. <b>W8</b> Microbial Risk Mitigation Project.	Winton Shire Council
	Bacteria and protozoa (notably Neagleria and Legionella)	Colonisation with opportunistic pathogens suited to warm water environment	Asset replacement program Vermin proofing Regular flushing Disinfection and monitoring of health facilities by QLD Health	Likelihood	Effective however residual risk resides.	Yes – Medium Risk	<b>W1.</b> Operational and Maintenance procedures. <b>W4.</b> Improve sampling and testing process, implementation of fortnightly in-house E.coli and Coliform testing. <b>W8.</b> Microbial Risk Mitigation Project.	Winton Shire Council
	Bacteria	Stagnation of water	Identification of dead ends with higher risk Fortnightly flushing program	Likelihood Consequence	Effective	Yes – Low Risk	<b>W1.</b> Operational and Maintenance procedures. Develop mains flushing procedure	Winton Shire Council
	Bacteria	Backflow	Installation of new metres with non-return valves Regular bacteriological tests	Likelihood	Residual risk resides.	Yes – Medium Risk	<b>W5.</b> Renewal of water meters, models with non-return valves. <b>W8</b> Microbial Risk Mitigation Project.	Winton Shire Council

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?	Is the level of residual risk acceptable	Proposed measures to reach an acceptable level or residual risk	Responsible Organisations
	Bacteria	Maintenance and repair of water main	None	N/A	N/A	Yes – Low Risk	<b>W1.</b> Operational and Maintenance procedures. Develop maintenance and repair procedure <b>W8</b> Microbial Risk Mitigation Project	Winton Shire Council
	Loss of infrastructure	Flood event	Critical infrastructure constructed above flood level	Consequence	Effective	Yes – Low Risk	Acceptable Risk	Winton Shire Council
Whole of System	Bacteria/ Chemical	No central water quality data file for trends analysis	Queensland Health lab analysis and notifications Analysis of lab reports	Likelihood Consequence	Effective however residual risk resides.	Yes – Medium Risk	<b>W6.</b> Implementation of central water quality data system to allow for trends analysis. <b>W8</b> Microbial Risk Mitigation Project	Winton Shire Council
	Bacteria	Poor record keeping of complaints and subsequent actions	Diary entries Complaints management system. Accurate data on the number of complaints and the reasons for these complaints are compiled in a formal register.	Likelihood	Effective however residual risk resides	Yes – Medium Risk	<b>W7.</b> Improve record keeping for maintenance records. <b>W8</b> Microbial Risk Mitigation Project	Winton Shire Council
	Bacteria	Poor record keeping of Maintenance activities	Diary Entries Monthly Reports	Likelihood	Effective however residual risk resides	Yes – Medium Risk	<b>W7.</b> Improve record keeping for maintenance records <b>W8</b> Microbial Risk Mitigation Project	Winton Shire Council
	Cyber Aggressors - potential external cyber security threats and breaches	Disruption to the town water supply due to cyber security breaches	Ability to easily operate the system manually Non-wireless system	Likelihood Consequence	Effective however residual risk resides	Yes – Medium Risk	<b>W9.</b> Install a new Control System, Telemetry and SCADA System for town water – secure system management by WSC firewalls (palo alto)	Winton Shire Council

## 6.2 Operation and Maintenance Procedures

During the risk assessment, it was identified that a large number of procedures are non-existent. As part of the Risk Management, Improvement Program new procedures will need to be developed.

New procedures will be given a procedure number, title, revision date and the process for implementing the procedure.

## 6.3 Management of Incidents and Emergencies

Table 6.2 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). Winton Shire Council has developed a Local Disaster Management Plan (current version dated August 2016). Level 5 incidents and emergencies should be handled under the Winton Shire Council Local Disaster Management Plan and are likely to be the result or cause of other emergencies that are covered under the plan.

Table 6.3 shows how incidents and emergencies are managed relevant to drinking water quality. Contact details for incident and emergency management are included in Winton Shire Councils Local Disaster Management Plan.

**Table 6.2 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 Australian Drinking Water Guidelines (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)
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)
	Cyber security threat or breach of the computerised system compromising the ability to supply water – short term water restrictions may be required
Level 2	Failure of infrastructure or source supply (water quality or supply unlikely to be compromised)
	Exceedances of ADWG aesthetic guideline (customer complaints possible)
Level 1	Exceedances of operational limit managed through operational and maintenance procedures

**Table 6.3 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 Winton Shire Council Local Disaster Management Plan		
	Report to the OWSR by phone and written incident report		
4	High level of E. coli (> 5 CFU/ 100 mL) or any pathogens detected in reticulation	1. Alert Director of Works and Chief Executive Officer	1. Technical / Water & Sewerage Manager
		2. Determine potentially affected area, isolate if possible. Issue Boil Water alert. Escalate emergency further if situation worsens.	2. Director of Works / CEO
		3. Report detection to OWSR by phone (Immediately by phone, written incident report – Part 1 incident form - within 24 hours)	3. Director of Works
		4. Resample for E. coli in potentially affected infrastructure	4. Technical / Water & Sewerage Manager
		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. Director of Works
		8. Non-compliance will be raised and will require signing off by the Director of Works and the Chief Executive Officer after corrective actions have taken place.	8. Director of Works / Chief Executive Officer
4	Failure of infrastructure (severe or emergency level supply restrictions required to ensure continuity of supply)	1. Alert Director of Works and Chief Executive Officer	1. Technical / Water & Sewerage Manager
		2. Determine reason for failure, isolate if possible. Consider options to recommence supply.	2. Director of Works
		3. Report to OWSR by phone (Immediately by phone, written incident report – Part 1 incident form - within 24 hours)	3. Director of Works
		4. Undertake comprehensive failure investigation	4. Director of Works
		5. Undertake necessary corrective actions to recommence supply and provide an estimate of when the supply can be recommenced	5. As appropriate
		6. Implement severe or emergency level supply restrictions. Consider escalating to a Level 1 incident. Notify the public.	6. Director of Works / Chief Executive Officer
		7. Upon resolution, provide written report to regulator (Part 2 incident form). Provide written report to the Chief Executive Officer	7. Director of Works
		8. Non-compliance will be raised and will require signing off by the Director of Works and the Chief Executive Officer after corrective actions have taken place.	8. Director of Works / 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 Director of Works and Chief Executive Officer	1. Technical / Water & Sewerage Manager
		2. Determine potentially affected area, isolate if possible. Consider Boil Water alert. Escalate emergency further if situation worsens.	2. Director of Works
		3. Report detection to OWSR by phone (Immediately by phone, written incident report – Part 1 incident form - within 24 hours)	3. Director of Works
		4. Resample for E. coli in potentially affected infrastructure	4. Technical / Water & Sewerage Manager
		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. Director of Works
		8. Non-compliance will be raised and will require signing off by the Director of Works and the Chief Executive Officer after corrective actions have taken place.	8. Director of Works / Chief Executive Officer
3	Failure of infrastructure (ability to supply water compromised – short term water restrictions may be required)	1. Alert Director of Works and Chief Executive Officer	1. Technical / Water & Sewerage Manager
2	Failure of infrastructure or source supply (water quality or supply unlikely to be compromised)	2. Determine reason for failure, isolate if possible. Consider options to recommence supply.	2. Director of Works
		3. Undertake comprehensive failure investigation	3. Director of Works
		4. Undertake necessary corrective actions to recommence supply and provide an estimate of when the supply can be recommenced	4. As appropriate
		5. Implement Short Term Water restrictions if required	5. Director of Works
		6. Provide written report to the Chief Executive Officer	6. Director of Works
		7. Non-compliance to be raised and will require signing off by the Director of Works and the Chief Executive Officer after corrective actions have taken place.	7. Director of Works / Chief Executive Officer
2	Minor exceedances of ADWG health guideline value for chemical parameter (determined value is close to guideline value).	1. Alert Director of Works	1. Technical / Water & Sewerage Manager
		2. Determine potentially affected area, isolate if possible (i.e. individual bore). Consider Water alert. Escalate emergency further if situation worsens.	2. Director of Works
		3. Report detection to OWSR by phone (Immediately by phone, written incident report – Part 1 incident form - within 24 hours)	3. Director of Works
		4. Resample for detected health parameter for all bores and combined bores (if possible)	4. Technical / Water & Sewerage Manager
		5. Undertake comprehensive contamination investigation	5. Director of Works

Level	Incident or emergency	Summary of actions to be taken (with documented procedure listed)	Position/s responsible for Action/s
		6. Undertake necessary corrective actions	6. Director of Works
		7. Upon resolution, provide written report to regulator (Part 2 incident form). Provide Report to Chief Executive Officer also.	7. Director of Works
		8. Non-compliance will be raised and will require signing off by the Director of Works and the Chief Executive Officer after corrective actions have taken place.	8. Director of Works / Chief Executive Officer
1	Exceedances of operational limit managed through operational and maintenance procedures	1. Alert Director of Works and Chief Executive Officer	1. Technical / Water & Sewerage Manager
		2. Review operational procedures.	2. Director of Works
		3. Rectify exceedance and bring parameter within operational limits. Parameter shall be corrected same day.	3. Technical / Water & Sewerage Manager
		4. Non-compliance to be raised and will require signing off by the Director of Works and the Chief Executive Officer after corrective actions have taken place.	4. Director of Works / Chief Executive Officer
3	Cyber security threat or breach of the computerised system compromising the ability to supply water – short term water restrictions may be required	1. Alert Director of Works and Chief Executive Officer	1. Technical Water & Sewerage Manager
		2. Implement Short Term Water restrictions if required	2. Director of Works
		3. Undertake a comprehensive investigation and in the event that the water quality has been compromised, report detection to OWSR by phone (Immediately by phone, written incident report – Part 1 incident form - within 24 hours)	3. Director of Works / Chief Executive Officer
		4. Undertake necessary corrective actions	4. Director of Works & Technical / Water & Sewerage Manager
		5. Revert to manual operation of the water reticulation system – if required	5. Technical / Water & Sewerage Manager
		6. Upon resolution, provide a written report to the regulator (Part 2 incident form). Provide Report to Chief Executive Officer also.	6. Director of Works
		7. Non-compliance will be raised and will require signing off by the Director of Works and the Chief Executive Officer after corrective actions have taken place.	7. Director of Works / Chief Executive Officer

## **6.4 Risk Management Improvement Program**

Unacceptable residual risks or risks identified in the plan have been included in the Risk Management Improvement Program (RMIP).

The RMIP also includes 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.

Table 6.4 below outlines the proposed RMIP to be implemented for Winton.

Winton source their water from an artesian bore, which does not require treatment before reticulation.

