BLIGH TANNER

Drinking Water Quality Management Plan

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Drinking Water Quality Management Plan

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Term	Definition
[Term]	Still got to do this if you want a glossary?

1 INTRODUCTION

1.1 Drinking Water Quality Management Plan

This document describes how Winton Shire Council provides a safe and reliable drinking water service to the community of Winton. The plan is prepared consistently with the DWQMP Guideline issued by the Department of Regional Development Manufacturing and Water. The plan demonstrates how we comply with our legislative obligations under the *Water Supply (Safety and Reliability) Act 2008, the Public Health Act 2005,* and the relevant subordinate regulations.

There are other legislative requirements that are related to the provision of a safe drinking water supply. These include the *Food Act 2006, Plumbing and Drainage Act, 2018, Planning Act 2016, Environmental Protection Act 1994, Water Act 2000, Work Health and Safety Act 2011.*

1.1.1 Winton Shire

The Winton Shire is covers an area of 53814km^2 in Central West Queensland. Winton itself is located 178 km to the north west of Longreach, and 470 km south east of Mount Isa.

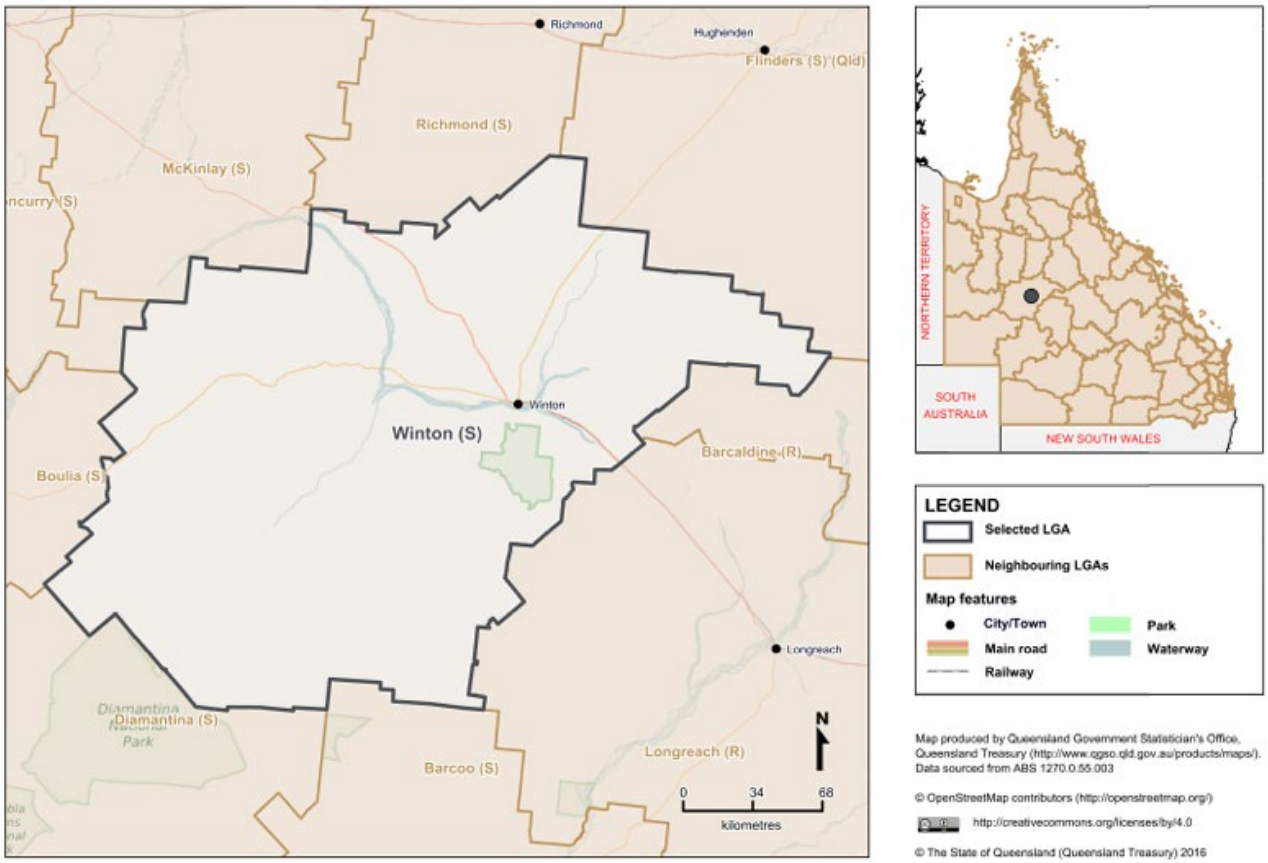


Figure 1 Winton LGA and location relative to Queensland

1.1.2 Winton Scheme

The Winton scheme, serving a population of approximately 875 people (2016 Census) is the only drinking water scheme operated by Council.

There are 544 residential connections and 7 non-residential connections. The bore scheme has total annual demand of 700.5 ML with a maximum daily demand of 3.2 ML/ day (2019/2020 Annual Performance Report). The total water use represents an average of 1.9 ML/day.

The local government area population projections (Queensland Government Statisticians Office - https://www.qgso.qld.gov.au/statistics/theme/population/population-projections/regions) are included in the table below for the low, medium and high growth projections. These demonstrate that at most, the population of the region will remain the same until 2041, but the medium and low projections both show significant decreases.

Table 1 Population Series (Entire LGA)

	2021	2026	2031	2036	2041
Low	1,090	932	783	631	483
Medium	1,101	993	906	825	751
High	1,112	1,058	1,041	1,040	1,050

Despite the likely decline in population (and connected population), council considers that the number of connections will remain relatively static, as will the overall water demand. This reflects the increasing importance of tourism to the region.

1.2 Key Stakeholders

The key stakeholders in drinking water quality management (or key customers) are listed in the table below

Table 2 Key Stakeholders

Organisation	Relevance	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: charlesd@winton.qld.gov.au	Small Drinking Water Service Provider
Australian Age of Dinosaurs	Large customer	Email: info@aaod.com.au Phone: (07) 4657 0078	Supplied direct from Bore 3 through their own infrastructure
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	Phone: (07) 3096 2822 Email: FSS@health.qld.gov.au	Water Analysis

Organisation	Relevance	Contact Name and Details	Relevance to Management of Drinking Water Quality
QLD Health Public Health Unit (Central QLD)	Public Health	Phone: (07) 4920 6989	Public Health
Aged Care	Sensitive User	Phone: (07) 4920 6989	Sensitive user
Winton Child Care Centre (Little Swaggies)	Sensitive User	Phone: (07) 4657 1522 Email: littleswaggies@winton.qld.gov.au	Sensitive user
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
Department of Natural Resources, Mines and Energy	Water Supply Regulator	Phone: 1300 596 708 Email: drinkingwater.reporting@dnrme.qld.gov.au	Regulation

CATCHMENT CHARACTERISATION

The Winton Scheme sources water from the Great Artesian Basin. Up until 2005, water for Winton was sourced from 2 bores (2 and 3) which are not currently used for drinking water supply (but could be reconnected in an emergency). Bores 1 -3 access aquifers in the Cadna-owie - Hooray and Adori aquifers. Bore report cards are included in Appendix 1.

Bore 4 was drilled in April 2005 and accesses the deeper Hutton aquifer. The general understanding of the aquifers is described in the image below (Radke et al. 2000).

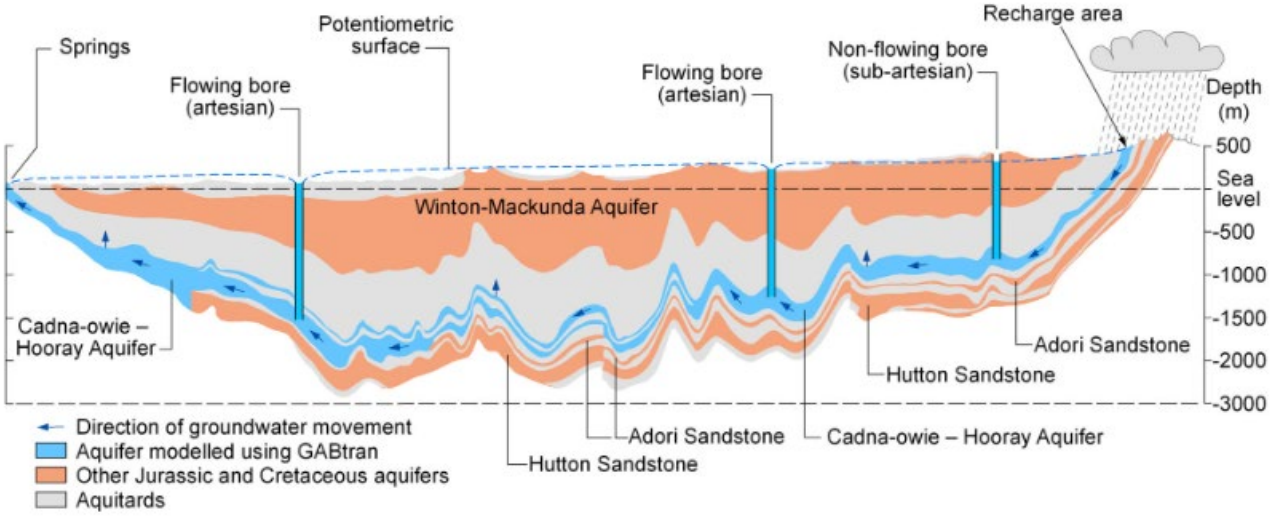


Figure 2 Graphical representation of the aquifers intercepted by Bores 1-4 in Winton

As these water sources are Jurassic and Cretaceous aquifers, with recharge areas on the edge of the Great Dividing Range, the land use and regional climate and rainfall are not relevant to the bore water quality. The water age in the Hutton sandstone is likely greater than 1 million years.

Bore Details are accessible directly by entering the registration number at the following website:

https://www.business.qld.gov.au/industries/mining-energy-water/water/bores-and-groundwater/bore-reports (site accessed 21/6/2022)

Table 3 Bore Details

	Bore 1	Bore 2	Bore 3	Bore 4
Registration #	407	14269	51918	118365
Drilled Date	1895	1960	1984	2005
Depth (m)	1222	1224	1222	1330
Flow rate (L/s)	67 (80 pumped)	19	11	30
Aquifer	Hooray and Adori	Hooray and Adori	Adori	Hutton
Borehead details	Repaired 1990, sealed.	Sealed	Sealed	Sealed
Standing water level (m)	31.67m (2005)	36.78 (2005)	35.75 (2005)	36.15 (2005)
Proportion of supply (%)	0	0	0	100
Reliability	Poor	Poor	Moderate	Good
Catchment categorisation	Fully Protected groundwater	Fully Protected groundwater	Fully Protected groundwater	Fully Protected groundwater
Water quality issues?	High temperature	High temperature	High temperature	High temperature

Note: the water quality from the bores meets ADWG health requirements. There have been periodic detections of parameters exceeding aesthetic guidelines that are likely to be associated with mains breaks (turbidity, colour, iron and manganese). The bore water itself does not vary significantly, as is expected from fully protected GAB aquifers.

2.1.1 Water Quality Bores 2-3

Bores 1-3 were all operated at various times from 1895 until the construction of Bore 4 in 2005 In the years leading up to the commissioning of Bore 4, Bore 1 was used only to supply the cooling ponds, and drinking water was supplied from Bore 2 and 3. As each bore is closely located, and within the same aquifers, there is no expectation that the water quality would be different, and there are no records that distinguish between the individual bores. The following data is from 2000 – April 2005 when Bore 4 was drilled, while the pumps were installed in 2007, there is no certainty that Bore 4 was not used at some time between 2005 and 2007.

Bore 3 is part of the drinking water system in that it has a single connection, immediately after the borehead to the Australian Age of Dinosaurs (AAoD). The point of supply is at the meter adjacent to the bore, and the pipeline and associated infrastructure were built by AAoD. At the point that the water is provided to AAoD, the water is at ~85°C. From this point it is the responsibility of AAoD. No microbial testing is currently undertaken on this supply as at the temperature supplied, the water is pasteurised, and there is no possibility that the water has pathogens.

The following table summarises all available data from 2000 – April 2005.

