Longreach Regional Council

Ilfracombe Isisford Longreach Yaraka

Drinking Water Quality Management Plan

January 2022

DOCUMENT CONTROL SHEET

DOCUMENT

Drinking Water Quality Management Plan

DRINKING WATER SERVICE PROVIDER (SPID 488)

Longreach Regional Council

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EXECUTIVE SUMMARY

This drinking water quality management plan has been developed in accordance with the regulatory guideline.

As such, it identifies the public health risks to each of the four drinking water services for Longreach Regional Council.

The plan was reviewed against the DWQMP Review and Audit Guidelines June 2019 checklist, followed by a risk assessment workshop and update to the plan, accordingly.

This review focussed on processes and hazardous events which previously had a high or above residual risk, where a process had been changed since the last review and/or if an improvement action had been identified for the process/hazard. Recent water quality was reviewed, where available.

All action items have been consolidated into an updated Risk Management Improvement Program, with key priorities to:

- Review the current operational monitoring across all schemes and implement a formal quarterly review of key water quality parameters and processes with key stakeholders
- Finalise the SCADA/telemetry and online monitoring upgrade specifications for all schemes
- Expediate the SCADA upgrades/implementation
- Undertake Health Based Target assessment and assess the need for further treatment (eg UV) for each scheme
- Implement outcomes of the HBT assessment

In addition to the above actions for all schemes, and in the context of the ongoing Boil Water Alerts, the following actions have been identified for the Isisford WTP:

- Upgrade/refurbishment of the clarifiers, which have struggled to meet turbidity removal targets in the past
- Review of the current pressure filter operation by the contractor, due to ongoing issues in meeting turbidity target

The full list of improvements can be found in the relevant section of this plan.

1 INTRODUCTION

This Drinking Water Quality Management Plan (DWQMP) is for the potable water schemes managed by Longreach Regional Council (LRC). This plan has been developed in accordance with the requirements of Section 93(3) of the *Water Supply (Safety and Reliability) Act 2008* (the Act). The DWQMP addresses the content requirement of the Drinking Water Quality Management Plan Guideline (the Guideline) (DNRME 2018).

This plan contains or references all of the policies, procedures, and registers that are required to maintain drinking water quality for the four drinking water supply schemes operated by Council.

1.1 Registered Service Details

Longreach Regional Council (Service Provider No 488) provides drinking water services to the Longreach, Ilfracombe, Isisford and Yaraka.

Table 1 Water Supply Details

Scheme	Current (2018)			Future (2028)		
	Population	Connections	Demand (ML/annum)	Population	Connections	Demand (ML/annum)
Ilfracombe	190	108	74.1	190	108	74.1
Isisford	120	86	42.7	120	83	42.7
Longreach	2970	1529	1718	2970	1523	1718
Yaraka	17	15	11.2	17	15	11.2

(Connections based on Longreach Regional Council KPI report 20120/21, current populations are based on Council data, or the 2016 Census which in the smaller communities reflects the population of the wider district, not just the connected population. The Queensland Government Statisticians Office has indicated that the 10-year regional growth rate from 2007-2017 was -1.5%, so the future demand is also estimated to remain unchanged)

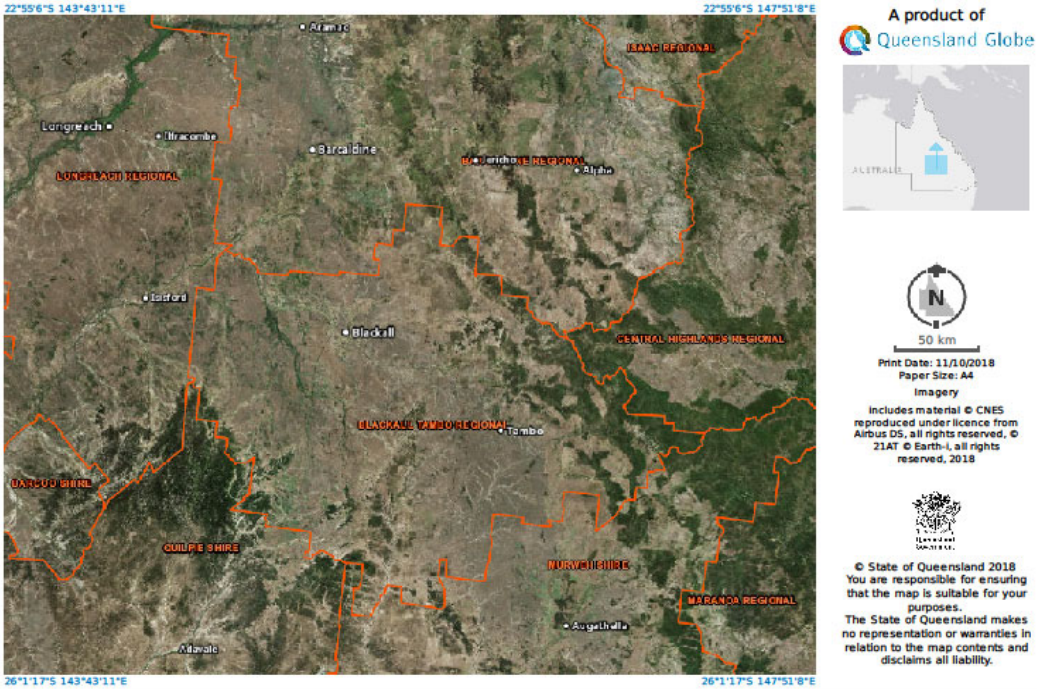
1.1.1 Regional Context

Longreach Regional Council is located in remote South West Queensland, has a total land area of 40,572 km^2, and is a gateway community to Outback Queensland. Longreach is home to the Stockmans Hall of Fame and the Qantas Founders Museum, and along with the camping that is available along the banks of the Barcoo and Thomson Rivers, these tourist attractions result in significant numbers of tourists into the region.

Longreach is the largest community in the Region with nearly 3,000 residents, with Ilfracombe the next largest, but with only 190.

1.1.2 Longreach Regional Council area

Figure 1 Longreach Regional Council Area



1.2 Key Stakeholders

Stakeholders involved in the management of drinking water include the following

Table 2 Key Stakeholder List

Organisation	Contact details	Relevance to management of drinking water quality	How the stakeholder is engaged in the DWQMP
Longreach Regional Council	Director Infrastructure Services/ Manager of Water and Waste	General concerns regarding suitable quality of water supplies	Participation in review of risks, hazards and hazardous events associated with all water supplies. Review of DWQMP documentation.
Longreach Regional Council	Water Treatment Plant Operators	Responsible for day to day operations of the Water supplies.	Participation in review of risks, hazards and hazardous events associated with all water supplies. Input to existing preventive barriers, operational initiatives and monitoring programs.
Water Supply Regulator, Regional Development, Manufacturing & Water (RDMW)	1300 596 709 DrinkingWater.Reporting @rdmw.qld.gov .au	Responsible for regulation of water providers in QLD	Approval of the DWQMP documentation.
Queensland Health	Central Queensland PHU (07) 49206989	Responsible for regulation of public health in QLD	Contacted for public health advice as necessary.

2 DETAILS OF THE WATER SUPPLY SYSTEMS

2.1 Catchment

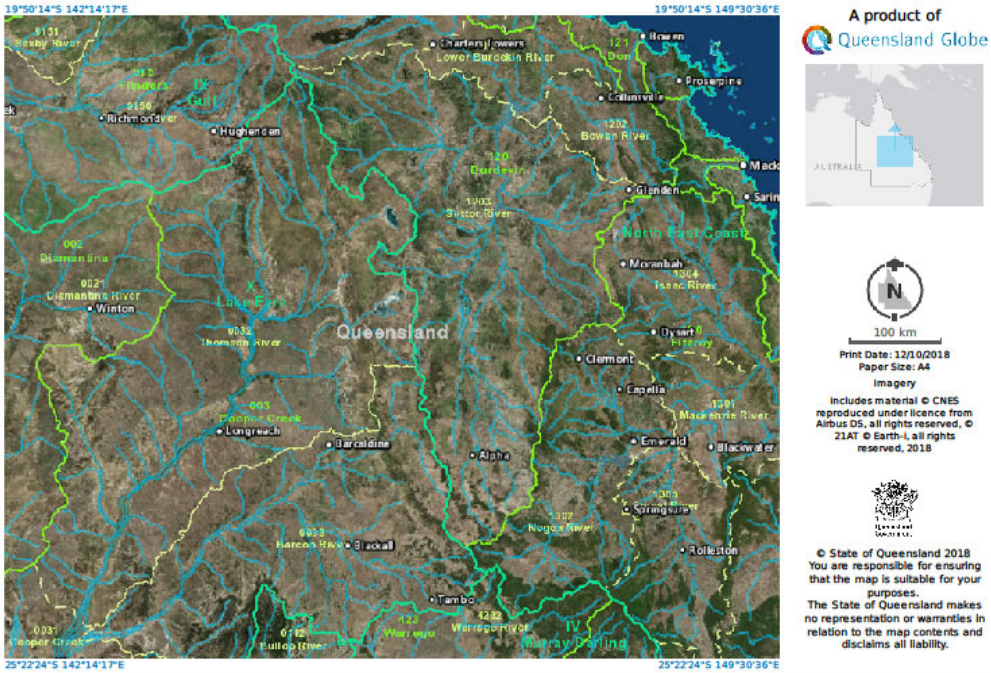
Water for all 4 council schemes are sourced from the Thomson and Barcoo River sub-catchments that, along with the Cooper Creek itself make up the Cooper Creek catchment. The Cooper Creek catchment is very large covering 14% of Queensland. However, the upper catchment is sparsely populated, with Aramac and Muttaburra both more than 100 km upstream of Longreach.

The Thomson River Catchment is ~95000 km^2, and is the water supply for both Ilfracombe and Longreach. The Thomson only flows seasonally, but generally at high flows at those times. This water is impounded in a series of 6 weirs that provide the water source for Longreach.

Ilfracombe harvests water seasonally into the offstream storages from Collumpton Creek. The Collumpton Creek is ephemeral, and completely dry for long periods of time.

The Barcoo Catchment provides the water supply for Isisford and Yaraka. Isisford extracts either directly from the Barcoo, and also pumps into an offstream storage. Yaraka has a small localised catchment for its water supply dam.

Figure 2 Cooper Creek Catchment

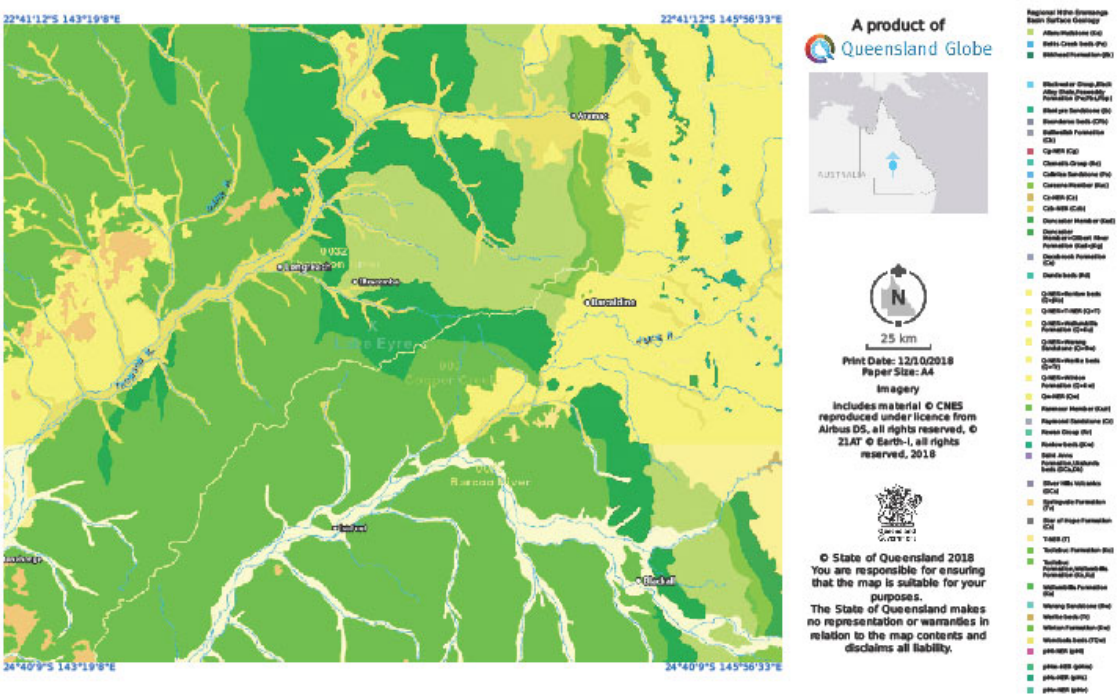


2.2 Geology

The catchment is part of the Eromanga Basin, which was an ancient inland sea. However, the surface geology is now classified mostly as tertiary and quaternary sediments. This highly weathered landscape does not have significant mineralisation, which is reflected by the lack of mining in the catchment. Activities in the upper reaches of the catchment around Hughenden are considered to be so distant as to not result in significant risks to the water supply.

Given the poor soils and low rainfall, as shown below, the predominant agriculture is low intensity grazing.

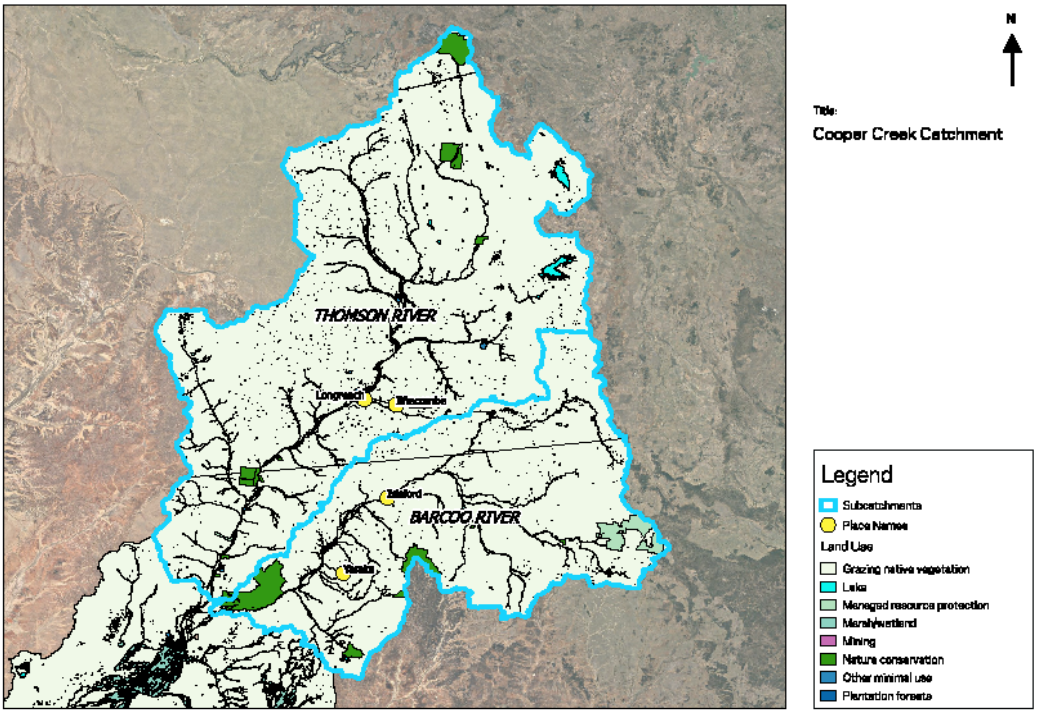
Figure 3 Longreach Regional Geology



2.3 Land Use

Given the poor soils and low rainfall, the majority of the catchment is largely undeveloped with the predominant land use being low density cattle grazing on undeveloped land. There is essentially no cropping other than in Longreach itself at the Agricultural high school, and as such there are minimal opportunities for significant contamination of the water source by agricultural chemicals (although the detection of trace herbicides would not be unexpected).

Figure 4 Cooper Creek Land Use

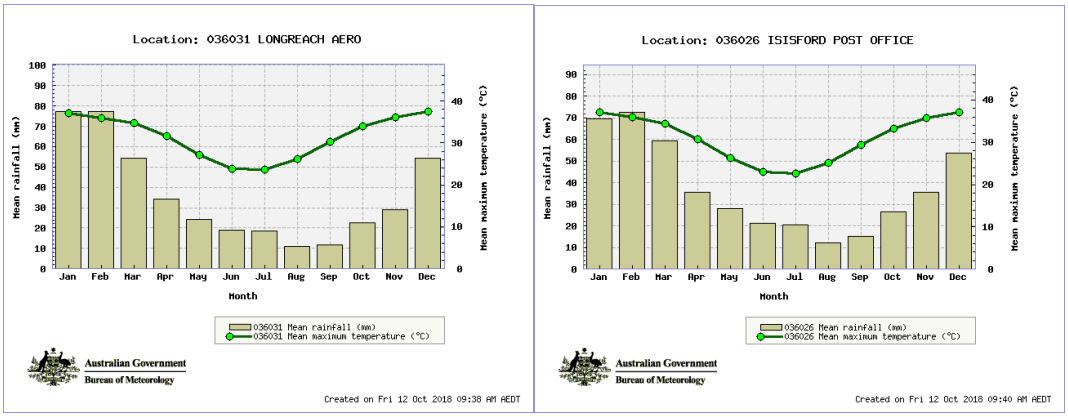


2.4 Climate

The entire Cooper Creek catchment is classified as arid or semi-arid, which is reflected by the climate data available from the Bureau of Meteorology.

Average summer temperatures are in the high 30sC, with winter average temperatures around 22C. Mean rainfall for Longreach is 40mm of less for autumn through spring, with average summer rainfall up to 80mm in January and February. Isisford has slightly higher February rainfall on average, but the pattern of predominant hot dry weather remains.

Figure 5 Rainfall and Temperature Averages



2.5 Longreach Water Supply System

2.5.1 The Longreach Water Treatment Plant

The Longreach WTP is a 9 ML/day capacity (20 hours operation, but typically 2.2 to 7.6 ML/day) plant that treats surface water from the Thomson River using a conventional treatment process of coagulation/flocculation filtration and chlorination.

The Thomson River only flows seasonally (for example in 2017 there were 3 flow events). In order to ensure a suitable water supply, there are a series of 6 weirs across the multiple channels that create pondages from which water is released as required to ensure that there is sufficient water at the intake. This has provided a 100% reliable supply when managed with water restrictions.

While the intake at the Town Weir is only 3 km from town, there is a flood channel between the weir channel and the town of Longreach, which prevent runoff from Longreach reaching the weir. The Flinders Highway and adjacent railway cross the top end of the catchment. The Landsborough Highway and Longreach - Winton railway cross the Thomson River over the pondage of the Town Weir at Longreach. Chemical spills could theoretically contaminate the River, but this could normally be managed by either avoiding upstream discharges from contaminated upstream weirs, or increasing them to either avoid the need to use, or to flush away contamination. In general, flow events have high flow, so contamination would pass the intake quickly (in the 2017 flow events, the peak flow was 2500, 2000 and 500 ML/day respectively.)

The Town Weir is used for camping and minor recreational purposes. In winter there could be up to 60 caravans/ motorhomes camped beside the weir. There is also picnic area adjacent to the river and swimming and boating is permitted in the weir. Because of the limited width of the river it is not heavily used for boating.

Water quality issues: The catchment is large and unprotected, with human and cattle access to the river, including campers grey water and nearby septic systems adjacent to the town intake. As such, microbial hazards are almost certain. The only other significant issue with the raw water is turbidity, but this is managed through the treatment process.

Raw water is pumped (duty standby submersible pumps, with screened intakes, and the structure protected from flood damage).

Raw water is dosed with coagulant (All Clear) ahead of a flash mixer and 2 parallel clarifiers. Clarified water is laundered to a series of 4 filters, after which the treated water is chlorinated with sodium hypochlorite into a dedicated contact tank prior to the 8.8 ML ground level reservoir. Sodium hypochlorite is transported by a licensed tanker and emptied into 2 x 10,000L storage tanks within a bunded chemical area. The contact tanks are roofed, sealed and vermin proofed to prevent recontamination (as is the water tower). The operational targets are stated in the WTP OCP and CCP procedures in Section 5 Preventive Measures on page 71.

Clarifier sludge, and filter backwash water are sent to on site sludge lagoons, and at present supernatant is added to the raw water supply (prior to the flash mixer) at a rate of ~5-10%. This has been identified as a high risk of recirculating protozoan pathogens to the head of plant, and the previous improvement item to investigate decommissioning the return supply has been replaced with an action to consider the supernatant return risk in a Health Based Targets assessment for the supply and to identify additional treatment (eg UV disinfection) to manage this risk.

Treated water is then pumped to the community either directly or via the 545 kL water tower. No area of the reticulation has low pressures.

There are some areas of long detention, and these are included in the verification monitoring program.

The reticulation network in Longreach includes:

Table 3 Longreach Reticulation Details

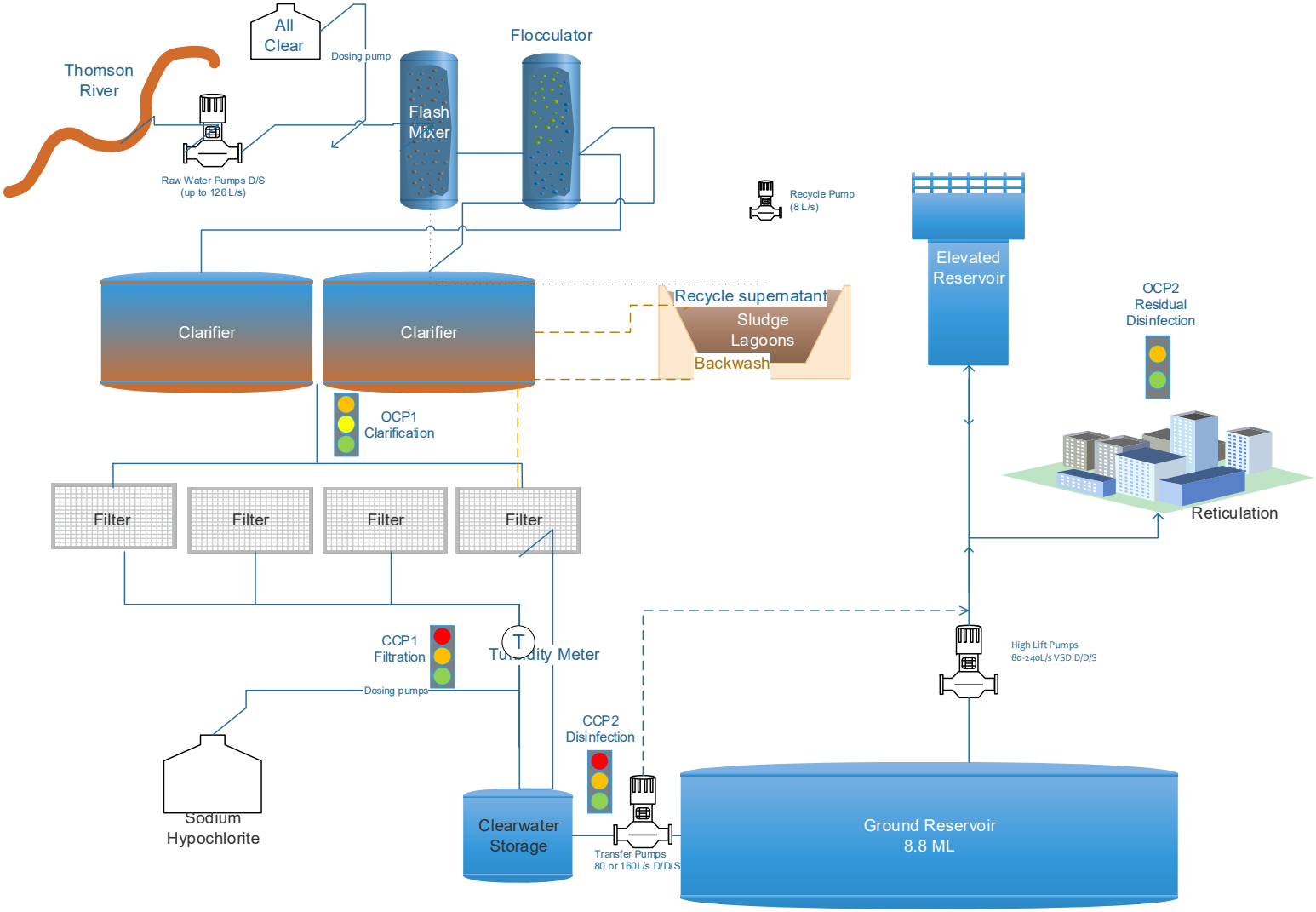
Pipe Material	Percentage	Age Range
Concrete	28%	~75 years
Asbestos Cement	45%	~50 years
PVC	22%	0-20 years
PE	5%	10 years

Historically there has been a raw water bypass to town – this has now been removed.

2.5.2 Groundwater bore

A bore was drilled to provide an alternate water supply, however the bore is hot and has high levels of fluoride. It was determined that the bore caused issues with chlorine dosing, and the community did not support the addition of fluoride to the supply, so the bore has been removed from the treatment process. Groundwater is now used for non-potable applications (e.g. roadworks), and is not part of the drinking water scheme, so not discussed further.

Figure 6 Longreach treatment plant schematic



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2.6 Ilfracombe Water Supply System

The Ilfracombe Water Treatment Plant is a 680kL/day conventional water treatment plant (20 hours operation, typical daily flow 160-540 kL). This has been recently supplemented with a groundwater bore that operates at 4L/s (288 kL/day 20 hours operation).

Conventional plant: Raw water is pumped from the ephemeral Collumpton Creek (when water levels allow) into the Murray/ MacMillan Dam, and then on to the Shannon Dam. Both Dams also have small catchments, but these are negligible in comparison to the water sourced from Collumpton Creek.

As for the broader Thomson, there is limited land use in the catchment over the low density cattle grazing. However, it is known that some locals access the dams for recreation. Water is normally treated from the Shannon Dam as the water quality in Shannon Dam is higher than the Murray/ MacMillan Dam (but can be treated direct from either source). Water is pumped from the larger Murray MacMillan Dam into the Shannon Dam where it visually flocculates.

Raw water into the treatment plant is dosed with hydrochloric acid (single dosing pump with spare on site) prior to addition of coagulant (polyDADMAC) with a single dosing pump (spare on site), prior to clarification through upflow tube settlers. Powder Activated Carbon (PAC) is used seasonally to address algal metabolites (taste and odour). Laundered water is then filtered with a sand filter prior to chlorination with sodium hypochlorite into the 350 kL roofed, and vermin proofed ground level reservoir that is used as a clear water tank. As for Longreach, sodium hypochlorite is transported by a licensed tanker and emptied into 1,000L storage tank within a bunded chemical area. Chlorinated water can either be pumped into the 228 kL elevated reservoir, or directly to town using a VSD pump. As a result of the installation of the VSD pumps, there are no areas of Ilfracombe that experience low pressures.

The former raw water bypass to town has been decommissioned.

Reverse osmosis plant A bore has recently been drilled between the Shannon Dam and the water treatment plant. The bore report card can be accessed at: http://resources.information.qld.gov.au/groundwater/reports/borereport?gw_pub_borecard&p_rn=163969.

The bore report has limited water quality information, but fluoride is high at 5.4 mg/L (one test – October 2018) is saline (conductivity 1900 µS/cm), high TDS (1100 mg/L) hot ~50C and elevated pH (>8.4).

Bore water is treated in a cooling tower (the cooling tower have potential access by vermin, which increases the source microbial risk) where fans operate to assist in the cooling of the bore water. This process also aerates the bore water which otherwise does have noticeable H_2S.

The cooled water (~30C) is then treated through mixed media pressure filters to protect the reverse osmosis membranes. These MMF filters are automatically backwashed on time or differential pressure.

From the MMF, treated water passes through an additional 5 micron prefilter prior to multistage reverse osmosis (RO). The RO feed water is dosed with antiscalant (polycarboxylic acid and phosphonic acid mixture, 10-30%) to minimise membrane fouling.

The combined RO permeate conductivity of the multiple pass RO is < 100 µS/cm, but is aggressive and has low pH (5.5). RO permeate then passes through an additional pressure vessel packed with calcium carbonate to both increase the pH and hardness. When new bags of calcium carbonate are added to the pressure vessel there is often an increase of the turbidity of this stream to ~1.2 NTU – however, this is not relevant as a public health risk as the turbidity increase is due to the residual calcium carbonate, and all microbial risks are effectively managed by the RO process.

Treated water analysis shows no parameters of concern, fluoride is 0.06 mg/L, and all other parameters are well below health guideline values. While the RO water is still soft, it is not overly aggressive, and the PE/PVC reticulation network is not subject to chemical corrosion.

Final treated water is chlorinated on the transfer line to the ground level reservoir where it mixes with the conventionally treated water.

The RO plant is currently run by a generator as the power supply to the water treatment plant is currently unable to provide sufficient power to operate both plants.

It is intended to operate the RO plant and conventional plants simultaneously to provide a consistent water quality to the Ilfracombe residents, however, this is only for aesthetic reasons, and any mixture of RO and conventionally treated water are able to meet the ADWG.