**Table 6.4 Risk Management Improvement Program**

Code	Improvement	Scheme Component / Sub-component	Hazard/ Hazardous event	Priority	Interim Action	Short-term Action	Long-term Action	Target date/s	Responsibility
<b>W1</b>	Draft new Operational and Maintenance Procedures: <ul style="list-style-type: none"> <li>Develop procedures for isolation</li> <li>Develop Reticulation Maintenance and repair procedure</li> <li>Develop Mains flushing procedure</li> <li>Develop water Sampling and testing procedure</li> <li>Standard response procedures for E.coli detections</li> <li>Elevated reservoir inspections procedures</li> </ul>	<ul style="list-style-type: none"> <li>Bores</li> <li>Distribution System</li> <li>Sourcing Infrastructure</li> </ul>	<ul style="list-style-type: none"> <li>Hazards that arise from the natural geological processes in the aquifer</li> <li>Accidental or intentional contamination</li> <li>Reticulation maintenance and repair</li> </ul>	High (based on large number of non-existent procedures)	N/A	Identify new procedures needed, develop and obtain approval and implement	N/A	Short term: In progress. Extension of time required. December 2020	Director of Works
<b>W2</b>	Provide restricted access to bores sites	<ul style="list-style-type: none"> <li>Sourcing infrastructure</li> </ul>	<ul style="list-style-type: none"> <li>Accidental or intentional contamination</li> </ul>	Low (Risk)	N/A	N/A	Provide restricted access to the bore 4 site by providing fencing and gates.	Completed	Director of Works
<b>W3</b>	Cleaning of Elevated Reservoir every 5 years	<ul style="list-style-type: none"> <li>Elevated Reservoir</li> </ul>	<ul style="list-style-type: none"> <li>Contamination due to vermin such as birds, lizards, frogs and insects.</li> </ul>	High (based on potential health risks)	N/A	Improve sampling and testing process, implementation of fortnightly in-house E.coli and Coliform testing.	Cleaning of Elevated Reservoir every 5 years	Short term: In progress. Extension of time required. June 2020 Long term: October 2022	Director of Works
<b>W4</b>	Improve sampling and testing process	<ul style="list-style-type: none"> <li>Distribution system</li> </ul>	<ul style="list-style-type: none"> <li>Contamination due to vermin such as birds, lizards, frogs and insects.</li> </ul>	High (based on potential health risks)	Continue with monitoring program currently in place. Maintain visual inspection of raw water sources and reticulation systems.	Implementation of fortnightly in-house E.coli and Coliform testing	N/A	Short term: June 2020  Equipment has been purchased Some testing training has been undertaken. Further training is required.	Director of Works

Code	Improvement	Scheme Component / Sub-component	Hazard/ Hazardous event	Priority	Interim Action	Short-term Action	Long-term Action	Target date/s	Responsibility
W5	Renewal of water meters with non-return valves.	<ul style="list-style-type: none"> <li>Distribution System</li> </ul>	<ul style="list-style-type: none"> <li>Backflow</li> </ul>	Medium	N/A	Develop asset replacement program targeting low use properties	Replace all water meters without non-return valves	Short term: Completed Long term: October 2025 Note: 40% completed	Director of Works
W6	Implementation of central water quality data system	<ul style="list-style-type: none"> <li>Whole of System</li> </ul>	<ul style="list-style-type: none"> <li>No central water quality data file for trends analysis</li> </ul>	High	N/A	Implementation of central water quality data system	Investigate the SWIM data management system for DWSP purposes	Short Term: In progress. Extension of time required. June 2020 Currently in the design phase Long Term: August 2019	Director of Works
W7	Improve record keeping for maintenance records and complaints.	<ul style="list-style-type: none"> <li>Whole of System</li> </ul>	<ul style="list-style-type: none"> <li>Poor record keeping</li> </ul>	High	N/A	Implement and maintain maintenance and complaints register for supply scheme	N/A	Short Term: Completed	Director of Works
W8	Microbial Risk Mitigation Project	<ul style="list-style-type: none"> <li>Whole of System</li> </ul>	<ul style="list-style-type: none"> <li>Contamination/Ingress of microorganisms</li> </ul>	High	Endorsement of project plan	Detailed Microbial Risk Assessment of Winton water supply by external specialist.	Design construct and Commission additional treatment barriers	Short Term: In progress. Extension of time required. December 2020 Long Term: December 2021	Director of Works
W9	Install a new Control System, Telemetry and SCADA System for town water	<ul style="list-style-type: none"> <li>Whole of System</li> </ul>	<ul style="list-style-type: none"> <li>Disruption to the town water supply due to cyber security threats</li> </ul>	Medium	N/A	N/A	Install a new Control System, Telemetry and SCADA System for town water – secure system management by WSC firewalls (palo alto)	Long Term: May 2021	Director of Works

## **6.5 Information Management**

The management of information associated with drinking water quality has been identified in the RMIP as an improvement item relating to drinking water quality. Improvements in the management of information are in progress and will be actioned in accordance with dates identified in the RMIP.

Improvements are proposed relating to water quality data management, and maintenance records. Table 6.5 below details the information management systems that the DWSP plans to adopt in order to provide a more rigorous information management system relating to drinking water quality.

## **6.6 Community Awareness**

An important requirement of providing a water supply with no residual disinfection added is to ensure that the users of the water are aware of what this means for them – particularly in terms of health and safety risk to the consumer after they have taken delivery of the product.

This awareness will be provided in the following ways:

1. Council to adopt the Drinking Water Quality Management Plan – this ensures that the Elected body are aware of the management plan on behalf of the community.
2. Council to advertise that the Drinking Water Quality Management Plan has been updated – this advertising to be through Winton Herald and Council's Facebook page.
3. Council to provide, through its website ([www.winton.qld.gov.au](http://www.winton.qld.gov.au)), access to electronic version of the Drinking Water Quality Management Plan.
4. Council to make available on request, a hardcopy of the Drinking Water Quality Management Plan at any publicly accessible customer service counters.

**Table 6.5 Summary of Water Quality Management Information Systems**

Information/ Document	Format (hardcopy / electronic)	Where stored (on electronic system / other)	Position Responsible	Information Management Process Description
Operational Monitoring Data	Electronic	info expert	Director of Works Council Water and Sewerage Manager Administration Officer	The Water and Sewerage Manager on a weekly basis completes operational monitoring data. Daily record sheets are filled out by operational staff and stored in Councils electronic filing system. Monthly reports are provided to the Director of Works detailing any maintenance issues identified in the system.
Water quality data	Electronic	Info expert	Director of Works Administration Officer	Water quality data is either received from an external laboratory or in-house lab testing. Water quality results received are logged by administration officers into a central data point where trends analysis is undertaken by engineering staff and exceedances of acceptable limits are detected immediately.
Complaints	Electronic	Info expert	Administration Officer Water and Sewerage Manager Councillors	Complaints are received by council through a number of methods, including verbally by phone or in person to Councillors, the Water and Sewerage Managers, the front office or through council's online complaints portal. Staff are required to relate all feedback to the WSC Administration staff.  The DWSP has formalised a complaints management system. Accurate data on the number of complaints and the reasons for these complaints are compiled in a formal register.
Maintenance	Electronic	info Expert	Administration Officer Water and Sewerage Manager Director of Works	A Monthly maintenance report is provided to the Administration Officer and the Director of Works. Information from this report is collated by the Administration Officer and recorded into Councils Maintenance Register.
DWQMP Document Register	Electronic	Info Expert	Administration Officer Director of Works	A Register of All DWQMP related documents is to be compiled stating the Document Title, the Revision Date and the version number. This register is to be filed in the same location as the registered documents and kept up to date as amendments to documents are undertaken.
Operational Procedures	Hard copy / Electronic	WTP / Operators vehicle / Operators office/ Info Expert	Director of Works Water and Sewerage Manager Administration Officer	Operational procedures are to be filed electronically in a specified location. Procedures are to be listed on the document register. Amended documents are to replace outdated documents with amendments detailed in the register.

## **7 OPERATIONAL AND VERIFICATION MONITORING PROGRAMS**

Details of the operational monitoring programs are tabulated below for Winton in Table 7.1. Details of the verification monitoring programs for Winton are tabulated in Table 7.3.

### **7.1 Operational Monitoring**

Operational monitoring conducted for Winton water supply scheme is tabulated in Table 7.1 below, detailing monitoring locations, parameters measured, target and critical levels and actions to be taken in the event the levels are exceeded.

The persons responsible for operational monitoring include the Chief Executive Officer, Director of Works and the Water & Sewerage Manager (Winton area). The Water & Sewerage Manager is responsible for conducting operational monitoring. The Water & Sewerage Manager manages day to day operations of the schemes in Winton.

Any exceedances of target limits shall be reported to the Director of Works. The non-compliance shall be dealt with during the same working day and brought below the target limit level. Non-compliance will be raised and will require signing off by the Director of Works after corrective actions are taken. Corrective actions will generally be determined by the non-compliance.

Any exceedances of critical limits shall be reported to the Director of Works. The non-compliance shall be dealt with during the same working day and brought below the critical and action limits. Non-compliance will be raised and will require signing off by the Director of Works and the Chief Executive Officer after corrective actions have taken place. Corrective actions will generally be determined by the non-compliance. A determination shall be made as to the cause of the exceedance and logged, and the Director of Works shall review current procedures to determine if they are applicable.

The Water & Sewerage Manager will be required to log all maintenance issues in an operations log and a copy of this shall be sent fortnightly to the Director of Works. While the Water & Sewerage Manager 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.



Table 7.1 Operational Monitoring

Site	Location	Monitoring Frequency	Parameter	Target value	Positions Responsible
Raw Water	• Bore 4	Weekly	Bore Pressure	50 - 55 kPa	<div>Overall Responsibility</div> <div>Director of Works</div> <div>Implementation review and Actions:</div> <div>Water and Sewerage Manager</div> <div>Operations:</div> <div>Water and Sewerage Manager</div>
			Bore-head Integrity	Sealed	
	• Inlet temperature	Daily (Automated)	Temperature	85-87°C	
Pump Station	• Heat Exchanger	Weekly	Pump Hour meter readings	N/A	
		Daily	Cool water inlet temp	20-35°C	
		Daily	Warm water outlet temp	50-55°C	
		Daily (Automated)	Outlet water to Retic	44°C max 50°C	
		Daily (Automated)	Hot water flow Rate	Duty 1. 16 -18L/s Duty 2.56 – 60L/s	
		Daily (Automated)	Cool water flow rate	Duty 1. 48 -52L/s Duty 2. 63 – 67L/s	
Distribution System	3 samples tested from the following: <ul style="list-style-type: none"><li>One sample taken from the elevated Water Reservoir (38 Werna St)</li></ul> 3 samples taken from the following: <ul style="list-style-type: none"><li>77 Blomfield Street</li><li>2 Dagworth</li><li>41 Sesbania</li><li>13 Elderslie</li><li>104 Elderslie</li></ul>	Fortnightly	E coli	0	
			Total Coliforms	0	
			Turbidity	<2NTU	
Storage	• Elevated water reservoir	Daily (Automated)	% Capacity	95% - Duty 1 Start 85% - Duty 2 Start	
		Annually	Hazard assessment	N/A	
		5 years maximum	Tank cleaning and disinfection	N/A	

## 7.2 Verification Monitoring

Table 7.2 and 7.3 tabulates the parameters to be monitored, monitoring locations and frequency of monitoring.