Table 4 Bores 2-3 Water quality data (combined data) 2000 - 2005

	Units	Number of samples	Detections	Minimum	Maximum	Median	Mode
Conductivity	mS/cm	34	34	470	530	500	510
pH	unitless	34	34	7.5	8.15	8	8
Total Hardness	mg/L as $CaCO_3$	34	34	17	27	22	22
Alkalinity	mg/L as $CaCO_3$	34	34	200	232	220	220
Silica	mg/L	34	34	43	60	50	55
TDS	mg/L	34	34	320	350	340	340
True Colour	HU	34	17	<1	12	2	1
Turbidity	NTU	34	5	<1	11	1	1
Sodium	mg/L	34	34	97	115	105	105
Potassium	mg/L	34	34	8	9.9	9	9
Calcium	mg/L	34	34	6.7	10.5	9	9
Magnesium	mg/L	34	34	0.1	0.2	0	0.1
Bicarbonate	mg/L	34	34	240	281	265	260
Carbonate	mg/L	34	34	0.4	2.3	1	1
Chloride	mg/L	34	34	27.5	29.5	29	29
Fluoride	mg/L	34	34	0.4	0.7	1	0.6
Nitrate	mg/L	34	0	<0.5	<0.5	NA	NA
Sulphate	mg/L	34	34	3.7	6.4	5	5
Iron	mg/L	34	34	<0.02	0.7	0.05	0.05
Manganese	mg/L	34	25	<0.03	0.05	0.03	0.03
Zinc	mg/L	34	22	<0.01	0.04	0.01	0.01
Aluminium	mg/L	34	0	<0.05	<0.05	NA	NA
Boron	mg/L	34	34	0.06	0.2	0.11	0.09

	Units	Number of samples	Detections	Minimum	Maximum	Median	Mode
Copper	mg/L	34	2	0.04	0.09	0.07	NA
E coli	MPN/100 mL	49	2	1	14	8	NA

Note: the laboratory has a limit of reporting for turbidity of 1 NTU.

This data confirms that Bores 2-3 are suitable for drinking water, and that there are no parameters that consistently exceed health guideline values. It is noted that there have been periodic detections of iron above the aesthetic guideline, but as these samples are collected from throughout the reticulation network, not just from the bore heads, this is considered to be related to reticulation issues, not the source water. The periodic colour and turbidity detections are also considered to be related to reticulation, not the bore water.

2.1.2 Water Quality Bore 4

Council maintains pdf copies of water quality data from 2000 onwards. This data is slowly being digitised and at this time data from 2012 until 2022 has been entered and checked.

This 10 year data set demonstrates that the bore water is highly stable, and council resources limited. The value in entering older data diminishes. Data has been entered without the “<” which has the effect of skewing the dataset at the lower end.

For example, turbidity is skewed as the laboratory limit of reporting is <1 NTU. Therefore a mode of 1 means that turbidity was actually <1 for most samples. Similar considerations apply to copper which had a detection limit of <0.03 mg/L for much of the dataset, with recent laboratory changes now lowering the detection limit to <0.003. The dataset therefore shows a minimum of 0.003, and a mode of 0.03, which effectively means that copper has not been detected in the majority of samples. Due to the way the data has been entered, it is not possible to quickly assess the number of detections, hence the following table does not assess the data in the same was as for Bores 1-3. Nonetheless, the data demonstrates that there have been no health related exceedances for chemical parameters, and there are rare examples of aesthetic exceedances.

Council prepares annual averages for data which are graphed. This would highlight if there were any changes in the water quality within the Hutton aquifer.

There is limited heavy metal data, but samples from 2022 are presented in

Table 5 Bore 4 Water quality data from 2008 - 2021

	Units	Number of samples	Minimum	Maximum	Median	Mode	Std Dev
Conductivity	mS/cm	756	445	496	462	463	9
pH	unitless	756	6.95	9.06	7.71	7.69	0.23
Total Hardness	mg/L as $CaCO_3$	756	27	46	31	31	1.46
Alkalinity	mg/L as $CaCO_3$	756	179	200	188	190	4
Silica	mg/L	756	42	56	52	52	1.19
TDS	mg/L	756	32	325	310	310	12.35
True Colour	HU	756	1	87	1	1	4.04
Turbidity	NTU	756	1	38	1	1	2.04
Sodium	mg/L	756	81	93	87	86	2.35
Potassium	mg/L	756	11	13	12	12	0.27
Calcium	mg/L	756	11	18	12	12	0.53
Magnesium	mg/L	755	0.01	0.47	0.1	0.1	0.05
Bicarbonate	mg/L	756	216	241	228	229	5.07
Carbonate	mg/L	756	0.1	4	0.7	0.6	0.46
Chloride	mg/L	756	26	41	29	29	0.79
Fluoride	mg/L	756	0.2	0.5	0.31	0.31	0.04
Nitrate	mg/L	756	-0.5	1.2	0.5	0.5	0.19
Sulphate	mg/L	756	2	9.7	5.1	5	0.60
Iron	mg/L	756	0.01	1.1	0.07	0.06	0.07
Manganese	mg/L	756	0.005	0.19	0.077	0.08	0.01
Zinc	mg/L	756	0.01	1.4	0.01	0.01	0.10
Aluminium	mg/L	756	0.03	0.05	0.05	0.05	0.01
Boron	mg/L	756	0.05	0.1	0.07	0.07	0.01

	Units	Number of samples	Minimum	Maximum	Median	Mode	Std Dev
Copper	mg/L	756	0.003	0.55	0.03	0.03	0.04
E coli (2016-2021)	MPN/100 mL	279	<1	2	<1	<1	NA
Antimony	mg/L	6	<0.0005	<0.0005	NA	NA	NA
Arsenic	mg/L	6	0.0007	0.001	0.007	0.0007	0.0001
Barium	mg/L	6	0.178	0.192	0.184	0.178	0.005
Boron	mg/L	6	0.037	0.041	0.0395	0.037	0.002
Cadmium	mg/L	6	<0.004	<0.004	NA	NA	NA
Chromium	mg/L	6	<0.0003	0.0003	0.0003	0.0003	NA
Mercury	mg/L	6	<0.0003	0.0008	0.0006	NA	0.0003
Molybdenum	mg/L	6	<0.0004	<0.0004	NA	NA	NA
Nickel	mg/L	6	<0.001	<0.001	NA	NA	NA
Selenium	mg/L	6	<0.001	<0.001	NA	NA	NA
Silver	mg/L	6	0.0006	0.001	0.0009	0.001	0.0002
Uranium	mg/L	6	<0.0004	<0.0004	NA	NA	NA

Exceedances:

There have been 3 detections of *E. coli* since 2016, 2 detected in April 2019, and 1 in February 2020. There was a previous analysis that identified 898 E coli samples (date range not stated), with 7 detections. Of those detections, 6 occurred between 2010 and 2012.

The Winton water supply was also contaminated with *Salmonella* in 2012. The Water Tower was taken offline, super chlorinated and refilled. No further issues have been detected.

There is some data for *Legionella* for the Winton Hospital and Multipurpose Health Centre – this showed 16 detections of *Legionella* in 78 samples between 2020 and 2021. However, this data is hard to interpret as there is a water treatment plant at the centre, and there is no ability to identify whether the positive samples were prior to the treatment plant, or only internal in the hospital after the point of supply. It may indicate a risk but is not definitive.

As can be seen, the water quality in all 4 bores is very good, with no parameters exceeding health guideline values. Similar to Bores 1-3, there are periodic detections of elevated colour and turbidity, likely related to mains breaks.

Manganese sometimes exceeds the 0.1 mg/L aesthetic threshold, and this potentially leads to longer term build-up in the reticulation network. This could be the reason for the single elevated level of 0.19 mg/L (which is still below the health guideline value). There have also been irregular detections of elevated levels of iron. Again, this does not appear to be related to the source water and is more likely to be related to issues within the reticulation network.

The main risk to the service is due to the fact that the water is hot, and it is reticulated to customers at elevated temperatures that may encourage survival of any pathogens that enter the system after the borehead. Alternatively, if cooling systems fail there is a risk of scalding.

The bores have not been tested for radiological parameters, but the Hutton and Hooray aquifers are used widely for drinking water supplies, so we are confident that there is not an issue. Samples from Bore 4 will be sent for testing in 2022 and will continue to be tested as stated in the verification monitoring program from when this version of the DWQMP is approved.

SCHEME DESCRIPTION

Winton water supply is 100% supplied from Bore 4 with the exception of one connection from Bore 3. The bore water is hot, with temperatures at the bore head of 86°C. In order to comply with the Plumbing Code of Australia, the water is therefore cooled (using heat exchangers) to 44°C prior to reticulation to customers.

Other than cooling, there is no treatment or disinfection of the water supply at this time.

It is noted that customers in Winton rely on the hot water that is provided in this way. The majority of households do not have water heaters to provide hot water, and instead rely on the heat of the water supplied. Council is reluctant to lower the temperature further without full community consultation as a change to cooler water implies that each connection would require a plumber to install a hot water heater and replumb the household.

Pipework remains in place to connect Bores 1-3 back into the drinking water supply. Currently Bore 1 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 non-potable water stand pipe. Bore No. 1 also supplies top up water to the cooling dams that supply cooling water for the heat exchangers. Bore 2 is currently shut off completely and has not been opened for many years. Bore 3 is not used for the main drinking supply, but provides supply to the AAoD.

There is no intention to use any bore other than Bore 4 for the drinking water supply at this time. The alternative bores remain connected by pipework, and could be used if there was a catastrophic failure of Bore 4. The pipes would be flushed prior to use if required. This is not normal operation, and not discussed further as Bore 4 has been the sole supply since ~2007. Nonetheless, this demonstrates that there is a contingency option for water supply, and council is not solely reliant on Bore 4.

3.1 Schematic

The physical location of the bores and pump station are shown in the following figure – the GIS mapping is available on the council website at https://winton.maps.arcgis.com/home/index.html and can be interrogated by any member of the public (select inground assets).