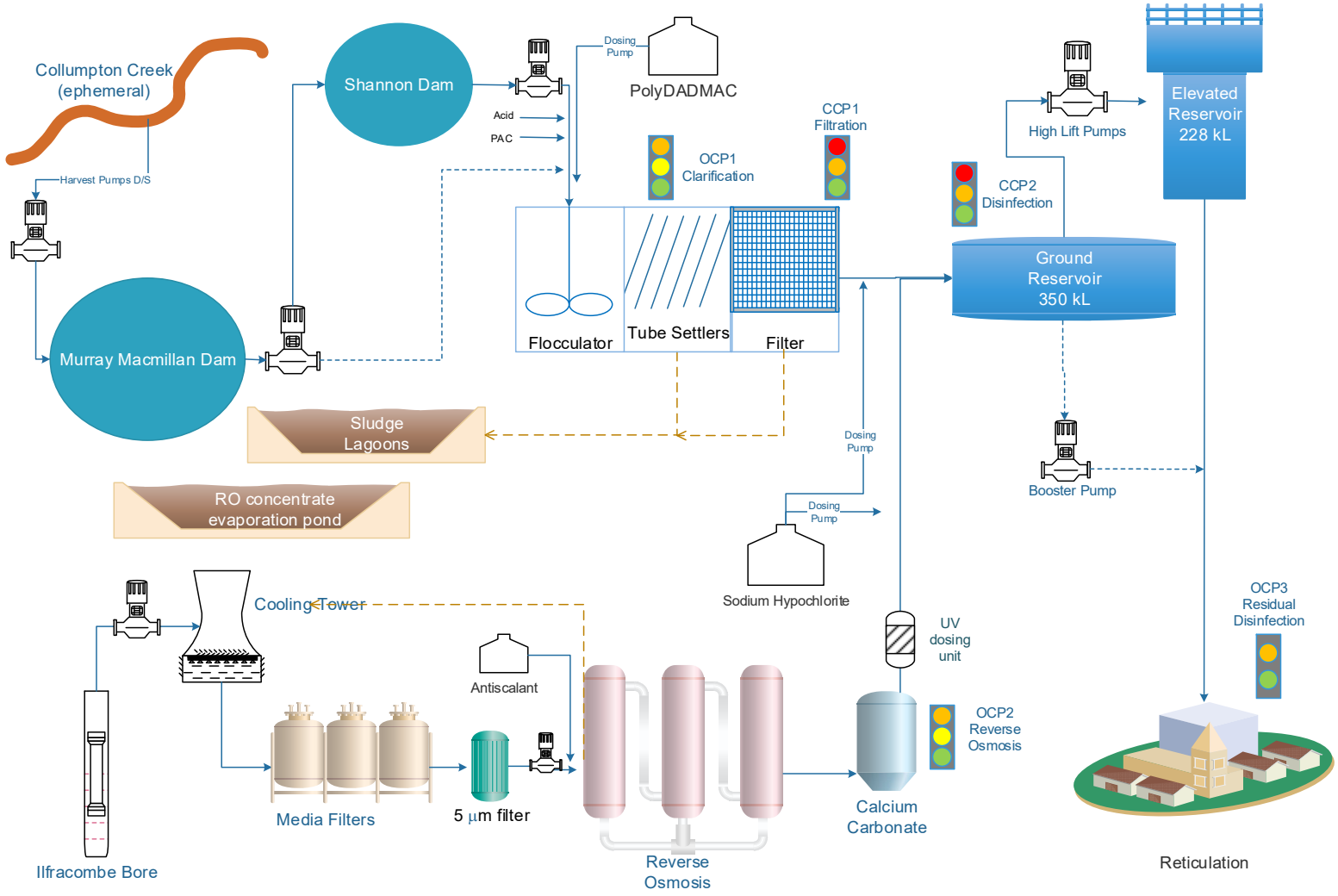
Reticulation

The reticulation network in Ilfracombe includes:

Table 4 Ilfracombe Reticulation Details

Pipe Material	Percentage	Age Range
PVC	43%	15 - 35 years
PE	57%	10 – 48 years

Figure 7 Ilfracombe treatment plant schematic



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2.7 Isisford Water Treatment Plant

The Isisford water treatment plant (720 kL/day - 20 hours operation) either treats water directly from the Barcoo River, or from the 257 ML off-stream storage. When there is sufficient water in the Barcoo, the river is used as the source, and while flowing, water is harvested from the River into the offstream storage in accordance with our licence conditions. Therefore, ultimately all water sourced is from the Barcoo, and this has proved reliable.

Raw water enters simultaneously into three new, enclosed raw water tanks. From these tanks, raw water is dosed (single dosing pump, spare on site) with All Clear prior to clarification. The clarifier is undersized and often produces pin-floc at the flow rates required to operate the water treatment plant. In 2017 and 2018, the flow rate has been reduced to improve performance. At time of writing a tender has been released for upgrades to the clarifier, and is included in the Risk Management Improvement Program (RMIP).

In 2018 a new filtration plant was installed. This includes a screen filter (for pump protection) and spin filters prior to 2 parallel pressure filters (only one is used at a time). The outlet of the pressure filters passes through a zeta potential mixer. The installation company claims that this process is effective in disrupting bacterial cells and protozoan oocysts, however there is no ability to monitor the performance of the mixer, nor scientific evidence to back this claim. As such, council has not assessed this as a treatment barrier.

When commissioned, the plant was not capable of reducing turbidity sufficiently to ensure effective disinfection. This has resulted in a boil water alert (BWA) that was introduced on 5th September 2018, and a further two on 18th January and 19th November 2021. Given the identified *Cryptosporidium* risk in the Barcoo River, the boil water alerts are not lifted unless the turbidity is consistently < 0.5 NTU.

During the latest review LRC has identified several high priority actions to address the recurring BWAs, including undertaking a HBT assessment to identify further treatment needs (eg UV), implementing upgrades as per the HBT assessment, upgrading/refurbishing the clarifiers, development and implementation of SCADA and online monitoring requirements to support operations and review of the current filter operation to CCP requirements.

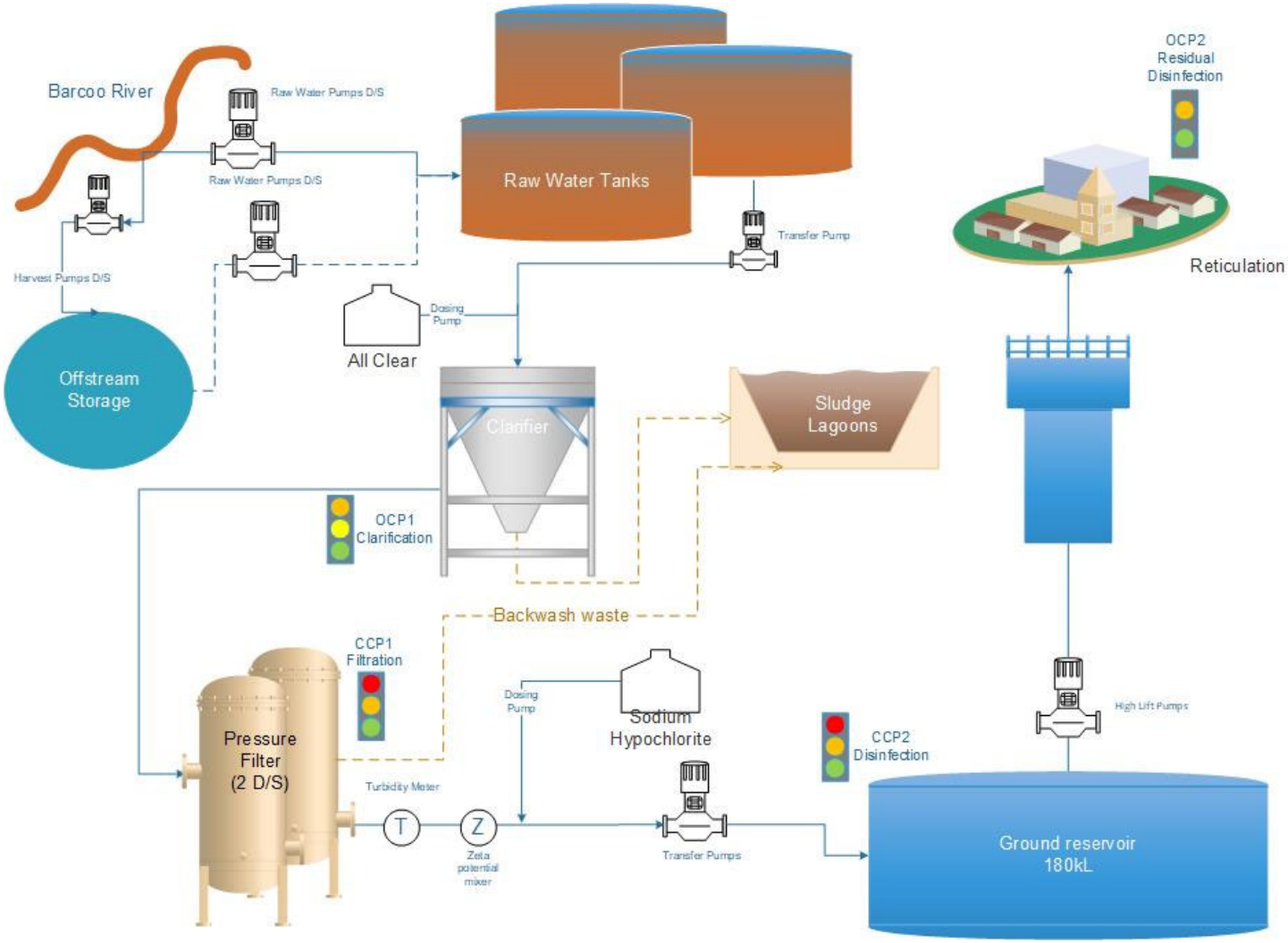
Following filtration, water is disinfected with sodium hypochlorite (single dosing pump, spare on site) before entering into the 180 kL ground water tank. A local transport company delivers 1,000L pod of sodium hypochlorite as required, which is stored in bunded area. After disinfection, water is then either pumped to the 120 kL Elevated Reservoir, or directly to town with a VSD pump.

The reticulation network in Isisford includes:

Table 5 Isisford Reticulation Details

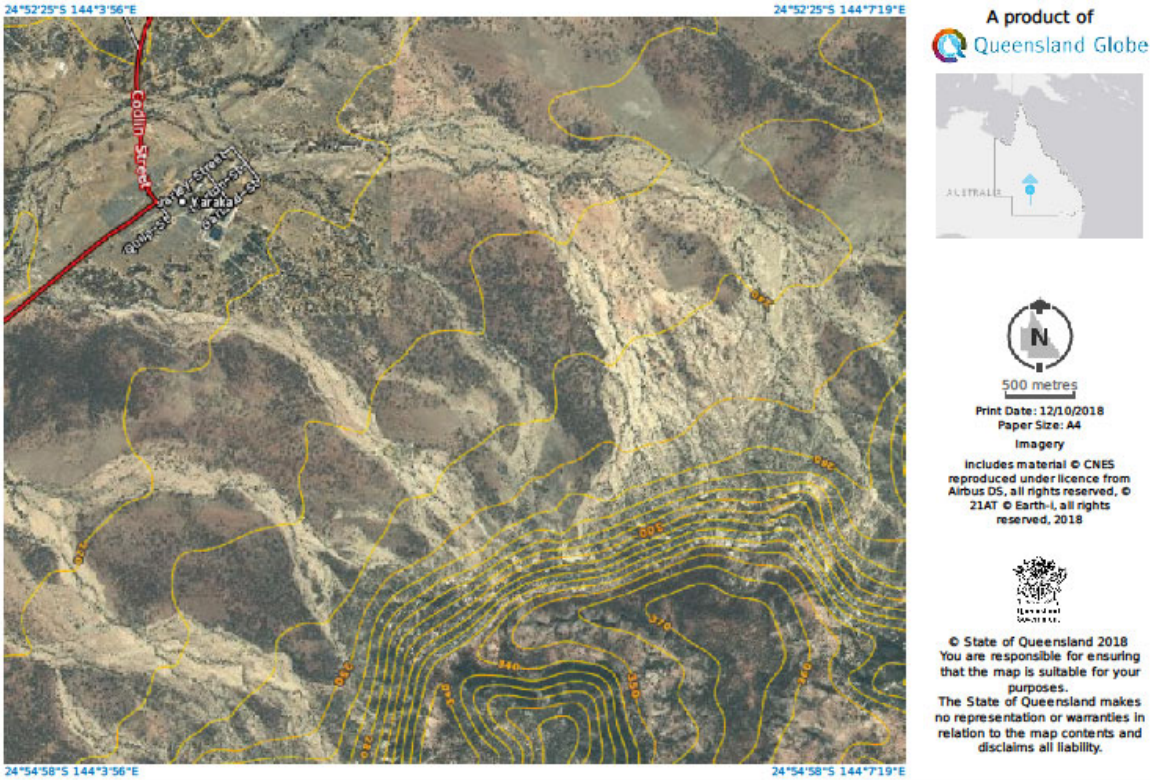
Pipe Material	Percentage	Age Range
Asbestos Cement	45%	~55 years
Galvanised Steel	5%	~35 years
PVC	32%	20- 30 years
PE	18%	10 – 30 years

Figure 8 Isisford Treatment Plant Schematic



2.1 Yaraka Water Treatment Plant

Yaraka sources water from a small sub catchment that captures incident rainfall. The Yaraka dams have a small catchment rising in the hills 4 km southeast of the dams. The hills rise 100m above the plains and have a rocky cap. The soil on the plains is a grey black soil and has a reasonable covering of low trees. The catchment is used for low density grazing and contains no roads, dwellings or other sources of contamination.



The Kiama Dam is an earth dam that provides the majority of water to the 45 kL/day (20hour operation) conventional treatment plant. Raw water from the Dam is pumped to a raw water tank, and then into an elevated header tank.

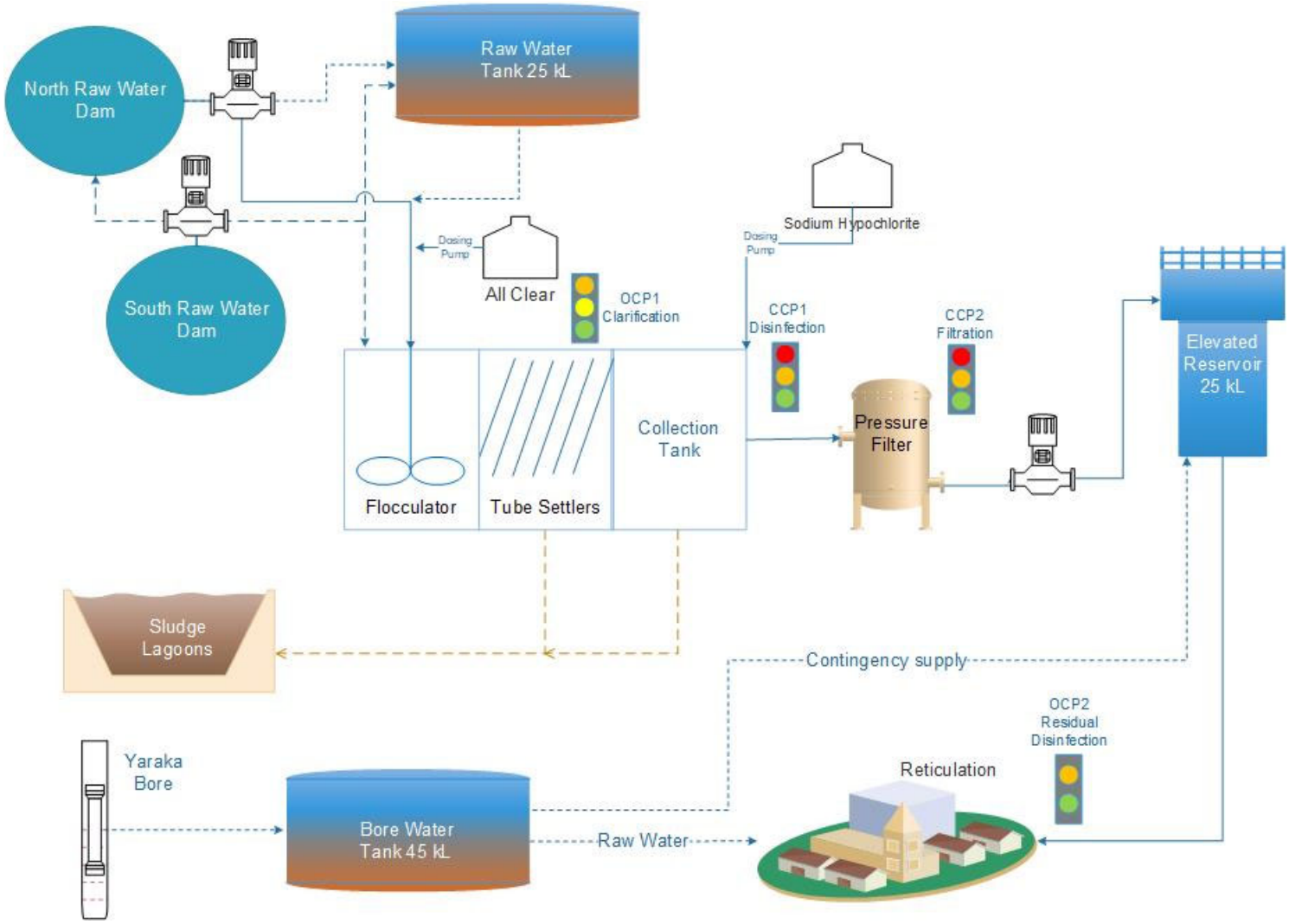
The Yaraka WTP (45 kL/day 20 hours operation) is a modular plant with a flocculator/ tube settler clarifier prior to a single pressure sand filter. Filtered water is dosed with sodium hypochlorite into the elevated 25 kL treated water tank. Sodium hypochlorite is purchased in 20L containers and stored in a bunded area.

The water treatment plant operates based on the level of the treated water tank.

There is a saline sub-artesian bore that is used for stock watering and wash down, but could be used to supplement the drinking water supply. It is not directly connected to the treated water supply, so cannot be used inadvertently.

The reticulation is 100% PE, with an age range of ~ 20-30 years.

Figure 9 Yaraka Treatment Plant Schematic



3 WATER QUALITY DATA

There have been numerous methods for capturing water quality data over the past 15 years. As such there are now some data gaps for some parameters. The following graphs and tables provide raw, treatment and treated water quality for each of the schemes. This information has been updated for this review and includes up to 7 years of recent data, as available. The analysis from previous reviews and recent analysis is available in Appendix A. Previous annual reports were also consulted in this review.

There have been ongoing issues around data capture, due to loss of key staff, and a high priority improvement item has been identified and implemented to review all operational monitoring requirements and implement a formal documented quarterly water quality review, aimed at building the capacity of plant operators to identify and respond to appropriate water quality signals, increase transparency within the organisation and support decision making.

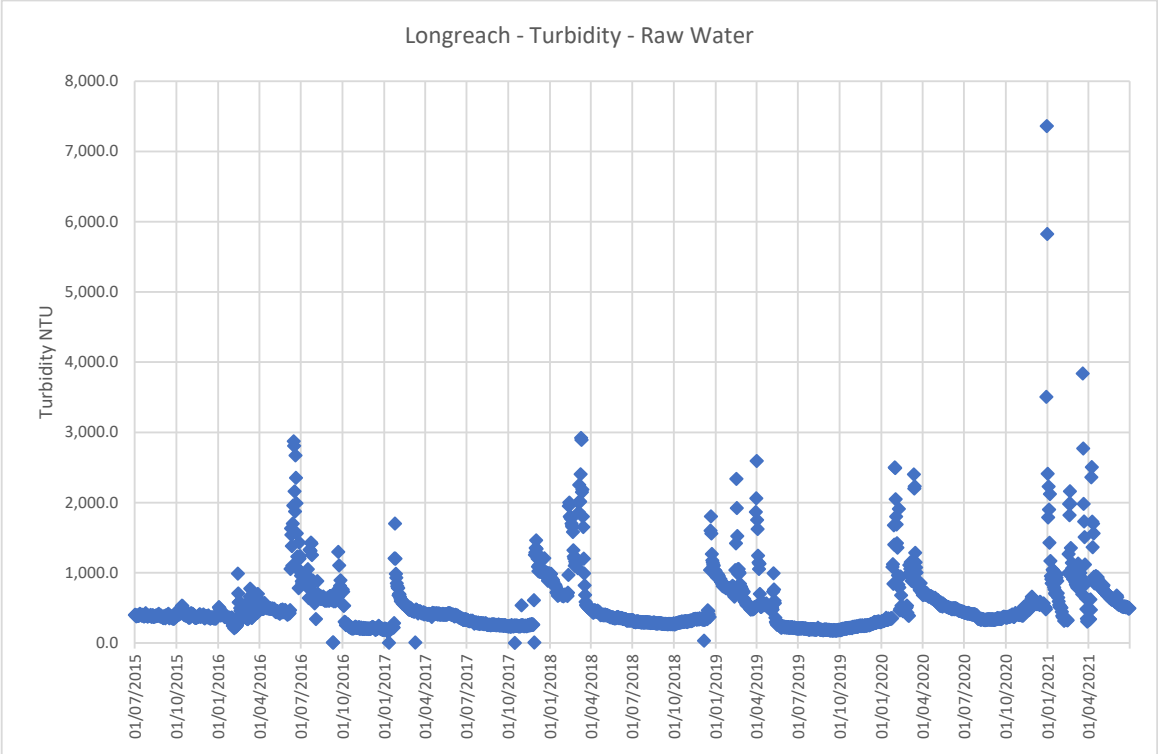
3.1 Longreach Water Quality

Longreach sources its water from the Thomson River which experiences highly variable turbidity loads, with high turbidity during inflow events, as can be seen in Figure 10. pH typically ranges from 6.5 to 7.9.

The treatment process works to reduce turbidity to acceptable limits. While the clarification does not currently meet operational targets (an improvement action has been identified to investigate the process) recent filtration trends show this to be working effectively and within CCP limits. Recent free chlorine trends show that the disinfection process is working effectively (Figure 11).

Turbidity in the Ground Level Reservoir reflects the improvements seen in filtration and the benefits in tank cleaning, which took place in the 2020/21 year. pH in treated water consistently meets the requirements for effective disinfection (6.5-8.5) (Figure 12).

The verification data long-term analysis from last 5 years shows improvements from all areas of reticulation monitoring compared to the previous long-term analysis (see Appendix A), with no detections of *E. coli* or total coliforms, an average of 1.19mg/L free chlorine with three detections below 0.2mg/L and an average turbidity of 0.44NTU, with 10 samples exceeding 1NTU (max 1.98NTU). LRC regularly flushes lines to manage reticulation dead-ends and associated water quality issues.



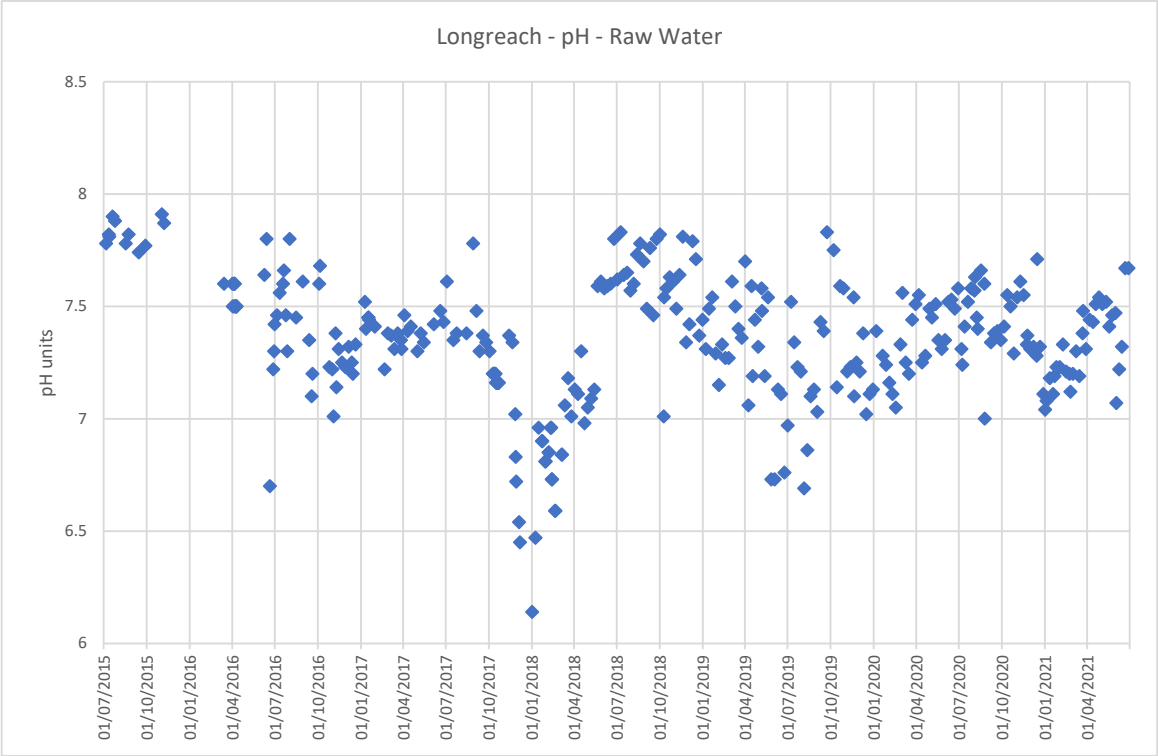
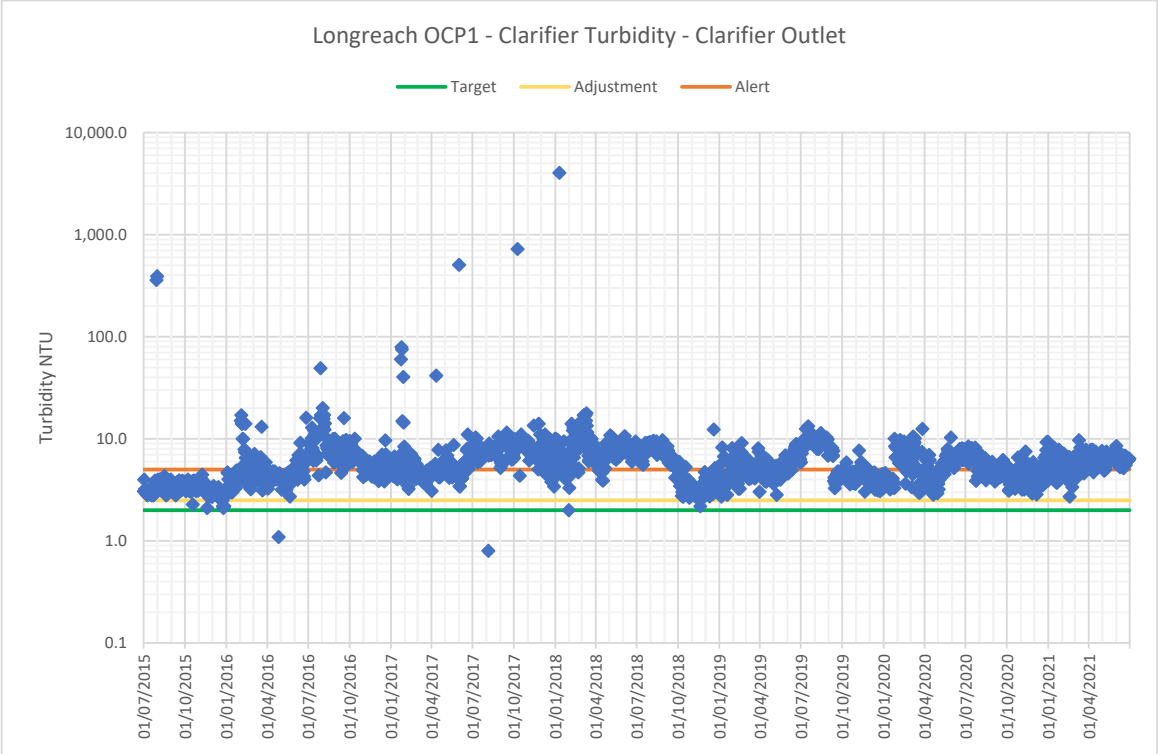