Winton have four deep artesian bores only one of which is currently used to supply water for the town. Bore water is delivered to heat exchanges for cooling before being directed to reticulation.

For Winton microbial, physical and inorganic verification monitoring will be conducted at various points in the reticulation system. Sampling for verification monitoring is to take place twice per year. Samples are to be taken from four locations within the distribution system, with one of these samples taken from the water tower outlet. Details of sampling locations and frequency are detailed in Table 7.2 below.

Data for verification monitoring shall be collated in a central location when each new analysis is undertaken, trends will be automatically updated based on the data set.

In the 2018 DWQMP amendment a number of analytes have been added to the verification monitoring program. The analytes added to the program are inorganic chemicals with ADWG prescribed health limits, proven to cause adverse impacts to health through drinking water. These analytes have been incorporated into the testing program based on independent specialist advice, where it was recommended that the DWSP ascertain if these potentially harmful chemicals are present in the water. The recommendation was that a minimum of three samples should be taken to determine if these chemicals are present. Therefore, if ongoing (>3) low detection values of inorganic chemicals are identified the DWSP may wish to remove these analytes from the verification monitoring program.

**Table 7.2 Verification Monitoring Locations and Timing**

Sampling locations	Location type	Minimum No. samples per year	Sampling Frequency	Sampling Times
38 Werna	Water Tower	2	Twice per year	1. November  2. May
77 Blomfield Street	Aged Care	1		
2 Dagworth	Residence			
41 Sesbania	Council Depot			
13 Elderslie	Residence			
104 Elderslie	Residence			
* Samples are to be taken from 4 locations above for each round of sampling				

**Table 7.3 Verification Monitoring**

Characteristic	Parameter	ADWG &/ or Regulation Value/ Target Limit	Frequency	Analysing Authority	Response to Exceedances
			In distribution system		
Microbial quality	<i>E.coli</i>	<i>Nil detect</i>	Every 6 Months	QHFSS	<i>Refer to Incident Management Plan</i> <i>Notify OWSR and complete incident reporting forms</i>
	<i>HPC</i>	<i>&lt;100 (cfu/ml) (not regulated)</i>			<i>Follow operational procedure for flushing mains</i>
Physical	<i>pH</i>	<i>pH 6.5–8.5</i>			<i>Acceptable risk, continue to monitor</i>
	<i>Colour</i>	<i>15 HU - Aesthetic</i>			
	<i>Turbidity</i>	<i>5 NTU - Aesthetic</i>			
	<i>Total Dissolved Solids</i>	<i>600mg/l - Aesthetic</i>			
	<i>Dissolved Oxygen</i>	<i>&gt; 85% - Aesthetic</i>			
	<i>Sodium</i>	<i>180mg/l - Aesthetic</i>			
Inorganics	<i>Iron</i>	<i>.3mg/l - Aesthetic</i>			<i>Notify OWSR and complete incident reporting forms</i>
	<i>Zinc</i>	<i>.3mg/l - Aesthetic</i>			
	<i>Antimony</i>	<i>.003mg/l - Health</i>			
	<i>Arsenic</i>	<i>.01mg/l - Health</i>			
	<i>Barium</i>	<i>2mg/l - Health</i>			
	<i>Beryllium</i>	<i>.06mg/l - Health</i>			
	<i>Cadmium</i>	<i>.002mg/l - Health</i>			
	<i>Chromium</i>	<i>.05mg/l - Health</i>			
	<i>Copper</i>	<i>2mg/l - Health</i>			
	<i>Cyanide</i>	<i>.08mg/l - Health</i>			
	<i>Iodide</i>	<i>.5mg/l - Health</i>			
	<i>Lead</i>	<i>.01mg/l - Health</i>			
	<i>Manganese</i>	<i>0.5mg/l - Health</i>			
	<i>Mercury</i>	<i>.001mg/l - Health</i>			
	<i>Molybdenum</i>	<i>.05 mg/l - Health</i>			
	<i>Nickel</i>	<i>.02mg/L - Health</i>			
	<i>Selenium</i>	<i>.01mg/l - Health</i>			
	<i>Silver</i>	<i>.1mg/l - Health</i>			
	<i>Uranium</i>	<i>.017mg/L - Health</i>			

# APPENDICES

# **Appendix A**

## **Drinking Water Quality Management Plan**

### **Approval Application**

# Drinking Water Quality Management Plan Approval Application



*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 Queensland Water Supply Regulator for approval of a drinking water quality management plan. The Department of Energy and Water Supply 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

Winton Shire Council

SPID

131

## 2. Contact Details

Principal Contact

Family name

Upton

Given name(s)

Thomas

Position

Chief Executive Officer

Postal address

PO Box 288

Winton QLD

Postcode 4735

Telephone number

( 07 ) 4657 2666

Fax number

( 07 ) 4657 1342

Mobile number

0427 571 124

Email address

ceo@winton.qld.gov.au

## 3. Drinking Water Scheme Details

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

Winton

(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

Upton

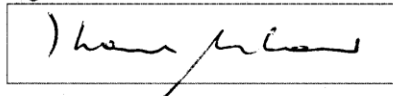
Given name(s)

Thomas

Position

Chief Executive Officer

Signature



Date (dd/mm/yyyy)

02 / 07 / 2013

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:

Queensland Water Supply Regulator  
Department of Energy and Water Supply  
PO Box 15456  
City East Qld 4002

**Print Form**

**Reset Form**

## **Appendix B**

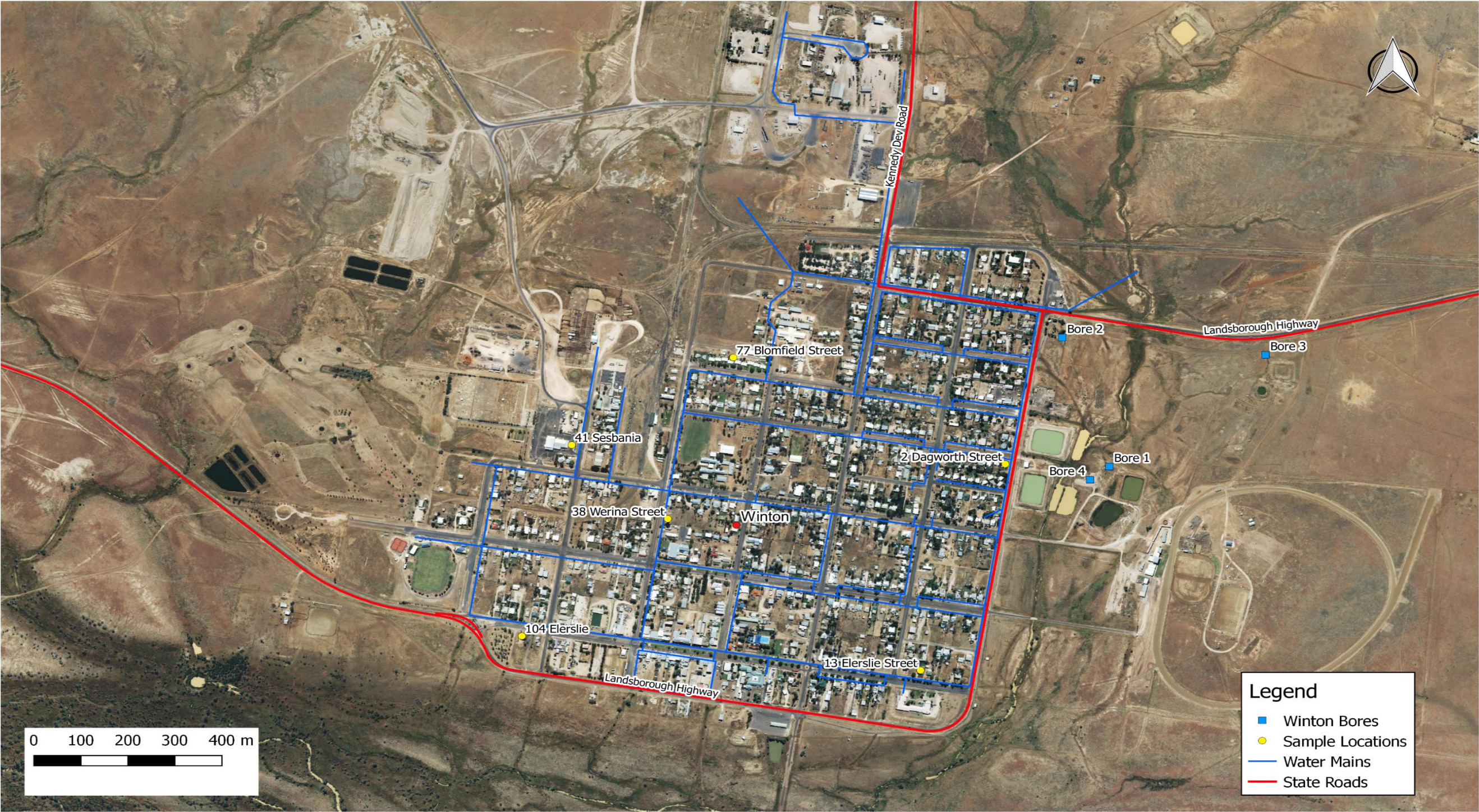
# **Water Sampling Locations and Supply Layouts**