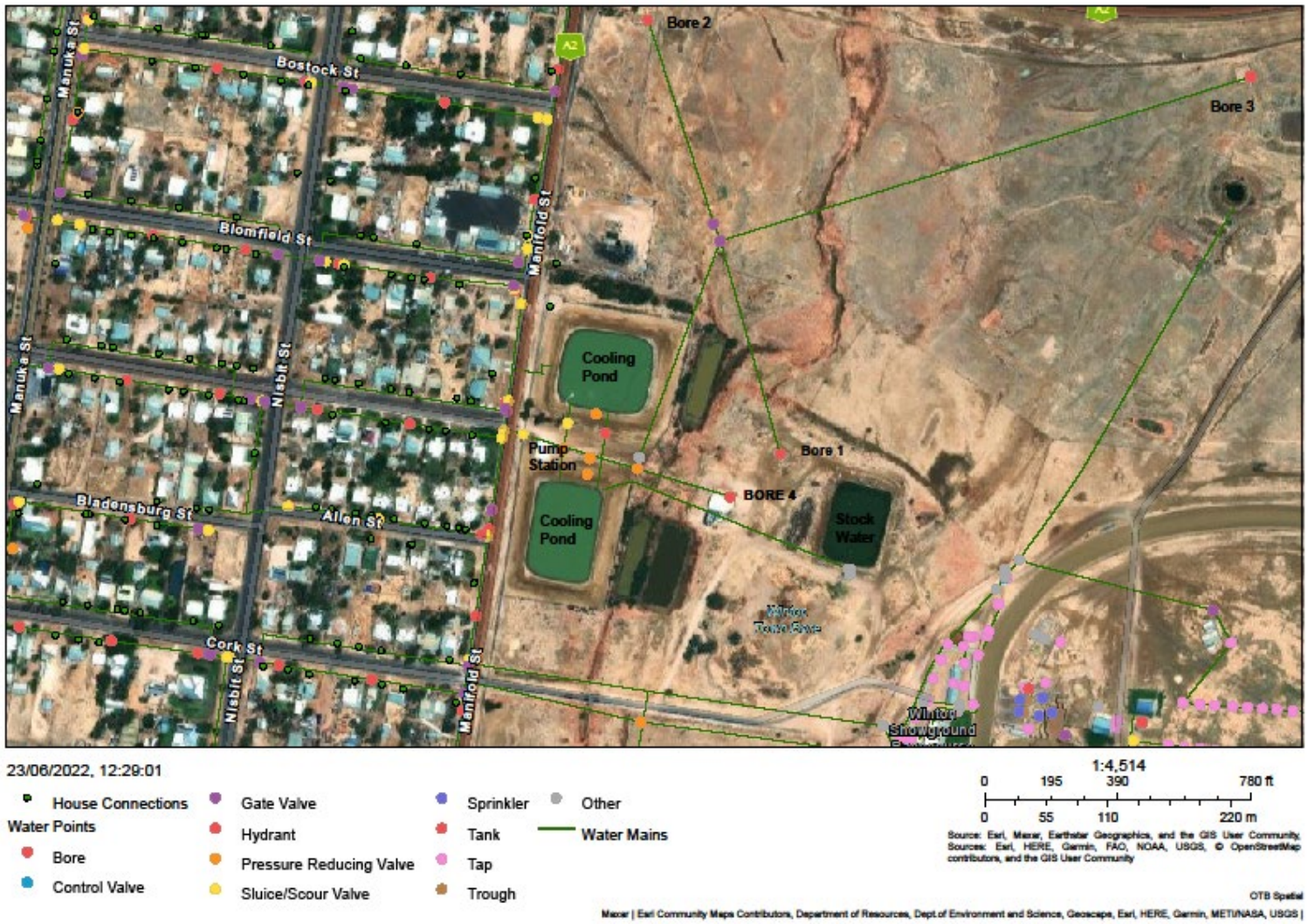


Figure 3 Location of Bores and Pump Station

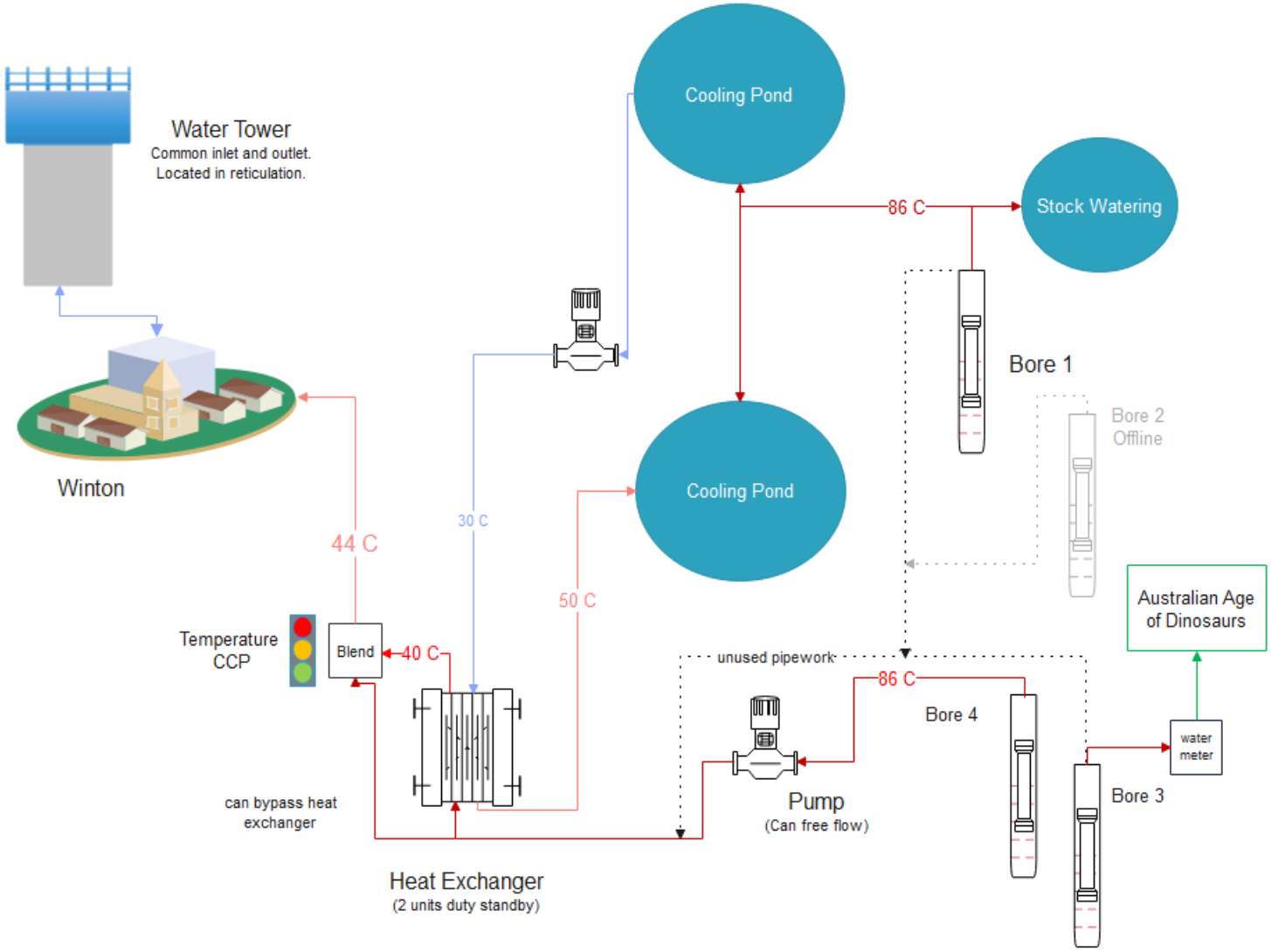
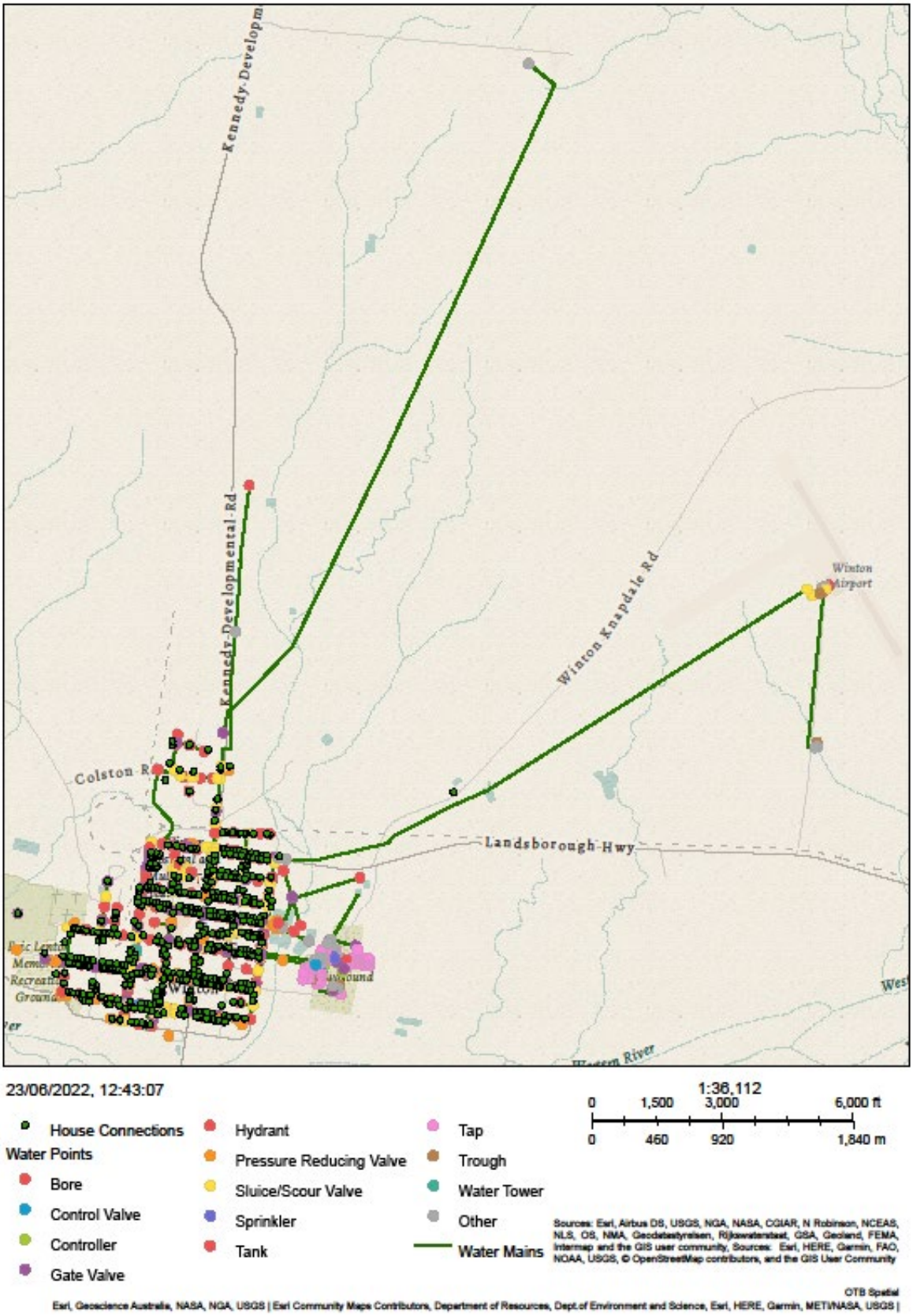


Figure 4 Schematic Diagram of Winton Infrastructure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Controller
Gate Valve
Hydrant
Pressure Reducing Valve
Sluice/Scour Valve
Sprinkler
Tank
Tap
Trough
Water Tower
Other
Water Mains
Sources: Esri, Airbus DS, USGS, NGA, NASA, CGIAR, N Robinson, NCEAS, NLS, OS, NMA, Geodatastyrelsen, Rijkswaterstaat, GSA, Geoland, FEMA, Intermap and the GIS user community, Sources: Esri, HERE, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community
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Figure 5 Full bore to tap schematic

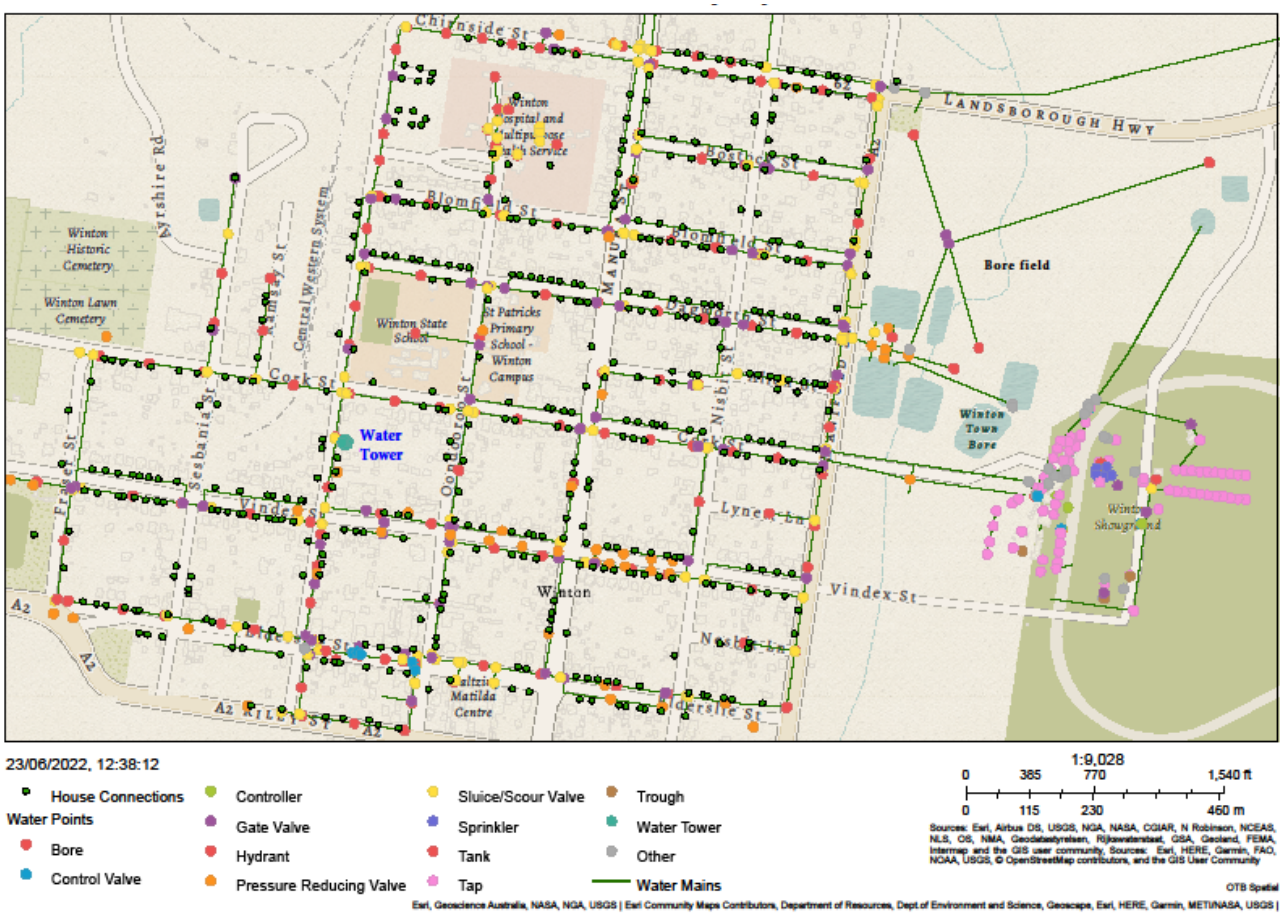

Figure 6 Winton reticulation

3.1.1 Geothermal power station

There is a geothermal power station that was constructed adjacent to Bore 4 headworks. This has never worked successfully and is isolated. If used, the bore water pipe passes through a heat exchanging fluid, and the heat used to volatilise the fluid and drive turbines. This is not council infrastructure and adds no risk to the system as there is no contact of bore water with the fluid. Currently the valves to the geothermal station are closed and so it is bypassed.

3.1.2 Heat Exchangers

There are two Alfa Laval Plate Heat Exchangers (model M15-BFG8) that are used as duty/ standby and are swapped monthly in accordance with storage and maintenance requirements.

Each heat exchanger has been designed to exchange 9710 kw of heat. The design condition is for 60L/s flow on the hot side, and 80L/s on the cold side. The hot water is cooled from 86°C to 44°C, while the cool side heats from 40°C to 59°C.

The heat exchangers have multiple metal plates that separate hot bore water from Bore 4 passing in the forward direction from cooling water (flowing in the reverse direction). The heat exchangers are stripped down annually and cleaned by an external contractor, and all plates have recently been sent for testing to ensure that all plates are intact and do not allow passage of water between the hot and cold sides, any plates that showed signs of corrosion were replaced.

The plates are sealed with gaskets, and it is not possibly to put the heat exchanger plates in the wrong configuration and achieve a seal. When the heat exchangers are dismantled and cleaned, the gaskets are inspected.