Figure 10 Longreach Raw Water Quality


Longreach OCP1 - Clarifier Turbidity - Clarifier Outlet
Target
Adjustment
Alert
Turbidity NTU
10,000.0
1,000.0
100.0
10.0
1.0
0.1
01/07/2015
01/10/2015
01/01/2016
01/04/2016
01/07/2016
01/10/2016
01/01/2017
01/04/2017
01/07/2017
01/10/2017
01/01/2018
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01/10/2018
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01/04/2019
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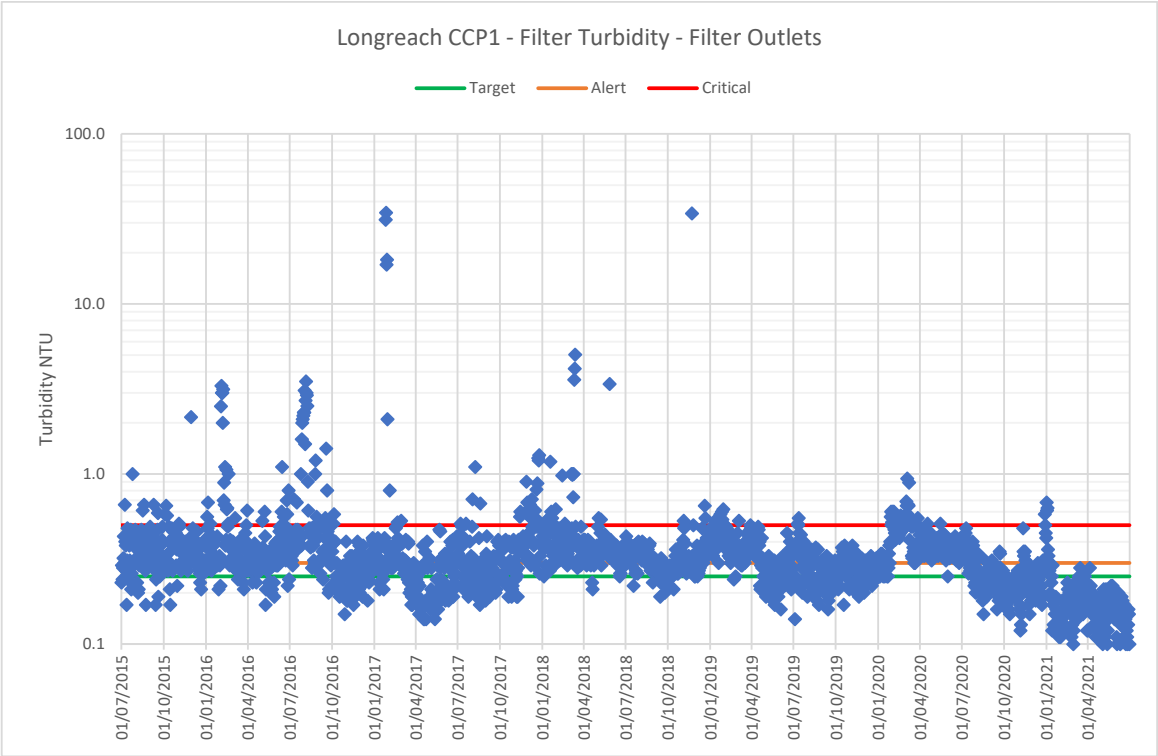
01/07/2020
01/10/2020
01/01/2021
01/04/2021


Longreach CCP1 - Filter Turbidity - Filter Outlets
Target
Alert
Critical
Turbidity NTU
100.0
10.0
1.0
0.1
01/07/2015
01/10/2015
01/01/2016
01/04/2016
01/07/2016
01/10/2016
01/01/2017
01/04/2017
01/07/2017
01/10/2017
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01/04/2021

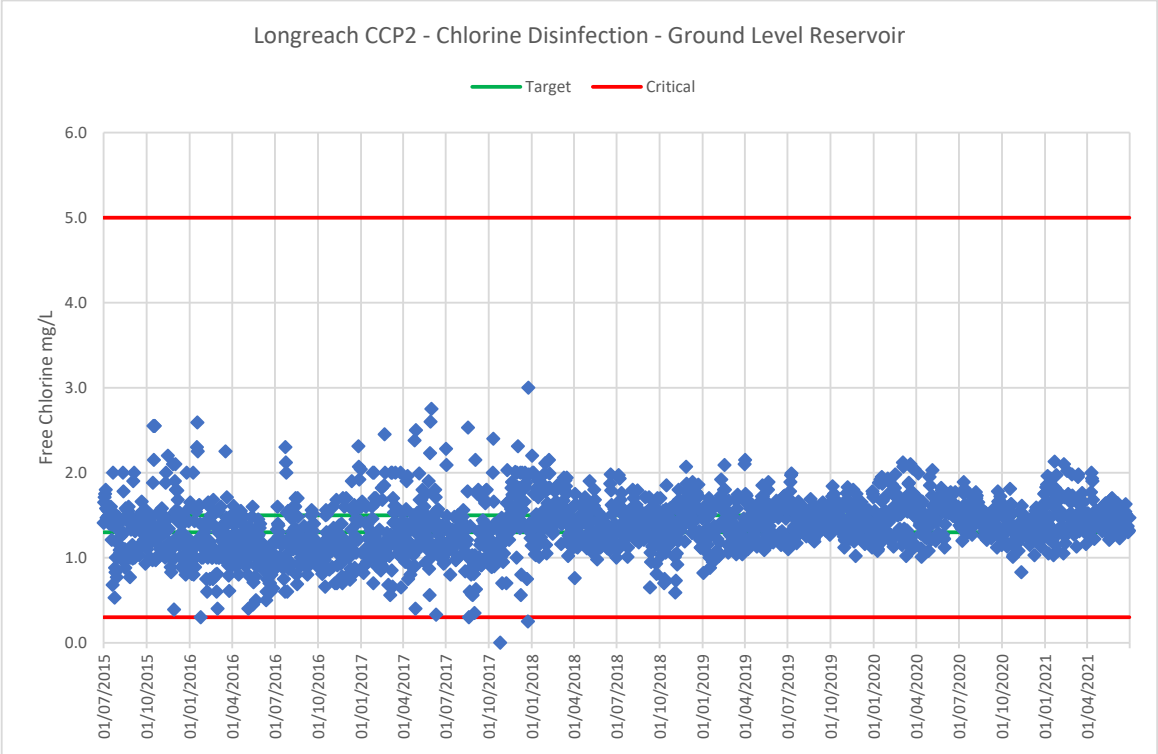
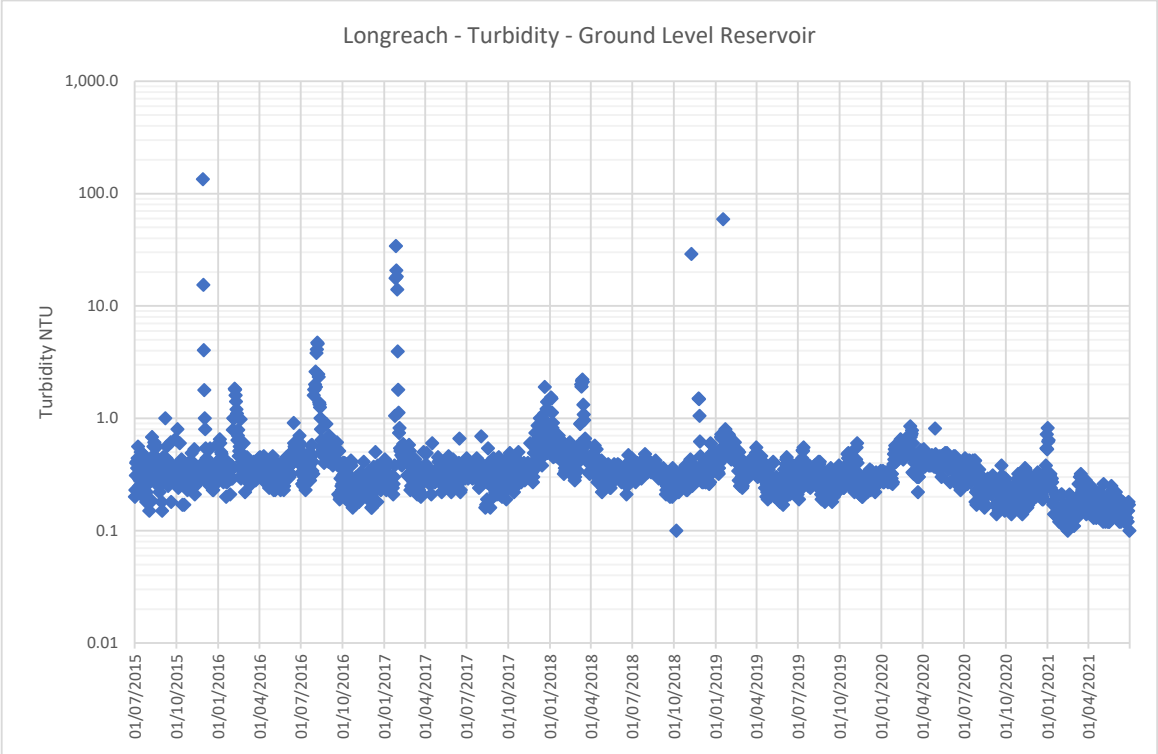


Figure 11 Longreach Control Points Water Quality



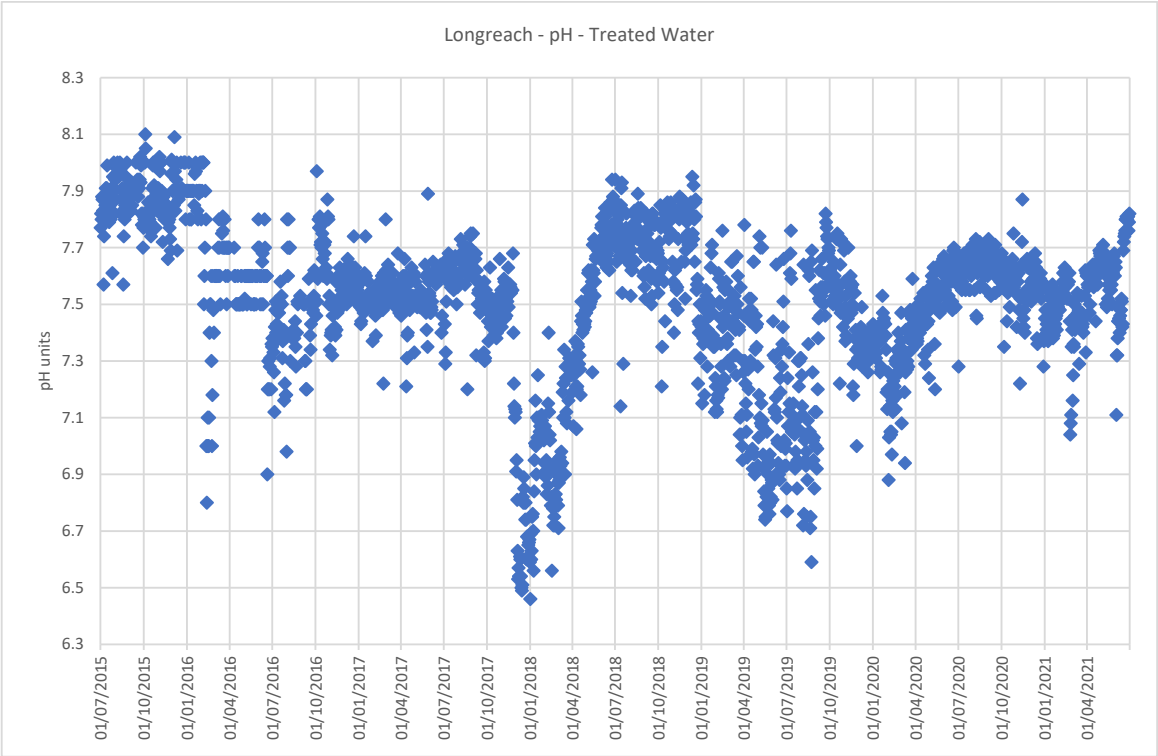


Figure 12 Longreach Treated Water Quality

Table 6 Longreach Verification monitoring data (2016-2021)

	Coliforms (mpn/100mL)	*E. coli* (mpn/100mL)	pH	Free chlorine (mg/L)	Turbidity (NTU)
Count	363	363	359	374	374
Maximum	0	0	7.93	2.10	1.98
Average	0	0	7.43	1.19	0.44
Minimum	0	0	6.50	0.10	0.12
Count if	>0 = 0	>0 = 0		<0.2 = 3	>1 = 10

There have been 8 reported incidents since 2011 in Longreach. These are detailed in Table 7.

Longreach RC has periodically tested for pesticides. In 2012 no traces were detected, while in 2018, trace tebuthiuron was detected. Queensland Health has confirmed the result was well below any threshold of concern.

Table 7 Incidents reported for the Longreach Scheme

Date	Parameter	Cause
22/02/2011	Trichloroacetic Acid	Routine Testing for THA & HAA in Water.
27/10/2011	Detection of E-Coli	Checked Records - Took more tests (both In-House & QLD Health). Test results came back clean.
24/09/2012	Raw Water pumped into Town Water Reticulation System.	Plant Fault due to a filter valve issue. The Raw Water pumps were switched to manual but not flowing at the correct flow rate.
21/06/2013	Detection of E-Coli	After Various Testing (In-House & QLD Health) Identified labelling error in samples.
12/12/2014	Detection of E-Coli	Contamination of Samples. Re-Training of Staff to be undertaken.
25/12/2014	High Turbidity	Dosing Pump burnt out (Mechanical Fault)
28/11/2015	Partially Treated Water pumped into Town Water Reticulation System.	WTP Fault - Dosing line for the coagulant was switched off. further investigations confirmed that the online turbidity meter did not shut the plant down nor did it raise an alarm.
25/01/2017	High Turbidity	Online Turbidity Meter shut WTP Down. A Run in the river has resulted in higher than expected turbidity. Dosing has been adjusted to correct issue.

3.2 Ilfracombe Water Quality

Ilfracombe sources its water from the Murray Macmillian and Shannon Dams, with turbidity typically less than 15NTU. Higher turbidity is experienced during inflow events, as can be seen in Figure 10. pH typically ranges from 7.2 to 9. There was a period of very low pH in March 2019. It is unclear if this is due to instrument issues and the data should be considered with caution.

There was limited long-term data available for the process control points, and significant gaps in turbidity data through the treatment process due to log sheet errors. This means that filtration cannot be properly assessed, however reticulation results do support that filtration is effective. The logsheet has now been rectified. The clarification process appears to work effectively to reduce the turbidity load prior to filtration (Figure 14). This is supported by reticulation data, with an average of 0.36NTU (Table 8). While the turbidity is generally low enough to confirm effective disinfection (as also shown by infrequent detections of *E. coli*), there are concerns that protozoan pathogens, if present, may not be removed. However, as the water supply is off-stream, and there is limited access to the dams by people or cattle, the protozoan risk, is significantly lower than Longreach or Isisford.

Recent free chlorine trends show that the disinfection process is working effectively within limits (Figure 14).

pH in treated water consistently meets the requirements for effective disinfection (6.5-8.5) (Figure 15)

The verification data long-term analysis from last 5 years shows no detections of *E. coli* or total coliforms, an average of 1.09mg/L free chlorine with only one detection below 0.2mg/L and an average turbidity of 0.36NTU, with 5 detections of turbidity exceeding 1NTU (maximum 1.55NTU). LRC has recently removed dead ends to manage water stagnation.

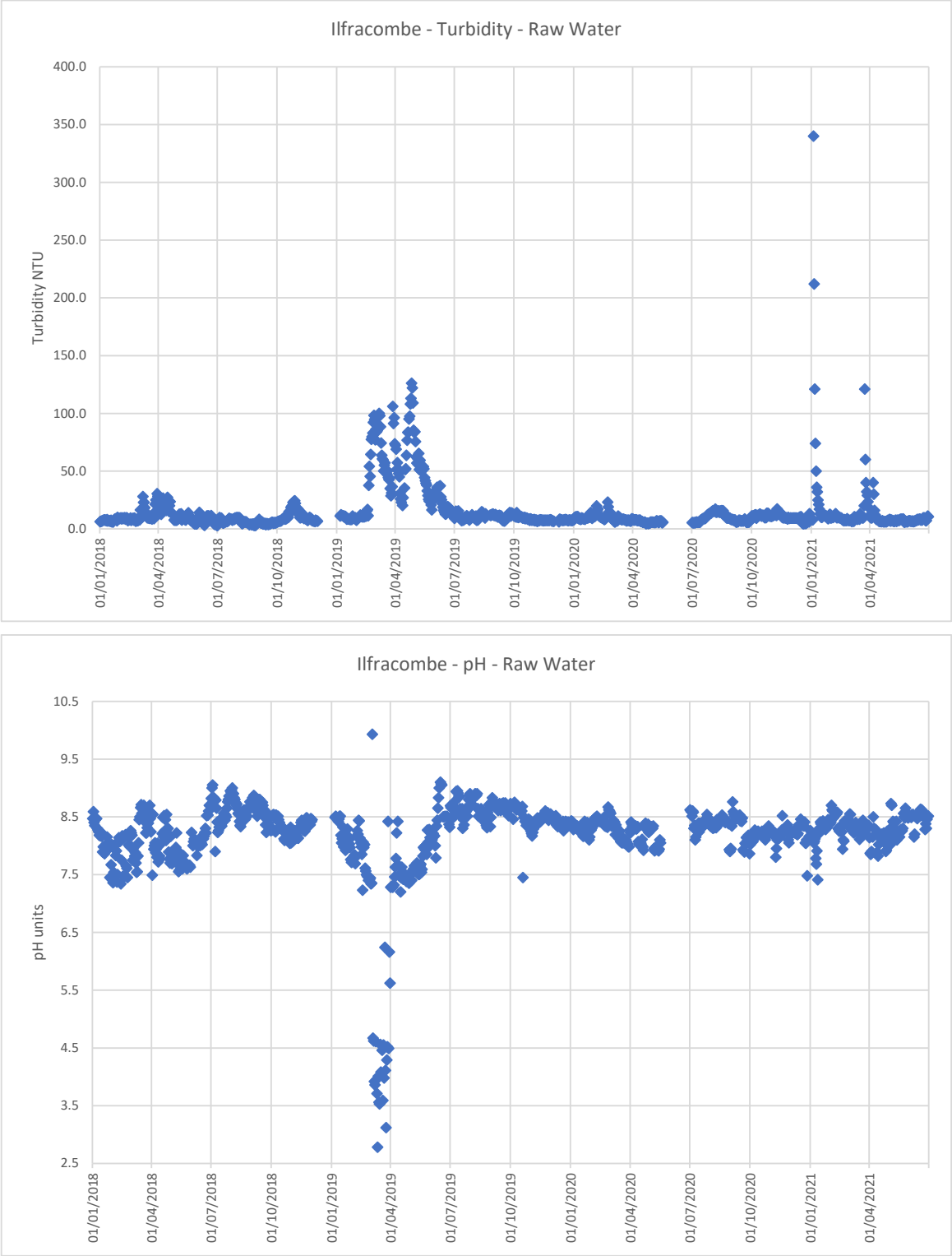
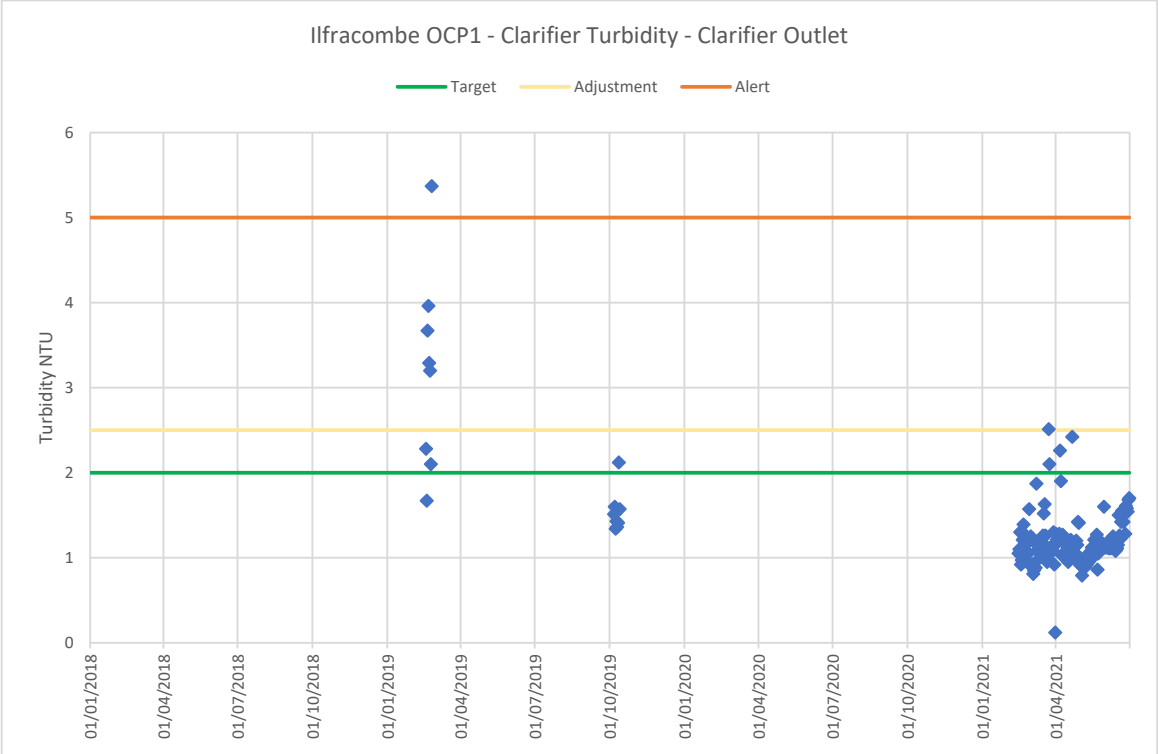


Figure 13 Ilfracombe Raw Water



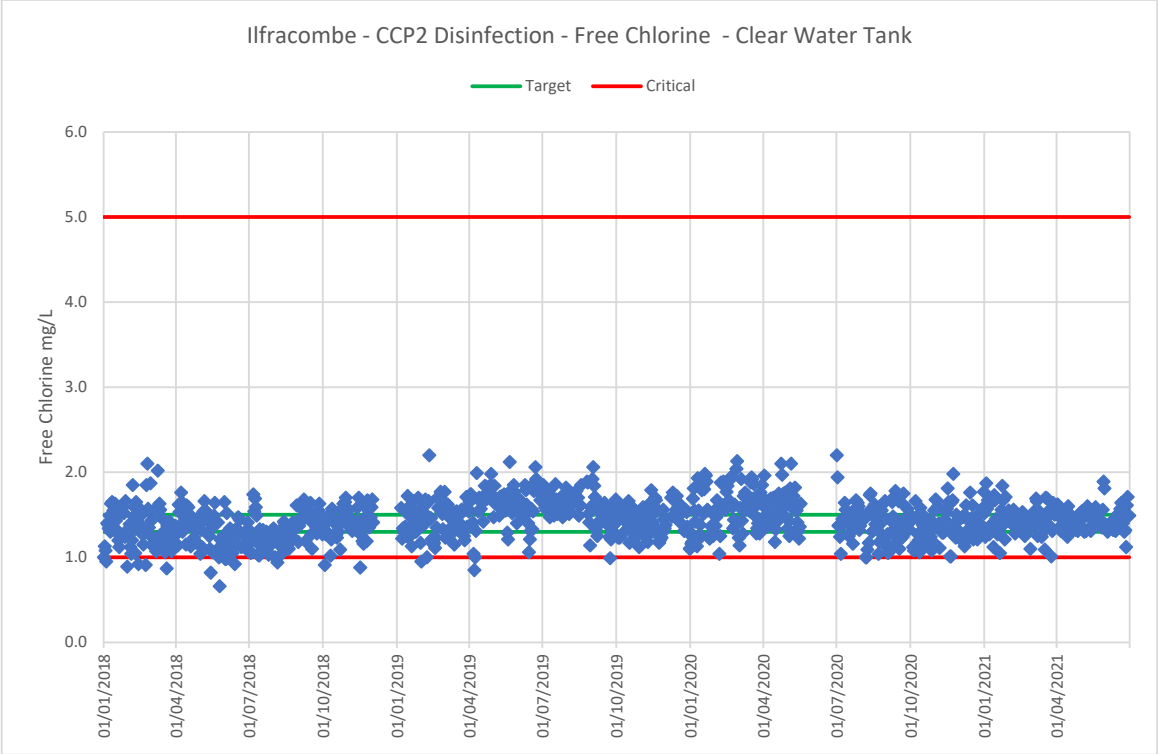


Figure 14 Ilfracombe Control Points Water Quality

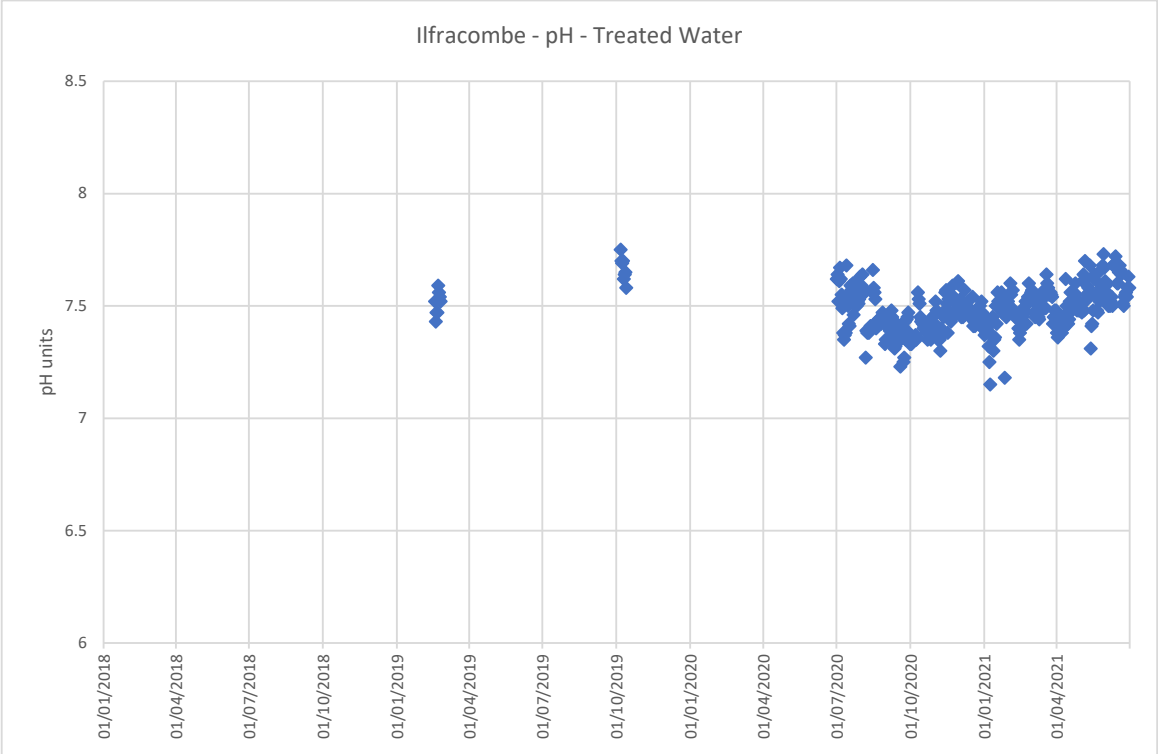


Figure 15 Ilfracombe Treated Water Quality

Table 8 Ilfracombe Verification monitoring data (2016-2021)

	Coliforms (mpn/100mL)	*E. coli* (mpn/100mL)	pH	Free chlorine (mg/L)	Turbidity (NTU)
Count	141	141	167	167	168
Maximum	0	0	8.10	1.87	1.55
Average	0	0	7.61	1.09	0.36
Minimum	0	0	7.22	0.05	0.11
Count if	>1 = 0	>1 = 0		<0.2 = 1	>1 = 5

There have been two incidents reported to the Regulator in the past 12 years, as shown in Table 9.

Table 9 Incidents reported for Ilfracombe

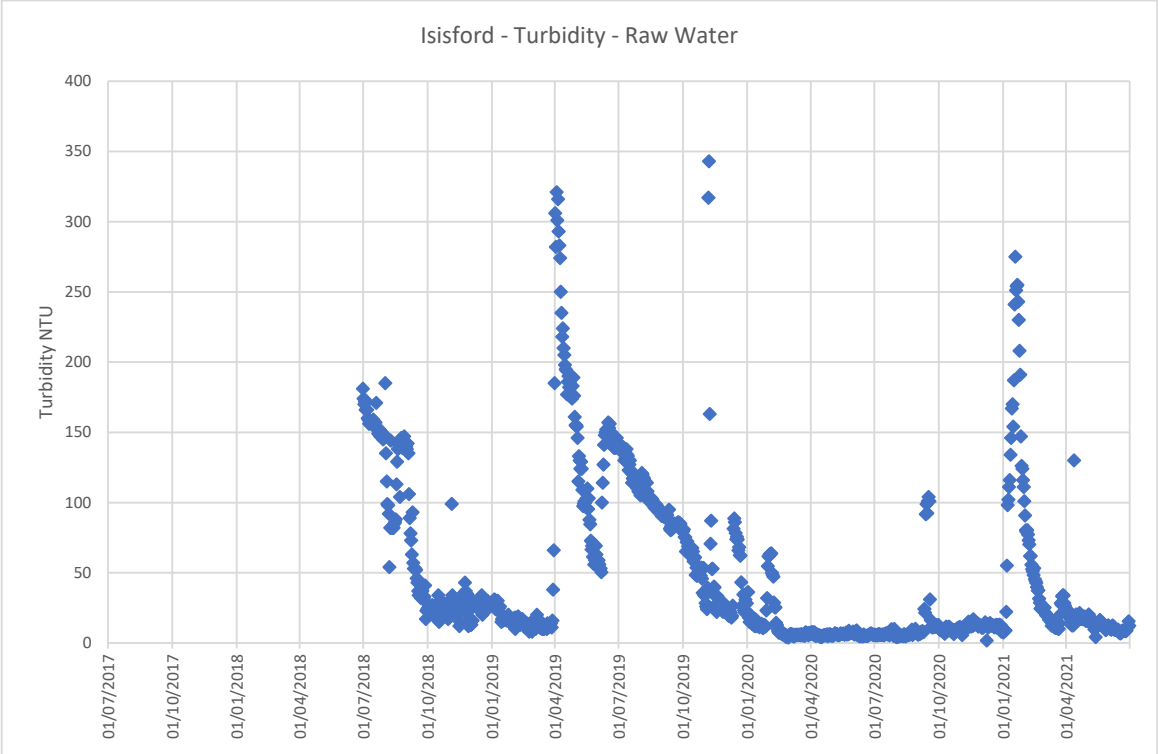
Date	Parameter	Cause
8/10/2010	Detection of *E-Coli*	*E Coli* Result from Test Sample
8/03/2016	Detection of *E-Coli*	Mis-Labelling of Samples. Re-training of Staff to be undertaken.