**B.1 Winton Water Supply Sampling Locations**

**B.2 Winton Water Supply Regular Flushing Locations**



B.1 Winton Water Supply Sampling Locations



Map:180126



**Winton Shire Council**  
**DWQMP Sampling Locations**

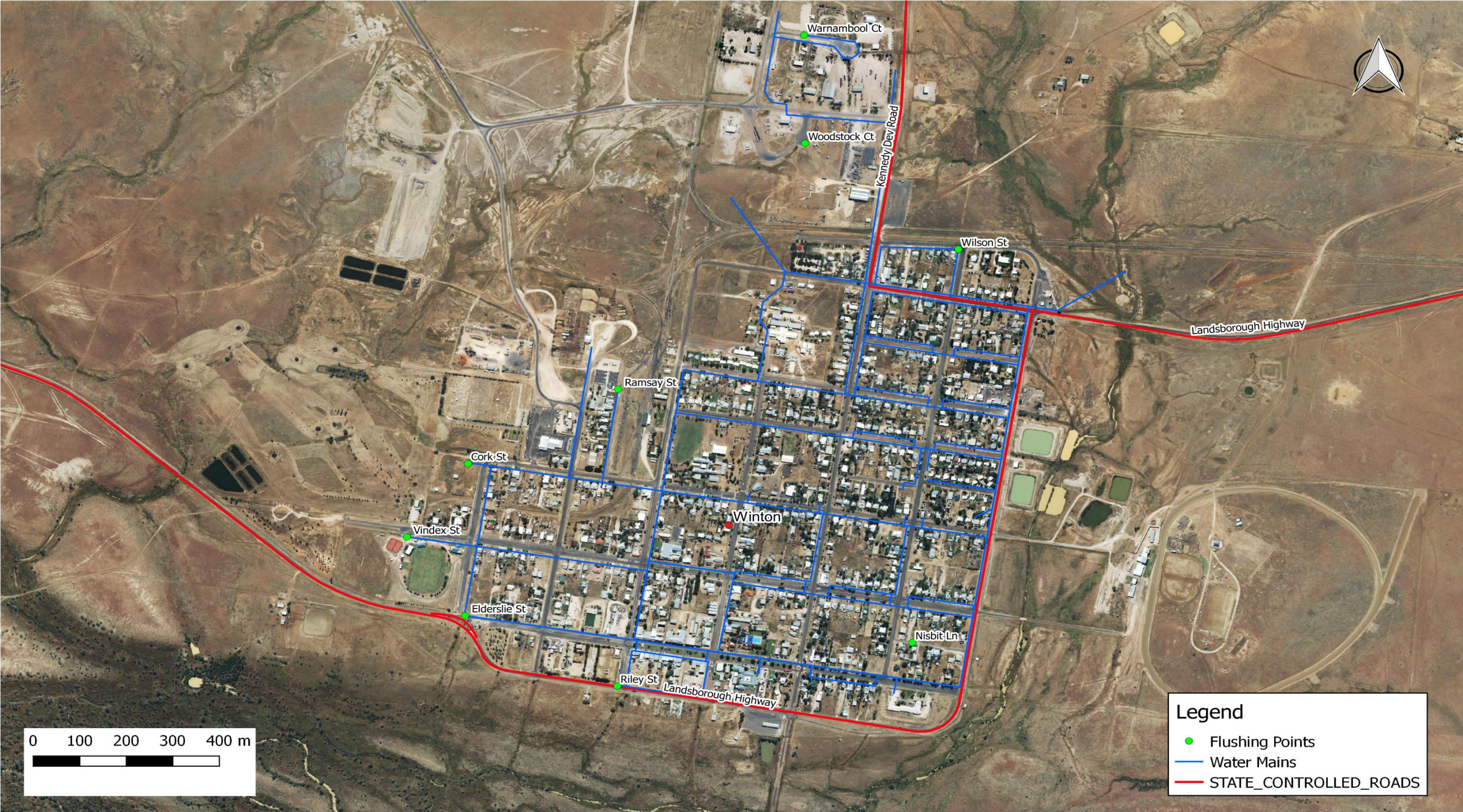


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B.2 Winton Water Supply Regular Flushing Locations



Map:180126



**Winton Shire Council  
Regular Flushing Locations**



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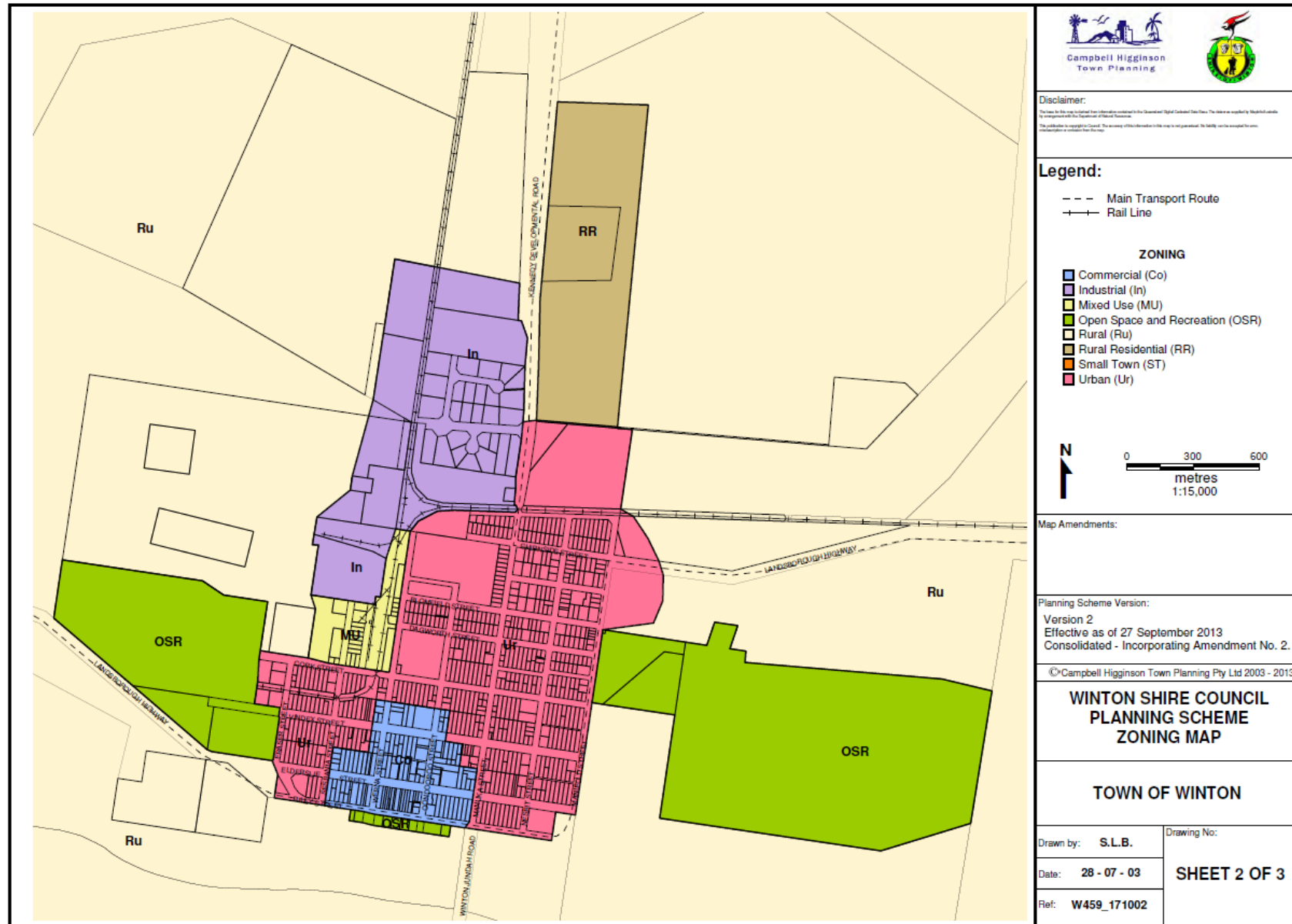


## **Appendix C**

### **Land Use Maps**

- C.1 Planning Scheme Zoning Map – Town of Winton**
- C.2 Major Mines by Commodity**
- C.3 Explanatory Permits**

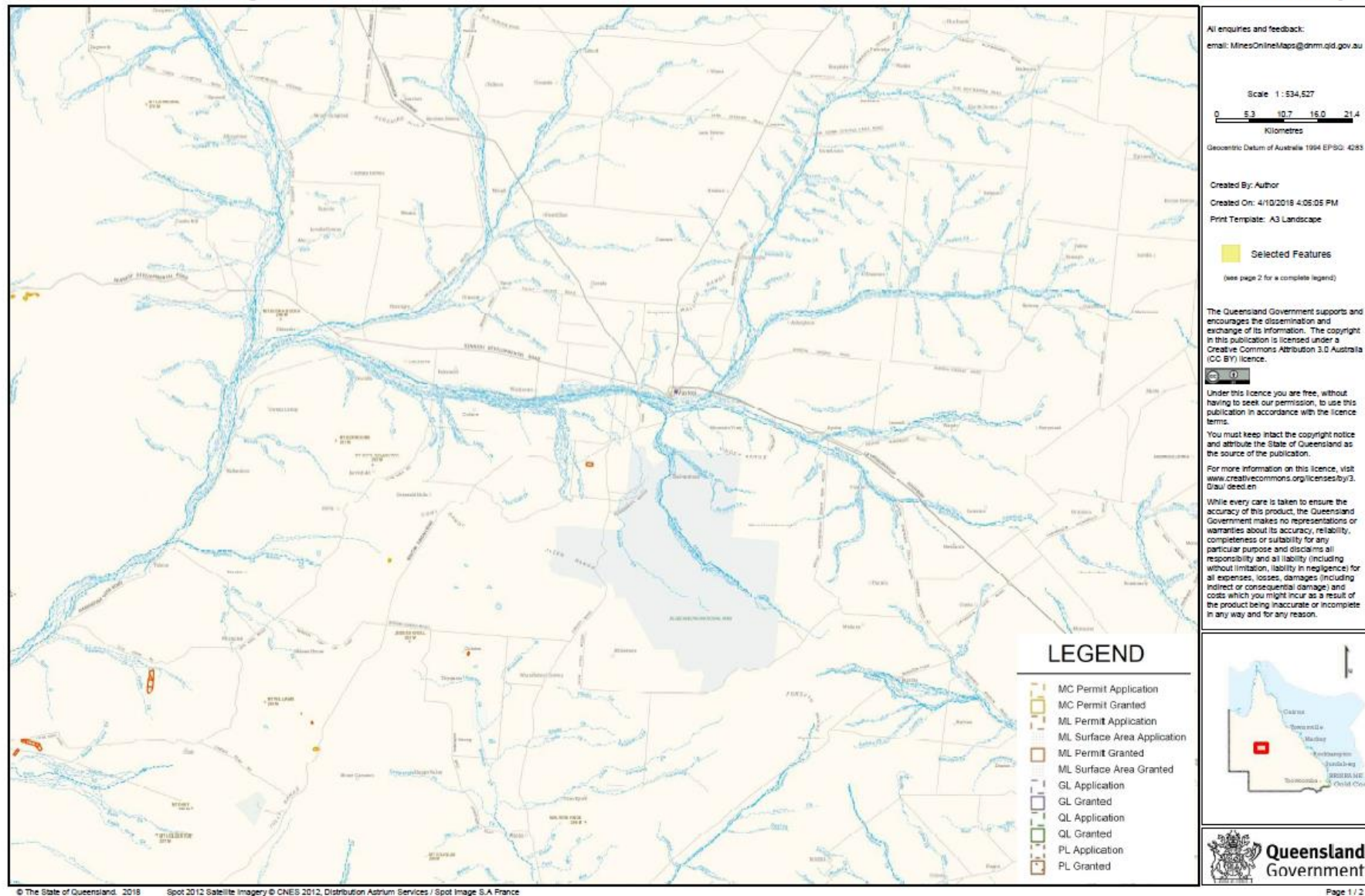
## C.1 Planning Scheme Zoning Map – Town of Winton