If the gaskets were compromised then (depending on where the break is) there is a theoretical possibility of water leaking from one side to the other. This can be tested for: When the heat exchanger is put back together, one side is pressurised, with the second side empty and open – if a gasket was compromised either the pressurised side leaks to the environment (most likely) or could potentially flow out the unpressurised side. If the first side is pressurised and there are no leaks, then the second side is able to be opened. If there are no leaks to the environment, the gaskets are intact. Therefore, when the maintenance procedure is followed, the risk of cross contamination is negligible. Maintenance of this type is carried out by a qualified service technician.

The cooling water is stored in an open storage. The cooling ponds are topped up with bore water from Bore 1 as required. As the cooling water is in an open storage, there will be microbial contamination. However, as this is physically separated from the drinking water supply, this is not considered a realistic risk.

There is a heat exchanger bypass line that is adjusted to re-blend some hot water into the cooled water to maintain a temperature of ~44°C. This hot water is then reticulated to town.

3.1.3 Pump Station

Water is pumped through the heat exchanger on both the hot and cooling sides. A reticulation pump pumps cooled water into reticulation and, if there is an excess of supply, into the water tower.

There are 4 cooling water pumps – 2 Grundfos 2RPSHF3C and 1 PSHFC-F and a Southern Cross 125x100-315. The three hot water pumps include 2 Grundfos 2RPSED2C and one Southern Cross 125x100-200.

3.1.4 Water Tower

The Water tower is located on Werna St and is an elevated 450 kL reinforced concrete storage. The water tower has been internally sealed with a tar like substance. Council has recently sent samples for polycyclic aromatic hydrocarbons and total recoverable hydrocarbons.

The water tower is vermin proof in that the air vent is surrounded by flyscreen that is held in place with wire to prevent any vermin ingress. There is a small hole associated with the level float, and the concrete hatch seals the opening, but not perfectly. The water tower is irregularly inspected as the access is via vertical ladders internally in the water tower prior, and then exits to the outside of the water tower. The ladder is noncompliant with current standards, and access requires multiple people with full harnesses and safety plans. Drones are therefore used annually, to check the hatch is still closed and that the flyscreen on the vent is in place. There has not been a record keeping process for these inspection to date, but footage will be saved on OneDrive.

It is noted that the water tower is close to the end of its serviceable life and is undersized according to standard industry guidelines. A new larger reservoir is identified in the improvement plan however, no timeline has been stated as this is a decision for Council and requires appropriate funding. This also requires significant community consultation as a new reservoir implies that there will be a difference in water temperature, which will affect all residents.

3.1.5 Reticulation

The reticulation network is approximately 34.2km long with an age and type breakdown as follows. Mains are predominantly 100-150mm with a range of size from 25mm through to 250 mm, and one 300mm rising main.

On average there are ~45 mains breaks per year. Each main break provides an opportunity for ingress of pathogens if not repaired correctly.

Backflow – households have water meters, and all meters will have check valves. However, it is thought that there may be some council connections that are unmetered, and therefore there is a risk of backflow at these locations.

Table 6 Reticulation Network composition

Type	(m)	count	Oldest	Youngest
Asbestos Cement	7018	49	1950	1987
Ductile Iron	5637	49	1978	2009
Unplasticised PVC	210	1	1998	2022
BlueBrute	1385	10	1950	2002
Polyvinyl Chloride	2118	18	2004	2022
Poly Pipe	17330	38	1960	2006
Galvanized Iron	500	1	1973	1973

The reticulation network is relatively small, but there are several short dead ends e.g. at the end of Ramsay St, Vindex St and Nesbit Lane, and 3 longer mains to the Airport, Prison Camp and Industrial area on the Kennedy Highway. Council has established a regular flushing program for these locations.

HAZARD IDENTIFICATION AND RISK ASSESSMENT

The hazard identification and risk assessment for the DWQMP was undertaken in two parts. In the first part, Bligh Tanner was engaged to undertake a microbial risk assessment of the Winton Water scheme from aquifer to customer drinking water taps.

The microbial risk assessment was undertaken using a methodology based on the 2010 DWQMP Guideline published by the Qld Government, and the relevant outcomes have been adopted for the DWQMP. There are some findings from that risk assessment that extend beyond the scope of the DWQMP which is from catchment to water meter.

Subsequently, the microbial risk assessment was both reviewed and expanded to include all hazards and hazardous events, resulting in the complete risk assessment presented in the DWQMP.

The process involved

- identification of relevant hazards,
- identification of the sources of hazards
- determining the consequence and likelihood of the hazard and hazardous event in the absence of controls resulting in the determination of the unmitigated risk

4.1 Identification of hazards

The risk assessment has considered biological, chemical, physical and radiological hazards, the full list of considered hazards is in the unmitigated risk table presented later.

4.2 Unmitigated Risks

The unmitigated risk assessment identified the hazards, the sources of the hazard, and then assessed the consequence and likelihood of the hazard being present.

The risk matrix with definitions are included overleaf.

The unmitigated risk for the microbial risk assessment determined the maximum risk that needs to be managed *in the absence of any controls.* This is a theoretical exercise that includes the likelihood of the presence of the particular microbial hazard. This risk assessment considers the unmitigated risk arising at different parts of the system, and so the sources of hazard that are identified also link to particular hazardous events. In the subsequent broader risk assessment, these microbial risks were combined to incorporate various parts of the system if the outcome was the same. Unmitigated risks were also assessed for chemical, physical and radiological hazards.

4.2.1 Consequences:

In the case of bacterial or viral contamination of a water supply, it is expected that all downstream customers from the point of contamination are likely to consume the water, and therefore, many people may become infected. Following this logic, pathogenic bacteria and viruses are considered to have a **Catastrophic** consequence. Similarly, the protozoan pathogens *Cryptosporidium* and *Giardia* would also be considered Catastrophic.

Opportunistic amoeba such as *Naegleria fowlerii* can survive within biofilms in the reticulation network, however the mechanism of infection requires forcing water up the nasal cavity. Drinking water contaminated with *Naegleria* does not result in infection. An outbreak is not expected to be declared, and therefore the consequence is **Major.**

Acanthamoeba is another opportunistic amoeba with public health consequences. As with *Naegleria, Acanthamoeba* is also a **Major** consequence due to the mode of infection, which would not trigger an outbreak.

Temperature in this scheme is also considered as a **Major** hazard as there would be widespread impact, but no outbreak. **Moderate** consequences apply to parameters with chronic health guideline values, while **Minor** and **Insignificant** risks apply to aesthetic only parameters.

4.2.2 Likelihood:

The likelihood of a particular hazard is included in the risk matrix and varies from Almost Certain if the hazard is considered to be present on a daily to weekly basis, to Rare where the hazard is not expected to arise over a 5 year period.

Table 7 Risk Matrix including definitions for consequence and likelihood

Public Health Risk Matrix		Consequence	Insignificant	Minor	Moderate	Major	Catastrophic
Likelihood			Isolated aesthetic exceedence - little operational disruption	Local aesthetic exceedence or Potential isolated breach of chemical health parameter	Widespread aesthetic exceedences, or Repeated breaches of chronic health guidelines	Potential acute health impact, no outbreak expected	Potential acute health impact, declared outbreak likely
Almost Certain	Occurs daily to weekly		Medium 6	High 10	High 15	Extreme 20	Extreme 25
Likely	1-4 occurrences per month		Medium 5	Medium 8	High 12	High 16	Extreme 20
Possible	1-11 occurrences per year		Low 3	Medium 6	Medium 9	High 12	High 15
Unlikely	1 occurrence per 1-5 years		Low 2	Low 4	Medium 6	Medium 8	High 10
Rare	<1 occurrence per 5 years		Low 1	Low 2	Low 3	Medium 5	Medium 6

4.3 Mitigated Risk Assessment.

A microbial risk assessment was undertaken in 2022 to assess the risks posed by the untreated drinking water supply. This had been a commitment of a previous DWQMP.

The microbial risk assessment is not included directly in this DWQMP, but the findings are summarised here, and many of the risk assessment items incorporated directly into the risk assessment.

Where risks are medium or below, the risk is acceptable. Where the risk is high or extreme and able to be reduced further, improvement actions are required to be identified. In some cases, it may not be possible to reduce the risk further, and if the level of risk is acceptable to council, it may be rated as low as reasonably practicable (ALARP).

4.3.1 Uncertainty:

The following definitions are used for uncertainty in the mitigated risk assessment.

Table 8 Uncertainty Descriptors

Uncertainty rating	Descriptor
Certain	The processes involved are thoroughly understood
Confident	The processes involved are well understood
Reliable	There is a reasonable understanding of the process
Estimate	There is limited understanding of the process
Unreliable	Based on best estimates

Table 9 Unmitigated Risk Assessment

Hazard	Location	Sources of Hazard	Unmitigated Risk			Comment
			Consequence	Likelihood	Risk	
Any Pathogen (Source)	Borehead	contamination of artesian aquifer or ingress through borehead	Catastrophic	Rare	Medium 5	The source water is pasteurised due to the heat. There is essentially no risk from the source itself.
Bacteria/ Virus (Source)	Borehead	contamination of artesian aquifer or ingress through borehead	Catastrophic	Rare	Medium 5	The source water is pasteurised due to the heat. There is essentially no risk from the source itself.
Cryptosporidium/ Giardia (Source)	Borehead	contamination of artesian aquifer or ingress through borehead	Catastrophic	Rare	Medium 5	The source water is pasteurised due to the heat. There is essentially no risk from the source itself.
Bacteria/ Virus	Reservoir (direct)	Ingress of faeces through vent or hatch	Catastrophic	Possible	High 15	Identified in 2022 Audit, and likely cause of 2012 *Salmonella* detections.
Cryptosporidium/ Giardia Reservoir	Reservoir (direct)	Ingress into reservoir	Catastrophic	Rare	Medium 5	No likely mechanism for direct contamination of the reservoir
Legionella	Reservoir (direct)	Ingress of bird faeces into reservoir, opportunistic contamination	Catastrophic	Unlikely	High 10	The reservoir has minor breaches of integrity e.g. to allow the float wire to enter the Reservoir. There is a small crack in the hatch, and the hatch does not seal perfectly. In the absence of controls, the unmitigated risk is raised to unlikely.
Naegleria	Reservoir (direct)	Contamination into the reservoir	Major	Unlikely	Medium 8	Direct contamination of the reservoir by *Naegleria* is not considered to be the mechanism of contamination.
Bacteria/ Virus	Reservoir (via reticulation)	Contamination from reticulation (mains break/ backflow) subsequently entering reservoir	Catastrophic	Possible	High 15	Mains breaks occurred 46 times in 19-20. Currently no hygienic mains break repair procedure, but using WIOA Video and formalising.
Cryptosporidium/ Giardia (chlorine resistant Protozoa)	Reservoir (via reticulation)	Contamination from reticulation (mains break/ backflow) subsequently entering reservoir	Catastrophic	Possible	High 15	Mains breaks occurred 46 times in 19-20. Currently no hygienic mains break repair procedure, but using WIOA Video and formalising.

Hazard	Location	Sources of Hazard	Unmitigated Risk			Comment
			Consequence	Likelihood	Risk	
Naegleria	Reservoir (via reticulation)	Contamination from reticulation (mains break/ backflow) subsequently entering reservoir	Major	Possible	High 12	No dedicated rising main - ingress from a main break and subsequent colonisation of the reservoir.
Acanthamoeba	Reticulation	Opportunistic contamination through mains breaks	Major	Possible	High 12	Mains breaks occurred 46 times in 19-20. Currently no hygienic mains break repair procedure, but using WIOA Video and formalising.
Bacteria/ Virus (Reticulation)	Reticulation	Mains break	Catastrophic	Possible	High 15	safe water mains repair - WIOA video. Laws officer to develop manual for water ops.
Bacteria/ Virus (Reticulation)	Reticulation	Backflow	Catastrophic	Possible	High 15	No testing program for backflow prevention devices. May not be appropriate protection on all required locations.
Cryptosporidium/ Giardia Reticulation	Reticulation	Backflow	Catastrophic	Possible	High 15	No testing program for backflow prevention devices. May not be appropriate protection on all required locations.
Legionella (Reticulation)	Reticulation	Backflow	Catastrophic	Unlikely	High 10	No testing program for backflow prevention devices. May not be appropriate protection on all required locations.
Naegleria	Reticulation	Backflow	Major	Possible	High 12	No testing program for backflow prevention devices. May not be appropriate protection on all required locations.
Naegleria	Reticulation	Opportunistic contamination through mains breaks	Major	Possible	High 12	Mains breaks occurred 46 times in 19-20. Currently no hygienic mains break repair procedure but using WIOA Video and formalising.
Pseudomonas	Reticulation	Opportunistic contamination	Major	Possible	High 12	Mains breaks occurred 46 times in 19-20. Currently no hygienic mains break repair procedure but using WIOA Video and formalising.
Bacteria/ Virus (cooling tanks)	Cooling tanks (customer)	Ingress of faeces into customer cooling tanks	Catastrophic	Almost Certain	Extreme 25	Customer cooling tanks are not maintained or inspected. Council EHO should be ensuring the quality of water is maintained. Beyond scope of DWQMP.