3.3 Isisford Water Quality Data

The Barcoo River can be highly turbid, and while the water out of the Offstream Storage is often well settled, the plant does experience high raw water turbidity during events. It was previously reported that the clarifier at Isisford struggles to achieve water quality of <5 NTU, and the old filtration plant (now replaced) did not effectively reduce turbidity. Data was not available to verify this, however the colour OCP shows improvements in colour control, likely to be mirrored somewhat in turbidity through clarification.

Council attempted to rectify this situation by the construction of the new water treatment plant. However, the new filtration plant is also unable to reduce the turbidity consistently below 1 NTU. Turbidity has improved substantially in the ground water reservoirs and reticulation system since early 2020 and the disinfection CCP mostly meets targets. In previous discussions with Qld Health, it has been determined that unless the turbidity from filters is sustained below 0.5 NTU that protozoan pathogens, which are considered likely to almost certain in the Barcoo River, will not be effectively removed. As such, Boil Water Alerts are used periodically for the supply. We have identified several improvement actions identified to relieve this situation including:

- Upgrading/ refurbishment of clarifiers to improve primary sediment removal – June 2022
- Prepare SCADA/telemetry and online monitoring specification to improve monitoring and control of treatment process – June 2022
- Implement SCADA upgrades, as per the specifications and including access to funding – June 2025
- Undertake a HBT assessment for the system and identify suitable treatment options (eg UV disinfection) – September 2022
- Implement treatment options as per the HBT assessment – December 2023



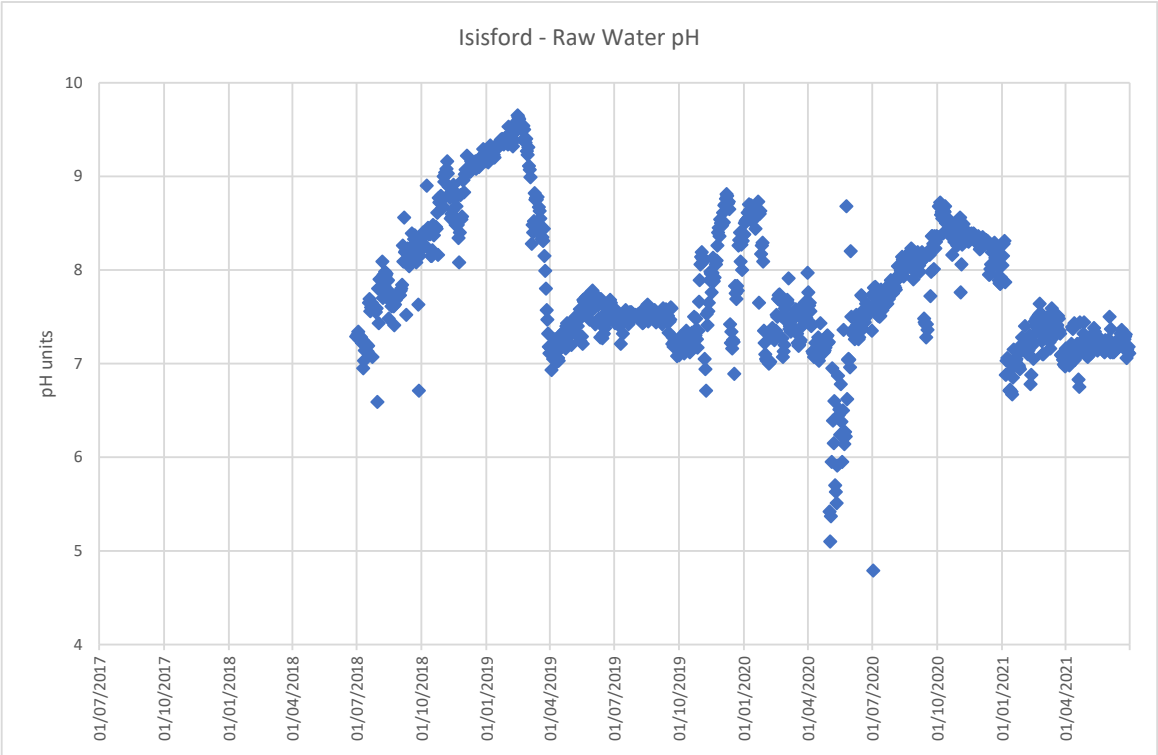
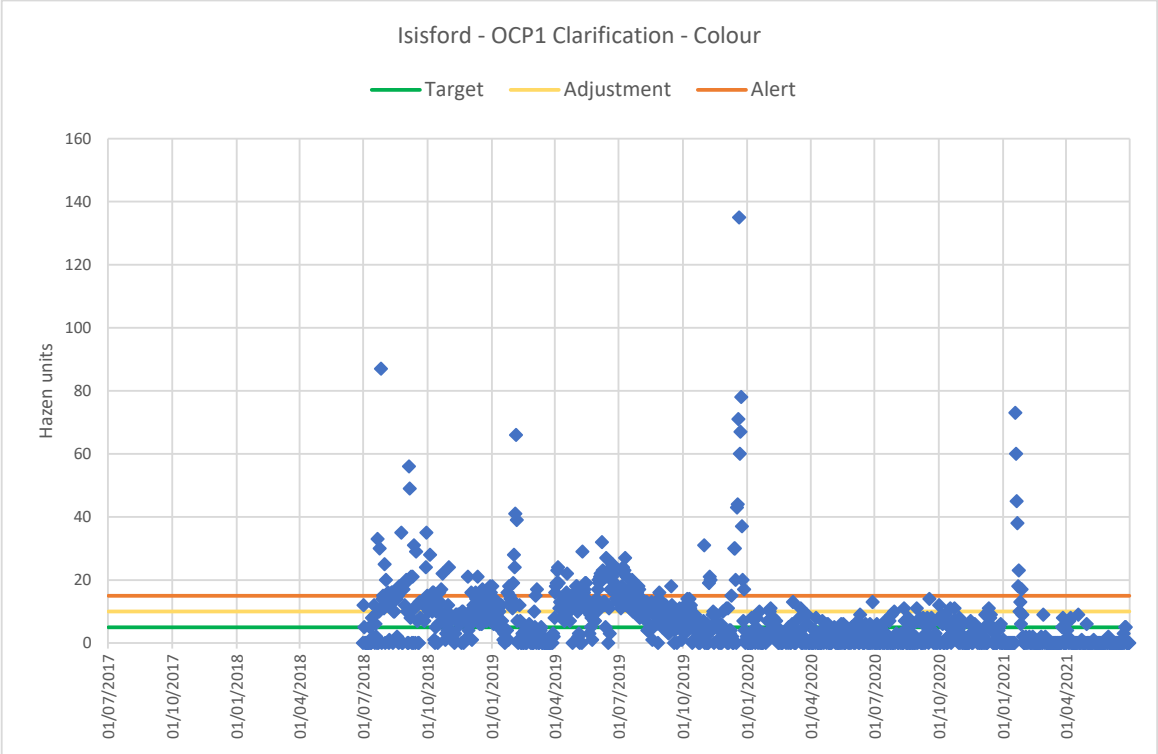


Figure 16 Isisford Raw Water Quality



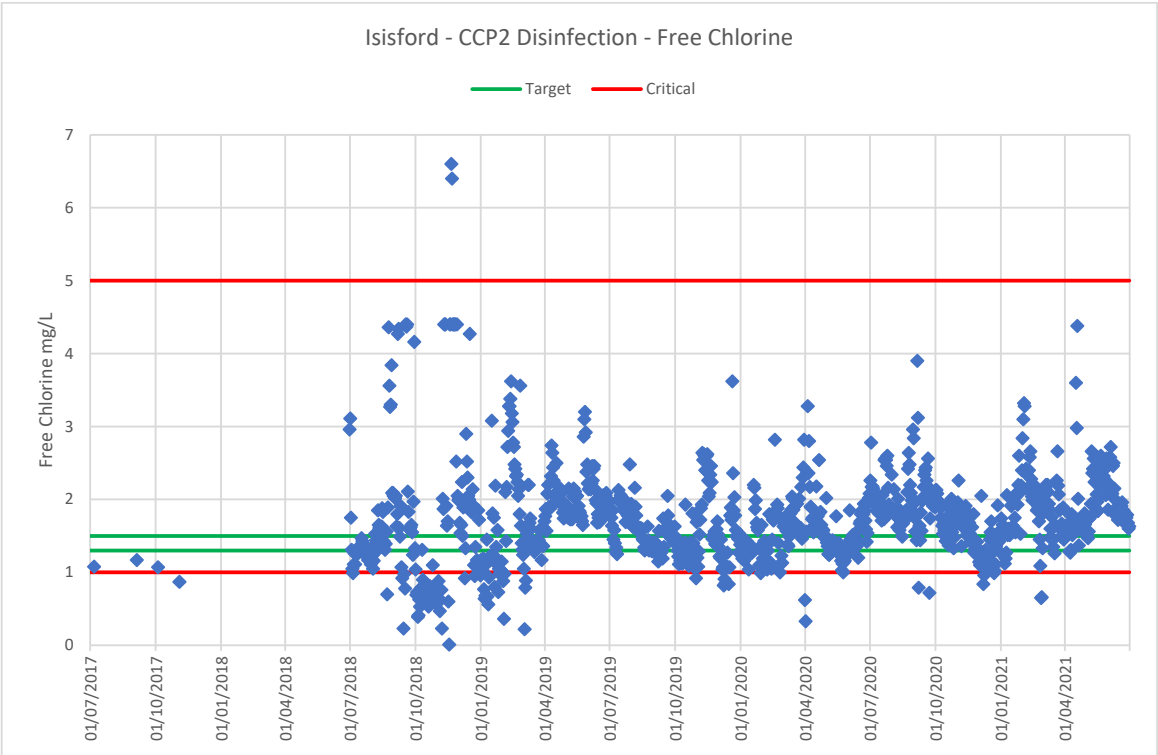
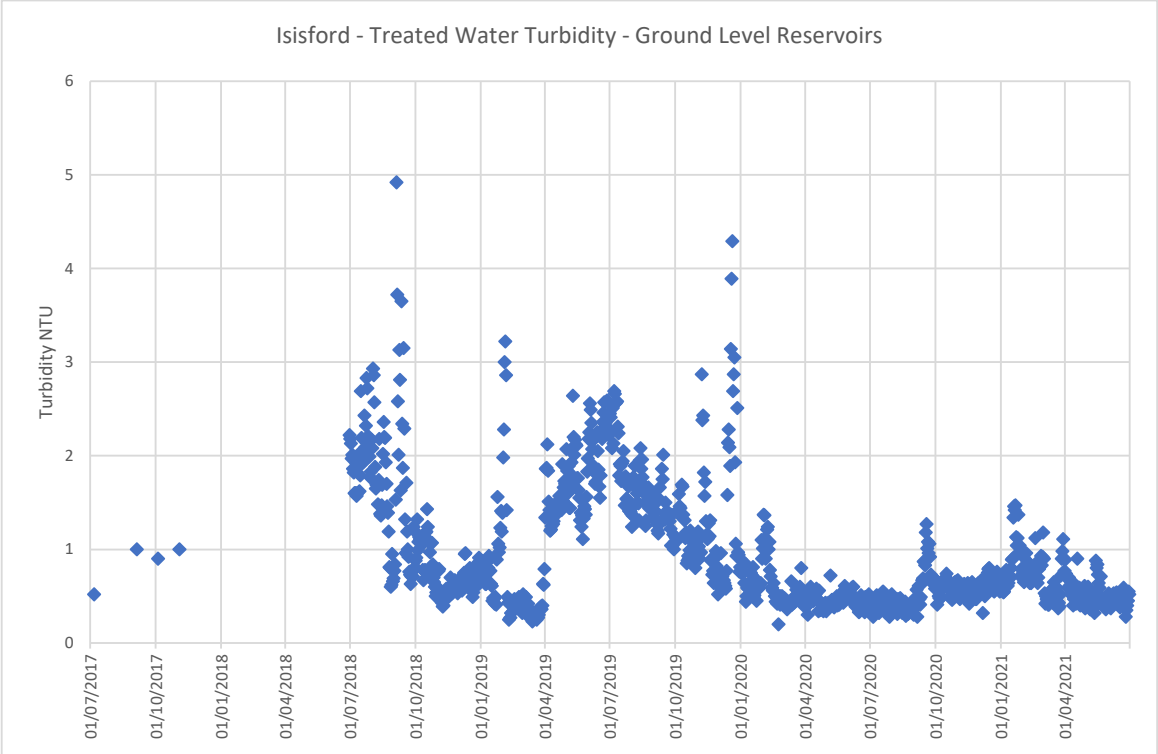


Figure 17 Isisford Control Points Water Quality



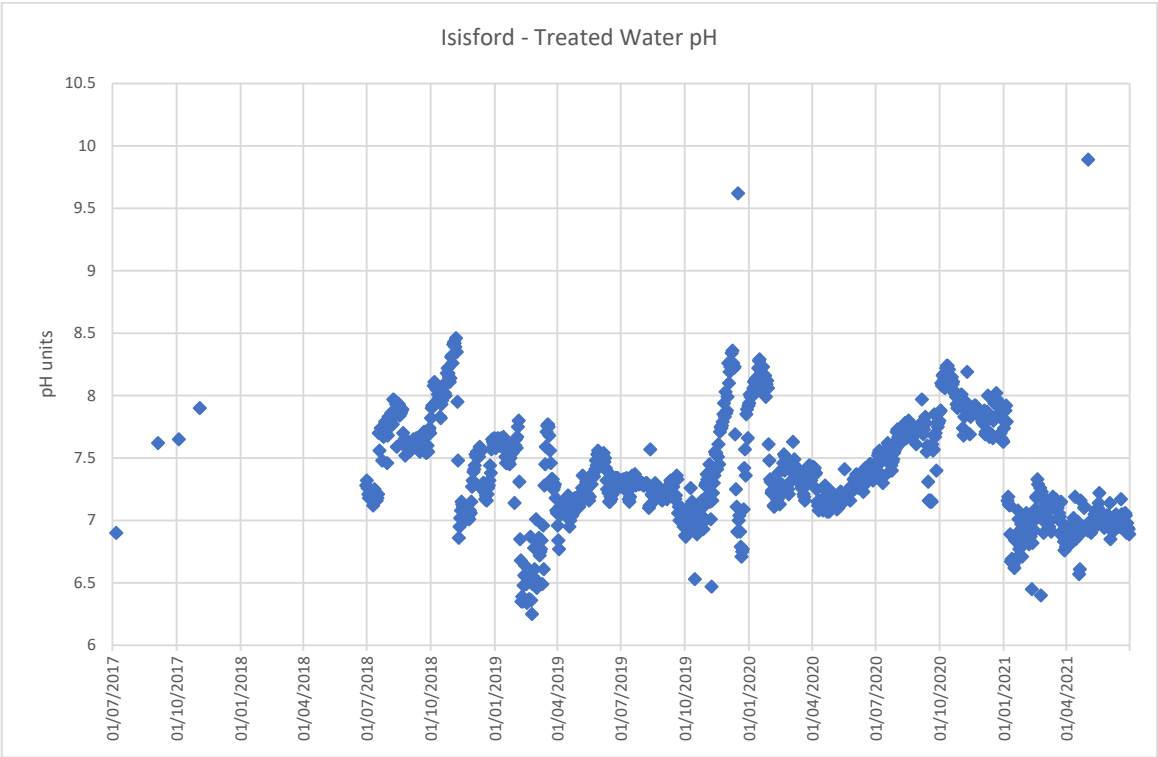


Figure 18 Isisford Treated Water Quality

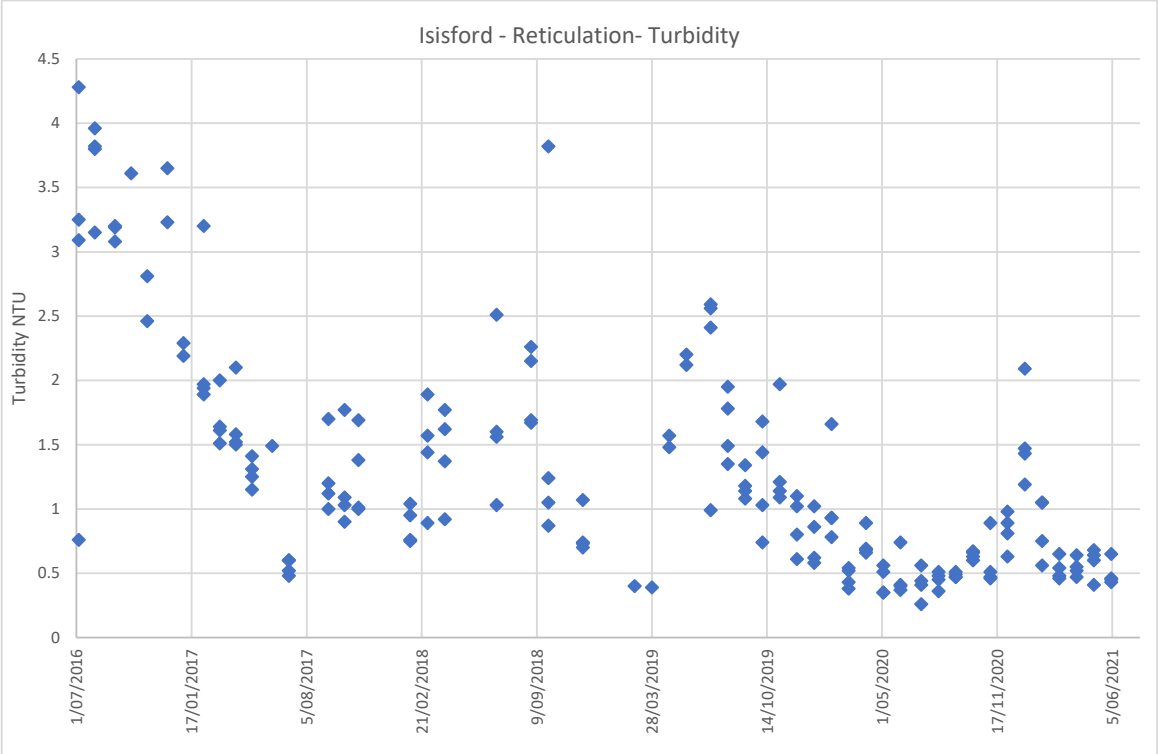


Figure 19 Isisford Reticulation Turbidity Trends

Table 10 Isisford Verification monitoring data (2016-2021)

	Coliforms (mpn/100mL)	*E. coli* (mpn/100mL)	pH	Free chlorine (mg/L)	Turbidity (NTU)
Count	199	199	186	185	181
Maximum	0	0	8	7	4
Average	0	0	7.49	1.35	1.32
Minimum	0	0	6.56	0.20	0.26
Count if	>1 = 0	>1 = 0		<0.2 = 0	>1 = 94

There have been new two incidents since the last review, both relating to high turbidites and resulting in extended BWA. See above discussion for improvement actions to mitigate this into the future.

Table 11 List of incidents - Isisford

Date	Parameter	Cause
17/02/2009	Detection of *E-Coli* & Pathogen	Concerns from Operator regarding potential contamination of samples which arrived at Isisford & Sample jar not sealed. Sampled received by QLD Health > 18Hrs Old.
17/12/2009	Detection of *E-Coli* & Pathogen	Concerns from Operator regarding potential contamination of samples which arrived at Isisford & Sample jar not sealed. Sampled received by QLD Health > 18Hrs Old.

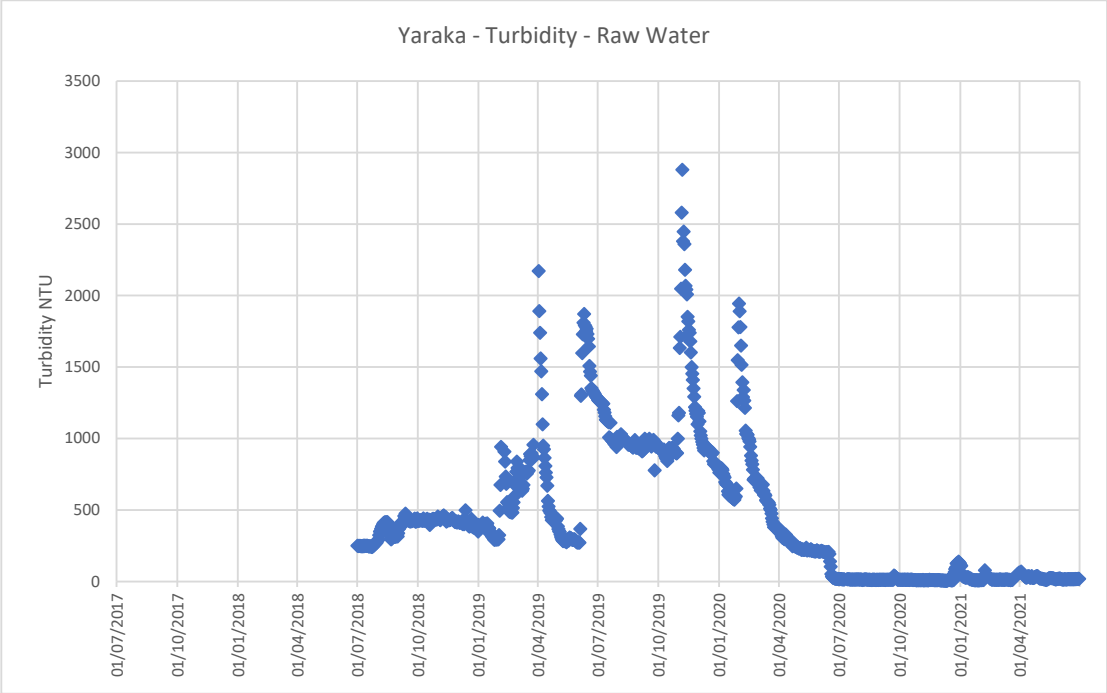
Date	Parameter	Cause
31/03/2013	Free Chlorine & Turbidity	Coagulant Pump not working properly causing partially treated water to be pumped through the Isisford Town Water Reticulation System.
31/03/2014	Event	WTP Fault - Internal Issue involving the appropriate training of staff.
5/09/2018	High Turbidity	WTP Failure - Mechanical Issue.
18/01/2021	High Turbidity	A Run in the river has resulted in higher then expected turbidity. Dosing has been adjusted to correct issue
19/11/2021	High Turbidity	A Run in the river has resulted in higher then expected turbidity. Dosing has been adjusted to correct issue

3.4 Yaraka Water Quality Data

The Yaraka dams have a small catchment with low density grazing and limited sources of other contamination. Raw water turbidity can be highly variable, with maximum 2,880 NTU recorded in November of 2019, however has remained stable since June 2020 at an average of approximately 20 NTU (Figure 20).

Control point data shows that filtered water turbidity and chlorine disinfection routinely exceeds target limits and at times critical limits (Figure 21), reflected in the ground water reservoir turbidity readings. Reticulation turbidity has exceeded 1NTU in 30 samples over the past 5 years, with free chlorine an average of 1.38mg/L during the same period. There have been no detections of *E. coli* or total coliforms in the past 5 years (Table 12).

The residual risk of protozoa has been assessed as High, based on the above and as an immediate response to poor treated water turbidity results, we will apply the same approach as Isisford and instigate BWA when necessary. We are also implementing an immediate review of operational monitoring and implementing formal water quality reviews every quarter. Other improvement items are discussed in section 9.



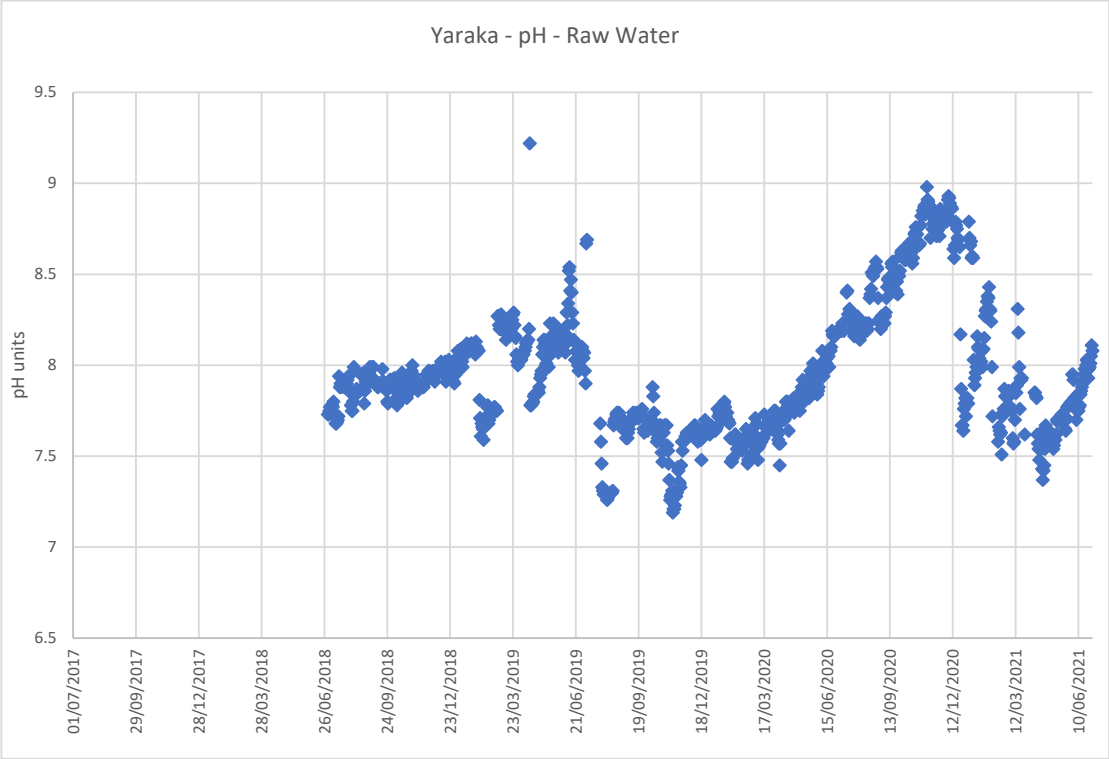
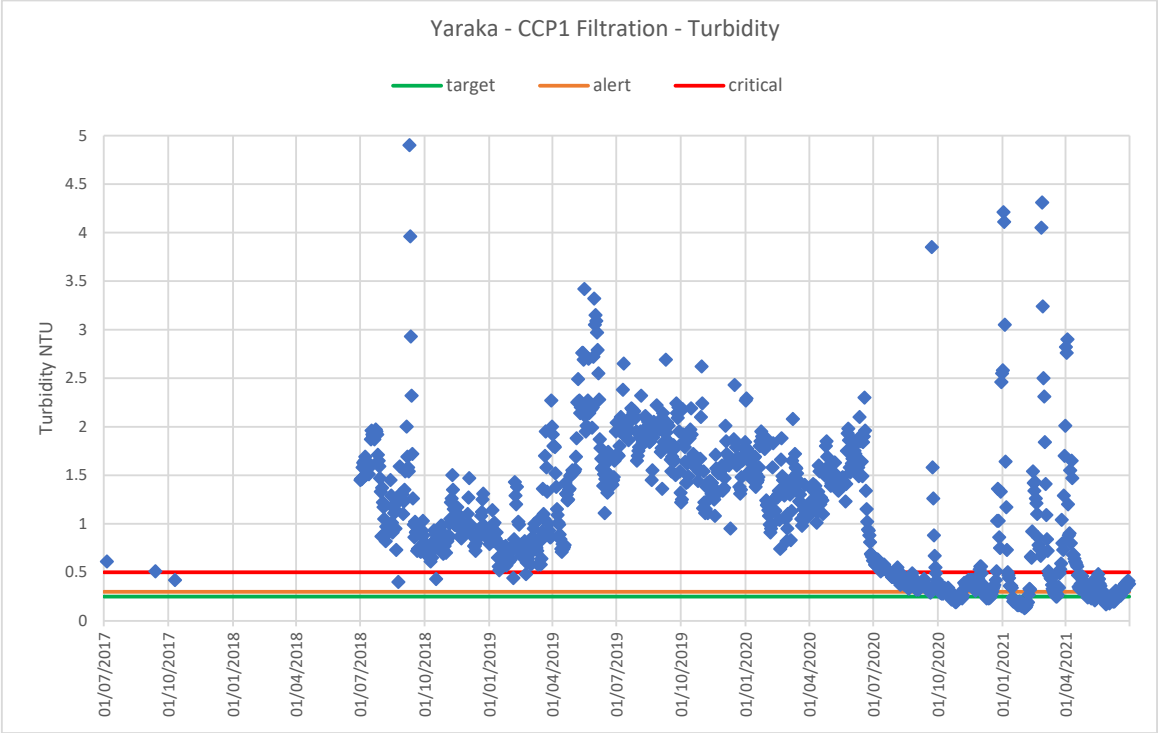