## C.2 Major Mines by Commodity

### Winton Active Mining Areas

### MinesOnlineMaps

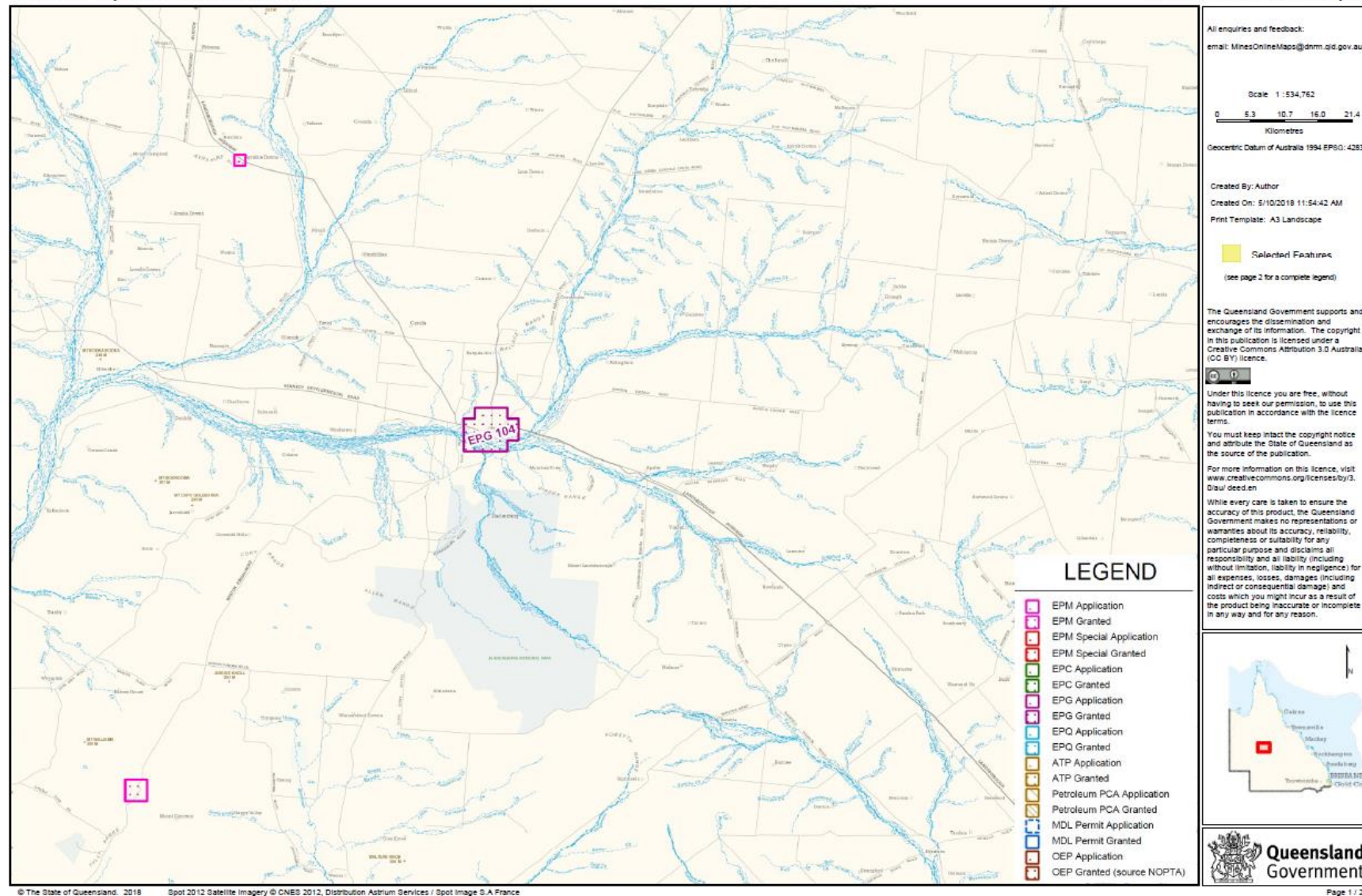




## C.3 Exploratory Permits

### Mine Exploratory Permits

MinesOnlineMaps



## **Appendix D**

### **Bore Water Report Cards**

**D.1 Bore 1**

**D.2 Bore 2**

**D.3 Bore 3**

**D.4 Bore 4**

## D.1 Bore 1

DATE 04/10/2018

### GROUNDWATER DATABASE

Page 1 of 6

#### BORE REPORT

REG NUMBER 407

##### REGISTRATION DETAILS

OFFICE Longreach	BASIN 0021	LATITUDE 22-23-06	MAP-SCALE 254
DATE LOG RECD	SUB-AREA	LONGITUDE 143-02-56	MAP-SERIES M
D/O FILE NO. 140/126/0003	SHIRE 7400-WINTON	EASTING 710935	MAP-NO SF54-12
R/O FILE NO. 25/22/W/1	LOT 113	NORTHING 7523118	MAP NAME WINTON
H/O FILE NO. 01129	PLAN AE95	ZONE 54	PROG SECTION
	ORIGINAL DESCRIPTION WINTON TOWN	ACCURACY	PRES EQUIPMENT HW
		GPS ACC	
GIS LAT -22.3850308719	PARISH NAME 6000-NO LONGER USED		ORIGINAL BORE NO WINTON NO1
GIS LNG 143.0487946977	COUNTY		BORE LINE -
CHECKED Y			
			POLYGON
			RN OF BORE REPLACED
FACILITY TYPE Artesian - Controlled Flow	DATE DRILLED 01/01/1895		DATA OWNER
STATUS Existing	DRILLERS NAME		
ROLES WS	DRILL COMPANY		
	METHOD OF CONST. CABLE TOOL		

##### CASING DETAILS

PIPE	DATE	RECORD NUMBER	MATERIAL DESCRIPTION	MAT SIZE (mm)	SIZE DESC	OUTSIDE DIAM (mm)	TOP (m)	BOTTOM (m)
A	01/01/1895	1	Steel Casing		WT	254	0.00	113.40
A	01/01/1895	2	Steel Casing		WT	203		287.10
A	01/01/1895	3	Steel Casing		WT	152		586.10
A	01/01/1895	4	Steel Casing		WT	127		922.60
A	01/01/1895	5	Steel Casing		WT	101	920.00	1222.20
A	09/03/1990	6	Steel Casing	6.300	WT	203	0.00	4.00
A	09/03/1990	7	Steel Casing	4.760	WT	127	0.00	2.00

##### STRATA LOG DETAILS

RECORD NUMBER	STRATA TOP (m)	STRATA BOT (m)	STRATA DESCRIPTION
1	0.00	155.75	SHALE
2	155.75	345.95	SANDSTONE AND SHALE



## BORE REPORT

REG NUMBER 407

RECORD NUMBER	STRATA TOP (m)	STRATA BOT (m)	STRATA DESCRIPTION
3	345.95	382.22	SHALE, CLAY, SAND
4	382.22	443.18	CLAY
5	443.18	499.57	CLAY, SAND AND SHALE
6	499.57	586.13	CLAY
7	586.13	762.00	SHALE AND CLAY
8	762.00	920.50	SHALE
9	920.50	974.45	SANDSTONE AND SHALE
10	974.45	1005.54	PIPECLAY
11	1005.54	1069.85	SHALE BANDS OF COAL
12	1069.85	1222.25	WHITE SANDSTONE

STRATIGRAPHY DETAILS

SOURCE	RECORD NUMBER	STRATA TOP (m)	STRATA BOT (m)	STRATA DESCRIPTION
DNR	1	0.00		QUATERNARY ALLUVIUM
DNR	2			WINTON FORMATION
DNR	3			MACKUNDA FORMATION
DNR	4			ALLARU MUDSTONE
DNR	5			TOOLEBUC FORMATION
DNR	6			WALLUMBILLA FORMATION
DNR	7			WYANDRA SANDSTONE MEMBER
DNR	8			CADNA-OWIE FORMATION
DNR	9			HOORAY SANDSTONE
DNR	10			WESTBOURNE FORMATION
DNR	11			ADORI SANDSTONE
DNR	12		1222.20	BIRKHEAD FORMATION

AQUIFER DETAILS

REC	TOP BED(M)	BOTTOM BED(M)	BED LITHOLOGY	DATE	SWL (m)	FLOW	QUALITY	YIELD (l/s)	CTR	CONDIT	FORMATION NAME
1	1085.10		SDST							PS	HOORAY SANDSTONE
2	1176.50		SDST							PS	ADORI SANDSTONE

## BORE REPORT

REG NUMBER 407

PUMP TEST DETAILS PART 1															
PIPE	DATE	REC RN OF NO. 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	01/01/1896	20 407	1085.10	1176.50	0.00	F/F	FR						33.40		
A	01/01/1913	20 407	1085.10	1176.50	0.00	F/F	FR						25.25		
A	30/07/1914	1											24.72		
A	27/10/1920	1											18.23		
A	28/07/1922	1											25.25		
A	21/04/1926	1											24.46		
A	23/07/1929	1											13.22		
A	10/11/1932	1											23.00		
A	27/04/1945	1													
A	08/12/1960	1											19.46		
A	22/03/1965	1													
A	05/12/1977	1 407				ART									
A	10/02/1982	1 407				ART	DT								
A	28/02/1990	1 407			0.00	ART	DT								
A	21/05/1999	1 407			1.00	ART	ST FR ST DT			18.98	120	15.94			
A	06/04/2004	1			0.99							167.80	4.50		
A	15/08/2005	1 118365		1222.25		ART									

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	01/01/1896	20		86.56				33.40		33.40						
A	01/01/1913	20		68.58				25.25		25.25						
A	30/07/1914	1		64.62				24.72		24.72						
A	27/10/1920	1		59.13				18.23		18.23						

## BORE REPORT

REG NUMBER 407

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	28/07/1922	1		56.54				25.25		25.25						
A	21/04/1926	1		55.11				24.46		24.46						
A	23/07/1929	1		54.44				13.22		13.22						
A	10/11/1932	1		50.01				23.00		23.00						
A	27/04/1945	1		46.60				24.79		24.79						
A	08/12/1960	1						19.46		19.46						
A	22/03/1965	1						20.84		20.84						
A	05/12/1977	1		29.10			18.40	16.20				14.00	0.00			
A	10/02/1982	1		29.70			28.10	20.30		20.30		14.70	2.20		245	
A	28/02/1990	1 270		35.90			32.40	18.73	120			13.89	0.00		827	
A	21/05/1999	1 390		34.53			32.07	18.98	1	19.57	35.78	18.05			440	
A	06/04/2004	1														
A	15/08/2005	1 900		31.67		1.68	2.62	0.00	630	0.00						