Hazard	Location	Sources of Hazard	Unmitigated Risk			Comment
			Consequence	Likelihood	Risk	
Cryptosporidium/ Giardia (chlorine resistant Protozoa)	Cooling tanks (customer)	Ingress of faeces into customer cooling tanks	Catastrophic	Possible	High 15	Customer cooling tanks are not maintained or inspected. Council EHO should be ensuring the quality of water is maintained. Beyond scope of DWQMP.
Aluminium	Source Water	natural sources	Minor	Rare	Low 2	No detections in any sample since 2000.
Chlorate	No source	sodium hypochlorite breakdown at redosing locations / contaminated chlorine supply	Moderate	Rare	Low 3	No source.
Chlorine	No source	chemical overdose	Moderate	Rare	Low 3	No source.
Colour		naturally occurring	Minor	Unlikely	Low 4	Have been some detections of colour above aesthetic guidelines, but less than 10 above 15 in 10 years of data, no history of complaints.
Copper	Reticulation	corrosion of pipework	Moderate	Rare	Low 3	No results above 0.55 mg/L in over 10 years of data
Zinc	Reticulation	natural geology, chemical impurities, corrosion of assets	Minor	Rare	Low 2	one result of 1.4 mg/L in over 10 years of data, none approaching aesthetic guideline.
Heavy Metals	Reticulation	natural geology	Moderate	Rare	Low 3	6 recent samples
Hydrocarbons (Retic)	Reticulation	mains contamination, tanker spills	Moderate	Unlikely	Medium 6	Possible for major spill near pipe that may be permeable.
Hydrocarbons (Reservoir)	Reservoir	Lining of the reservoir leaching	Moderate	Unlikely	Medium 6	The lining has been in place for 50 years with no noticeable taste. Testing has commenced, but results not yet received. Considered unlikely to still be leaching now even if it did originally.
Iron	Reticulation	natural geology, sediment	Minor	Unlikely	Low 4	Have been periodic detections of iron in reticulation, with some above aesthetic guideline. Likely associated with mains breaks.
Lead	Reticulation	lead containing brass fittings, lead joins in pipes	Moderate	Unlikely	Medium 6	6 results only

Hazard	Location	Sources of Hazard	Unmitigated Risk			Comment
			Consequence	Likelihood	Risk	
Manganese	Reticulation	Aquifer	Moderate	Rare	Low 3	The highest result is 0.19mg/L above aesthetic, but below health guidelines. (This includes both Hooray and Hutton bores).
Nitrate	Reticulation	Contamination from sewerage	Moderate	Rare	Low 3	The Hutton bore is 1200m deep, and there have been no detections of nitrate above detection limit in >10 years of data. (And no detections for the Hooray bores either).
Pesticides	Reticulation	agriculture, horticulture, illegal disposal, spill	Moderate	Rare	Low 3	The bore is 1200m deep, and thereis no feasible mechanism of contamination.
pH	Reticulation	pH increases through AC pipes	Minor	Unlikely	Low 4	There is 7km of AC mains, and only one pH result above 8.5 in 10 years of data.
Radioactivity	Reticulation	natural geology	Moderate	Unlikely	Medium 6	No data - but Hooray and Hutton aquifers are not known to have radioactivity
Taste and odour	Reticulation	stagnating water in reticulation, old mains	Moderate	Almost Certain	High 15	Water in Winton has a sulfur smell.
THMs	Reticulation	No identifiable source	Moderate	Rare	Low 3	No organics in bore water, no chlorination, will not occur.
Turbidity (Retic)	Reservoir	sloughing of biofilm in reservoir	Moderate	Possible	Medium 9	The water tower has a biological growth on surfaces that may potentially slough off.
Turbidity (Retic)	Reticulation	sloughing of biofilm in reticulation, resuspension of sediment in reservoirs/mains, main break	Moderate	Possible	Medium 9	There was one result of 5 NTU and another of 38 NTU turbidity recorded in reticulation in August 2017, but no other samples since have been above 5 NTU. Prior to 2017 there was approximately 1 elevated (above aesthetic) result every 2 years.

Hazard	Location	Sources of Hazard	Unmitigated Risk			Comment
			Consequence	Likelihood	Risk	
Loss of Supply	Reticulation / Whole of System	raw water supply compromised/ infrastructure failure/ inability to provide sufficient supply e.g. during a fire.	Major	Rare	Medium 4	Multiple sources, can operate in manual, Bore 4 provides 60 L/s freeflow and ~80L/s at 35m head pumped and there is 450 kL in the Reservoir. Bore can fill reservoir without pumps. The level of reserve is less than should be planned for, but the bore flow rate alone provides >275kL/ hour. WSA 03-2011-3.1 section 3.1.5 indicates that water supply systems are not designed for specific fire fighting capability. AS 2419.1 2005 (Fire hydrant installation) requirement is for 10L/s at 200 Kpa. This is achieved throughout Winton direct from the bores. The Water Tower top water level provides 27m static head.
Malicious action	Pump Station / Reservoir	sabotage	Catastrophic	Rare	Medium 5	This has not been an issue in Winton.
Operator Error	Whole of system	mistake/ lack of training / overworked	Catastrophic	Possible	High 15	The major source of risk is via main break repairs as there are few other activities that can impact the safety of the water supply.
Cyber Security	Pump Station/ Whole of system	Cyber attack	Moderate	Possible	Medium 9	There are few processes that can be interrupted that would result in ongoing issues.
Mercury		bore water	Moderate	Unlikely	Medium 6	Recent results all below ADWG health guideline. Was detected, and needs to be monitored.
Temperature			Major	Possible	High 12	Power outages more frequent in storm season, 1-2 occurrences a year with hot water entering reticulation.

4.4 Process by process assessment

4.4.1 Source water hazard.

The source water is the fully protected great artesian basin aquifer. The water is effectively pasteurised as it is of sufficiently high temperature leaving the source and therefore there are no pathogens at the source. There is no chemical data that indicates any chemical hazards above health guideline values.

4.4.2 Heat exchangers

The heat exchangers bring cooled water (stored in the surface water storage) in close proximity to the hot water, but the sources are separated by metal plates and gaskets. Testing of the heat exchanger as it is brought online from cleaning/ servicing would identify failed gaskets and there is no movement of components due to the confining forces squeezing plates together. While there is a theoretical risk of water passing between sides, this is considered highly unlikely.

4.4.3 Reticulation

From the pump station, cooled water (44°C) enters reticulation prior to the Water Tower. This temperature is too hot for most pathogens, although *Legionella* may survive. However, water continues to cool as it passes through the network, and the temperature tested at the standpipe near the slaughter yards was 38°C, and hence ideal for pathogen survival.

Water leaving the pump station should remain pasteurised and is safe. However, there are then opportunities for recontamination. For example, through mains breaks and backflow.

The 20/21 Performance Report identified 145 mains breaks per 100km, or 50 breaks. Each break provides an opportunity for contamination. The prior year had 46 breaks.

4.4.4 Household water tanks

Many households have water tanks for potable water that are used as “cooling tanks” on site. This also requires that the resident has pressure pumps to repressurise into the house. These should be installed by a licensed plumber and should have an air gap (or backflow prevention valve) from the mains supply into the tank. Further, the water pumps should be installed by a licenced plumber. These cooling tanks are often repurposed rainwater tanks and are not vermin proof.

It is suspected that many households have undertaken plumbing works illegally. As such, there is a possibility that some installations are not compliant, and at worst, the pumps could pressurise against the water meter. If the meter fails there could be backflow from these sources.

These tanks are beyond the customer meter, are technically outside the scope of the DWQMP, but may be a source of pathogens if there is backflow from those houses.

Council regulates water other than drinking water under the Public Health Regulation 2018, however, it is not clear that the tanks on site are a public health risk when on private properties. Food businesses are also expected to have cooling tanks, and it is Councils responsibility to ensure these are safe under the Food Act 2006.

4.5 Water Tower

The water tower is “vermin proof” but is not hermetically sealed. For example, there is a small hole where the cable for the level float exits the water tower. There is a low likelihood of vermin entering the water tower through these penetrations. The recent 2022 audit identified that the

level of vermin proofing for the water tower is not sufficient for a supply with no disinfection residual.

More likely, either through backflow or from mains breaks, pathogens could enter the reticulation network and then into the water tower – in either case, there is a feasible pathway by which contamination can enter the water tower.

As the temperature in the water tower will be cooler than at the pump station, and likely close to 40°C, there is clearly a risk that *Legionella* could proliferate in the water tower. Similarly, the temperature tolerance of *Naegleria fowlerii* is such that *if* it entered into the reticulation mains through a mains break (or backflow), then if could grow at these temperatures. Council intends to commence annual monitoring for these pathogens even though the ADWG does not recommend specific pathogen testing. This is to provide greater understanding of the risk but is not intended to replace *Escherischia coli* monitoring. It is noted that *Escherischia coli* is also thermotolerant and could also survive at these temperatures, and so pathogens of faecal origin would be expected to be detected using this indicator bacteria.

Table 10 Mitigated Risk Assessment and Improvement Actions

Risk ID	Hazard	Location	Sources of Hazard	Unmitigated Risk	Comment	Primary preventive measure	Residual Risk				Improvement Recommendations	Timeframe	Priority
							Consequence	Likelihood	Risk	Uncertainty			
W1	Any Pathogen (Source)	Borehead	contamination of artesian aquifer or ingress through borehead	Medium 5	The source water is pasteurised due to the heat. There is essentially no risk from the source itself.	Workday inspections including bore pressure and temperature	Catastrophic	Rare	Medium 5	Certain			
W2	Bacteria/ Virus (Source)	Borehead	contamination of artesian aquifer	Medium 5	The source water is pasteurised due to the heat. There is essentially no risk from the source itself.	Workday inspections including bore pressure and temperature	Catastrophic	Rare	Medium 5	Certain			
W3	*Cryptosporidium/ Giardia (chlorine resistant Protozoa)*	Borehead	contamination of artesian aquifer	Medium 5	The source water is pasteurised due to the heat. There is essentially no risk from the source itself.	Workday inspections including bore pressure and temperature	Catastrophic	Rare	Medium 5	Certain			
W4	Bacteria/ Virus	Reservoir (direct)	Ingress of faeces through vent or hatch	High 15	Identified in 2022 Audit, and likely cause of 2012 *Salmonella* detections.	Plastic mesh around the vent. No regular inspections. 2022 Audit identified that bird faeces on mesh may drop in.	Catastrophic	Unlikely	High 10	Estimate	Replace hatch with McBerns style hatch or similar, replace vent with secure vent. Develop regular reservoir inspection program (at least annually).	W4 22/23 FY	High
W5	*Cryptosporidium/ Giardia (chlorine resistant Protozoa)*	Reservoir (direct)	Ingress into reservoir	Medium 5	No likely mechanism for direct contamination of the reservoir		Catastrophic	Rare	Medium 5	Estimate	Replace hatch with McBerns style hatch or similar, replace vent with secure vent. Develop regular reservoir inspection program (at least annually).	W4 22/23 FY	High
W6	Bacteria/ Virus	Reservoir (via reticulation)	Contamination from reticulation subsequently entering reservoir	High 15	Mains breaks occurred 46 times in 19-20. Currently no hygienic mains break repair procedure	Trained staff for main repair, but no specific procedure.	Catastrophic	Unlikely	High 10	Estimate	W6a Finalise and roll out best management practices for water main breaks and repairs procedure to document WIOA Youtube video. Include a chlorination procedure for the isolated section of main during repair. W6b Consider dedicated rising main to reservoir with weekly procedure to pasteurise. W6c Develop interim decontamination procedure	W6a 1/12/2022 W6b 2027 W6c 2022	W6a High W6b Medium W6c High