Figure 20 Yaraka Raw Water Quality



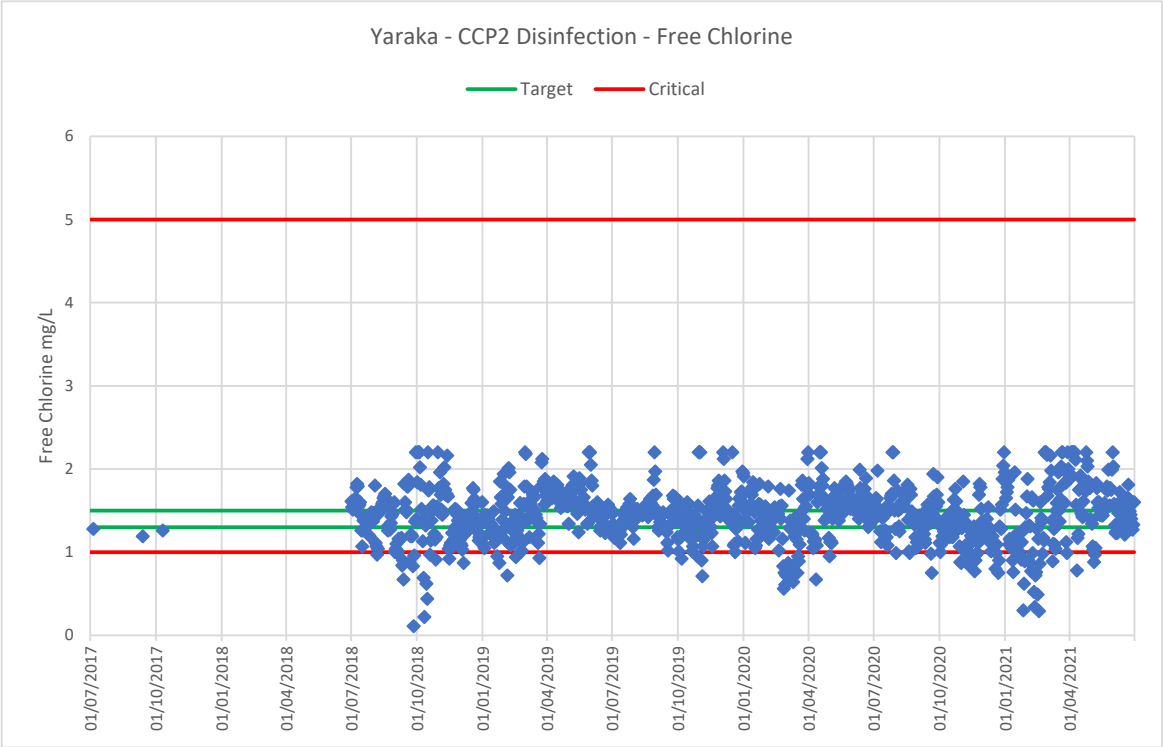
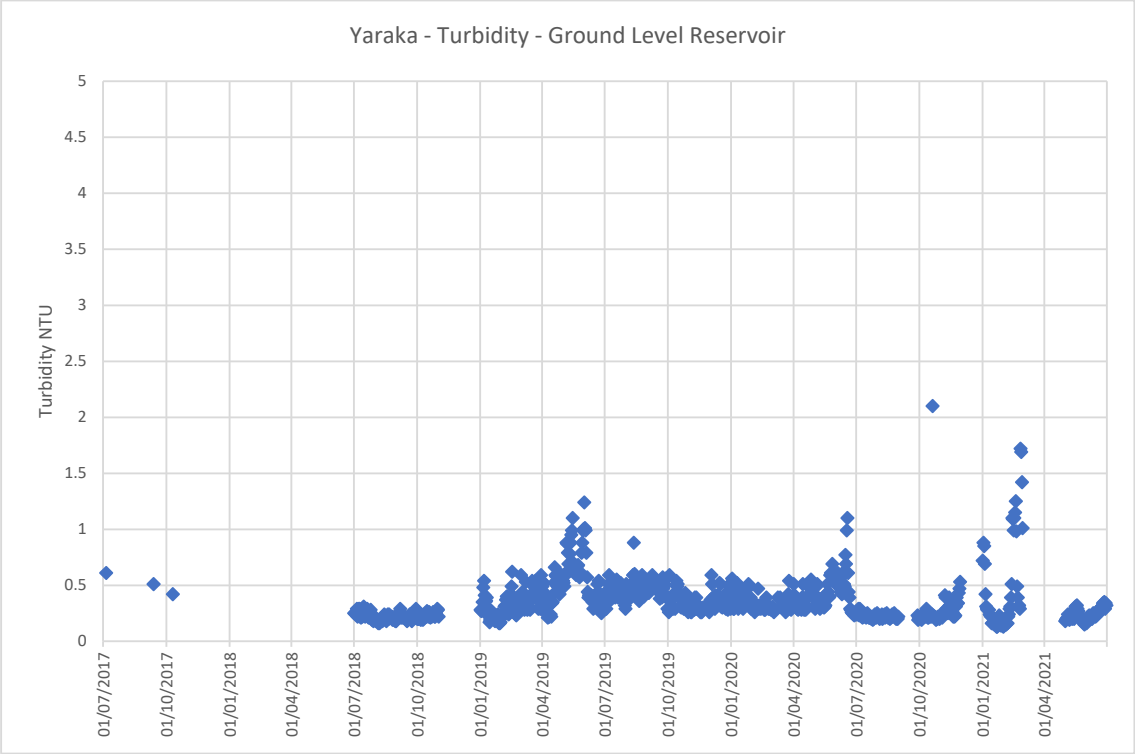


Figure 21 Yaraka Control Points Water Quality



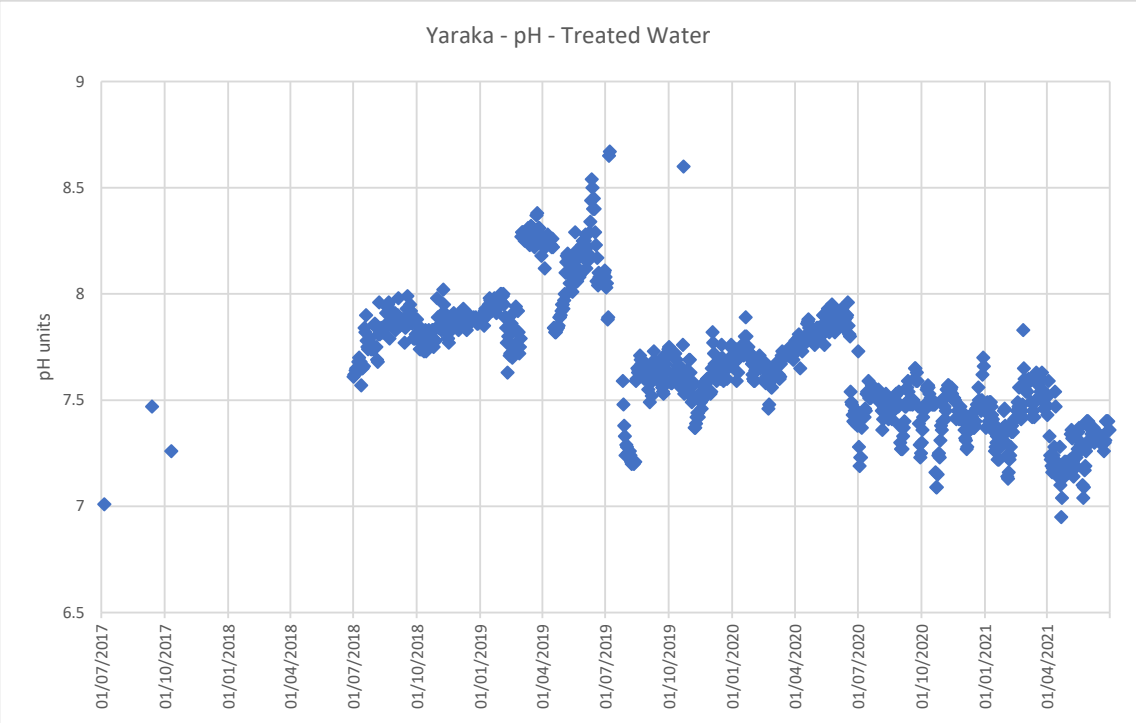


Figure 22 Yaraka Treated Water Quality

Table 12 Yaraka Verification monitoring data (2016 - 2021)

	Coliforms (mpn/100mL)	*E. coli* (mpn/100mL)	pH	Free chlorine (mg/L)	Turbidity (NTU)
Count	87	88	74	76	76
Maximum	0	0	8.29	2.20	3.00
Average	0	0	7.56	1.38	0.97
Minimum	0	0	7.01	0.92	0.19
Count if	#>1 = 0	#>1 = 0		#<0.2 = 0	#>1 = 31

No incidents have been reported for Yaraka.

3.4.1 Water Quality Incidents

There have been 21 water quality incidents reported to the regulator since the commencement of reporting. These highlight the treatment processes are not fully monitored, and this has at times resulted in poor quality water entering the reticulation networks. These are detailed in the tables above.

In 2015 the Longreach WTP the coagulant dosing line was turned off, and partially treated water released into the network. This resulted in a Boil Water Alert. A similar incident occurred in 2017 due to a dosing pump failure.

However, there have been few confirmed *E. coli* detections – for example, in Ilfracombe, there was a positive laboratory sample (*E coli* detected with no free chlorine), where the in house sample had 1.42 mg/L chlorine and no detectable *E. coli*). This is considered by council to have been a case of mislabelling the laboratory sample. A similar incident occurred in 2016. Operators have been retrained in sample collection.

Disinfection by-products have been detected in the Longreach supply, with trichloroacetic acid the main DBP of concern. However, THMs are also elevated, and approach the guideline value.

Council is now extending the monitoring of disinfection by-products to all of its schemes.

During the previous review of the Plan, following the upgrade of the filtration at the Isisford WTP, there was a high turbidity spike that resulted in the need for a Boil Water Alert. Council continues to apply this approach and has had two further BWA in 2021 (instigated when filtered water turbidity exceeds 1NTU). BWA are lifted when we can consistently demonstrate <1 NTU at the WTP. There are a number of improvement items Council has identified, discussed in relevant parts of this plan, to minimise or fully remove the need for BWAs into the future.

Council has undertaken *Bacteroides* typing using PCR methods previously, and this confirms the human and bovine origins of the faecal sources in both the Barcoo and the Dam. That is to say, the uncertainty in our assessment of the protozoan risk has reduced, but the risk itself has not.

4 RISK ASSESSMENT

A comprehensive overhaul of the Longreach risk assessment occurred during the last review. In January 2022, the risk assessment was revisited where processes with a high residual risk or above, processes that have changed since last review and/or processes with improvement actions were reviewed.

The risk matrix is a slight modification of the RDMW Guideline version.

The aims of the risk assessment were to:

- reassess the current risk assessment to ensure that the outcomes are accurate
- capture any additional risks to the service that were not previously identified
- identify future actions to address any unacceptable risks
- amend the risk management improvement program

4.1 Methodology

The risk methodology was amended during the previous assessment and is described below.

The risk assessment follows the following process:

+ Identify the hazards
+ Determine the unmitigated risks
+ Identify the preventive measures,
+ Determine the mitigated risks
+ Identify the procedures used to ensure the preventive measures are effective
+ Where mitigated risks are unacceptable, identify risk management improvements

4.1.1 Hazard identification

The hazards identified in the previous risk assessment, and any additional relevant hazards, will be listed.

The type of hazard is identified (biological, chemical, physical, whole of system), followed by identifying the sources for each of the hazards.

4.1.2 Unmitigated risk assessment

Unmitigated risk is determined by considering the consequence and likelihood of a hazard in the absence of any other controls.

The consequence and likelihood descriptors are included in Table 14 Risk Matrix and Descriptors.

Once the consequence and likelihood are determined, the risk is read from the risk matrix. Risks that are Medium or Low are acceptable, whereas risks higher than Medium are unacceptable.

For example, for most hazards, this is the risk of drinking raw water with no treatment. For chemicals that are added in the water treatment process (e.g. chlorine) theunmitigated risk assumes that chlorine has been added, but without any monitoring or control of the dose rate.

The uncertainty of the risk assessment is then determined, and any comments captured.

4.1.3 Mitigated risk assessment

The mitigated risk assessment is undertaken by considering the hazardous events that could lead to the hazard being present. The unmitigated risk is brought forward from the unmitigated risk assessment, and the barriers that prevent or minimise the risk of that hazard are identified.

Barriers include the current treatment barriers (filtration/ disinfection etc), but also include any actions that may minimise the hazard in the catchment (e.g. fencing off-stream storages to exclude access).

The effectiveness of these measures are then considered in the context of any recent incidents, and with water quality data where available.

4.1.4 Documented procedure

Where an unacceptable unmitigated risk becomes acceptable when mitigated, it is important to ensure that the risk is managed at all times. The procedure(s) used to ensure the effectiveness of the barrier is documented in the risk register.

The documented procedures for the key barriers for public health will become critical control points - these are documented as single page traffic light procedures (example on last page).

4.1.5 Comments

Any comments that contextualise the risk assessment are captured.

4.1.6 Risk Management Improvement Plan

Risk management actions are captured in the last thee columns of the risk register, based on priority and consolidated in the Risk Management Improvement Plan. Where a mitigated risk is unacceptable, a risk management improvement plan (RMIP) item is identified and prioritised based on residual risk rating and sequencing of actions required to mitigate the risk further. Any high or greater residual risk is considered unacceptable unless determined to be As Low As Reasonably Practicable (ALARP), in which case it is noted.

It is noted that some items may not be supported by Council in the first year proposed, in which case, they will remain on the RMIP to be implemented when they receive funding. Further detail on the RMIP is included in section 9.

4.1.7 Risk Assessment Team

Table 13 Risk Assessment Team

Name	Position	Years at Council	Previous risk assessment experience
Sarah Lunau	Facilitator	NA	15+
Roger Naidoo	Director Infrastructure Services	7 years at Council	10+
Ingrid Miller	Acting Assets/Technical Officer	<1 years at Council	3yrs
James Doyle	Water & Sewerage Supervisor	35 years at council	10+
Shae-Ellyn King	Infrastructure Administration Officer	12 years at council	<1yr

Table 14 Risk Matrix and Descriptors

Public Health Risk Matrix		Consequence	Insignificant	Minor	Moderate	Major	Catastrophic
Likelihood			Isolated aesthetic exceedence - little operational disruption	Local aesthetic exceedence, 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	High	High	Extreme	Extreme
Likely	1-4 occurrences per month		Medium	Medium	High	High	Extreme
Possible	1-11 occurrences per year		Low	Medium	Medium	High	High
Unlikely	1 occurrence per 1-5 years		Low	Low	Medium	Medium	High
Rare	<1 occurrence per 5 years		Low	Low	Low 3	Medium	Medium

Table 15 Uncertainty Descriptors

Uncertainty Level	Uncertainty descriptor
Certain	The processes involved are thoroughly understood and supported by very extensive on site knowledge
Confident	The processes involved are well understood and supported by extensive on site knowledge
Reliable	There is a good understanding of the process which is supported by operational experience and periodic water quality data
Estimate	The process is somewhat understood, based on limited operational experience
Unreliable	The process is not well understood

Table 16 Unmitigated Risk Assessment

Hazard	Type of Hazard	Sources of Hazard	Unmitigated Risk			Uncertainty	Comments
			Consequence	Likelihood	Risk		
Bacteria/ Virus (Source Water)	Biological	grazing, recreational activities, onsite sewage, wild animals, waste dumping	Catastrophic	Almost Certain	Extreme 25	Certain	Known recreation activity at offtake in Thompson. Septic systems and campers along river bank at offtake. Camping at offtake at the Weir on the Barcoo, disperse cattle grazing.
Bacteria/ Virus (Reticulation)	Biological	faecal contamination into reservoirs or mains ingress	Catastrophic	Likely	Extreme 20	Confident	Also used to assess the Ilfracombe cooling tower, as the Ilfracombe source water is an artesian bore with low risk, but could be recontaminated in cooling tower.
Protozoa (Crypto/ Giardia) (L, Is)	Biological	grazing, recreational activities, onsite sewage, wild animals, waste dumping	Catastrophic	Almost Certain	Extreme 25	Confident	Offstream storages used for Ilfracombe and Yaraka - less access, but still potential for contamination
Protozoa (Crypto/ Giardia) (Y, Ilf)	Biological	grazing, wild animals	Catastrophic	Likely	Extreme 20	Confident	
Protozoa (Crypto/ Giardia) (Retic)	Biological	reservoir contamination, mains contamination	Catastrophic	Possible	High 15	Reliable	Few sources into reservoirs, but contamination of mains is possible by backflow or after mains breaks.
Protozoa (Naeglaria) (Retic)	Biological	reservoir contamination, mains contamination	Major	Possible	High 12	Estimate	Water temperature is conducive to Naeglaria
Aluminium	Chemical	coagulant overdose, natural sources	Minor	Possible	Medium 6	Reliable	Alum not used - other coagulants are less of a problem
Chlorate	Chemical	sodium hypochlorite breakdown	Moderate	Likely	High 12	Estimate	Heat in summer, delivered every 9 weeks Ilfracombe,
Chlorine	Chemical	chemical overdose	Moderate	Likely	High 12	Reliable	
Conductivity	Chemical	Natural occurrence, Ilfracombe Bore	Moderate	Almost Certain	High 15	Confident	Bore has 1900 µS/cm -well above ADWG recommendations
Copper	Chemical	Natural occurrence, corrosion of pipework	Moderate	Possible	Medium 9	Estimate	has not been an issue
Cyanobacteria	Biological	Algal bloom in river/ offstream storage	Minor	Likely	Medium 8	Reliable	Offstream storages are more likely than the River sources
Cyanobacterial toxins	Chemical	toxic algal blooms	Major	Possible	High 12	Estimate	Limited testing of cyanobacteria
Disinfection byproducts	Chemical	elevated organics and long detention times	Moderate	Likely	High 12	Reliable	Removal of organics not assured, elevated temperatures increase reaction rate.
Fluoride	Chemical	natural geology - not added	Moderate	Unlikely	Medium 6	Confident	Fluoride was added with the bore water - bore decommissioned.
Fluoride (Ilfracombe bore)	Chemical	natural geology - bore has >5 mg/L fluoride	Moderate	Almost Certain	High 15	Confident	Bore has high conductivity and high fluoride
Heavy metals	Chemical	mining activities, natural geology, chemical impurities, corrosion of assets	Moderate	Possible	Medium 9	Reliable	
Lead	Chemical	Brass fittings - lead not used	Moderate	Unlikely	Medium 6	Estimate	Potential through brass fittings. No known lead joints in systems.
Hydrocarbons	Chemical	bore contamination, mains contamination, tanker spills	Moderate	Unlikely	Medium 6	Reliable	Possible river contamination with tanker spill

Hazard	Type of Hazard	Sources of Hazard	Unmitigated Risk			Uncertainty	Comments
			Consequence	Likelihood	Risk		
Iron	Chemical	natural geology, sediment	Minor	Likely	Medium 8	Reliable	
Manganese	Chemical	natural geology, storage overturning	Moderate	Unlikely	Medium 6	Reliable	Offstream storages will overturn every few years
Pesticides	Chemical	Agriculture, horticulture	Moderate	Unlikely	Medium 6	Reliable	Pastoral college only realistic source other than specific weed control near offtake in Longreach
Taste and odour	Chemical	algae blooms	Insignificant	Almost Certain	Medium 6	Confident	Annual in Ilfracombe.
Colour	Physical	naturally occurring	Insignificant	Likely	Medium 5	Confident	Colour has not normally been an issue
Hardness	Physical	local geology, cement lined pipes	Minor	Unlikely	Low 4	Reliable	
Hardness (Yaraka)	Physical	local geology	Minor	Almost Certain	High 10	Reliable	Yaraka Bore
pH	Physical	source water changes, overdose/ underdose pH correction chemicals, degradation of concrete in mains	Moderate	Almost Certain	High 15	Confident	pH in offstream storages is elevated (algal influence)
pH (Ilfracombe bore)	Physical	Reverse Osmosis - addition of antiscalant without subsequent stabilising of water with calcium carbonate	Moderate	Almost Certain	High 15	Confident	pH is ~5.5 when calcium carbonate is not used.
Turbidity	Physical	fires, storms, flooding, agriculture, rainfall in different subcatchments	Moderate	Almost Certain	High 15	Certain	Thompson consistently high turbidity. Offstream storages are lower turbidity but consistently above 1 NTU.
Turbidity (Retic)	Physical	sloughing of biofilm, accumulation when dry, resuspension of sediment in reservoirs/mains, main break	Minor	Likely	Medium 8	Reliable	
Loss of Supply	Whole of System	Drought	Catastrophic	Unlikely	High 10	Estimate	
Loss of Supply	Whole of System	Raw water supply compromised, catastrophic WTP failure	Catastrophic	Unlikely	High 10	Estimate	
Radioactivity	Radiological	Natural geology	Moderate	Rare	Low 3	Estimate	
All hazards	All	Any event leading to loss of supply/ do not drink alert	Catastrophic	Almost Certain	Extreme 25	Unreliable	
Cyber Security	Cyber	Loss of computer control/ Cyber attack/ Loss of data	Catastrophic	Rare	Medium 6	Unreliable	

Table 17 Longreach Mitigated Risk Assessment

Process Step	Source of hazard/ Hazardous event	Primary hazard	Other hazards managed by same barriers	Maximum Risk	Previous Comments	Primary Preventive Measure	Other Preventative Measures	Documented Procedure	2022 Residual Risk					2022 Risk Management Improvements & Priorities (see RMIP for full details)		
									Consequence	Likelihood	Risk Level	Uncertainty	2022 Comments	High	Medium	Low
Catchment	Camping/ human activities/ swimming in weirs	Protozoa (Crypto/ Giardia) (L, Is)	Bacteria/virus (source water)	Extreme 25	Direct contact is common	Full treatment at plant			Catastrophic	Likely	Extreme 20	Reliable	LRC is master planning for upgrades to camping area and a new caravan park. Full septic /sewage treatment will be implemented. There is currently a septic trench at camping ground downstream from inlet pumps which can be inundated during events and potentially flow back to the inlet pumps	Undertake HBT assessment and need for further treatment (eg UV) include supernatant in assessment criteria	Implement treatment upgrades as per HBT assessment	Masterplan for full amenities at camping area near Thompson River
Catchment	Unrestricted livestock or wild/feral animal access	Protozoa (Crypto/ Giardia) (L, Is)	Bacteria/virus (source water)	Extreme 25	Unrealistic to fence catchment	Full treatment at plant			Catastrophic	Likely	Extreme 20	Reliable	No change	Undertake HBT assessment and need for further treatment (eg UV) include supernatant in assessment criteria	Implement treatment upgrades as per HBT assessment	
Catchment	Flood event, storm flow	Bacteria/ Virus (Source Water)		Extreme 25	Disinfection is effective	Full treatment at plant			Catastrophic	Rare	Medium 6	Confident				
Catchment	Animal access including birds, vermin, livestock, swimming in Weir	Bacteria/ Virus (Source Water)		Extreme 25	Disinfection is effective	Full treatment at plant			Catastrophic	Rare	Medium 6	Confident				
Catchment	Chemical spill in catchment	Hydrocarbons	Pesticides	Medium 6	Would be aware of major incident	Full treatment at plant	Disaster management plan		Moderate	Rare	Low 3	Confident				
Catchment	Point sources (e.g. mines, industry, dip sites)	Heavy metals		Medium 9		Full treatment at plant			Moderate	Rare	Low 3	Confident				
Catchment	Nutrient buildup leading to algal bloom	Cyanobacteria		Medium 8		Full treatment at plant			Moderate	Rare	Low 3	Reliable				

Process Step	Source of hazard/ Hazardous event	Primary hazard	Other hazards managed by same barriers	Maximum Risk	Previous Comments	Primary Preventive Measure	Other Preventative Measures	Documented Procedure	2022 Residual Risk					2022 Risk Management Improvements & Priorities (see RMIP for full details)		
									Consequence	Likelihood	Risk Level	Uncertainty	2022 Comments	High	Medium	Low
Catchment	Algal blooms	Taste and odour		Medium 6		Full treatment at plant			Insignificant	Rare	Low 1	Confident				
Catchment	Algal blooms	Cyanobacterial toxins		High 12	Oxidation is effective for majority of toxins.	Full treatment at plant			Major	Rare	Medium 5	Confident				
Catchment	Drought, bushfire	Loss of supply		High 10		Drought Management Plan			Catastrophic	Rare	Medium 6	Reliable	DMP last reviewed in 2015. New guidelines for DMP 2021. Review required every 10 yrs or if DMP triggered (which ever is sooner)		Review Drought Management	
Catchment	Raw water pump failure	Loss of Supply		High 10	2 pumps are same age and will need 6 month lead time to replace - critical assets.	Duty standby pumps, protected from floods			Catastrophic	Rare	Medium 6	Confident	The inlet pumps are estimated at 15 years old. Current condition is unknown		Assess condition of inlet pumps. Develop contingency plan for inlet pump failure as replacement will take long lead time	
Catchment	Changing river conditions	Turbidity		High 15	Turbidity is managed below 5 NTU.	Full treatment at plant			Moderate	Possible	Medium 9	Confident				
Coagulant dosing	Failure of dosing equipment or underdosing	Turbidity	Disinfection by-products	High 15	Daily testing of clarified water - after plant has settled	Filtration	Coagulation	Jar testing procedure, daily testing	Moderate	Unlikely	Medium 6	Reliable				
Coagulant dosing	Failure of dosing equipment or underdosing	Protozoa (Crypto/ Giardia) (L, Is)	Turbidity	Extreme 25	There is a reduction of cryptosporidium through these steps, but not sufficient	Filtration	Coagulation		Catastrophic	Unlikely	High 10	Reliable	The RAPAD specification needs to include online monitoring of clarification turbidity OCP and associated alarms. Currently the clarifier is not meeting OCP targets. Note that filtration is working well and meets CCPs so likelihood reduced to unlikely.	SCADA /telemetry & online monitoring specification to include clarifier turbidity monitoring and appropriate alarms/ process action (eg slow inlet flow, shutdown etc)	Assess need to upgrade clarifier to meet OCP Implement SCADA upgrades	Implement clarifier upgrades if appropriate as per outcomes of clarifier assessment
Coagulant dosing	Overdosing of coagulant	Aluminium		Medium 6	All Clear, not a major risk of Al breakthrough	Clarification	Filtration		Minor	Unlikely	Low 4	Confident				

Process Step	Source of hazard/ Hazardous event	Primary hazard	Other hazards managed by same barriers	Maximum Risk	Previous Comments	Primary Preventive Measure	Other Preventative Measures	Documented Procedure	2022 Residual Risk					2022 Risk Management Improvements & Priorities (see RMIP for full details)		
									Consequence	Likelihood	Risk Level	Uncertainty	2022 Comments	High	Medium	Low
Recycle of Supernatant	Increased pathogen load due to recycling	Protozoa (Crypto/ Giardia) (L, Is)		Extreme 25	This increases the risk of protozoa	Filtration	Coagulation		Catastrophic	Unlikely	High 10		Supernatant is returned at a maximum of 10%. Previous action to consider removal of recycle stream to be included in HBT /UV assessment. Note that filtration is working well and meets CCPs so likelihood reduced to unlikely.	Include supernatant in assessment criteria for treatment upgrades (ie HBT and UV assessment)	Implement treatment upgrades as per HBT assessment	
Media filtration	Filters unable to operate below 0.3 NTU consistently.	Protozoa (Crypto/ Giardia) (L, Is)	Turbidity	Extreme 25		Filtration	Coagulation	Plant Manual - includes backwash, and CCP	Catastrophic	Unlikely	High 10	Confident	Filter sand replaced in late 2020 and data analysis demonstrates working well and within limits consistently. Auto shutdown whole of plant on CCP exceedance. Likelihood was reduced to unlikely based on data. With further monitoring this may reduce to rare	Review current operational monitoring and implement a formal quarterly review of water quality data with key stakeholders		
Media filtration	Filters unable to operate below 0.3 NTU consistently but very few results above 5 NTU	Turbidity	Protozoa (source water)	High 15	Backwash on head loss or time, Ripen to waste	Filtration	Coagulation	Plant Manual - includes backwash, and CCP	Moderate	Unlikely	Medium 6	Reliable				
Chlorine dosing	Chlorine dosing equipment failure or underdosing	Bacteria/ Virus (Source Water)		Extreme 25	Target dose 1.5 mg/L, duty standby pumps	Disinfection		Plant manual and CCP	Catastrophic	Unlikely	High 10	Reliable	Likelihood reduced to unlikely based on data analysis which demonstrate good control. Further monitoring may reduce this further. Online chlorine monitoring and alarming to be included in SCADA RAPAD specifications	Review current operational monitoring and implement a formal quarterly review of water quality data with key stakeholders SCADA /telemetry & online monitoring specification to include online chlorine monitoring and appropriate CCP alarms/ process action (eg outlet or full plant shutdown etc)	Implement SCADA upgrades	