BORE CONDITION

DATE	DRAIN DETAILS		HEADWORKS				FLOW IRREGULARITY	PRECIPITATE	EST USE (ML/yr)	STOCK		COMMENT
	TOT LEN (km)	MAX C RUN D (km) N	RET LEN (km)	C D N	C T L	LEAK				CATTLE	SHEEP	
21/05/1999				G	F							TOWN WATER SUPPLY
06/04/2004	0.0	0.0		G	F					0	0	Town Supply

ELEVATION DETAILS

PIPE	DATE	ELEVATION	PRECISION	DATUM	MEASUREMENT POINT	SURVEY SOURCE
A	01/01/1895	185.30	EST	STD	R	

WATER ANALYSIS PART1

PIPE	DATE	RD ANALYST	QAN	DEPT H (m)	RMK	SRC	COND (uS/cm)	pH	Si (mg/L)	TOTAL IONS (mg/L)	TOTAL SOLIDS (mg/L)	HARD	ALK	FIG. OF MERIT	SAR	RAH
A	28/02/1990	1 GCL	133167	1222.00	MA	GR	461	8.2	51	378.57	310.88	23	195	0.1	8.4	3.44

## BORE REPORT

REG NUMBER 407

PIPE	DATE	RD ANALYST	QAN	DEPT H (m)	RMK	SRC	COND (uS/cm)	pH	Si (mg/L)	TOTAL IONS (mg/L)	TOTAL SOLIDS (mg/L)	HARD	ALK	FIG. OF MERIT	SAR	RAH
A	21/05/1999	1 GCL	193063	1222.00	MA	GB	470	8.5	49	391.32	320.87	25	200	0.1	8.4	3.49

WATER ANALYSIS PART 2

PIPE	DATE	RD	Na	K	Ca	Mg	Mn	HCO3	Fe	CO3	Cl	F	NO3	SO4	Zn	Al	B	Cu
A	28/02/1990	1	92.4	8.3	8.8	0.2	0.02	233.5	0.00	2.1	26.1	0.45	0.0	6.7				
A	21/05/1999	1	96.0	11.0	9.8	0.1	0.05	235.0	0.05	4.1	29.0	0.40	0.5	5.1	0.02	0.05	0.10	0.05

WATER LEVEL DETAILS

\*\*\*\* NO RECORDS FOUND \*\*\*\*

WIRE LINE LOG DETAILS

DATE	RUN	OPERATOR	TYPE	SOURCE	TOP (m)	BOTTOM (m)	COMMENTS
13/09/2001	1	B ISBISTER	CALU	WINTON SHIRE	.79	1227.89	

FIELD MEASUREMENTS

PIPE	DATE	DEPTH (m)	COND (uS/cm)	pH	TEMP (C)	NO3 (mg/L)	DO (mg/L)	Eh (mV)	ALK (mEq)	METH	SOURCE
A	22/03/1956				83.0					PU	GB
A	08/11/1960				84.0					PU	GB
A	05/12/1977				84.0					PU	GB
A	10/02/1982				85.0					PU	GB
A	28/02/1990		460		87.0					MA	GS
A	21/05/1999			7.3	85.0					PU	
A	06/04/2004		531	6.8	83.5					PU	GB

SPECIAL WATER ANALYSIS

\*\*\*\* NO RECORDS FOUND \*\*\*\*

BORE REPORT

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## D.2 Bore 2

DATE 04/10/2018

### GROUNDWATER DATABASE

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#### BORE REPORT

REG NUMBER 14269

#### REGISTRATION DETAILS

OFFICE Longreach	BASIN 0021	LATITUDE 22-22-53	MAP-SCALE 254
DATE LOG RECD	SUB-AREA	LONGITUDE 143-02-52	MAP-SERIES M
D/O FILE NO. 25/22/W/1	SHIRE 7400-WINTON	EASTING 710826	MAP-NO SF54-12
R/O FILE NO. 25/22/W/1	LOT 118	NORTHING 7523511	MAP NAME WINTON
H/O FILE NO. 01129	PLAN AE151	ZONE 54	PROG SECTION
	ORIGINAL DESCRIPTION PASTURAGE RESERVE R9	ACCURACY	PRES EQUIPMENT HW
		GPS ACC	
GIS LAT -22.3814974556	PARISH NAME 6000-NO LONGER USED		ORIGINAL BORE NO TOWN BORE NO. 2
GIS LNG 143.0476876181	COUNTY		BORE LINE -
CHECKED Y			
			POLYGON
FACILITY TYPE Artesian - Controlled Flow	DATE DRILLED 17/07/1960		RN OF BORE REPLACED
STATUS Existing	DRILLERS NAME G BIRKENSLEIGH		DATA OWNER
ROLES	DRILL COMPANY W L SIDES & SONS		
	METHOD OF CONST. ROTARY RIG		

#### CASING DETAILS

PIPE	DATE	RECORD NUMBER	MATERIAL DESCRIPTION	MAT SIZE (mm)	SIZE DESC	OUTSIDE DIAM (mm)	TOP (m)	BOTTOM (m)
A	17/07/1960	1	Steel Casing		WT	254	0.00	91.10
A	17/07/1960	2	Steel Casing		WT	203	0.00	1224.40
A	17/07/1960	3	Perforated or Slotted Casing		AP		1079.90	1191.80
A	17/07/1960	4	Grout					

#### STRATA LOG DETAILS

RECORD NUMBER	STRATA TOP (m)	STRATA BOT (m)	STRATA DESCRIPTION
1	0.00	20.70	UNKNOWN LIKELY YELLOW CLAY
2	20.70	24.40	SANDY YELLOW CLAY CONTRACTOR W SIDES
3	24.40	26.50	CLAY AND COARSE GRAVEL
4	26.50	26.80	HARD LIMESTONE DRILLER G BIRKENSLEIGH
5	26.80	28.00	FINE SANDY CLAY

## BORE REPORT

REG NUMBER 14269

RECORD NUMBER	STRATA TOP (m)	STRATA BOT (m)	STRATA DESCRIPTION
6	28.00	35.40	BLUE GREY CLAY
7	35.40	36.60	HARD BAND CLAY
8	36.60	40.80	BLUE CLAY BANDS COAL
9	40.80	46.60	BLUE MUDSTONE
10	46.60	56.10	BLUE YELLOW MUDSTONE HARD BANDS
11	56.10	60.40	BLUE MUDSTONE
12	60.40	65.20	BLACK COAL
13	65.20	75.00	YELLOW AND BLUE MUDSTONE
14	75.00	79.20	YEL AND BLUE MUDSTONE BANDS COAL
15	79.20	88.70	YELLOW BLUE CLAY HARD BANDS
16	88.70	94.50	YELLOW BLUE CLAY BANDS COAL
17	94.50	134.10	BLUE MUDSTONE
18	134.10	207.30	BLUE MUDSTONE SILTY BANDS
19	207.30	468.50	SILTY MUDSTONE WITH HARD BANDS
20	468.50	468.80	FRACTURED LIMESTONE
21	468.80	480.40	MUDSTONE WITH HARD FRACTURED BANDS
22	480.40	482.50	SILTY MUDSTONE
23	482.50	500.50	MUDSTONE WITH HARD BANDS
24	500.50	725.10	MUDSTONE WITH HARD SHALE BANDS
25	725.10	752.90	MUDSTONE AND HARD FRACTURED SHALE
26	752.90	971.10	MUDSTONE WITH HARD BANDS
27	971.10	986.40	MUDSTONE AND SILT
28	986.40	1004.60	MUDSTONE
29	1004.60	1005.20	MUDDY SANDSTONE
30	1005.20	1132.00	SILTY MUDSTONE
31	1132.00	1132.90	MUDDY SANDSTONE
32	1132.90	1207.00	SANDSTONE *
33	1207.00	1208.20	SHALE
34	1208.20	1218.00	SANDSTONE * SUPPLY 1575 M3D
35	1218.00	1224.40	HARD SANDSTONE
903			00/00/1960 DISCH 1691.4 M3D

## BORE REPORT

REG NUMBER 14269

STRATIGRAPHY DETAILS

SOURCE	RECORD NUMBER	STRATA TOP (m)	STRATA BOT (m)	STRATA DESCRIPTION
DNR	1	0.00	9.40	QUATERNARY ALLUVIUM
DNR	2	9.40	307.80	WINTON FORMATION
DNR	3	307.80	475.50	MACKUNDA FORMATION
DNR	4	475.50	731.50	ALLARU MUDSTONE
DNR	5	731.50	746.80	TOOLEBUC FORMATION
DNR	6	746.80	957.10	WALLUMBILLA FORMATION
DNR	7	957.10	964.50	WYANDRA SANDSTONE MEMBER
DNR	8	964.50	990.10	CADNA-OWIE FORMATION
DNR	9	990.10	1127.80	HOORAY SANDSTONE
DNR	10	1127.80	1146.00	WESTBOURNE FORMATION
DNR	11	1146.00	1173.50	ADORI SANDSTONE
DNR	12	1173.50	1224.40	BIRKHEAD FORMATION

AQUIFER DETAILS

REC	TOP BED(M)	BOTTOM BED(M)	BED LITHOLOGY	DATE	SWL (m)	FLOW	QUALITY	YIELD (l/s)	CTR	CONDIT	FORMATION NAME
1	990.60		MDST							FR	HOORAY SANDSTONE
2	1089.70		SDST							PS	HOORAY SANDSTONE
3	1161.30		SDST							PS	ADORI SANDSTONE

PUMP TEST DETAILS PART 1

PIPE	DATE	REC RN OF NO. 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	08/11/1960	1 14269											
A	05/12/1977	1 14269				ART							
A	10/02/1982	1 14269				ART	DT						
A	28/02/1990	1 14269			1.30	ART	DT						
A	20/05/1999	1 14269			0.94	ART	ST FR ST DT			12.16		5.41	
A	15/08/2005	1 118365		1218.00		ART							



## BORE REPORT

REG NUMBER 14269

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	08/11/1960	1		28.17				19.54		19.57						
A	05/12/1977	1		28.67			26.70	21.23				12.00	0.00			
A	10/02/1982	1		27.43			25.50	18.20				12.50	3.00		227	
A	28/02/1990	1 300		27.04			25.50	14.24	120			10.42	0.00		862	
A	20/05/1999	1 390		25.95			24.82	12.16	120	13.27	29.33	10.05			125	
A	15/08/2005	1 905		36.78			5.11	0.00	1	0.00						

## BORE CONDITION

DRAIN DETAILS		HEADWORKS		LEAK		FLOW		PRECIPITATE		EST USE		STOCK		COMMENT	
DATE	TOT LEN (km)	MAX C RUN D (km) N	RET LEN (km)	C D N	C T L	IRREGULARITY				(ML/yr)	CATTLE	SHEEP			
20/05/1999				G	F									TOWN WATER SUPPLY	