Risk ID	Hazard	Location	Sources of Hazard	Unmitigated Risk	Comment	Primary preventive measure	Residual Risk				Improvement Recommendations	Timeframe	Priority
							Consequence	Likelihood	Risk	Uncertainty			
W7	*Cryptosporidium/ Giardia (chlorine resistant Protozoa)*	Reservoir (via reticulation)	Contamination from reticulation subsequently entering reservoir	High 15	Mains breaks occurred 46 times in 19-20. Currently no hygienic mains break repair procedure	Trained staff for main repair, but no specific procedure.	Catastrophic	Unlikely	High 10	Estimate	W6a Finalise and roll out best management practices for water main breaks and repairs procedure to document WIOA Youtube video. Include a chlorination procedure for the isolated section of main during repair. W6b Consider dedicated rising main to reservoir with weekly procedure to pasteurise. W6c Develop interim decontamination procedure	W6a 1/12/2022 W6b 2027 W6c 2023	W6a High W6b Medium W6c High
W8	*Naegleria*	Reservoir (via reticulation)	ingress into mains and subsequent entry into Reservoir	High 12	No dedicated rising main - ingress from a main break and subsequent colonisation of the reservoir	*Naegleria* can grow in temperatures from 25 up to 46 C - this is the typical range of the reservoir, so risk in this case increases.	Major	Likely	High 16	Estimate	W6a Finalise and roll out best management practices for water main breaks and repairs procedure to document WIOA Youtube video. Include a chlorination procedure for the isolated section of main during repair. W6b Consider dedicated rising main to reservoir with weekly procedure to pasteurise. W6c Develop interim decontamination procedure	W6a 1/12/2022 W6b 2027 W6c 2024	W6a High W6b Medium W6c High
W9	*Acanthamoeba/ Pseudomonas*	Reticulation	Opportunistic contamination through mains breaks	High 12	Decontamination procedure in Appendix of DWQMP, yet to be trialled.	*Acanthamoeba* can grow in temperatures up to 37 - 42 C (species dependent) The reservoir is commonly above this, so risk remains, but does not increase. *Pseudomonas* has same risk profile.	Major	Possible	High 12	Estimate	W6c Develop interim decontamination procedure	W9 Dec 2022	High
W10	Bacteria/ Virus (Reticulation)	Reticulation	Mains break	High 15	Mains breaks occur nearly weekly. Safe water mains repair - WIOA video. Laws officer to develop manual for water ops.	Trained staff for main repair, but no specific procedure.	Catastrophic	Possible	High 15	Estimate	W6a Finalise and roll out best management practices for water main breaks and repairs procedure to document WIOA Youtube video. Include a chlorination procedure for the isolated section of main during repair.	W6a 1/12/2022	High

Risk ID	Hazard	Location	Sources of Hazard	Unmitigated Risk	Comment	Primary preventive measure	Residual Risk				Improvement Recommendations	Timeframe	Priority
							Consequence	Likelihood	Risk	Uncertainty			
W11	Bacteria/ Virus (Reticulation)	Reticulation	Backflow	High 15	No testing program for backflow prevention devices. May not be appropriate protection on all required locations.	Not all connections are believed to be metered. Meters are not modern double check valve type.	Catastrophic	Possible	High 15	Estimate	Ensure all connections have AS compliant meters. Audit of customer connections, and investigate a smart metering program. Commence testing of all backflow prevention devices annually. Engage plumbing inspector and inspect household pumps and cooling tanks to ensure appropriate backflow prevention (e.g. air gap)	W11a - Backflow prevention devices - Technical officer to commence audit of devices, then ensure testing. By July 2023. W11b Audit of customer connections (water meters) by July 2025 W11c Household plumbing by July 2025. Investigation into smart metering - this is linked to RAPAD project - expression of interest regionally (current).	W11a Medium W11b low W11c low
W12	*Cryptosporidium/ Giardia (chlorine resistant Protozoa)*	Reticulation	Backflow	High 15	No testing program for backflow prevention devices. May not be appropriate protection on all required locations.	Not all connections are believed to be metered. Meters are not modern double check valve type.	Catastrophic	Possible	High 15	Estimate	Ensure all connections have AS compliant meters. Audit of customer connections, and investigate a smart metering program. Commence testing of all backflow prevention devices annually. Engage plumbing inspector and inspect household pumps and cooling tanks to ensure appropriate backflow prevention (e.g. air gap)	W11a - Backflow prevention devices - Technical officer to commence audit of devices, then ensure testing. By July 2023. W11b Audit of customer connections (water meters) by July 2025 W11c Household plumbing by July 2025. Investigation into smart metering - this is linked to RAPAD project - expression of interest regionally (current).	W11a Medium W11b low W11c low

Risk ID	Hazard	Location	Sources of Hazard	Unmitigated Risk	Comment	Primary preventive measure	Residual Risk				Improvement Recommendations	Timeframe	Priority
							Consequence	Likelihood	Risk	Uncertainty			
W13	*Legionella* (Reticulation)	Reticulation	Backflow, opportunistic contamination, mains breaks	High 10	The reservoir has minor breaches of integrity e.g. to allow the float wire to enter the Reservoir. There is a small crack in the hatch, and the hatch does not seal perfectly. In the absence of controls, the unmitigated risk is raised to unlikely. Note QH undertakes quarterly testing. In 2020 and 2021 16 of 78 samples were positive, (all positives detected in one quarter) - however hospital has its own treatment plant and there is no way to determine if the positive samples relate to the Winton supply, or are internal to the building post the additional treatment.	*Legionella* proliferates at temperatures between 25 and 45 C - this is the typical range of the reservoir, so risk in this case increases.	Catastrophic	Almost Certain	Extreme 25	Estimate	W6b Consider dedicated rising main to reservoir with weekly procedure to pasteurise.	2027	Medium
W14	*Naegleria*	Reticulation	Backflow	High 12	Water meters should have check valves.		Major	Possible	High 12	Estimate	Ensure all connections have AS complaint meters. Employ or engage contract plumbing inspector and inspect household pumps and cooling tanks to ensure appropriate backflow prevention (e.g. air gap)	W11a - Backflow prevention devices - Technical officer to commence audit of devices, then ensure testing. By July 2023.	Medium
W15	*Naegleria*	Reticulation	Opportunistic contamination through mains breaks	High 12	Mains breaks occurred 46 times in 19-20. Currently no hygienic mains break repair procedure	*Naegleria* can grow in temperatures from 25 up to 46 C - this is the typical range of the reticulation network, so risk in this case increases.	Major	Likely	High 16	Estimate	W6a Finalise and roll out best management practices for water main breaks and repairs procedure to document WIOA Youtube video. Mains replacement program	Mains replacement program - $140-$180k per year. Undertaking criticality assessment and wll do condition assessments to inform more targeted replacement. Using app to map the locations of mains breaks (commencing 2022).	
W16	Turbidity (Retic)		Stirred up sediment in reticulation	Medium 9		Flushing program	Moderate	Unlikely	Medium 6	Confident			
W17	Operator Error			High 15		Have raised PO with RTO for Cert 3 for 5 people.	Catastrophic	Possible	High 15	Estimate	W17a Five people to commence and complete Cert 3. W17b Develop outstanding procedures	W17a PO has been raised - will occur over 2 years. W17b See table 11 DWQMP	W17a High W17b High

Risk ID	Hazard	Location	Sources of Hazard	Unmitigated Risk	Comment	Primary preventive measure	Residual Risk				Improvement Recommendations	Timeframe	Priority
							Consequence	Likelihood	Risk	Uncertainty			
W18	Cyber Security		SCADA at	Medium 9		All facilities are connected by fibre controlled owned and operated by Council. Will maintain 4 cores for water assets. Multiple routing for redundancy. Completely separated network - will only cross to corporate network behind firewalls. Council has Palo Alto firewalls and use Dark Trace.	Moderate	Unlikely	Medium 6	Confident	Automation project - New SCADA system will have dedicated server. 30% of the project is considering cyber security.	Deliver by 2024 pending BOR approval.	High
W19	Malicious action		Pump Station	Medium 5		Fencing at pump station and water tower. No history of any issues.	Catastrophic	Rare	Medium 5	Reliable			
W20	Loss of Supply		Power outage, pressure sustaining valve failing, major failure of rising main.	Medium 4		Redundancy in 2 heat exchangers, will free flow if pumps fail.	Major	Rare	Medium 4	Confident			
W21	Loss of Supply		Long term water supply security	Medium 4		Single 450 kL Reservoir	Major	Rare	Medium 4	Confident	Long term master plan for water supply	2024	High
W22	Lead			Medium 6			Moderate	Unlikely	Medium 6	Estimate	6 monthly monitoring to commence		
W23	Hydrocarbons (Reservoir)	Reservoir	Leaching from lining in reservoir	Medium 6	Been in place for 50 years, no complaints indicating consistent leaching	No preventive measures - not considered necessary at this time	Moderate	Unlikely	Medium 6	Estimate	W23 Commence monitoring for TRH and PAH and respond if detected above ADWG Health guideline	Commenced	Medium
W24	Hydrocarbons (Retic)	Reticulation	Tanker spill	Medium 6			Moderate	Rare	Low 3	Estimate			
W25	Taste and odour	Bore	Natural characteristic of aquifer	High 15	Local residents are used to the smell - tourists notice.	No preventive measures - As low as reasonably practicable	Moderate	Almost Certain	High 15	Confident	No improvement action warranted . There is no intent to consider aeration at this stage.	Risk is accepted as it is.	
W26	Mercury			Medium 6			Moderate	Unlikely	Medium 6	Estimate			

Risk ID	Hazard	Location	Sources of Hazard	Unmitigated Risk	Comment	Primary preventive measure	Residual Risk				Improvement Recommendations	Timeframe	Priority
							Consequence	Likelihood	Risk	Uncertainty			
W27	Temperature		Power outage	High 12		Temperature CCP including actions. Notification to operator by SMS. Cooling water pump has generator, currently requires manual startup until new SCADA system in place. Majority of houses have cool water tank. (hot water would be much hotter than Plumbing Code).	Major	Unlikely	Medium 8	Reliable	W27 Operator attends plant as soon as aware of power outage. SCADA upgrade to have temperature alarm, backup batteries, generator automatically started, or will shut down system if no generator	Deliver by 2024 pending BOR approval.	
W28	Radioactivity		Aquifer	Medium 6		Aquifer not believed to be impacted - no literature demonstrating impact in Hooray or Hutton aquifers.	Moderate	Unlikely	Medium 6	Estimate			

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.

Winton Shire Council is in the process of introducing new mains break repairs procedures based on WIOA practices: the video is able to be accessed at the following link. Council has saved a copy of this video.

https://www.youtube.com/watch?v=8BZ_oWg0nNM&t

It is intended that procedures are reviewed at least every 2 years in line with the DWQMP review to confirm suitability. The next plan review will identify if the procedures need to be changed.

Table 11 Procedures

Name	Status	Document date	Review Date
Mains repair video	Available	WIOA Publication	NA
Mains repair procedure	In preparation complete by DATE	Camden to fill in detail.	Camden to fill in detail.
In house and external testing procedures	In preparation complete by DATE	Camden to fill in detail.	Camden to fill in detail.
Flushing program	In preparation complete by DATE	Camden to fill in detail.	Camden to fill in detail.
Boil Water Alert	Available (DWQMP Appendix B)	Camden to fill in detail.	Camden to fill in detail.
Lifting Boil Water Alert	Available (DWQMP Appendix B)	Camden to fill in detail.	Camden to fill in detail.
Decontamination of water tower	Available (DWQMP Appendix C)	Camden to fill in detail.	Camden to fill in detail.
Pump station operation	In preparation complete by DATE	Camden to fill in detail.	Camden to fill in detail.

OPERATIONAL MONITORING

Operational staff monitor water temperature, flow and pressure at least every weekday at the bore and pump station.

The current SCADA system sends SMS alerts if there are temperature or pump failures.

Council is planning an upgrade of the system automation through a Building our Regions 6 grant application, but this has not yet been funded.

Temperature is considered as a critical control point and is managed as per the CCP procedure on the following page.

Temperature CCP – Winton Pump Station

What is measured	Where or how is it measured	When is it measured	What is the control point	What are the hazards	Record Keeping
Temperature	Online thermometer after reblending hot water	Continuous online weekday recording	Heat exchanger and manual blending valve	Hot water (scalding)	SCADA Operator records.

Critical
> 50°C

- SMS to operator (SCADA)
- Immediately shut blending valve
- Ensure cooling water pump is operating. Immediately restart, or if unable to do so immediately, close valve to reticulation to cease supply from bore
- Inform Director of Works immediately – Incident to be reported to DRDMW.
- Re-establish cooling flow and when temperature is below 50°C can recommence supply

Adjustment
< 42°C or
> 46°C

- Check cooling water flow rate and bore flow rate – rectify if required
- If flow rates are normal, adjust blending rate by either closing or opening the bypass valve slightly
- Observe temperature for 10 minutes after changing valve to confirm at target temperature

Target
44°C

- Check bore temperature and pressure each weekday
- Check cooling water pump and cooling water flow rate
- Check blending valve position

VERIFICATION MONITORING

Water sampling has historically been at the same locations. In this version of the DWQMP, the sampling locations have been reconsidered, and altered to better ensure coverage of likely areas of change or higher risk. The new sampling sites are intended to be geographically separated and representative of the water quality provided.

Table 12 Sampling locations

Location	Reason
Bores 3 and 4	Source water
Water Tower	Possibly harbours microbial contaminants
Hospital/Aged Care	Higher risk consumers, northern side of town
Airport	Long dead end main to North East
Work Camp	Long dead end main to North
Industrial Estate	North west reticulation extremity, dead end main
13 Elderslie St	South eastern side of town, historical sampling point
104 Elderslie St	South western side of town, historical sampling point

Table 13 Monitoring parameters and frequency

Location	Parameter Group	Frequency
Bore 3 and Bore 4	Radiological	Every 2 years
	Physical	6 monthly
	Chemical	6 monthly
	Heavy Metals	Annually
Water Tower	Physical	6 monthly
	Chemical	6 monthly
	Heavy Metals	6 monthly
	PAH, TRH	6 monthly
	E. coli	Fortnightly
	Legionella pneumophila and *Naegleria fowleri*	Annually
Dead End Reticulation (Minimum of one of the following: Airport, Work Camp, Industrial Estate)	*E. coli*	Fortnightly
	Physical	6 monthly
	Chemical	6 monthly
	Heavy Metals	6 monthly
Representative Reticulation (Minimum of one of the following: 13 Elderslie St, 103 Elderslie St, Hospital/Aged Care)	*E. coli*	Fortnightly
	Physical	6 monthly
	Chemical	6 monthly
	Heavy Metals	6 monthly

The monitoring locations are identified in the following figures.