Process Step	Source of hazard/ Hazardous event	Primary hazard	Other hazards managed by same barriers	Maximum Risk	Previous Comments	Primary Preventive Measure	Other Preventative Measures	Documented Procedure	2022 Residual Risk					2022 Risk Management Improvements & Priorities (see RMIP for full details)		
									Consequence	Likelihood	Risk Level	Uncertainty	2022 Comments	High	Medium	Low
Chlorine dosing	Turbidity impact disinfection effectiveness	Bacteria/ Virus (Source Water)		Extreme 25	Turbidity is typically below 1 NTU	Disinfection		Plant manual and CCP	Catastrophic	Rare	Medium 6	Reliable	Turbidity below CCP. Chlorine control good			
Chlorine dosing	Chlorine overdosing	Chlorine		High 12	Target dose 1.5 mg/L, duty standby pumps	Disinfection		Plant manual and CCP	Moderate	Unlikely	Medium 6	Reliable	Manual test taken daily Online chlorine monitoring and alarming to be included in SCADA RAPAD specifications		Implement SCADA upgrades	
Chlorine dosing	Chlorine age	Disinfection byproducts		High 12	Target dose 1.5 mg/L	Coagualtion/Filtration	Disinfection		Moderate	Possible	Medium 9	Reliable				
Chlorine dosing	Sodium hypochlorite breakdown	Chlorate		High 12	na	Chemical specifications & storage management			Moderate	Possible	Medium 9	Estimate	Include chlorate testing to understand risk		Include chlorate testing in DBP rounds	
Chlorine dosing	Inadequate chlorine contact time	Bacteria/ Virus (Source Water)		Extreme 25	Validated for >15 mg.min/L at 0.2 mg/L chlorine and 85% operating level. Baffle factor 0.1	GLR contact tank	Disinfection	Plant manual and CCP	Catastrophic	Rare	Medium 6	Confident				
GLR	Animal access including birds, amphibians, reptiles or rodents	Bacteria/ Virus (Reticulation)		Extreme 20	residual maintained in reservoir	Sealed, secure reservoir	Disinfection		Catastrophic	Rare	Medium 6	Reliable				
Water Tower	Human access	All hazards		Extreme 25	Cameras installed in some locations in town, not a major issue	Security	Disinfection		Catastrophic	Rare	Medium 6	Unreliable				
Water Tower	Animal access including birds, amphibians, reptiles or rodents	Protozoa (Crypto/ Giardia) (Retic)		High 15	Unlikely that protozoa contaminate the reservoir. Divers have inspected RAPAD Councils in past 2 years. 2022 - all reservoirs last cleaned 20/21	Sealed, secure reservoir. Routine inspection program via RAPAD.			Catastrophic	Rare	Medium 6	Reliable	All reservoirs cleaned in 20/21 year. Reservoir cleaning has been identified by the RAPAD group for every 5 years		Incorporate reservoir security/vermin inspections into routine operational Safety Hazard inspections	
Water Tower	Stagnation	Bacteria/ Virus (Reticulation)		Extreme 20	No measurement of chlorine in tower - test in park nearby.	High water usage		Weekly testing in the reticulation	Catastrophic	Rare	Medium 6	Reliable			Implement chlorine monitoring from the water tower to determine if there is loss of FCR in the tower	

Process Step	Source of hazard/ Hazardous event	Primary hazard	Other hazards managed by same barriers	Maximum Risk	Previous Comments	Primary Preventive Measure	Other Preventative Measures	Documented Procedure	2022 Residual Risk					2022 Risk Management Improvements & Priorities (see RMIP for full details)		
									Consequence	Likelihood	Risk Level	Uncertainty	2022 Comments	High	Medium	Low
Reticulation	Colonisation of reticulation with opportunistic pathogens	Protozoa (Naeglaria) (Retic)		High 12	Chlorine typically > 1 mg/L	Disinfection		Disinfection CCP	Major	Rare	Medium 5	Reliable				
Reticulation	Build-up of sediments or slimes	Turbidity		High 15	Some dead ends, and stagnation at some locations	Routine flushing			Moderate	Unlikely	Medium 6	Reliable	Routine flushing is undertaken however requires better documentation. Reduced to unlikely based on customer complaint data and turbidity data		Development documentation (SOP) for routine flushing program	
Reticulation	Corrosion of pipes and valves	Iron		Medium 8	Not identified as a problem	Asset management and replacement of old mains			Minor	Possible	Medium 6	Reliable				
Reticulation	Cross-contamination, backflow	Protozoa (Crypto/ Giardia) (Retic)		High 15	Meters with backflow prevention. Backflow prevention on businesses.	Backflow meter register			Catastrophic	Rare	Medium 6	Estimate				
Reticulation	Pipe bursts or leaks	Bacteria/ Virus (Reticulation)		Extreme 20		Asset management and replacement of old mains	residual disinfection	Main break repair procedure	Catastrophic	Rare	Medium 6	Reliable				
Reticulation	Inadequate pressure	Loss of supply		High 10	Water tower calls VSD from GLR at 75% - no issues	Head pressure from elevated reservoir			Minor	Unlikely	Low 4	Reliable				
Whole of system	Power failure	Loss of supply		High 10	2 generators - one raw water, WTP needs to be manually started.	Generators	1 day water in GLR	Generator procedure.	Moderate	Rare	Low 3	Estimate	Message received via phone on power failure. No incident of failure to supply so likelihood reduced to rare			

Process Step	Source of hazard/ Hazardous event	Primary hazard	Other hazards managed by same barriers	Maximum Risk	Previous Comments	Primary Preventive Measure	Other Preventative Measures	Documented Procedure	2022 Residual Risk					2022 Risk Management Improvements & Priorities (see RMIP for full details)		
									Consequence	Likelihood	Risk Level	Uncertainty	2022 Comments	High	Medium	Low
Whole of system	Lack of visibility of plant processes	All hazards		Extreme 25	No SCADA alarms to operator to identify failures/ water quality issues	Daily monitoring			Catastrophic	Unlikely	High 10	Estimate	As per individual process comments. Highest unlikelihood from processes is unlikely	Review current operational monitoring and implement a formal quarterly review of water quality data with key stakeholders SCADA /telemetry & online monitoring specification to include online monitoring of OCPs and CCP, with appropriate alarms/ process action (eg outlet or full plant shutdown etc)	Implement SCADA upgrades	
Whole of system	Inadequate back-up options (e.g. duty/standby)	Loss of Supply		High 10	Duty standby pumps, but no list of critical spares	Duty/standby available			Catastrophic	Unlikely	High 10	Estimate	Council has employed an Asset Manager to develop and implement AMS. LRC has critical spares on site and operators have good understanding of critical spares so previous action closed - needs to be documented	Assess asset criticality assessment to ensure all critical assets and spares are identified and documented	AMS to capture water critical spares	
Whole of system	Inadequate operators/staff training	All hazards		Extreme 25	Operator undertaking Cert 3. Supervisor is trained.	3 operators available		Ensure sufficient staff and maintain training	Catastrophic	Rare	Medium 6	Reliable	TNA and training matrix complete. HR processes to ensure training is implemented. Close previous action. SOPs developed			
Whole of system	Sabotage	All hazards		Extreme 25	No history of issues, but security at plant is not ensured	Plant fenced, buildings locked when not on site.			Catastrophic	Rare	Medium 6	Unreliable	All facilities are accessed through electronic, traceable access. Reduced to rare due to no security breaches. Automated gates deemed unnecessary and requiring high level of maintenance. Previous action to be closed.			

Process Step	Source of hazard/ Hazardous event	Primary hazard	Other hazards managed by same barriers	Maximum Risk	Previous Comments	Primary Preventive Measure	Other Preventative Measures	Documented Procedure	2022 Residual Risk					2022 Risk Management Improvements & Priorities (see RMIP for full details)		
									Consequence	Likelihood	Risk Level	Uncertainty	2022 Comments	High	Medium	Low
Whole of system	Loss of computer control of plant processes	Cyber Security		Medium 6		Clone of plant computer stored offsite - can immediately replace if required.	Firewalls and access by username and password		Catastrophic	Rare	Medium 6	Unreliable				

Table 18 Ilfracombe Mitigated Risk Assessment

Process Step	Source of hazard/ Hazardous event	Primary hazard	Other hazards managed by same barriers	Maximum Risk	Previous Comments	Primary Preventive Measure	Other Preventative Measures	Documented Procedure	2022 Residual Risk				2022 Comments	2022 Risk Management Improvements & Priorities (see RMIP for full details)		
									Consequence	Likelihood	Risk Level	Uncertainty		High	Medium	Low
Catchment	Camping/ human activities/ swimming in weirs	Protozoa (Crypto/ Giardia) (Y, Ilf)	Bacteria/virus (source water)	Extreme 20	Some evidence of swimming in Shannon and Murray Dams	Full treatment at plant	signage		Catastrophic	Unlikely	High 10	Reliable	Shannon and Murray Dams have been fenced and locked with exclusion fence. Likelihood reduced to unlikely	Undertake HBT assessment and need for further treatment (eg UV)	Implement treatment upgrades as per HBT assessment	
Catchment	Unrestricted livestock or wild/feral animal access	Protozoa (Crypto/ Giardia) (Y, Ilf)	Bacteria/virus (source water)	Extreme 20	Shannon and Murray McMillan Dams are fenced. Upper catchment unfenced, but significant detention.	Full treatment at plant			Catastrophic	Possible	High 15	Reliable		Undertake HBT assessment and need for further treatment (eg UV)	Implement treatment upgrades as per HBT assessment	
Catchment	Flood event, storm flow	Bacteria/ Virus (Source Water)		Extreme 25	Disinfection is effective.	Full treatment at plant			Catastrophic	Rare	Medium 6	Confident				
Catchment	Power failure	Loss of supply		High 10	Access to Shannon and Murray Dam is weather dependent.	Generator at Shannon Dam			Catastrophic	Rare	Medium 6	Confident	Access to generator has been resolved			
Catchment	Animal access including birds, vermin, livestock, swimming in Weir	Bacteria/ Virus (Source Water)		Extreme 25	Disinfection is effective	Full treatment at plant			Catastrophic	Rare	Medium 6	Confident				
Catchment	Chemical spill in catchment	Hydrocarbons	Pesticides	Medium 6	Would be aware of major incident	Full treatment at plant	Disaster management plan		Moderate	Rare	Low 3	Confident				
Catchment	Point sources (e.g. mines, industry, dip sites)	Heavy metals		Medium 9		Full treatment at plant			Moderate	Rare	Low 3	Confident				
Catchment	Nutrient buildup leading to algal bloom	Cyanobacteria		Medium 8	Annual algal blooms	Full treatment at plant			Moderate	Possible	Medium 9	Reliable				
Catchment	Algal blooms	Taste and odour		Medium 6	PAC dosing implemented if T and O noticed	Full treatment at plant			Insignificant	Unlikely	Low 2	Confident				

Process Step	Source of hazard/ Hazardous event	Primary hazard	Other hazards managed by same barriers	Maximum Risk	Previous Comments	Primary Preventive Measure	Other Preventative Measures	Documented Procedure	2022 Residual Risk				2022 Comments	2022 Risk Management Improvements & Priorities (see RMIP for full details)		
									Consequence	Likelihood	Risk Level	Uncertainty		High	Medium	Low
Catchment	Algal blooms	Cyanobacterial toxins		High 12	Oxidation is effective for majority of toxins.	Full treatment at plant			Major	Rare	Medium 5	Confident				
Catchment	Drought, bushfire	Loss of supply		High 10		Drought Management Plan			Catastrophic	Rare	Medium 6	Reliable	DMP last reviewed in 2015. New guidelines for DMP 2021. Review required every 10 yrs or if DMP triggered (which ever is sooner)		Review Drought Management	
Catchment	Raw water pump failure	Loss of Supply		High 10	Duty standby pumps, protected from floods				Catastrophic	Rare	Medium 6	Confident				
Catchment	Changing river conditions	Turbidity		High 15	Turbidity is managed below 5 NTU.	Full treatment at plant			Moderate	Possible	Medium 9	Confident				
Acid dosing	Overdose	pH		High 15	Target pH is 7.5-7.8	Manually set dose rate		Written calculations - not electronic version	Minor	Unlikely	Low 4	Reliable				
Acid dosing	Underdose	pH		High 15	Raw pH can get up over 9	Manually set dose rate		Written calculations - not electronic version	Minor	Unlikely	Low 4	Reliable				
Coagulant dosing	Failure of dosing equipment or underdosing (underdose acid results in fine floc)	Turbidity	Disinfection by-products	High 15	Daily testing of clarified water - after plant has settled. Jar testing as required typically < 3 NTU off clarifier, unlikely over 5 NTU.	Clarification	Filtration	Jar testing procedure, daily testing	Moderate	Unlikely	Medium 6	Reliable				

Process Step	Source of hazard/ Hazardous event	Primary hazard	Other hazards managed by same barriers	Maximum Risk	Previous Comments	Primary Preventive Measure	Other Preventative Measures	Documented Procedure	2022 Residual Risk				2022 Comments	2022 Risk Management Improvements & Priorities (see RMIP for full details)		
									Consequence	Likelihood	Risk Level	Uncertainty		High	Medium	Low
Coagulant dosing	Failure of dosing equipment or underdosing	Protozoa (Crypto/ Giardia) (Y, Ilf)	Turbidity	Extreme 20	There is a reduction of Cryptosporidium through these steps, but not sufficient	OCP Clarification	Filtration		Catastrophic	Unlikely	High 10	Reliable	Include online clarified water turbidity monitoring and associated OCP alarms/actions in RAPAD specification. Note manual data shows clarifier process to be working within OCP limits so likelihood reduced to unlikely	SCADA /telemetry & online monitoring specification to include clarifier turbidity monitoring and appropriate alarms/ process action (eg slow inlet flow, shutdown etc)	Implement SCADA upgrades	
Coagulant dosing	Overdosing of coagulant	Aluminium		Medium 6	All Clear, not a major risk of Al breakthrough	Clarification	Filtration		Minor	Unlikely	Low 4	Reliable				
PAC dosing	Underdose	Taste and odour	cyanotoxins	Medium 6	Chlorine may also oxidise cyanotoxins if present	PAC dosing when algae observed or taste and odour.			Insignificant	Possible	Low 3	Reliable	PAC dosing used about 3 months of the year in response to taste & odour. Need to document triggers for dosing in BGA manual/SOP	Develop BGA manual/SOP		
Media filtration	Filter breakthrough	Protozoa (Crypto/ Giardia) (Y, Ilf)	Turbidity	Extreme 20	Turbidity 0.3-0.4 NTU up to 0.7 in 2018.	Filtration	Coagulation	Plant Manual - includes backwash, and CCP	Catastrophic	Possible	High 15	Estimate	Recent filtered water turbidity data is not available due to log sheet errors. This is reflected in the uncertainty rating. The log sheets have now been corrected. Include online filter turbidity monitoring and associated alarms and plant shutdowns on CCP exceedances in SCADA RAPAD specifications - likelihood not changed as data not available	Review current operational monitoring and implement a formal quarterly review of water quality data with key stakeholders SCADA /telemetry & online monitoring specification to include online chlorine monitoring and appropriate CCP alarms/ process action (eg outlet or full plant shutdown etc)	Implement SCADA upgrades	

Process Step	Source of hazard/ Hazardous event	Primary hazard	Other hazards managed by same barriers	Maximum Risk	Previous Comments	Primary Preventive Measure	Other Preventative Measures	Documented Procedure	2022 Residual Risk				2022 Comments	2022 Risk Management Improvements & Priorities (see RMIP for full details)		
									Consequence	Likelihood	Risk Level	Uncertainty		High	Medium	Low
Media filtration	Filter breakthrough	Turbidity	Protozoa (source water)	High 15	Backwash on head loss or time - ripen delay before into production, but not ripening to waste.	Filtration	Coagulation	Plant Manual - includes backwash, and CCP	Moderate	Unlikely	Medium 6	Reliable				
Reverse Osmosis	Membrane breach	Fluoride (Ilfracombe bore)		High 15	fluoride is removed more preferentially than conductivity	Reverse Osmosis		OCP for RO	Moderate	Rare	Low 3	Confident				
Reverse Osmosis	Membrane breach	Conductivity		High 15	multi pass RO - combined conductivity typically ~60 uS/cm	Reverse Osmosis		OCP for RO	Moderate	Rare	Low 3	Confident				
Reverse Osmosis	Contamination of cooling tower	Bacteria/ Virus (Reticulation)		Extreme 20	Only bacteria and virus assessed as protozoa are not considered likely to enter the cooling tower	Reverse Osmosis		OCP for RO	Catastrophic	Rare	Medium 6	Confident				
CaCO3 contact tank	Insufficient calcium carbonate to stabilise water	Conductivity		High 15		Calcium Carbonate contact tank		OCP for RO	Moderate	Rare	Low 3	Confident				

Process Step	Source of hazard/ Hazardous event	Primary hazard	Other hazards managed by same barriers	Maximum Risk	Previous Comments	Primary Preventive Measure	Other Preventative Measures	Documented Procedure	2022 Residual Risk				2022 Comments	2022 Risk Management Improvements & Priorities (see RMIP for full details)		
									Consequence	Likelihood	Risk Level	Uncertainty		High	Medium	Low
Antiscalant	Insufficient calcium carbonate to stabilise water	pH (Ilfracombe bore)		High 15	pH drops significantly due to loss of alkalinity, and addition of antiscalant - antiscalant is dosed at low concentrations, not believed to be possible to overdose.	Calcium Carbonate contact tank		OCP for RO	Moderate	Rare	Low 3	Confident				
Chlorine dosing	Chlorine dosing equipment failure or underdosing	Bacteria/ Virus (Source Water)		Extreme 25	Target dose 1-1.5 mg/L,single pump	CCP Disinfection		Plant manual and CCP	Catastrophic	Possible	High 15	Reliable	Include online chlorine monitoring and associated alarms and plant shutdowns on CCP exceedances in SCADA RAPAD specifications	SCADA /telemetry & online monitoring specification to include online chlorine monitoring and appropriate CCP alarms/ process action (eg outlet or full plant shutdown etc)	Implement SCADA upgrades	
Chlorine dosing	Chlorine overdosing	Chlorine		High 12	Target dose 1-1.5 mg/L,single pump	Disinfection		Plant manual and CCP	Moderate	Possible	Medium 9	Reliable	Include online chlorine monitoring and associated alarms and plant shutdowns on CCP exceedances in SCADA RAPAD specifications		Implement SCADA upgrades	
Chlorine dosing	Chlorine age	Disinfection byproducts		High 12	Not routinely tested in Ilfracombe	Coagualtion/Filtration	Disinfection		Moderate	Possible	Medium 9	Estimate				
Chlorine dosing	Sodium hypochlorite breakdown	Chlorate		High 12	na	Chemical specifications & storage management			Moderate	Possible	Medium 9	Estimate	Include chlorate testing to understand risk. New hypo every 9 weeks at ilfracombe		Include chlorate testing in DBP rounds	

Process Step	Source of hazard/ Hazardous event	Primary hazard	Other hazards managed by same barriers	Maximum Risk	Previous Comments	Primary Preventive Measure	Other Preventative Measures	Documented Procedure	2022 Residual Risk				2022 Comments	2022 Risk Management Improvements & Priorities (see RMIP for full details)		
									Consequence	Likelihood	Risk Level	Uncertainty		High	Medium	Low
Chlorine dosing	Inadequate chlorine contact time	Bacteria/ Virus (Reticulation)		Extreme 20	350 kL, 3.9m down to 1.5m, flow rate to town unsure. Need to confirm L/s	GLR contact tank	Disinfection	Plant manual and CCP	Catastrophic	Unlikely	High 10	Reliable	As per CCP procedure, large draws of water could result in inadequate Ct. SOP required for this scenario. Data shows good control of CCP	Determine flow rate and validate chlorine contact time to determine minimum critical limit and develop SOP for fire flows, incorporating any chlorine Ct actions		
GLR	Animal access including birds, amphibians, reptiles or rodents	Bacteria/ Virus (Reticulation)		Extreme 20	Residual maintained in reservoir	Sealed, secure reservoir	Disinfection		Catastrophic	Rare	Medium 6	Reliable				
Elevated Reservoir	Animal access including birds, amphibians, reptiles or rodents	Protozoa (Crypto/ Giardia) (Retic)		High 15	Unlikely that protozoa contaminate the reservoir. Divers have inspected RAPAD Councils in past 2 years.	Routine Inspections			Catastrophic	Rare	Medium 6	Reliable	All reservoirs cleaned in 20/21 year. Reservoir cleaning has been identified by the RAPAD group for every 5 year. Previous action closed			
Elevated Reservoir	Contamination in elevated reservoir	Bacteria/ Virus (Reticulation)		Extreme 20	Elevated res is normally kept above 1 mg/L	Sealed, secure reservoir		Weekly testing in the reticulation	Catastrophic	Rare	Medium 6	Reliable				
Reticulation	Colonisation of reticulation with opportunistic pathogens	Protozoa (Naeglaria) (Retic)		High 12	Chlorine typically > 0.5 mg/L	Disinfection		Disinfection CCP	Major	Rare	Medium 5	Reliable				
Reticulation	Build-up of sediments or slimes/ stagnation	Turbidity		High 15	Some dead ends, and stagnation at some locations	Weekly flushing behind Rec centre and Leichardt and Murray Sts		OCP for reticulation	Moderate	Unlikely	Medium 6	Estimate	Dead end removed and likelihood reduced to unlikely. Previous action closed.			
Reticulation	Corrosion of pipes and valves	Iron		Medium 8	Not identified as a problem	Asset management and replacement of old mains			Minor	Possible	Medium 6	Reliable				
Reticulation	Cross-contamination, backflow	Protozoa (Crypto/ Giardia) (Retic)		High 15	Meters with backflow prevention. Backflow prevention on businesses.	Backflow meter register			Catastrophic	Rare	Medium 6	Estimate				

Process Step	Source of hazard/ Hazardous event	Primary hazard	Other hazards managed by same barriers	Maximum Risk	Previous Comments	Primary Preventive Measure	Other Preventative Measures	Documented Procedure	2022 Residual Risk				2022 Comments	2022 Risk Management Improvements & Priorities (see RMIP for full details)		
									Consequence	Likelihood	Risk Level	Uncertainty		High	Medium	Low
Reticulation	Pipe bursts or leaks	Bacteria/ Virus (Reticulation)		Extreme 20	Generally have .5 - 0.7 mg/L residual in reticulation.	Asset management and replacement of old mains	residual disinfection	Mains break repair procedure	Catastrophic	Rare	Medium 6	Reliable				
Reticulation	Inadequate pressure	Loss of supply		High 10	Elevated Reservoir and Treated water pumps provide pressure. However western side of town main repairs can be done by flushing Eastern side, and pressure will drop. Inability to isolate.	Head pressure from elevated reservoir			Minor	Unlikely	Low 4	Reliable	Valves have been installed/ repaired to allow isolation for repairs. Previous action to be closed			
Whole of system	Lack of visibility of plant processes	All hazards		Extreme 25	No SCADA alarms to operator to identify failures/ water quality issues	daily monitoring			Catastrophic	Possible	High 15	Estimate	As per individual process above related to poor plant visibility. Highest likelihood used.	Review current operational monitoring and implement a formal quarterly review of water quality data with key stakeholders SCADA /telemetry & online monitoring specification to include online monitoring of OCPs and CCP, with appropriate alarms/ process action (eg outlet or full plant shutdown etc)	Implement SCADA upgrades	

Process Step	Source of hazard/ Hazardous event	Primary hazard	Other hazards managed by same barriers	Maximum Risk	Previous Comments	Primary Preventive Measure	Other Preventative Measures	Documented Procedure	2022 Residual Risk				2022 Comments	2022 Risk Management Improvements & Priorities (see RMIP for full details)		
									Consequence	Likelihood	Risk Level	Uncertainty		High	Medium	Low
Whole of system	Power failure	Loss of supply		High 10	2 generators - one raw water at Shannon Dam, WTP automatic startup.	Generators		Generator procedure.	Moderate	Possible	Medium 9	Estimate	Include power failure as alarm in SCADA specification	SCADA /telemetry & online monitoring specification to include power failure alarms. Kept as high priority in line with other SCADA project items	Implement SCADA upgrades	
Whole of system	Lack of visibility of plant processes	All hazards		Extreme 25	No SCADA alarms to operator to identify failures/ water quality issues	daily monitoring			Catastrophic	Possible	High 15	Estimate	See each process for information. Highest likelihood from processes used	Review current operational monitoring and implement a formal quarterly review of water quality data with key stakeholders SCADA /telemetry & online monitoring specification to include online monitoring of OCPs and CCP, with appropriate alarms/ process action (eg outlet or full plant shutdown etc)	Implement SCADA upgrades	
Whole of system	Inadequate back-up options (e.g. duty/standby)	Loss of Supply		High 10	Spare pump, but no list of critical spares	Duty/standby available			Catastrophic	Unlikely	High 10	Estimate	Council has employed an Asset Manager to develop and implement AMS. LRC has critical spares on site and operators have good understanding of critical spares so previous action closed - spares need to be documented	Assess asset criticality assessment to ensure all critical assets and spares are identified and documented	AMS to capture water critical spares	

Process Step	Source of hazard/ Hazardous event	Primary hazard	Other hazards managed by same barriers	Maximum Risk	Previous Comments	Primary Preventive Measure	Other Preventative Measures	Documented Procedure	2022 Residual Risk				2022 Comments	2022 Risk Management Improvements & Priorities (see RMIP for full details)		
									Consequence	Likelihood	Risk Level	Uncertainty		High	Medium	Low
Whole of system	Inadequate operators/staff training	All hazards		Extreme 25	Operator trained to Cert 3. Supervisor is trained.	Relief operators from Longreach		Ensure sufficient staff and maintain training	Catastrophic	Rare	Medium 6	Reliable	TNA and training matrix complete. HR processes ensure training is implemented. Close previous action. SOPs developed			
Whole of system	Sabotage	All hazards		Extreme 25	No history of issues, but security at plant is not ensured	Plant building locked, 2 security fences around site, isolated location away from town.			Catastrophic	Rare	Medium 6	Unreliable	All facilities are accessed through electronic system, with traceable access. Reduced to rare due to no security breaches. Automated gates deemed unnecessary and requiring high level of maintenance. Previous action closed.			
Whole of system	Insufficient working valves	Loss of supply		High 10	Have had to turn off whole town to repair mains if breaks are in sections that cannot be turned off	Valves available for isolation			Catastrophic	Rare	Medium 6	Reliable	Valves have been installed/ repaired to allow isolation for repairs. Previous action to be closed			
Whole of system	Loss of computer control of plant processes	Cyber Security		Medium 6	Conventional plant is manual. RO plant is the only possibility.	Site security, MF and RO plant control systems can only be accessed when generator running			Catastrophic	Rare	Medium 6	Unreliable	Council has copy of xylem. Previous action to be closed			

Table 19 Isisford Mitigated Risk Assessment

Process Step	Source of hazard/ Hazardous event	Primary hazard	Other hazards managed by same barriers	Maximum Risk	Comments	Primary Preventive Measure	Other Preventative Measures	Documented Procedure	2022 Residual Risk				2022 Comments	2022 Risk Management Improvements & Priorities (see RMIP for full details)		
									Consequence	Likelihood	Risk Level	Uncertainty		High	Medium	Low
Catchment (Barcoo)	Camping/ human activities/ swimming in weirs	Protozoa (Crypto/ Giardia) (L, Is)	Bacteria/virus (source water)	Extreme 25		Full treatment at plant	signage		Catastrophic	Likely	Extreme 20	Reliable	Full amenities have been built in town for campers and there is a caravan dump point in town	Undertake HBT assessment and need for further treatment (eg UV)	Implement treatment upgrades as per HBT assessment	
Catchment	Unrestricted livestock or wild/feral animal access	Protozoa (Crypto/ Giardia) (L, Is)	Bacteria/virus (source water)	Extreme 25	Unrealistic to fence catchment	Full treatment at plant			Catastrophic	Likely	Extreme 20	Reliable	Off stream storage is in process of been fenced. Will be complete June 2022.	Complete fencing of offline storage		
Catchment	Flood event, storm flow	Bacteria/ Virus (Source Water)		Extreme 25	Disinfection is effective.	Full treatment at plant			Catastrophic	Rare	Medium 6	Confident	Pumping protocol for offline storage already in the DMP. Previous action to be removed. DMP review is an action already.			
Catchment	Power failure	Loss of supply		High 10		Generator at WTP runs raw water pumps			Catastrophic	Rare	Medium 6	Confident	All weather access is not an issue at Isisford so reduced to likelihood of rare and previous action removed			
Catchment	Animal access including birds, vermin, livestock, swimming in Weir	Bacteria/ Virus (Source Water)		Extreme 25	Disinfection is effective	Full treatment at plant			Catastrophic	Rare	Medium 6	Confident				
Catchment	Chemical spill in catchment	Hydrocarbons	Pesticides	Medium 6	Would be aware of major incident	Full treatment at plant	Disaster management plan		Moderate	Rare	Low 3	Confident				
Catchment	Point sources (e.g. mines, industry, dip sites)	Heavy metals		Medium 9		Full treatment at plant			Moderate	Rare	Low 3	Confident				
Catchment	Nutrient buildup leading to algal bloom	Cyanobacteria		Medium 8	Annual algal blooms	Full treatment at plant			Moderate	Possible	Medium 9	Reliable				
Catchment	Algal blooms	Taste and odour		Medium 6		Full treatment at plant			Minor	Unlikely	Low 4	Confident				