## ELEVATION DETAILS

\*\*\*\* NO RECORDS FOUND \*\*\*\*

## WATER ANALYSIS PART1

PIPE	DATE	RD ANALYST	QAN	DEPT H (m)	RMK	SRC	COND (uS/cm)	pH	Si (mg/L)	TOTAL IONS (mg/L)	TOTAL SOLIDS (mg/L)	HARD	ALK	FIG. OF MERIT	SAR	RAH
A	28/02/1990	1 GCL	133171		PU	GB	668	8.6	50	570.61	439.91	8	306			5.96
A	03/05/1990	1 GCL	133171	0.00	MA	GS	670	8.6	50	571.70	441.25	8	305		24.4	5.94
A	13/08/1999	1 GCL	193064	1224.00	MA	GB	690	8.6	47	607.56	461.41	10	326		23.5	6.32

## WATER ANALYSIS PART 2

PIPE	DATE	RD	Na	K	Ca	Mg	Mn	HCO3	Fe	CO3	Cl	F	NO3	SO4	Zn	Al	B	Cu
A	28/02/1990	1	159.0	3.0	3.1	0.0	0.00	355.5	0.00	8.6	33.7	1.21	0.0	6.5				
A	03/05/1990	1	160.0	3.0	3.1	0.1	0.10	355.0	0.10	8.6	33.5	1.20	0.5	6.5				
A	13/08/1999	1	170.0	4.2	3.8	0.1	0.02	380.0	0.02	8.6	34.0	1.40	0.5	4.4	0.02	0.05	0.40	0.05

## WATER LEVEL DETAILS

\*\*\*\* NO RECORDS FOUND \*\*\*\*

## BORE REPORT

REG NUMBER 14269

WIRE LINE LOG DETAILS							
DATE	RUN	OPERATOR	TYPE	SOURCE	TOP (m)	BOTTOM (m)	COMMENTS
12/10/1960	1		SN	AGS	0	1211	SHALEY BED 721-738M. SANDSTONES 984-1009, 12020-1032, 1080-1116, 1135-1162M.
12/10/1960	1		SP	AGS	0	1211	
12/10/1960	1		SPR	AGS	0	1211	WINTON FORM 0-398M. TAMBO & ROMA 398-980.5M. BLYTHESDALE 980.5-1211M.
15/09/2001	4	B ISBISTER	CALU	WINTON SHIRE	-76	944.99	
15/09/2001	1	B ISBISTER	CALU	WINTON SHIRE	1.67	11.22	
15/09/2001	2	B ISBISTER	CALU	WINTON SHIRE	71.12	101.87	
15/09/2001	5	B ISBISTER	CALU	WINTON SHIRE	459.07	536.62	
15/09/2001	3	B ISBISTER	CALU	WINTON SHIRE	945.39	1224.99	
16/09/2001	2	B ISBISTER	CALU	WINTON SHIRE	-1.58	1223.27	
16/09/2001	2	B ISBISTER	GR	WINTON SHIRE	-1.37	1225.88	
16/09/2001	1	B ISBISTER	GR	WINTON SHIRE	.13	1225.98	
16/09/2001	1	B ISBISTER	CALU	WINTON SHIRE	489.23	540.63	
17/12/2001	1		CAL	DNR	0	1225	CASING 8" 0-1225M. SLOTS 1086-1088, 1092-1094, 1112-1114, 1175, 1180-1182.
17/12/2001	1		CCL	DNR	0	1225	CASING 0-1225M. SEE REPORT
17/12/2001	1		TEMPL	DNR	0	1225	TEMP AT BOTTOM = 97 DEG C.
17/12/2001	1		GR	DNR	0	1225	TOOLEBUC 724-742M. SANDSTONES 955-957, 1010-1011, 1027-1034, 1090-1092, 1151-1159, 1162-1166, 1223-1226M.
04/01/2004	1	B ISBISTER	FLOW	WINTON SHIRE	13.48	1074.33	
04/01/2004	7	B ISBISTER	FLOW	WINTON SHIRE	191.05	1197.25	
04/01/2004	2	B ISBISTER	FLOW	WINTON SHIRE	1040.14	1220.54	
04/01/2004	5	B ISBISTER	FLOW	WINTON SHIRE	1045.46	1217.36	
04/01/2004	6	B ISBISTER	FLOW	WINTON SHIRE	1045.63	1207.63	
04/01/2004	8	B ISBISTER	FLOW	WINTON SHIRE	1049.37	1204.37	
04/01/2004	9	B ISBISTER	FLOW	WINTON SHIRE	1049.52	1052.62	

## BORE REPORT

REG NUMBER 14269

DATE	RUN	OPERATOR	TYPE	SOURCE	TOP (m)	BOTTOM (m)	COMMENTS
04/01/2004	10	B ISBISTER	FLOW	WINTON SHIRE	1052.64	1207.64	
04/01/2004	3	B ISBISTER	FLOW	WINTON SHIRE	1191.8	1220.45	
04/01/2004	4	B ISBISTER	FLOW	WINTON SHIRE	1191.95	1217.45	
30/03/2004	1		FLOW	DNR	0	1220	INFLOWS BETWEEN 1090 AND 1180M. NO INFLOWS BELOW 1180M. WHEN LOCKED NO WATER ESCAPING.

FIELD MEASUREMENTS

PIPE	DATE	DEPTH (m)	COND (uS/cm)	pH	TEMP (C)	NO3 (mg/L)	DO (mg/L)	Eh (mV)	ALK (mEq)	METH	SOURCE
A	08/11/1960				79.0					PU	GB
A	05/12/1977				82.0					PU	GB
A	10/02/1982				82.0					PU	GB
A	28/02/1990		670		80.0					PU	GB
A	20/05/1999			7.4	79.0					PU	

SPECIAL WATER ANALYSIS

\*\*\*\* NO RECORDS FOUND \*\*\*\*

BORE REPORT

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## D.3 Bore 3

DATE 04/10/2018		GROUNDWATER DATABASE		Page 1 of 6				
BORE REPORT								
REG NUMBER 51918								
<u>REGISTRATION DETAILS</u>								
OFFICE Longreach		BASIN 0021	LATITUDE 22-22-55	MAP-SCALE 254				
DATE LOG RECD		SUB-AREA	LONGITUDE 143-03-10	MAP-SERIES M				
D/O FILE NO. 140/126/0003		SHIRE 7400-WINTON	EASTING 711359	MAP-NO SF54-12				
R/O FILE NO. 25/22/W/1		LOT 118	NORTHING 7523451	MAP NAME WINTON				
H/O FILE NO. 1129		PLAN AE151	ZONE 54	PROG SECTION				
ORIGINAL DESCRIPTION RESERVE 9		ACCURACY	PRES EQUIPMENT					
GPS ACC								
GIS LAT -22.3819699564	PARISH NAME 6000-NO LONGER USED	ORIGINAL BORE NO WINTON TOWN NO 3						
GIS LNG 143.0528725621	COUNTY	BORE LINE -						
CHECKED Y								
FACILITY TYPE Artesian - Controlled Flow		DATE DRILLED 30/09/1984	POLYGON					
STATUS Existing		DRILLERS NAME	RN OF BORE REPLACED					
ROLES		DRILL COMPANY	DATA OWNER					
METHOD OF CONST. ROTARY RIG								
<u>CASING DETAILS</u>								
PIPE	DATE	RECORD NUMBER	MATERIAL DESCRIPTION	MAT SIZE (mm)	SIZE DESC	OUTSIDE DIAM (mm)	TOP (m)	BOTTOM (m)
A	30/09/1984	1	Steel Casing	6.400	WT	273	0.00	51.00
A	30/09/1984	2	Steel Casing	6.000	WT	219	0.00	199.00
A	30/09/1984	3	Steel Casing	5.000	WT	165	90.00	1212.00
A	30/09/1984	4	Perforated or Slotted Casing	15.800	AP	165	1072.00	1212.00
A	30/09/1984	5	Open End	5.000	WT	165	1212.00	1212.00
A	30/09/1984	6	Open Hole			203	1212.00	1222.00
X	30/09/1984	1	Grout			303	0.00	51.00
X	30/09/1984	2	Grout			165	77.00	497.00
<u>STRATA LOG DETAILS</u>								
RECORD NUMBER	STRATA TOP (m)	STRATA BOT (m)	STRATA DESCRIPTION					
1	0.00	2.00	BLACK CLAY DRILLER J HARDINGHAM					

## BORE REPORT

REG NUMBER 51918

RECORD NUMBER	STRATA TOP (m)	STRATA BOT (m)	STRATA DESCRIPTION
2	2.00	11.00	YELLOW SHALE ROTARY NT 12
3	11.00	29.00	GREY SHALE
4	29.00	29.50	COAL
5	29.50	42.00	GREY SHALE
6	42.00	42.50	COAL
7	42.50	90.00	GREY SHALE
8	90.00	91.00	BROWN ROCK
9	91.00	99.00	SHALE
10	99.00	101.00	HARD ROCK
11	101.00	199.00	SHALE BANDS OF ROCK
12	199.00	560.00	SHALE & BROWN LIMESTONE
13	560.00	794.00	GREY SHALE
14	794.00	975.00	SANDSTONE & SHALE
15	975.00	1013.00	MUDSTONE
16	1013.00	1222.00	SANDSTONE BANDS SHALE FLOW
902			24/10/1984 SWL 24.31 M TMP NUL C
903			24/10/1984 DISCH 2411.0 M3D

STRATIGRAPHY DETAILS

SOURCE	RECORD NUMBER	STRATA TOP (m)	STRATA BOT (m)	STRATA DESCRIPTION
DNR	1	1013.00	1220.00	ADORI SANDSTONE
DNR	2	794.00	975.00	HOORAY SANDSTONE

AQUIFER DETAILS

REC	TOP BED(M)	BOTTOM BED(M)	BED LITHOLOGY	DATE	SWL (m)	FLOW	QUALITY	YIELD (l/s)	CTR	CONDIT	FORMATION NAME
1	1013.00	1220.00								PS	ADORI SANDSTONE
2	794.00	975.00	SDST							PS	HOORAY SANDSTONE

## BORE REPORT

REG NUMBER 51918

PUMP TEST DETAILS PART 1

PIPE	DATE	REC RN OF NO. PUMP-BORE	TOP (m)	BOTTOM (m)	DIST METH (m)	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	24/10/1984	1 51918			1.00	ART	DT					
A	01/03/1990	1 51918			1.30	ART	DT					
A	19/05/1999	1 51918			1.00	ART	FR ST DT		25.22	120	15.02	
A	15/08/2005	1 118365		1222.00		ART						

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	24/10/1984	1 342		36.70			20.40	27.91	120			22.80	0.00			
A	01/03/1990	1 342		31.53			28.10	28.23	120			18.52	0.00		1070	
A	19/05/1999	1 360		31.36			13.89	25.10	1	25.22						
A	15/08/2005	1 906		35.75			6.13	0.00	90	0.00						