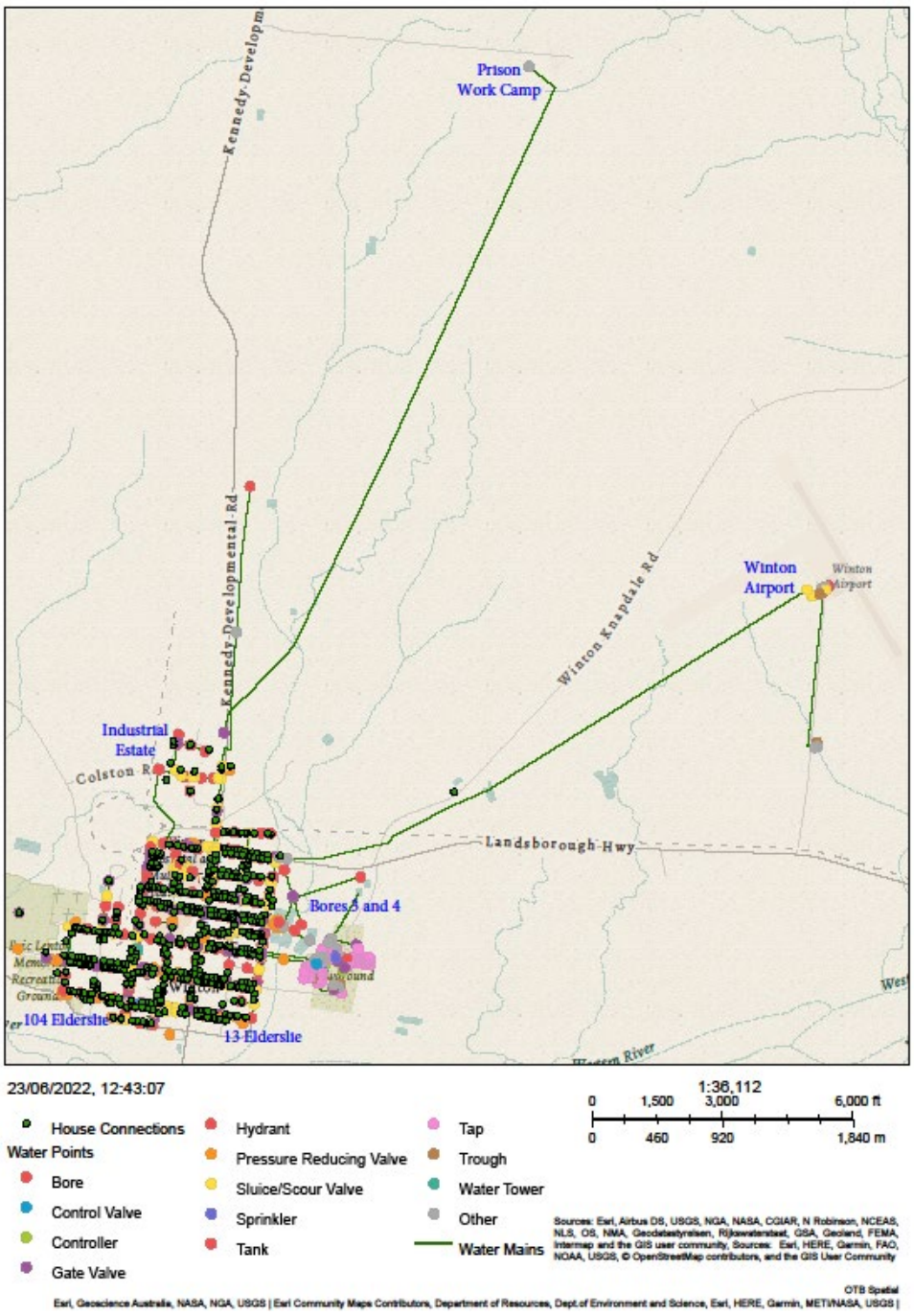

Figure 7 Water sampling locations - furthest extent

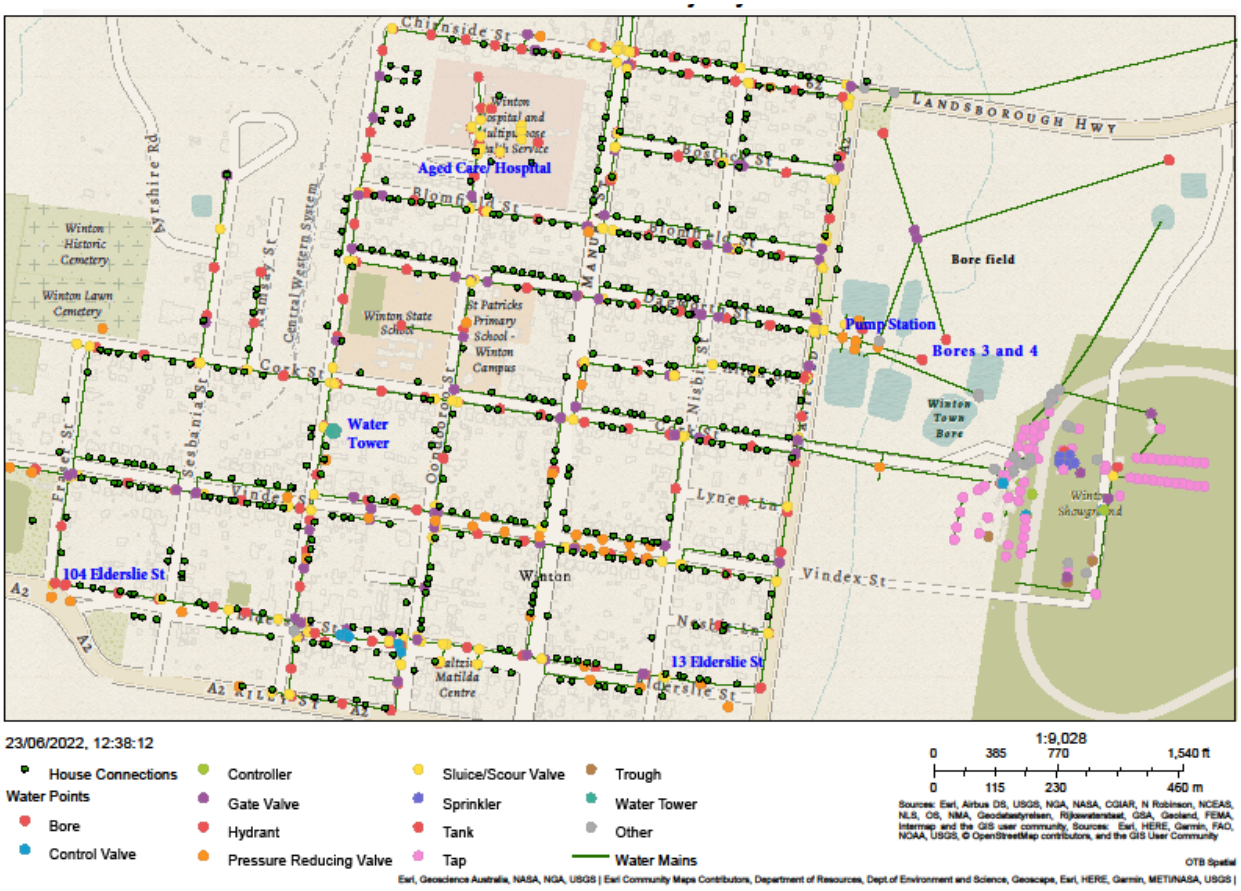

Figure 8 Water Sampling Location - in town

7.1 Why are these parameters monitored?

Physical and Chemical parameters, as per the QHFSS standard monitoring suites will be analysed as previously. The list of parameters in each suite is included in the table below.

Heavy Metals analysis will be undertaken annually in the bores and 6 monthly in reticulation. This is considered appropriate as there is no treatment so the reticulation samples reflect the bores plus any additional contribution from the reticulation network.

Council intends to monitor the bores for radiological parameters to demonstrate the level of risk. The ADWG suggests 2 yearly monitoring for bores, however, artesian sources are unlikely to change. Therefore the frequency may be revisited in the future depending on the results.

Polyaromatic hydrocarbons and total petroleum hydrocarbons (or total recoverable hydrocarbons depending on the laboratory) will be tested to identify if the lining of the reservoir is leaching these parameters as required by the Regulator. This is investigative monitoring, and if not detected will be discontinued after the following review of the DWQMP.

Microbial sampling. The Public Health Regulation 2018 requires a minimum of 1 sample for E coli per month. The proposed monitoring is for a minimum of 4 samples per month. Note: there is no monitoring for *E. coli* at the bores as the water temperature of 86°C precludes the possibility of microbial contamination of the source water. Were *E. coli* detected at that point it could only be from contamination of the sample.

Legionella pneumophila and *Naegleria fowleri* samples will be taken annually from the Water Tower. If these species are detected, these will be reported immediately, as per the reporting requirements for *E. coli*.

Non-pathogenic forms (e.g. any other species of *Legionella*) are non-reportable.

Table 14 Parameters in each group

Parameter Group	Analytes	Reporting Limit
Physical	Conductivity, alkalinity, hardness, pH, colour, turbidity, TDS	Nil – none of these have health guideline values Turbidity is not a surrogate indicator of pathogen risk in an undisinfected groundwater system.
Radiological	Gross α and Gross β	Gross α = 0.5 Bq/L, Gross β = 0.5 Bq/L after K^{40} correction
Chemical (QHFSS SWA Suite)	Sodium, potassium, calcium, magnesium, chloride, fluoride, nitrate, sulfate, aluminium, boron, copper, iron, manganese, zinc	ADWG Health Guidelines for relevant parameters
Heavy Metals suite (total)	Antimony, arsenic, barium, boron, cadmium, chromium, mercury, molybdenum, nickel, selenium, silver, uranium	ADWG Health Guidelines for relevant metals
Organics	PAH and TRH (or TPH)	ADWG Health Guidelines for relevant organic parameters.

INCIDENT AND EMERGENCY RESPONSE

Notification of the occurrence of incidents or emergencies can be identified in a number of ways e.g.:

- customers via Council office or direct contact with a Council officer,
- an alarm from the SCADA system identifying a failure within the operation of the water supply system, or
- from a Council officer e.g. after identifying a failure likely to lead to a public health risk, or by identification of a positive *E. coli* from an in-house test.
- Laboratory reporting of a water quality results exceeding the ADWG health guideline values.

The flowchart overleaf depicts the process followed for the management of water supply incidents.

During full scale emergency response and recovery scenarios such as natural disasters or man-made disasters, the Local Disaster Management Group is activated in accordance with Winton Shire Council's Local Disaster Management Plan.

8.1 Incident levels

Winton Shire Council operates on a 3 level incident framework of Yellow, Amber and Red.

Yellow:- Low Risk.

These are operational issues that could escalate if not responded to. The incidents are managed immediately and effectively by operational staff without public health impact to the community.

The staff member notifies the Director of Works of the incident and remedial action taken (this is typically verbally, and there are no records retained for these incidents). There is no need for community notification at this level.

An example would be the identification of, and response to a dirty water complaint that can be resolved immediately by flushing.

Amber: - High Risk.

Amber incidents include all exceedances of ADWG Health Guideline values, and any incident where the normal actions under the DWQMP do not effectively manage the issue and Council is concerned or believes that public health may be impacted if nothing more is done.

This includes temperature > 50C being provided to customers.

If council was subject to a cyber-attack impacting the ability to supply safe water, this would also be considered as an amber incident.

Actions: Report to the Regulator. Implement short term measures immediately. Longer term risk reduction measures to be identified and prioritised for presentation to Council to obtain funding.

Operational staff and/or the Cadet Engineer investigate the incident and advise the Director of Works of the findings. A plan to resolve the issue is developed and implemented.

Examples of an amber incident includes a detection of a chemical parameter above the ADWG health guideline value, or the detection of *E. coli / Legionella pneumophila* /*Naegleria fowleri*.

The detection of a pathogen / disease outbreak would be at the upper end of the Amber category. This would require close engagement with regulatory agencies, primarily Queensland Health who would be the lead contact agency, but also DRDMW via Queensland Health.

Red:- Very High Risk.

These incidents will require the activation of the Disaster Management Plan. An example would be a natural disaster such as an earthquake that impacted the bores, water tower and reticulation simultaneously.

Short term measures implemented immediately. Longer term risk reduction given top priority.

Actions: The Director of Works, who will inform the CEO.

Once a decision is made to activate the Disaster Management Plan, it takes precedence – however, in this supply system, the ability to provide hot water from Bore 3 would mean that there are very few disasters that would actually impact the ability to provide safe water.

For natural disasters, the Disaster Management Group will assume control.

Any notifiable incident will be reported to DNRME as practicable.