Process Step	Source of hazard/ Hazardous event	Primary hazard	Other hazards managed by same barriers	Maximum Risk	Comments	Primary Preventive Measure	Other Preventative Measures	Documented Procedure	2022 Residual Risk				2022 Comments	2022 Risk Management Improvements & Priorities (see RMIP for full details)		
									Consequence	Likelihood	Risk Level	Uncertainty		High	Medium	Low
Catchment	Algal blooms	Cyanobacterial toxins		High 12	Oxidation is effective for majority of toxins.	Full treatment at plant			Major	Rare	Medium 5	Confident				
Catchment	Drought, bushfire	Loss of supply		High 10		Drought Management Plan			Catastrophic	Rare	Medium 6	Reliable	DMP last reviewed in 2015. New guidelines for DMP 2021. Review required every 10 yrs or if DMP triggered (which ever is sooner)		Review Drought Management	
Catchment	Raw water pump failure	Loss of Supply		High 10	duty standby pumps				Catastrophic	Rare	Medium 6	Confident				
Catchment	Changing raw water conditions	Turbidity		High 15	Turbidity is managed below 5 NTU.	Full treatment at plant			Moderate	Possible	Medium 9	Confident				
Acid dosing	Overdose	pH		High 15	Target pH is 6.5-8.2	Manually set dose rate			Minor	Unlikely	Low 4	Reliable				
Acid dosing	Underdose	pH		High 15	Raw pH can get up over 8.5	Manually set dose rate			Minor	Unlikely	Low 4	Reliable				
Coagulant dosing	Failure of dosing equipment or underdosing (underdose acid results in fine floc)	Turbidity	Disinfection by-products	High 15	All Clear 300 used.	Clarification	Filtration	Jar testing procedure (monthly or as water conditions change), daily testing	Moderate	Likely	High 12	Reliable	Tender released for D&C clarifier upgrade in January 2022. Design should include duty/standby dosing pumps and ability for full SCADA integration	Upgrade/refurbishment of clarifiers Include SCADA /telemetry & online monitoring specification for clarifier turbidity monitoring and appropriate alarms/ process action (eg slow inlet flow, shutdown etc) in design	Implement SCADA upgrades	
Coagulant dosing	Failure of dosing equipment or underdosing	Protozoa (Crypto/ Giardia) (L, Is)	Turbidity	Extreme 25	Single dosing pump, and no online monitoring of raw or clarified water	Clarification	Filtration		Catastrophic	Likely	Extreme 20	Reliable	Tender released for D&C clarifier upgrade in January 2022. Design should include duty/standby dosing pumps and ability for full SCADA integration. Previous action replaced with upgrade.	Upgrade/refurbishment of clarifiers Include SCADA /telemetry & online monitoring specification for clarifier turbidity monitoring and appropriate alarms/ process action (eg slow inlet flow, shutdown etc) in design	Implement SCADA upgrades	

Process Step	Source of hazard/ Hazardous event	Primary hazard	Other hazards managed by same barriers	Maximum Risk	Comments	Primary Preventive Measure	Other Preventative Measures	Documented Procedure	2022 Residual Risk				2022 Comments	2022 Risk Management Improvements & Priorities (see RMIP for full details)		
									Consequence	Likelihood	Risk Level	Uncertainty		High	Medium	Low
Coagulant dosing	Overdosing of coagulant	Aluminium		Medium 6	All Clear 300 or 400 if pH is elevated, not a major risk of Al breakthrough	Clarification	Filtration		Minor	Unlikely	Low 4	Reliable				
Pressure Filters	Filter breakthrough	Protozoa (Crypto/ Giardia) (L, Is)	Turbidity	Extreme 25	New plant being commissioned - historically unmanaged risk. Currently unknown.	Filtration	Coagulation	Plant set up to backwash on turbidity, head loss or time. Plant operational manuals have been provided.	Catastrophic	Unlikely	High 10	Unreliable	Contractor to review pressure filter operation. Plant was commissioned and manuals received, however still experiencing issues. There is an online turbidity meter and SCADA may be capable of measuring turbidity however units are unserviceable at present. Tis to be considered in SCADA specification.	Review pressure filter operation. SCADA /telemetry & online monitoring specification to include filter turbidity monitoring and appropriate alarms/ process action (eg slow inlet flow, shutdown etc) At least two operators to be trained in use & calibration of monitoring equipment for all systems	Implement SCADA upgrades	
Pressure Filters	Filter breakthrough	Turbidity	Protozoa (source water)	High 15	Backwash occurs, and then second filter comes online - but not ripening to waste.	Filtration	Coagulation	Plant set up to backwash on turbidity, head loss or time. Plant operational manuals have been provided.	Moderate	Unlikely	Medium 6	Unreliable				
Chlorine dosing	Chlorine dosing equipment failure or underdosing	Bacteria/ Virus (Source Water)		Extreme 25	Target dose 1-1.5 mg/pump	Disinfection		Plant manual and CCP	Catastrophic	Possible	High 15	Estimate	Chlorine meter purchased. Spare pump on site. Manual monitoring shows up to 5 occurrences of Cl below CCP limits in 20-21 year. Include online Cl monitoring and alarming in SCADA upgrade. Include duty/standby dosing pumps in upgrade.	SCADA /telemetry & online monitoring specification to include online chlorine monitoring and appropriate CCP alarms/ process action (eg outlet or full plant shutdown etc). Also include duty/standby dosing pumps		
Chlorine dosing	Chlorine overdosing	Chlorine		High 12	Target dose 1-1.5 mg/L,single pump	Disinfection		Plant manual and CCP	Moderate	Possible	Medium 9		Chlorine meter purchased. Spare pump on site. Include online Cl monitoring and alarming in SCADA upgrade. Include duty/standby dosing pumps in upgrade			

Process Step	Source of hazard/ Hazardous event	Primary hazard	Other hazards managed by same barriers	Maximum Risk	Comments	Primary Preventive Measure	Other Preventative Measures	Documented Procedure	2022 Residual Risk				2022 Comments	2022 Risk Management Improvements & Priorities (see RMIP for full details)		
									Consequence	Likelihood	Risk Level	Uncertainty		High	Medium	Low
Chlorine dosing	Chlorine reacting with organics	Disinfection byproducts		High 12		Coagualtion/ Filtration	Disinfection		Moderate	Possible	Medium 9	Unreliable	Do at same time as Longreach, to improve uncertainty	Implement THM and HAA testing in line with Longreach sampling.		
Chlorine dosing	Sodium hypochlorite breakdown	Chlorate		High 12	na	Chemical specifications & storage management			Moderate	Possible	Medium 9	Estimate	Include chlorate testing to understand risk		Include chlorate testing in DBP rounds	
Chlorine dosing	Inadequate chlorine contact time	Bacteria/ Virus (Reticulation)		Extreme 20	180 kL, 2.4m down to 1.5m, flow rate to town unsure. Need to confirm L/s	GLR contact tank	Disinfection	Plant manual and CCP	Catastrophic	Unlikely	High 10	Estimate	Maximum flow is approx 10 L/s for Ct calculation. SCADA upgrades will include online monitoring & alarming of Cl	Determine flow rate and validate chlorine contact time to determine minimum critical limit and develop SOP for fire flows, incorporating any chlorine Ct actions		
GLR	Animal access including birds, amphibians, reptiles or rodents	Bacteria/ Virus (Reticulation)		Extreme 20	Residual maintained in reservoir	Sealed, secure reservoir	Disinfection		Catastrophic	Rare	Medium 6	Reliable				
Elevated Reservoir	Animal access including birds, amphibians, reptiles or rodents	Protozoa (Crypto/ Giardia) (Retic)		High 15	Unlikely that protozoa contaminate the reservoir. Divers have inspected RAPAD Councils in past 2 years.	Routine Inspection Program			Catastrophic	Rare	Medium 6	Reliable	All reservoirs cleaned in 20/21 year. Reservoir cleaning has been identified by the RAPAD group for every 5 years			
Elevated Reservoir	Contamination in elevated reservoir	Bacteria/ Virus (Reticulation)		Extreme 20	Elevated res is normally kept above 1 mg/L	Head pressure from elevated reservoir		Weekly testing in the reticulation	Catastrophic	Rare	Medium 6	Reliable				
Reticulation	Colonisation of reticulation with opportunistic pathogens	Protozoa (Naeglaria) (Retic)		High 12	Chlorine typically > 0.5 mg/L	Disinfection		Disinfection CCP	Major	Rare	Medium 5	Reliable	Outskirts now tested and results are good for FCR. Previous action closed			
Reticulation	Build-up of sediments or slimes/ stagnation	Turbidity		High 15	Some dead ends, and stagnation at some locations. Racecourse/ clinic	Mains flushing		OCP for reticulation	Moderate	Likely	High 12	Estimate	Mains replacement program 2022 to eliminate dead ends, which replaced previous action. Lines routinely scoured as part of RAPAD	Implement mains replacement program		

Process Step	Source of hazard/ Hazardous event	Primary hazard	Other hazards managed by same barriers	Maximum Risk	Comments	Primary Preventive Measure	Other Preventative Measures	Documented Procedure	2022 Residual Risk				2022 Comments	2022 Risk Management Improvements & Priorities (see RMIP for full details)		
									Consequence	Likelihood	Risk Level	Uncertainty		High	Medium	Low
Reticulation	Corrosion of pipes and valves	Iron		Medium 8	Not identified as a problem	Asset management and replacement of old mains			Minor	Possible	Medium 6	Reliable				
Reticulation	Cross-contamination, backflow	Protozoa (Crypto/ Giardia) (Retic)		High 15	Meters with backflow prevention. Potential cross connections to raw water scheme. Raw water scheme at higher pressure.	Check backflow preverntion register			Catastrophic	Unlikely	High 10	Estimate	Known cross connections have been removed, however accidental connection to raw water remains a risk. Once mains replacement is complete LRC will consider removal of raw water	Assess removal of raw water system once mains replacement is complete		
Reticulation	Pipe bursts or leaks	Bacteria/ Virus (Reticulation)		Extreme 20	Generally have .5 - 0.7 mg/L residual in reticulation.	Asset management and replacement of old mains	residual disinfection	main break repair procedure	Catastrophic	Unlikely	High 10	Reliable	Mains repair procedure in place includes hygienic practices. Operators are trained ALARP			
Reticulation	Inadequate pressure	Loss of supply		High 10	At high demand, the booster pump kicks in - can be low pressure in park.	Booster pumps			Minor	Rare	Low 2	Reliable				
Whole of system	Power failure	Loss of supply		High 10	Generator at WTP - manually started.	Generator			Moderate	Possible	Medium 9	Estimate	SCADA project to include power failure alarms as this is a manual process at present	SCADA /telemetry & online monitoring specification to include power failure alarms.		
Whole of system	Lack of visibility of plant processes	All hazards		Extreme 25	No SCADA alarms to operator to identify failures/ water quality issues	daily monitoring			Catastrophic	Possible	High 15	Estimate	As per individual process above related to poor plant visibility. Highest likelihood used.	Review current operational monitoring and implement a formal quarterly review of water quality data with key stakeholders SCADA /telemetry & online monitoring specification to include online monitoring of OCPs and CCP, with appropriate alarms/ process action (eg outlet or full plant shutdown etc)	Implement SCADA upgrades	

Process Step	Source of hazard/ Hazardous event	Primary hazard	Other hazards managed by same barriers	Maximum Risk	Comments	Primary Preventive Measure	Other Preventative Measures	Documented Procedure	2022 Residual Risk				2022 Comments	2022 Risk Management Improvements & Priorities (see RMIP for full details)		
									Consequence	Likelihood	Risk Level	Uncertainty		High	Medium	Low
Whole of system	Inadequate back-up options (e.g. duty/standby)	Loss of Supply		High 10	Spare pump, but no list of critical spares	Duty/standby available			Catastrophic	Unlikely	High 10	Estimate	Council has employed an Asset Manager to develop and implement AMS. LRC has critical spares on site and operators have good understanding of critical spares so previous action closed - needs to be documented	Assess asset criticality assessment to ensure all critical assets and spares are identified and documented	AMS to capture water critical spares	
Whole of system	Inadequate operators/staff training	All hazards		Extreme 25	Operator to do pre course for Cert III. Casual operator and supervisor are trained.	Casual support operator and Relief operators from Longreach and Ilfracombe		Ensure sufficient staff and maintain training	Catastrophic	Rare	Medium 6	Unreliable	TNA and training matrix complete. HR processes to ensure training is implemented. Close previous action. Training on plant complete and manual/SOPs developed, Previous actions closed.			
Whole of system	Sabotage	All hazards		Extreme 25	No history of issues, but security at plant is not ensured	Plant fenced and locked when not attended.			Catastrophic	Rare	Medium 6	Unreliable	All facilities are accessed through electronic, traceable access. Reduced to rare due to no security breaches. Automated gates deemed unnecessary and requiring high level of maintenance. Previous action to be closed.			
Whole of system	Insufficient working valves	Loss of supply		High 10	Not all valves in reticulation work - have to shut off supply to fix mains break.	Valves available for isolation			Catastrophic	Unlikely	High 10	Reliable	Mains replacement program 2022 to eliminate dead ends, which replaced previous action. Lines routinely scoured as part of RAPAD	Implement mains replacement program		
Whole of system	Loss of computer control of plant processes	Cyber Security		Medium 6	Only the new filtration process is computer controlled.	No external access to computer program. Control system in locked building.			Catastrophic	Rare	Medium 6	Unreliable	Solari acquired form provider. Previous action closed			

Table 20 Yaraka Mitigated Risk Assessment

Process Step	Source of hazard/ Hazardous event	Primary hazard	Other hazards managed by same barriers	Maximum Risk	Comments	Primary Preventive Measure	Other Preventative Measures	Documented Procedure	2022 Residual Risk				2022 Comments	2022 Risk Management Improvements & Priorities (see RMIP for full details)		
									Consequence	Likelihood	Risk Level	Uncertainty		High	Medium	Low
Catchment	Camping/ human activities/ swimming in weirs	Protozoa (Crypto/ Giardia) (Y, Ilf)	Bacteria/virus (source water)	Extreme 20	Dams fenced for livestock	Full treatment at plant	signage		Catastrophic	Likely	Extreme 20	Reliable	There are no taps - previous action removed	Undertake HBT assessment and need for further treatment (eg UV) include supernatant in assessment criteria	Implement treatment upgrades as per HBT assessment	
Catchment (Yaraka and Ilfracombe)	Unrestricted livestock or wild/feral animal access	Protozoa (Crypto/ Giardia) (Y, Ilf)	Bacteria/virus (source water)	Extreme 20	Dams fenced for livestock	Full treatment at plant			Catastrophic	Likely	Extreme 20	Reliable	No change	Undertake HBT assessment and need for further treatment (eg UV) include supernatant in assessment criteria	Implement treatment upgrades as per HBT assessment	
Catchment	Flood event, storm flow	Bacteria/ Virus (Source Water)		Extreme 25	Disinfection is effective.	Full treatment at plant			Catastrophic	Rare	Medium 6	Confident	Pumping protocol for offline storage already in the DMP. Previous action to be removed. DMP review is an action already.			
Catchment	Power failure	Loss of supply		High 10		Generator available	several days treated water in storage		Catastrophic	Rare	Medium 6	Confident				
Catchment	Animal access including birds, vermin, livestock, swimming in Weir	Bacteria/ Virus (Source Water)		Extreme 25	Disinfection is effective	Full treatment at plant			Catastrophic	Rare	Medium 6	Confident				
Catchment	Chemical spill in catchment	Hydrocarbons	Pesticides	Medium 6	Would be aware of major incident	Full treatment at plant	Disaster management plan		Moderate	Rare	Low 3	Confident				
Catchment	Point sources (e.g. mines, industry, dip sites)	Heavy metals		Medium 9		Full treatment at plant			Moderate	Rare	Low 3	Confident				
Catchment	Nutrient buildup leading to algal bloom	Cyanobacteria		Medium 8	Annual algal blooms	Full treatment at plant			Moderate	Possible	Medium 9	Reliable				
Catchment	Algal blooms	Taste and odour		Medium 6		Full treatment at plant			Insignificant	Unlikely	Low 2	Confident				

Process Step	Source of hazard/ Hazardous event	Primary hazard	Other hazards managed by same barriers	Maximum Risk	Comments	Primary Preventive Measure	Other Preventative Measures	Documented Procedure	2022 Residual Risk				2022 Comments	2022 Risk Management Improvements & Priorities (see RMIP for full details)		
									Consequence	Likelihood	Risk Level	Uncertainty		High	Medium	Low
Catchment	Algal blooms	Cyanobacterial toxins		High 12	Oxidation is effective for majority of toxins.	Full treatment at plant			Major	Rare	Medium 5	Confident				
Catchment	Drought, bushfire	Loss of supply		High 10		Drought Management Plan			Catastrophic	Rare	Medium 6	Reliable	DMP last reviewed in 2015. New guidelines for DMP 2021. Review required every 10 yrs or if DMP triggered (which ever is sooner)		Review Drought Management	
Catchment	Raw water pump failure	Loss of Supply		High 10	Duty standby pumps, protected from floods				Catastrophic	Rare	Medium 6	Confident				
Catchment	Changing raw water conditions	Turbidity		High 15	Turbidity is managed below 5 NTU.	Full treatment at plant			Moderate	Possible	Medium 9	Confident				
Coagulant dosing	Failure of dosing equipment or underdosing	Turbidity	Disinfection by-products	High 15	All Clear 300 used.	Clarification	Filtration	Jar testing procedure (monthly or as water conditions change), daily testing	Moderate	Possible	Medium 9	Estimate	Include duty/standby, turbidity monitoring and alarming in SCADA specification. Likelihood reduced to possible based on pump outages		Implement SCADA upgrades	
Coagulant dosing	Failure of dosing equipment or underdosing	Protozoa (Crypto/ Giardia) (Y, Ilf)	Turbidity	Extreme 20	Single dosing pump, and no online monitoring of raw or clarified water	Clarification	Filtration		Catastrophic	Possible	High 15	Estimate	Include duty/standby, turbidity monitoring and alarming in SCADA specification	SCADA /telemetry & online monitoring specification to include clarifier turbidity monitoring and appropriate alarms/ process action (eg slow inlet flow, shutdown etc). Also include duty/standby dosing pumps	Implement SCADA upgrades	
Coagulant dosing	Overdosing of coagulant	Aluminium		Medium 6	All Clear, not a major risk of Al breakthrough	Clarification	Filtration		Minor	Unlikely	Low 4	Reliable				

Process Step	Source of hazard/ Hazardous event	Primary hazard	Other hazards managed by same barriers	Maximum Risk	Comments	Primary Preventive Measure	Other Preventative Measures	Documented Procedure	2022 Residual Risk				2022 Comments	2022 Risk Management Improvements & Priorities (see RMIP for full details)		
									Consequence	Likelihood	Risk Level	Uncertainty		High	Medium	Low
Media Filters	Filter breakthrough	Protozoa (Crypto/ Giardia) (Y, Ilf)	Turbidity	Extreme 20	manual backwash	Filtration	Coagulation		Catastrophic	Possible	High 15	Estimate	Data shows regularly above target limits. Recent data shows improvement. Include filter turbidity monitoring and alarms in SCADA specifications	Review current operational monitoring and implement a formal quarterly review of water quality data with key stakeholders SCADA /telemetry & online monitoring specification to include online filter turbidity monitoring and appropriate CCP alarms/ process action (eg outlet or full plant shutdown etc)	Implement SCADA upgrades	
Media Filters	Filter breakthrough	Turbidity	Protozoa (source water)	High 15	manual backwash	Filtration	Coagulation		Moderate	Possible	Medium 9	Unreliable	SCADA /telemetry & online monitoring specification to include auto backwashes	SCADA /telemetry & online monitoring specification to include auto backwashes	Implement SCADA upgrades	
Chlorine dosing	Chlorine dosing equipment failure or underdosing	Bacteria/ Virus (Source Water)		Extreme 25	Target dose 1-1.5 mg/L,single pump	Disinfection		Plant manual and CCP	Catastrophic	Possible	High 15	Estimate	Data shows regularly below target limits in 20/21. Recent data shows improvement. Include duty/standby dosing pumps & online Cl monitoring and alarms. New chlorine meter was purchased so previous action closed.	Review current operational monitoring and implement a formal quarterly review of water quality data with key stakeholders SCADA /telemetry & online monitoring specification to include online chlorine monitoring and appropriate CCP alarms/ process action (eg outlet or full plant shutdown etc). Also duty/standby dosing pumps	Implement SCADA upgrades	

Process Step	Source of hazard/ Hazardous event	Primary hazard	Other hazards managed by same barriers	Maximum Risk	Comments	Primary Preventive Measure	Other Preventative Measures	Documented Procedure	2022 Residual Risk				2022 Comments	2022 Risk Management Improvements & Priorities (see RMIP for full details)		
									Consequence	Likelihood	Risk Level	Uncertainty		High	Medium	Low
Chlorine dosing	Chlorine overdosing	Chlorine		High 12	Target dose 1-1.5 mg/L,single pump	Disinfection		Plant manual and CCP	Moderate	Possible	Medium 9		Include duty/standby dosing pumps & online Cl monitoring and alarms. New chlorine meter was purchased so previous action closed.			
Chlorine dosing	Chlorine reacting with organics	Disinfection byproducts		High 12		Coagualtion/Filtration	Disinfection		Moderate	Possible	Medium 9	Unreliable	Do at same time as Longreach, to improve uncertainty	Implement THM and HAA testing in line with Longreach sampling.		
Chlorine dosing	Sodium hypochlorite breakdown	Chlorate		High 12	na	Chemical specifications & storage management			Moderate	Possible	Medium 9	Estimate	Include chlorate testing to understand risk		Include chlorate testing in DBP rounds	
Chlorine dosing	Inadequate chlorine contact time	Bacteria/ Virus (Reticulation)		Extreme 20	180 kL, 2.4m down to 1.5m, flow rate to town unsure. Need to confirm L/s	Elevated reservoir prior to reticulation for contact time	Disinfection	Plant manual and CCP	Catastrophic	Unlikely	High 10	Estimate	Estimated max flow rate 1L/s	Determine flow rate and validate chlorine contact time to determine minimum critical limit and develop SOP for fire flows, incorporating any chlorine Ct actions		
GLR	Animal access including birds, amphibians, reptiles or rodents	Bacteria/ Virus (Reticulation)		Extreme 20	Residual maintained in reservoir	Disinfection	Disinfection		Catastrophic	Rare	Medium 6	Reliable				
Elevated Reservoir	Animal access including birds, amphibians, reptiles or rodents	Protozoa (Crypto/ Giardia) (Retic)		High 15	Unlikely that protozoa contaminate the reservoir. Divers have inspected RAPAD Councils in past 2 years.	Routine inspection program			Catastrophic	Rare	Medium 6	Reliable	All reservoirs cleaned in 20/21 year. Reservoir cleaning has been identified by the RAPAD group for every 5 years			
Elevated Reservoir	Contamination in elevated reservoir	Bacteria/ Virus (Reticulation)		Extreme 20	Elevated res is normally kept above 1 mg/L	Sealed, secure reservoir		Weekly testing in the reticulation	Catastrophic	Rare	Medium 6	Reliable				
Reticulation	Colonisation of reticulation with opportunistic pathogens	Protozoa (Naeglaria) (Retic)		High 12	Chlorine typically > 0.5 mg/L	Disinfection		Disinfection CCP	Major	Rare	Medium 5	Reliable	No change			

Process Step	Source of hazard/ Hazardous event	Primary hazard	Other hazards managed by same barriers	Maximum Risk	Comments	Primary Preventive Measure	Other Preventative Measures	Documented Procedure	2022 Residual Risk				2022 Comments	2022 Risk Management Improvements & Priorities (see RMIP for full details)		
									Consequence	Likelihood	Risk Level	Uncertainty		High	Medium	Low
Reticulation	Build-up of sediments or slimes/ stagnation	Turbidity		High 15	Some dead ends, and stagnation at some locations. Racecourse/ clinic	Mains flushing		OCP for reticulation	Moderate	Likely	High 12	Estimate	No change	Implement chlorine testing at outskirts/dead ends in Yaraka and establish flushing regime if necessary	Assess opportunities to eliminate dead end mains if needed	
Reticulation	Corrosion of pipes and valves	Iron		Medium 8	Not identified as a problem	Asset management and replacement of old mains			Minor	Possible	Medium 6	Reliable				
Reticulation	Cross-contamination from raw water contingent supply, backflow	Protozoa (Crypto/ Giardia) (Retic)		High 15	Meters with backflow prevention. Potential cross connections to raw water scheme. Raw water scheme at higher pressure.	Check backflow preverntion register			Catastrophic	Rare	Medium 6	Reliable	Drought Management Plan review to consider how to manage raw water used as contingent supply Cross connections were identified and removed, so previous action closed. Likelihood of further cross connections in town of 16 people is rare			
Reticulation	Pipe bursts or leaks	Bacteria/ Virus (Reticulation)		Extreme 20	Generally have .5 - 0.7 mg/L residual in reticulation.	Asset management and replacement of old mains	residual disinfection	main break repair procedure	Catastrophic	Unlikely	High 10	Reliable	Mains repair procedure in place includes hygienic practices. Operators are trained, previous action removed ALARP			
Reticulation	Inadequate pressure	Loss of supply		High 10	At high demand, the booster pump kicks in - can be low pressure in park.	Booster pumps			Minor	Rare	Low 2	Reliable				
Whole of system	Power failure	Loss of supply		High 10	portable generator available as required	Generator			Moderate	Possible	Medium 9	Estimate				

Process Step	Source of hazard/ Hazardous event	Primary hazard	Other hazards managed by same barriers	Maximum Risk	Comments	Primary Preventive Measure	Other Preventative Measures	Documented Procedure	2022 Residual Risk				2022 Comments	2022 Risk Management Improvements & Priorities (see RMIP for full details)		
									Consequence	Likelihood	Risk Level	Uncertainty		High	Medium	Low
Whole of system	Lack of visibility of plant processes	All hazards		Extreme 25	No SCADA alarms to operator to identify failures/ water quality issues	daily monitoring			Catastrophic	Possible	High 15	Estimate	As per individual process comments. Highest likelihood used	Review current operational monitoring and implement a formal quarterly review of water quality data with key stakeholders SCADA /telemetry & online monitoring specification to include online monitoring of OCPs and CCP, with appropriate alarms/ process action (eg outlet or full plant shutdown etc)	Implement SCADA upgrades	
Whole of system	Inadequate back-up options (e.g. duty/standby)	Loss of Supply		High 10	Spare pump, but no list of critical spares	Duty/standby available			Catastrophic	Unlikely	High 10	Estimate	Council has employed an Asset Manager to develop and implement AMS. LRC has critical spares on site and operators have good understanding of critical spares so previous action closed - needs to be documented	Assess asset criticality assessment to ensure all critical assets and spares are identified and documented	AMS to capture water critical spares	
Whole of system	Inadequate operators/staff training	All hazards		Extreme 25	1 part time operator - support from Casual operator	Casual support operator and Relief operators from isisford		Ensure sufficient staff and maintain training	Catastrophic	Rare	Medium 6	Unreliable	1 full time operator with support from other trained operators TNA and training matrix complete. HR processes to ensure training is implemented.		Succession planning for a new operator -as part of succession planning LRC will assess automation of plant. In interim back-up operators from other systems are available	
Whole of system	Sabotage	All hazards		Extreme 25	No history of issues, but security at plant is not ensured	Plant is next door to operators house. Very few people in Yaraka, Site fenced, and buildings locked when not attended.			Catastrophic	Rare	Medium 6	Unreliable	All facilities are accessed through electronic, traceable access. Reduced to rare due to no security breaches. Automated gates deemed unnecessary and requiring high level of maintenance. Previous action to be closed.			

Process Step	Source of hazard/ Hazardous event	Primary hazard	Other hazards managed by same barriers	Maximum Risk	Comments	Primary Preventive Measure	Other Preventative Measures	Documented Procedure	2022 Residual Risk				2022 Comments	2022 Risk Management Improvements & Priorities (see RMIP for full details)		
									Consequence	Likelihood	Risk Level	Uncertainty		High	Medium	Low
Whole of system	Insufficient working valves	Loss of supply		High 10	Valving not an issue for isolation at Yaraka	Valves available for isolation			Catastrophic	Rare	Medium 6	Reliable	Valving not an issue for isolation at Yaraka. Previous action removed and likelihood reduced to rare			
Whole of system	Loss of computer control of plant processes	Cyber Security		Medium 6	Manual treatment plant. No possibility of this hazard at this site.						#N/A		Review as part of SCADA implementation			

5 PREVENTIVE MEASURES

In addition to the items identified in the preventive measure column of the risk registers, Council has developed Operational Control Points and Critical Control Points for each of the Schemes

In addition to the OCPs and CCP, Longreach Regional Council has up to date O and M manuals for the Longreach WTP and Ilfracombe WTPs. While Isisford and Yaraka have O and M manuals, these are becoming outdated as processes have changed. Nonetheless, the CCPs provide sufficient control of the key operational processes.

Other operational procedures include:

- Mains repair procedure
- Reservoir inspection procedure

All procedures are the responsibility of the Director of Infrastructure Services. As the CCPs have been developed as a part of this version of the DWQMP, they will be reviewed on the following triggers:

1. Following significant changes in process, or
2. Upon commissioning of SCADA monitoring and control of the operational process, or
3. At the time of the scheduled DWQMP review

5.1.1 Cyber Security and IT

Longreach Council WTPs are low risk for cyber attack as processes are manual at Yaraka, and Ilfracombe (Conventional plant), with minimal computer control at Ilfracombe (RO plant) Isisford filtration plant. The Longreach WTP has the highest level of control.