BORE CONDITION

\*\*\*\* NO RECORDS FOUND \*\*\*\*

ELEVATION DETAILS

\*\*\*\* NO RECORDS FOUND \*\*\*\*

WATER ANALYSIS PART1

PIPE	DATE	RD ANALYST	QAN	DEPT H (m)	RMK	SRC	COND (uS/cm)	pH	Si (mg/L)	TOTAL IONS (mg/L)	TOTAL SOLIDS (mg/L)	HARD	ALK	FIG. OF MERIT	SAR	RAH
A	24/10/1984	1 GCL	106269	1220.00		GB	520	7.8	45	416.74	339.75	17	198		11.8	3.64
A	01/03/1990	1 GCL	133965			GB	472	8.3	51	415.59	337.82	19	213	0.1	10.6	3.87
A	21/05/1999	1 GCL	193065	1222.00	MA	GB	520	8.4		448.50	308.72	19	233		11.5	4.27

WATER ANALYSIS PART 2

PIPE	DATE	RD	Na	K	Ca	Mg	Mn	HCO3	Fe	CO3	Cl	F	NO3	SO4	Zn	Al	B	Cu
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## BORE REPORT

REG NUMBER 51918

PIPE	DATE	RD	Na	K	Ca	Mg	Mn	HCO3	Fe	CO3	Cl	F	NO3	SO4	Zn	Al	B	Cu
A	24/10/1984	1	110.0	8.3	6.3	0.2	0.01	240.0	0.03	1.0	44.0	0.40	0.5	6.0				
A	01/03/1990	1	107.0	10.2	7.5	0.1	0.06	253.7	1.62	3.0	28.2	0.54	0.0	5.3				
A	21/05/1999	1	115.0	9.0	7.4	0.1	0.03	275.0	0.05	4.3	31.0	0.60	0.5	5.3	0.02	0.05	0.10	0.05

WATER LEVEL DETAILS

PIPE	DATE	MEASURE (m)	N/R	RMK	MEAS TYPE	PIPE	DATE	MEASURE (m)	N/R	RMK	MEAS TYPE	PIPE	DATE	MEASURE (m)	N/R	RMK	MEAS TYPE
A	26/03/1984	36.77		R	NR												

WIRE LINE LOG DETAILS

DATE	RUN	OPERATOR	TYPE	SOURCE	TOP (m)	BOTTOM (m)	COMMENTS
18/09/2001	6	B ISBISTER	CALU	WINTON SHIRE	-1.61	6.94	
18/09/2001	1	B ISBISTER	CALU	WINTON SHIRE	-1.37	1206.98	
18/09/2001	1	B ISBISTER	GR	WINTON SHIRE	-.94	1210.41	
18/09/2001	4	B ISBISTER	CALU	WINTON SHIRE	75.71	104.91	
18/09/2001	5	B ISBISTER	CALU	WINTON SHIRE	96.19	107.09	
18/09/2001	2	B ISBISTER	CALU	WINTON SHIRE	224.85	239.85	
18/09/2001	3	B ISBISTER	CALU	WINTON SHIRE	225.88	237.93	
07/12/2001	1		CAL	DNR	0	1207	CASING 210MM ID 0-80M. 175MM ID 80-87M. 155 ID 87-1207M. SLOTS AT 1077, 1082, 1114, 1116, 1196, 1202M
07/12/2001	1		CCL	DNR	0	1207	CASING 0-1207M. SEE REPORT
07/12/2001	1		TEMPL	DNR	0	1210	TEMP AT BOTTOM - 97 DEGREES C.
07/12/2001	1		GR	DNR	0	1210	TOOLEBUC 720-740M. GOOD SANDSTONES 940-946, 984, 992-1001, 1011-1022, 1074-1078, 1100, 1131-1155, 1200-1210M.
04/02/2004	1	B ISBISTER	FLOW	WINTON SHIRE	.15	14	
04/02/2004	2	B ISBISTER	FLOW	WINTON SHIRE	13.56	1205.56	
01/04/2004	1		FLOW	DNR	0	1205	INFLOWS FROM 1205-1155, 1135-1120 AND 1070M. WHEN LOCKED IN, IT APPEARS WATER FROM LOWER BEDS ESCAPES TO BEDS AT 1070M.



## BORE REPORT

REG NUMBER 51918

PIPE	DATE	DEPTH (m)	COND (uS/cm)	FIELD MEASUREMENTS				Eh (mV)	ALK (mEq)	METH	SOURCE
				pH	TEMP (C)	NO3 (mg/L)	DO (mg/L)				
A	24/10/1984		470		82.0					PU	GB
A	01/03/1990				85.0					PU	GB

SPECIAL WATER ANALYSIS

\*\*\*\* NO RECORDS FOUND \*\*\*\*

## BORE REPORT

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## D.4 Bore 4

DATE 04/10/2018		GROUNDWATER DATABASE		Page 1 of 5				
BORE REPORT								
REG NUMBER 118365								
<u>REGISTRATION DETAILS</u>								
OFFICE Longreach	BASIN 0021	LATITUDE 22-23-08	MAP-SCALE 254					
DATE LOG RECD 03-OCT-05	SUB-AREA	LONGITUDE 143-02-54	MAP-SERIES M					
D/O FILE NO. 140/126/0003	SHIRE 7400-WINTON	EASTING 710897	MAP-NO SF 54-12					
R/O FILE NO.	LOT 113	NORTHING 7523075	MAP NAME					
H/O FILE NO.	PLAN AE95	ZONE 54	PROG SECTION					
	ORIGINAL DESCRIPTION	ACCURACY GPS	PRES EQUIPMENT					
		GPS ACC 75						
GIS LAT -22.385370929	PARISH NAME 6000-NO LONGER USED	ORIGINAL BORE NO WINTON TOWN BORE NO 4						
GIS LNG 143.0484506993	COUNTY	BORE LINE -						
CHECKED Y								
		POLYGON						
FACILITY TYPE Artesian - Controlled Flow	DATE DRILLED 18/04/2005	RN OF BORE REPLACED						
STATUS Existing	DRILLERS NAME BODEY, STEVEN	DATA OWNER DNR						
ROLES WS	DRILL COMPANY QLD DRILLING SERVICES							
	METHOD OF CONST. ROTARY MUD							
<u>CASING DETAILS</u>								
PIPE	DATE	RECORD NUMBER	MATERIAL DESCRIPTION	MAT SIZE (mm)	SIZE DESC	OUTSIDE DIAM (mm)	TOP (m)	BOTTOM (m)
A	18/04/2005	1	Steel Casing	9.500	WT	354	0.00	110.00
A	18/04/2005	2	Steel Casing	9.500	WT	273	0.00	110.00
A	18/04/2005	3	Steel Casing	9.500	WT	219	110.00	1070.00
A	18/04/2005	4	Steel Casing	7.200	WT	168	1060.00	1330.00
A	18/04/2005	5	Perforated or Slotted Casing				1170.00	1330.00
X	18/04/2005	6	Grout			431	0.00	110.00
X	18/04/2005	7	Grout			270	0.00	110.00
X	18/04/2005	8	Grout			270	110.00	1070.00
<u>STRATA LOG DETAILS</u>								
RECORD NUMBER	STRATA TOP (m)	STRATA BOT (m)	STRATA DESCRIPTION					
1	0.00	28.00	YELLOW AND BROWN CLAY					

## BORE REPORT

REG NUMBER 118365

RECORD NUMBER	STRATA TOP (m)	STRATA BOT (m)	STRATA DESCRIPTION
2	28.00	114.00	GREY SHALE AND COAL BANDS
3	114.00	152.00	BROWN SHALE AND SILTSTONE
4	152.00	172.00	SANDSTONE
5	172.00	520.00	GREY SHALE
6	520.00	984.00	DARK BROWN SHALE
7	984.00	1009.00	MUDSTONE
8	1009.00	1040.00	SILTSTONE
9	1040.00	1069.00	WHITE PUGGY SHALE
10	1069.00	1176.00	SILTY SANDSTONE
11	1176.00	1325.00	SANDSTONE WHITE
12	1325.00	1330.00	BLACK/GREY SANDSTONE

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	1070.00	1325.00	SDST	18/04/2005	21.04	Y	US 542 PH8	80.00	Y	PS	HUTTON SANDSTONE

PUMP TEST DETAILS PART 1

PIPE	DATE	REC RN OF NO. PUMP-BORE	TOP (m)	BOTTOM (m)	DIST METH (m)	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	18/04/2005	1 118365	1070.00	1325.00	ART							
A	15/08/2005	1 118365	1069.00	1325.00	ART	FR DT ST					22.27	

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
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## BORE REPORT

REG NUMBER 118365

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	18/04/2005	1		21.04				80.00								
A	15/08/2005	1	870	36.15			21.63	79.39	1	81.39						

BORE CONDITION

DATE	DRAIN DETAILS		HEADWORKS				FLOW	PRECIPITATE	EST USE	STOCK	COMMENT	
	TOT LEN (km)	MAX C RUN D (km) N	RET LEN (km)	C D N	C T L	LEAK	IRREGULARITY		(ML/yr)	CATTLE	SHEEP	
15/08/2005												New bore drilled for town supply. Bore tested while pressure monitored in other three bores.

ELEVATION DETAILS

\*\*\*\* NO RECORDS FOUND \*\*\*\*

WATER ANALYSIS PART1

PIPE	DATE	RD ANALYST	QAN	DEPT H (m)	RMK	SRC	COND (uS/cm)	pH	Si (mg/L)	TOTAL IONS (mg/L)	TOTAL SOLIDS (mg/L)	HARD	ALK	FIG. OF MERIT	SAR	RAH
A	15/08/2005	1 GCL	219150		PU	GB	453	7.9	55	376.00	319.00	26	183	0.1	8.1	3.10

WATER ANALYSIS PART 2

PIPE	DATE	RD	Na	K	Ca	Mg	Mn	HCO3	Fe	CO3	Cl	F	NO3	SO4	Zn	Al	B	Cu
A	15/08/2005	1	94.0	13.0	10.0	0.2	0.05	221.0	0.11	0.9	31.0	0.40	< 0.5	5.4	< 0.01	< 0.05	0.09	< 0.03

WATER LEVEL DETAILS

\*\*\*\* NO RECORDS FOUND \*\*\*\*

WIRE LINE LOG DETAILS

\*\*\*\* NO RECORDS FOUND \*\*\*\*

FIELD MEASUREMENTS

\*\*\*\* NO RECORDS FOUND \*\*\*\*

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DATE 04/10/2018

GROUNDWATER DATABASE

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BORE REPORT

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REG NUMBER 118365

SPECIAL WATER ANALYSIS

\*\*\* NO RECORDS FOUND \*\*\*

BORE REPORT

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## **Appendix E**

### **Bore Casing and Stratification Details**