For incidents other than full scale emergency response and recovery scenarios, first contact is the operator who will escalate notification to Group Manager of Assets and Engineering Services, Director of Works, and finally the Chief Executive Officer as necessary.

Table 15 Communication Responsibilities

Position	Responsibility/Authority
Local Disaster Controller	Communications with State and Federal Agencies
Director of Works	Communications with Emergency Management Groups, DW Regulator and Queensland Health
Cadet Engineer	Communications with contractors and Internal services, DW Regulator
Plumbers, Operators, On-call Officers	Communications with contractors and Internal services as delegated
Labourers and Trainees	Internal communications only, unless directed

8.1.1 Boil Water Alerts

Boil water alerts are an important public health intervention where unsafe or potentially unsafe water has entered the reticulation network. Council will normally liaise with the Public Health Unit regarding the need to issue a Boil Water Alert but may issue one without consultation where we believe it necessary.

The boil water alert would be alerted to all customers by door knocking.

In all instances where a Boil Water Alert is issued, this is a reportable incident.

A boil water alert template is included in Appendix B.

INFORMATION MANAGEMENT

Information is mostly retained in OneDrive. This allows staff appropriate access to the information.

Cyber Security – see line W18 of risk assessment. BOR6 automation project also has high level cyber security component, but this is not yet funded so not discussed further.

Table 16 Information Management

Information/ Document	Format and storage location (hardcopy / electronic)	Position Responsible	Information Management Process Description
Operational Monitoring Data	Electronic – Corporate OneDrive	Cadet Engineer Director of Works Council Administration Officer	The Cadet Engineer or Director of Works on a weekly basis complete the 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.
Verification data	Electronic – Corporate OneDrive	Director of Works Administration Officer	Water quality data is either received form 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 – Corporate OneDrive	Administration Officer Director of Works Councillors	Complaints are received by council through a number of methods, including verbally by phone or in person to Councillors, the Director of Works, 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 – Corporate OneDrive	Administration Officer 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 – Corporate OneDrive	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 at WTP and in operators vehicles/ operators office. / Electronic – Info Expert	Director of Works Administration Officer	Operational procedures are filed electronically in a specified location. Amended documents replace outdated documents with update history captured in OneDrive.

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. Information to be provided to customers about maintaining cooling water tanks. To be sent annually with rates notice (or alternative)

Council to make available on request, a hardcopy of the Drinking Water Quality Management Plan at any publicly accessible customer service counters

REVIEW AND CONTINUAL IMPROVEMENT

The DWQMP is reviewed in accordance with the regulator's requirements. We expect this to be every 2 years but will implement the review as required in the information notice for the decision.

The improvement plan is linked directly to the mitigated risk assessment table as the improvements arise directly from the risk assessment. These have assigned dates and priorities and are the responsibility of the Director of Works to implement.

AUDIT

Audits are required under the *Water Supply (Safety and Reliability) Act 2008.* The Regulator states the dates for audits, and Council ensures that these are undertaken as required, and audit outcomes reviewed and responded to as appropriate.

REFERENCES

NHMRC NMMRC National Water Quality Management Strategy, Australian Drinking Water Guidelines 6 2011v3.6 Jan 2022

Radke, B.M., J. Ferguson, R.G. Cresswell, T.R. Ransley, and M.A. Habermehl. 2000. 'Hydrochemistry and implied hydrodynamics of the Cadna-Owie - Hooray aquifer, Great Artesian Basin.' in, *Hydrochemistry and implied hydrodynamics of the Cadna-Owie - Hooray aquifer, Great Artesian Basin* (Bureau of Rural Sciences: Canberra).

APPENDIX A
BORE REPORT CARDS

GROUNDWATER DATABASE

BORE REPORT

REG NUMBER 407

REGISTRATION DETAILS

		BASIN	0021	LATITUDE	22-23-06	MAP-SCALE	254
OFFICE	Longreach	SUB-AREA		LONGITUDE	143-02-56	MAP-SERIES	M
DATE LOG RECD		SHIRE	7400-WINTON	EASTING	710935	MAP-NO	SF54-12
D/O FILE NO.	140/126/0003	LOT	113	NORTHING	7523118	MAP NAME	WINTON
R/O FILE NO.	25/22/W/1	PLAN	AE95	ZONE	54	PROG SECTION	
H/O FILE NO.	01129	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

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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 NO.	RN OF PUMP-BORE	TOP (m)	BOTTOM (m)	DIST (m)	METH	TEST TYPES	PUMP TYPE	SUCTION SET (m)	Q PRIOR TO TEST (l/s)	DUR OF Q PR (min)	PRES ON ARRIV (m)	Q ON ARRIV (l/s)
A	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 TOT LEN (km)	MAX RUN (km)	C D N	HEADWORKS RET LEN (km)	C D N	C T L	LEAK	FLOW IRREGULARITY	PRECIPITATE	EST USE (ML/yr)	STOCK CATTLE	STOCK SHEEP	COMMENT
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	DEPTH (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	DEPTH (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 ****

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GROUNDWATER DATABASE

BORE REPORT

REG NUMBER 14269

REGISTRATION DETAILS

OFFICE	Longreach	BASIN	0021	LATITUDE	22-22-53
DATE LOG RECD		SUB-AREA		LONGITUDE	143-02-52
D/O FILE NO.	25/22/W/1	SHIRE	7400-WINTON	EASTING	710826
R/O FILE NO.	25/22/W/1	LOT	118	NORTHING	7523511
H/O FILE NO.	01129	PLAN	AE151	ZONE	54
		ORIGINAL DESCRIPTION	PASTURAGE RESERVE R9	ACCURACY	
				GPS ACC	
GIS LAT	-22.3814974556	PARISH NAME	6000-NO LONGER USED		
GIS LNG	143.0476876181	COUNTY			
CHECKED	Y				

MAP-SCALE	254		
MAP-SERIES	M		
MAP-NO	SF54-12		
MAP NAME	WINTON		
PROG SECTION			
PRES EQUIPMENT	HW		
ORIGINAL BORE NO	TOWN BORE NO. 2		
BORE LINE	-		
POLYGON			
RN OF BORE REPLACED			
DATA OWNER			

FACILITY TYPE	Artesian - Controlled Flow	DATE DRILLED	17/07/1960
STATUS	Existing	DRILLERS NAME	G BIRKENSLEIGH
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 NO.	RN OF PUMP-BORE	TOP (m)	BOTTOM (m)	DIST (m)	METH	TEST TYPES	PUMP TYPE	SUCTION SET (m)	Q PRIOR TO TEST (l/s)	DUR OF Q PR (min)	PRES ON ARRIV (m)	Q ON ARRIV (l/s)
A	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

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

ELEVATION DETAILS

**** NO RECORDS FOUND ****

WATER ANALYSIS PART1

PIPE	DATE	RD ANALYST	QAN	DEPTH (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 ****

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GROUNDWATER DATABASE

BORE REPORT

REG NUMBER 51918

REGISTRATION DETAILS

		BASIN	0021	LATITUDE	22-22-55	MAP-SCALE	254
OFFICE	Longreach	SUB-AREA		LONGITUDE	143-03-10	MAP-SERIES	M
DATE LOG RECD		SHIRE	7400-WINTON	EASTING	711359	MAP-NO	SF54-12
D/O FILE NO.	140/126/0003	LOT	118	NORTHING	7523451	MAP NAME	WINTON
R/O FILE NO.	25/22/W/1	PLAN	AE151	ZONE	54	PROG SECTION	
H/O FILE NO.	1129	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						
						POLYGON	
						RN OF BORE REPLACED	
FACILITY TYPE	Artesian - Controlled Flow	DATE DRILLED	30/09/1984			DATA OWNER	
STATUS	Existing	DRILLERS NAME					
ROLES		DRILL COMPANY					
		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	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

STRATA LOG DETAILS

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 NO.	RN OF PUMP-BORE	TOP (m)	BOTTOM (m)	DIST (m)	METH	TEST TYPES	PUMP TYPE	SUCTION SET (m)	Q PRIOR TO TEST (l/s)	DUR OF Q PR (min)	PRES ON ARRIV (m)	Q ON ARRIV (l/s)
A	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	DEPTH (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

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

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	24/10/1984		470		82.0					PU	GB
A	01/03/1990				85.0					PU	GB

SPECIAL WATER ANALYSIS

**** NO RECORDS FOUND ****

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GROUNDWATER DATABASE

BORE REPORT

REG NUMBER 118365

REGISTRATION DETAILS

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	
						RN OF BORE REPLACED	
FACILITY TYPE	Artesian - Controlled Flow	DATE DRILLED	18/04/2005			DATA OWNER	DNR
STATUS	Existing	DRILLERS NAME	BODEY, STEVEN				
ROLES	WS	DRILL COMPANY	QLD DRILLING SERVICES				
		METHOD OF CONST.	ROTARY MUD				

CASING DETAILS

PIPE	DATE	RECORD NUMBER	MATERIAL DESCRIPTION	MAT SIZE (mm)	SIZE DESC	OUTSIDE DIAM (mm)	TOP (m)	BOTTOM (m)
A	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

STRATA LOG DETAILS

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 NO.	RN OF PUMP-BORE	TOP (m)	BOTTOM (m)	DIST (m)	METH	TEST TYPES	PUMP TYPE	SUCTION SET (m)	Q PRIOR TO TEST (l/s)	DUR OF Q PR (min)	PRES ON ARRIV (m)	Q ON ARRIV (l/s)
A	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

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 TOT LEN (km)	MAX RUN (km)	C D N	HEADWORKS RET LEN (km)	C D N	C T L	LEAK	FLOW IRREGULARITY	PRECIPITATE	EST USE (ML/yr)	STOCK CATTLE	STOCK SHEEP	COMMENT
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	DEPTH (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 ****

REG NUMBER 118365

SPECIAL WATER ANALYSIS

**** NO RECORDS FOUND ****

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APPENDIX B
BOIL WATER ALERT TEMPLATES

Boil Water Alert

DATE IN EFFECT

Winton Shire Council advises that customers in Winton should boil all drinking water until further notice.

As a precaution, you are advised that water used for consumption should be brought to the boil (for example in a kettle). Water should be transferred to a clean container with a lid and refrigerated or allowed to cool before use.

Boiled or bottled water should be used for:

- Drinking,
- Preparing or cooking food or drinks,
- Making baby formula,
- Making ice or,
- Brushing teeth.
- Babies and toddlers should be sponge bathed.
- Children should take boiled or bottled water to school.

Be careful to avoid being scalded when handling hot water.

Dishes can be washed in a dishwasher, or can be washed in hot soapy water and dried before using.

Residents can continue to shower and wash clothes as normal.

For further information contact Council on 4657 2666

Lifting of Boil Water Alert

DATE IN EFFECT

Winton Shire Council advises that customers in Winton are no longer required to boil your drinking water.

Council apologises for the inconvenience caused.

For further information contact Council on 4657 2666

APPENDIX C
DECONATAMINATION PROCEDURE

DECONTAMINATION PROCEDURE – WATER TOWER

Purpose:

This procedure is used in the event of microbial contamination of the water tower. The principle is that the water tower can be pasteurised by the heat of the bore water.

It is imperative that no customers are exposed to water above 50C as this has a high risk of scalding. Therefore, care must be taken to fully isolate all customers from the Bore to the water tower.

During this procedure, there will be approximately 2 hours when the town will have no additional water supply. As residents use water, the reticulation network will begin to depressurise.

Methodology

1. Notification to town of an unplanned outage
2. Close valves as appropriate to be able to send hot water into the water tower.
3. Commence backwards from water tower inlet up Werna St, and then down Dagworth St to the water compound
    a. Shut off all house meters along the route too
4. Leave water tower providing water until the last valve (there are disruptions to the households that are shut off, but the rest of town still gets water from the tower)
    a. Isolate water tower BEFORE allowing hot water to leave water compound.
    b. When mains to water tower are isolated from customers, commence running hot water only into the reservoir (bypass heat exchangers)
5. Option 1 – overflow. Add 86°C water and monitor overflow water temperature until it reaches 63°C.
    a. Note temperature and time when 63°C was reached.
6. Continue adding hot bore water for either 30 minutes OR until it reaches 72°C. E.g. no need to empty the water tower but will need to continue running bore into tower until temperature is reached. It only needs to be held at 72°C for 15 seconds for pit to be pasteurised using high temperature short time pasteurisation. Keep records of temp and time.
7. Option 2 – scour water tower, then refill until it overflows. If pumped, it will take ~95 minutes total time. Check overflow water temperature and confirm it is above 63°C.
    a. If yes, move to step 8
    b. If not, continue to overflow until it has been at 63°C for 30 minutes. Note temperatures and times.
8. Keep water tower offline and isolate with the hot water in the tower.
9. Use heat exchangers and re-establish 44°C water.
    a. Can now start providing water to customers.

10. Reverse all isolations from the pump station outwards to the water tower, including customer meters.
11. Town now has water re-established. Monitor temp in water tower, and when below plumbing code maximum temperature of 50°C can again supply water from the water tower.
12. Take Colilert sample to test internally
13. If decontaminating due to Legionella or Naegleria, arrange additional sample.

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