The Longreach WTP plant computer has been cloned and the clone is kept offsite in a different location. This would allow Council to reinstate control if the computer failed (e.g. power surge/ computer failure etc). Council will ask the service providers to provide a backup of the computer programs for the RO plant at Ilfracombe, and the filtration plant at Isisford.

Council servers (storage of procedures and historical data) are considered secure. In addition to the standard antivirus scanning, to prevent computer viruses and malware, there are Cisco firewalls preventing unauthorised external access, and username and password access provisions for all authorised staff. Administrator privileges are generally limited to IT staff, so it is not generally possible for staff to deliberately or inadvertently install any additional programs onto the server.

Business data is also considered secure; all information is hosted by Civica and mirrored to a further remote site. There are shadow copies of all data created multiple times per day, and physical backups also occur daily. Major sites are connected using fibre networks.

Council does allow staff devices (username and password required) to connect to the network. Usage of any computer or device connected to the server / network can be tracked using a combination of Sinefa or UniFi.

While council allows guest access to the Council systems, this is through its own zone, with no access to any council information. Council provides free public WiFi in certain areas of town, however, this is completely separate to the Council network.

CCP 1

Longreach Filter Turbidity Critical Control Point Procedure

What is measured	Where or how is it measured	What is the control point	What are the hazards	Record Keeping
Combined filter turbidity of filtered water entering the clearwater tank	Continuous online SCADA monitoring and Daily grab sample	Media filters	Protozoan pathogens, turbidity	SCADA trends and daily record sheet

Critical Limit
> 0.5 NTU
for > 15 minutes

- Retest to confirm result
- Cease transfer of water from clearwater tank
- Contact Director Infrastructure Services
- Check OCP1 Clarification procedure to ensure that the clarifier is effectively reducing turbidity - take corrective actions indicated in that procedure
- Check CCP2 Disinfection procedure as elevated turbidity can increase chlorine demand and impact disinfection effectiveness
- If > 1 NTU report as a drinking water incident and issue Boil Water Alert

Alert Level
> 0.3 NTU

- Retest to confirm turbidity is above 0.3 NTU
- Check OCP1 Clarification procedure to ensure that clarifier is operating effectively
- If clarifier performance is poor, consider need to reduce flow rate through WTP or to stop plant
- Backwash affected filters
- Contact Water and Sewerage Supervisor

Target Turbidity
< 0.25 NTU

- WTP water sampling and testing
- Plant walkaround and visual inspection
- Equipment checks
- Dosing rate checks
- Instrument calibration
- Routine backwashing of filters

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CCP 2

Longreach Disinfection Critical Control Point Procedure

What is measured	Where or how is it measured	What is the control point	What are the hazards	Record Keeping
Free and Total Chlorine in treated water leaving clear water tank	Daily grab sample for free and total chlorine and continuous online free chlorine measurement	Chlorine dosing into clearwater tank	Bacteria and Viruses	Daily record sheet

Critical Limits
< 0.3 mg/L Free Chlorine
> 5 mg/L Total Chlorine

- Retest to confirm result
- if above 4.5 mg/L free chlorine, measure total chlorine
- If WTP running, cease transfer of water from clearwater tank
- Contact Director Infrastructure Services
- If low chlorine, check CCP 1 Filtration procedure as elevated turbidity can impact disinfection effectiveness
- If < 0.3 mg/L has been delivered to customers, consider need to report an incident (Event). Some customers will have received inadequately disinfected water.
- Record details on the daily WTP sheet

Alert Levels
Free Chlorine
> 1.5 mg/L or
< 1.3 mg/L

- Retest to confirm result
- Inspect chlorine dosing systems - e.g ensure that there is sufficient sodium hypochlorite
- Check dosing lines are connected and intact
- Adjust chlorine dose to bring level back within target
- Check OCP 1 Clarification procedure to ensure that clarifier is operating effectively
- Check CCP 1 Filtration procedure to ensure that there is no filter breakthrough causing chlorine demand
- Contact Water and Sewerage Supervisor
- Record details on the daily WTP sheet

Target Level
Free Chlorine
1.3 to 1.5 mg/L

- WTP water sampling and testing
- Plant walkaround and visual inspection
- Equipment checks
- Dosing rate checks
- Instrument calibration

Validation:

Inputs for CT Calculation: GLR volume 8.8L; minimum operating level 80%; treated water pump flow 240L/s. CWT has separate inlet and outlets, but has no internal baffles; baffling factor used for this calculation was 0.1.
Using these highly conservative assumptions, the minimum free chlorine critical limit of 0.3mg/L results in a CT of 15mg.min/L

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Longreach Clarification Operational Control Point Procedure

OCP 1

What is measured	Where or how is it measured	What is the control point	What are the hazards	Record Keeping
Turbidity, Colour and pH of clarified water	Daily grab samples	Coagulant dosing	Turbidity, Pathogens	Daily records in plant diary

Alert Level
Turbidity > 5 NTU
Colour > 15 HU

Turbidity
- Inspect clarifier and floc size
- Inspect dosing system, drop test dosing pump(s) to confirm correct dosing
- Ensure dosing lines are not blocked/ damaged
- Carry out jar test if pumps operating correctly
- Contact Water and Sewerage Supervisor
- Consider if there is a need to stop production
- Adjust coagulant dosages if necessary
- Test combined filtered water turbidity and pH hourly, and other parameters as needed
- Record details in the WTP diary

Colour
- If colour > 15 HU in clarified water jar test and adjust coagulant dose as required

Adjustment
Turbidity > 2.5 NTU
Colour > 10 HU

Turbidity
- Inspect clarifier and floc size
- Inspect dosing system, drop test dosing pump(s) to confirm correct dosing
- Ensure dosing lines are not blocked/ damaged
- Carry out jar test if pumps operating correctly
- Adjust coagulant and flocculant dosages if necessary
- Test combined filtered water turbidity and pH hourly, and other parameters as needed
- Record details in the WTP diary

Colour
- If colour > 10 HU in clarified water jar test and adjust coagulant dose as required

Target
Turbidity < 2 NTU
Colour < 5 HU

- WTP water sampling and testing
- Plant walkaround and visual inspection
- Equipment checks
- Dosing rate checks
- Instrument calibration

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Longreach Reticulation Operational Control Point Procedure

OCP 2

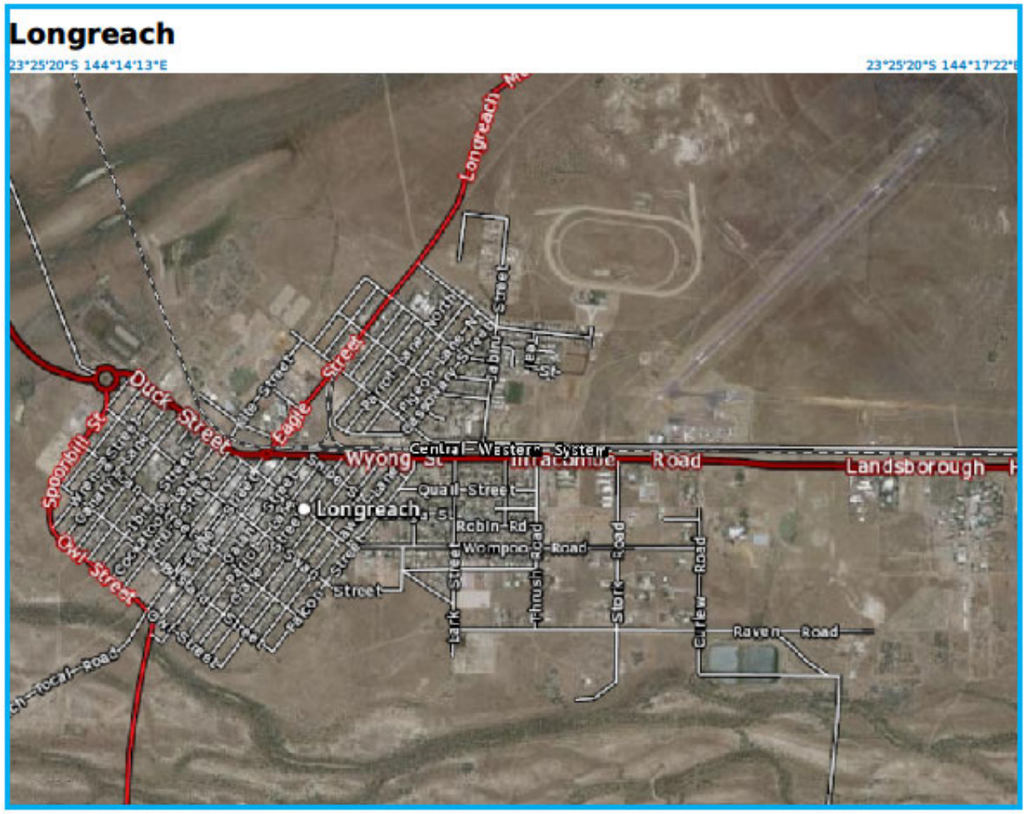
What is measured	Where or how is it measured	What is the control point	What are the hazards	Record Keeping
Free chlorine in reticulation	6/ week grab samples at various reticulation sample points	Chlorine leaving the WTP	Bacteria and viruses	Daily records in plant diary

Alert Level
Free chlorine
< 0.2 mg/L or > 1.5 mg/L

- Flush downstream hydrant for 10 minutes and retest
- If chlorine level has been re-established at the normal level for that site, note need to flush in daily operational sheet
- If chlorine is not at normal levels, check CCP 2 Disinfection to ensure proper dosing
- Check chlorine residual in reservoir to ensure adequate chlorine in reservoir
- If chlorine dosing and reservoir chlorine are normal, flush for a further 10 minutes and retest.
- If chlorine returns to normal, record in daily operational sheet
- If chlorine is not back to normal, contact Water and Sewerage **Supervisor**

Target
Free chlorine
> 0.2 mg/L

- Routine weekly sampling of chlorine in reticulation
- Sampling locations include
  - Wren St -end of main
  - PCYC
  - Edkins Park first point after WTP
  - Gull St - Racecourse - end of main
  - DPI -end of main
  - Cramsie Muttaburra Road - end of main



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CCP 1

Isisford Filter Turbidity Critical Control Point Procedure

What is measured	Where or how is it measured	What is the control point	What are the hazards	Record Keeping
Combined filter turbidity of filtered water entering the clearwater tank	Daily grab sample	Media filters	Protozoan pathogens, turbidity	daily record sheet

Critical Limit
> 0.5 NTU
for > 15 minutes

- Retest to confirm result
- Cease transfer of water from clearwater tank
- Contact Director Infrastructures Services
- Check OCP1 Clarification procedure to ensure that the clarifier is effectively reducing turbidity - take corrective actions indicated in that procedure
- Check CCP2 Disinfection procedure as elevated turbidity can increase chlorine demand and impact disinfection effectiveness
- If > 1 NTU report as a drinking water incident and issue Boil Water Alert

Alert Level
> 0.3 NTU

- Retest to confirm turbidity is above 0.3 NTU
- Check OCP1 Clarification procedure to ensure that clarifier is operating effectively
- If clarifier performance is poor, consider need to reduce flow rate through WTP or to stop plant
- Backwash affected filters
- Contact Water and Sewerage Supervisor

Target Turbidity
< 0.25 NTU

- WTP water sampling and testing
- Plant walkaround and visual inspection
- Equipment checks
- Dosing rate checks
- Instrument calibration
- Routine backwashing of filters

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CCP 2

Isisford Disinfection Critical Control Point Procedure

What is measured	Where or how is it measured	What is the control point	What are the hazards	Record Keeping
Free and Total Chlorine in treated water leaving clear water tank	Daily grab sample for free and total chlorine and continuous online free chlorine measurement	Chlorine dosing into clearwater tank	Bacteria and Viruses	Daily record sheet

Critical Limits
< 1 mg/L Free Chlorine
> 5 mg/L Total Chlorine

- Retest to confirm result
- if above 4.5 mg/L free chlorine, measure total chlorine
- If WTP running, cease transfer of water from clearwater tank
- Contact Director Infrastructure Services
- If low chlorine, check CCP 1 Filtration procedure as elevated turbidity can impact disinfection effectiveness
- If booster pumps have reduced clearwater tank below 40%, Director Infrastructure Services to evaluate whether this is an Event.
- Record details on the daily WTP sheet

Alert Levels
Free Chlorine
> 1.5 mg/L or
< 1.3 mg/L

- Retest to confirm result
- Inspect chlorine dosing systems - e.g ensure that there is sufficient sodium hypochlorite
- Check dosing lines are connected and intact
- Adjust chlorine dose to bring level back within target
- Check OCP 1 Clarification procedure to ensure that clarifier is operating effectively
- Check CCP 1 Filtration procedure to ensure that there is no filter breakthrough causing chlorine demand
- Contact Manager Water and Sewerage Supervisor
- Record details on the daily WTP sheet

Target Level
Free Chlorine
1.3 to 1.5 mg/L

- WTP water sampling and testing
- Plant walkaround and visual inspection
- Equipment checks
- Dosing rate checks
- Instrument calibration

Validation: The CT for Isisford is difficult to calculate. When operating at lower demand, water passes through the contact tank into the elevated reservoir. However, the booster pumps pump directly from the clearwater tank. This occurs with network flushing/ fire demand. Under these circumstances, 1 mg/L maintains adequate CT until the CWT level drops to 40% assuming a baffle factor of 0.3. As this would potentially occur in a firefighting scenario, in which case continuity of supply is critical, it is not appropriate to shut down the WTP. In this scenario, the Manager will need to decide when to call the PHU.

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Isisford Clarification Operational Control Point Procedure

OCP 1

What is measured	Where or how is it measured	What is the control point	What are the hazards	Record Keeping
Turbidity, Colour and pH of clarified water	Daily grab samples	Coagulant dosing	Turbidity, Pathogens	Daily records in plant diary

Alert Level
Turbidity > 5 NTU
Colour > 15 HU

Turbidity
- Inspect clarifier and floc size
- Inspect dosing system, drop test dosing pump(s) to confirm correct dosing
- Ensure dosing lines are not blocked/ damaged
- Carry out jar test if pumps operating correctly
- Contact Water and Sewerage Supervisor
- Consider if there is a need to stop production
- Adjust coagulant dosages if necessary
- Test combined filtered water turbidity and pH hourly, and other parameters as needed
- Record details in the WTP diary

Colour
- If colour > 15 HU in clarified water jar test and adjust coagulant dose as required

Adjustment
Turbidity > 2.5 NTU
Colour > 10 HU

Turbidity
- Inspect clarifier and floc size
- Inspect dosing system, drop test dosing pump(s) to confirm correct dosing
- Ensure dosing lines are not blocked/ damaged
- Carry out jar test if pumps operating correctly
- Adjust coagulant and flocculant dosages if necessary
- Test combined filtered water turbidity and pH hourly, and other parameters as needed
- Record details in the WTP diary
-

Colour
- If colour > 10 HU in clarified water jar test and adjust coagulant dose as required

Target
Turbidity < 2 NTU
Colour < 5 HU

- WTP water sampling and testing
- Plant walkaround and visual inspection
- Equipment checks
- Dosing rate checks
- Instrument calibration

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Isisford Reticulation Operational Control Point Procedure

OCP 2

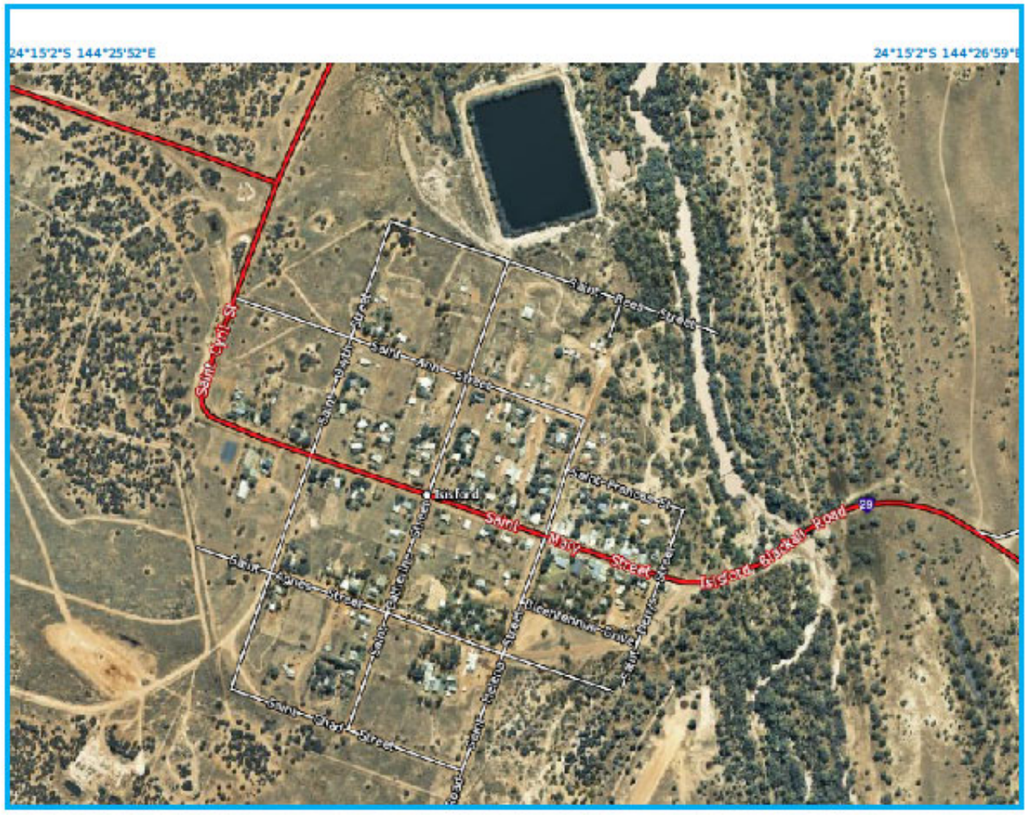
What is measured	Where or how is it measured	What is the control point	What are the hazards	Record Keeping
Free chlorine in reticulation	6/ week grab samples at various reticulation sample points	Chlorine leaving the WTP	Bacteria and viruses	Daily records in plant diary

Alert Level
Free chlorine
< 0.2 mg/L or > 1.5 mg/L

- Flush downstream hydrant for 10 minutes and retest
- If chlorine level has been re-established at the normal level for that site, note need to flush in daily operational sheet
- If chlorine is not at normal levels, check CCP 2 Disinfection to ensure proper dosing
- Check chlorine residual in reservoir to ensure adequate chlorine in reservoir
- If chlorine dosing and reservoir chlorine are normal, flush for a further 10 minutes and retest.
- If chlorine returns to normal, record in daily operational sheet
- If chlorine is not back to normal, contact Water and Sewerage Supervisor

Target
Free chlorine
> 0.2 mg/L

- Routine weekly sampling of chlorine in reticulation
- Sampling locations include
  - St Bee's St Helana St - first point after WTP
  - Racecourse - end of main
  - Golf club - end of main
  - Park - general community area



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BLIGH TANNER

CCP 1

Ilfracombe Filter Turbidity Critical Control Point Procedure

What is measured	Where or how is it measured	What is the control point	What are the hazards	Record Keeping
Turbidity of filtered water entering the clearwater tank	Daily grab sample	Media filters	Protozoan pathogens, turbidity	Daily record sheet

Critical Limit
> 0.5 NTU
for > 15 minutes

- Retest to confirm result
- Cease transfer of water from clearwater tank
- Contact Director Infrastructure Services
- Check OCP1 Clarification procedure to ensure that the clarifier is effectively reducing turbidity - take corrective actions indicated in that procedure
- Check CCP2 Disinfection procedure as elevated turbidity can increase chlorine demand and impact disinfection effectiveness
- If > 1 NTU report as a drinking water incident and issue Boil Water Alert

Alert Level
> 0.3 NTU

- Retest to confirm turbidity is above 0.3 NTU
- Check OCP1 Clarification procedure to ensure that clarifier is operating effectively
- If clarifier performance is poor, consider need to reduce flow rate through WTP or to stop plant
- Backwash affected filters
- Contact Water and Sewerage Supervisor

Target Turbidity
< 0.25 NTU

- WTP water sampling and testing
- Plant walkaround and visual inspection
- Equipment checks
- Dosing rate checks
- Instrument calibration
- Routine backwashing of filters

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CCP 2

Ilfracombe Disinfection Critical Control Point Procedure

What is measured	Where or how is it measured	What is the control point	What are the hazards	Record Keeping
Free (and Total) Chlorine in treated water leaving clear water tank	Daily grab sample for free chlorine	Chlorine dosing into clearwater tank (both RO and conventional plants)	Bacteria and Viruses	Daily record sheet

Critical Limits
< 1 mg/L Free Chlorine
> 5 mg/L Total Chlorine

- Retest to confirm result
- if above 4.5 mg/L free chlorine, measure total chlorine
- Cease transfer of water from clearwater tank to elevated reservoir
- Contact Director Infrastructure Services
- If low chlorine, check alert actions below, and CCP 1 Filtration procedure as elevated turbidity can impact disinfection effectiveness
- If booster pumps have reduced clearwater tank below 40%, Director Infrastructure Services to evaluate whether this is a reportable event.
- Note: The reverse osmosis plant produces microbiologically safe water - while operating without chlorine is not advised, this could be an option to maintain supply if chlorination cannot be re-established.
- Record details on the daily WTP sheet

Alert Levels
Free Chlorine
> 1.5 mg/L or
< 1.3 mg/L

- Retest to confirm result
- Inspect chlorine dosing systems - e.g ensure that there is sufficient sodium hypochlorite
- Check dosing lines are connected and intact for both the conventional and RO treatment plants
- Adjust chlorine dose to bring level back within target
- Check OCP 1 Clarification procedure to ensure that clarifier is operating effectively
- Check CCP 1 Filtration procedure to ensure that there is no filter breakthrough causing chlorine demand
- Contact Water and Sewerage Supervisor
- Record details on the daily WTP sheet

Target Level
Free Chlorine
1.3 to 1.5 mg/L

- WTP water sampling and testing
- Plant walkaround and visual inspection of dosing systems for both the RO and conventional treatment plants
- Equipment checks
- Dosing rate checks
- Instrument calibration

Validation: The CT for Ilfracombe is difficult to calculate. When operating at lower demand, water passes through the contact tank into the elevated reservoir. However, the booster pumps pump directly from the clearwater tank. This occurs with network flushing/ fire demand. Under these circumstances, 1 mg/L maintains adequate CT until the CWT level drops to 40% assuming a baffle factor of 0.3. As this would potentially occur in a firefighting scenario, in which case continuity of supply is critical, it is not appropriate to shut down the WTP. In this scenario, the Manager will need to decide when to call the PHU.

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Ilfracombe Clarification Operational Control Point Procedure

OCP 1

What is measured	Where or how is it measured	What is the control point	What are the hazards	Record Keeping
Turbidity, Colour and pH of clarified water	Daily grab samples	Coagulant dosing	Turbidity, Pathogens	Daily records in plant diary

Alert Level
Turbidity > 5 NTU
Colour > 15 HU

Turbidity
- Inspect clarifier and floc size
- Inspect dosing system, drop test dosing pump(s) to confirm correct dosing
- Ensure dosing lines are not blocked/ damaged
- Carry out jar test if pumps operating correctly
- Contact Water and Sewerage Supervisor
- Consider if there is a need to stop production
- Adjust coagulant dosages if necessary
- Test combined filtered water turbidity and pH hourly, and other parameters as needed
- Record details in the WTP diary

Colour
- If colour > 15 HU in clarified water jar test and adjust coagulant dose as required

Adjustment
Turbidity > 2.5 NTU
Colour > 10 HU

Turbidity
- Inspect clarifier and floc size
- Inspect dosing system, drop test dosing pump(s) to confirm correct dosing
- Ensure dosing lines are not blocked/ damaged
- Carry out jar test if pumps operating correctly
- Adjust coagulant and flocculant dosages if necessary
- Test combined filtered water turbidity and pH hourly, and other parameters as needed
- Record details in the WTP diary
-

Colour
- If colour > 10 HU in clarified water jar test and adjust coagulant dose as required

Target
Turbidity < 2 NTU
Colour < 5 HU

- WTP water sampling and testing
- Plant walkaround and visual inspection
- Equipment checks
- Dosing rate checks
- Instrument calibration

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Ilfracombe RO Plant Operational Control Point Procedure

OCP 2

What is measured	Where or how is it measured	What is the control point	What are the hazards	Record Keeping
Conductivity and pH of treated water	Daily grab samples	Reverse Osmosis membranes and Calcium Carbonate contact tank	Pathogens (membrane breach) and pH	Daily records in plant diary

Alert Level
Conductivity
<60 or > 300 µS/cm
pH < 6.5

- If pH < 6.5 cease production until more calcium carbonate has been added to the calcium carbonate contact tank.
- Conductivity will also drop if the calcium carbonate is exhausted.

- Conductivity > 300 µS/cm can only occur if there is a breach of the RO membrane. If this occurs, shut down the plant immediately
- Contact Water and Sewerage Supervisor
- Do not operate RO plant until an external service has been completed, or the affected membrane module is taken out of service.

Adjustment
Conductivity
<90 µS/cm
pH < 6.8

- If pH < 6.8 consider need to add more calcium carbonate to the calcium carbonate contact tank

Target
Conductivity
100- 200 µS/cm
pH 6.8 - 7.4

- Reverse Osmosis plant sampling and testing
- Plant walkaround and visual inspection
- Equipment checks
- Record individual reverse osmosis module permeate conductivity (conductivity of each membrane module depends on the stage of RO - typical values are 15 - 120 µS/cm)
- Record feed pump pressures

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Ilfracombe Reticulation Operational Control Point Procedure

OCP 3

What is measured	Where or how is it measured	What is the control point	What are the hazards	Record Keeping
Free chlorine in reticulation	6/ week grab samples at various reticulation sample points	Chlorine leaving the WTP	Bacteria and viruses	Daily records in plant diary

Alert Level
Free chlorine
< 0.2 mg/L or > 1.5 mg/L

- Flush downstream hydrant for 10 minutes and retest
- If chlorine level has been re-established at the normal level for that site, note need to flush in daily operational sheet
- If chlorine is not at normal levels, check CCP 2 Disinfection to ensure proper dosing
- Check chlorine residual in reservoir to ensure adequate chlorine in reservoir
- If chlorine dosing and reservoir chlorine are normal, flush for a further 10 minutes and retest.
- If chlorine returns to normal, record in daily operational sheet
- If chlorine is not back to normal, contact Water and Sewerage Supervisor

Target
Free chlorine
> 0.2 mg/L

- Routine weekly sampling of chlorine in reticulation
- Sampling locations include
  - Church and Scour Road - first point after WTP
  - Oval - end of water main
  - Racecourse - end of main
  - Leichardt St and Murray St - extent of reticultion

Ilfracombe

23°29'2"S 144°29'55"E 23°29'2"S 144°30'46"E

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CCP 1

Yaraka Disinfection Critical Control Point Procedure

What is measured	Where or how is it measured	What is the control point	What are the hazards	Record Keeping
Free and Total Chlorine in treated water leaving collection tank	Daily grab sample for free and total chlorine	Chlorine dosing into collection tank	Bacteria and Viruses	Daily record sheet

Critical Limits
< 1 mg/L Free Chlorine
> 5 mg/L Total Chlorine

- Retest for water leaving Elevated Tower to town
- If above 4.5 mg/L free chlorine, measure total chlorine
- If WTP running, cease transfer of water from collection tank
- Contact Director Infrastructure Services
- If low chlorine, check CCP 1 Filtration procedure as elevated turbidity can impact disinfection effectiveness
- Record details on the daily WTP sheet

Alert Levels
Free Chlorine
> 1.5 mg/L or
< 1.3 mg/L

- Retest to confirm result
- Inspect chlorine dosing systems - e.g ensure that there is sufficient sodium hypochlorite
- Check dosing lines are connected and intact
- Adjust chlorine dose to bring level back within target
- Check OCP 1 Clarification procedure to ensure that clarifier is operating effectively
- Check CCP 2 Filtration procedure to ensure that there is no filter breakthrough causing chlorine demand
- Contact Water and Sewerage Supervisor
- Record details on the daily WTP sheet

Target Level
Free Chlorine
1.3 to 1.5 mg/L

- WTP water sampling and testing
- Plant walkaround and visual inspection
- Equipment checks
- Dosing rate checks
- Instrument calibration

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CCP 2

Yaraka Filter Turbidity Critical Control Point Procedure

What is measured	Where or how is it measured	What is the control point	What are the hazards	Record Keeping
Turbidity of filtered water entering the clearwater tank	Daily grab sample	Media filters	Protozoan pathogens, turbidity	Daily record sheet

Critical Limit
> 0.5 NTU
for > 15 minutes

- Retest to confirm result
- Cease transfer of water from clearwater tank
- Contact Director Infrastructure Services
- Check OCP1 Clarification procedure to ensure that the clarifier is effectively reducing turbidity - take corrective actions indicated in that procedure
- Check CCP1 Disinfection procedure as elevated turbidity can increase chlorine demand and impact disinfection effectiveness
- If > 1 NTU report as a drinking water incident and issue Boil Water Alert

Alert Level
> 0.3 NTU

- Retest to confirm turbidity is above 0.3 NTU
- Check OCP1 Clarification procedure to ensure that clarifier is operating effectively
- If clarifier performance is poor, consider need to reduce flow rate through WTP or to stop plant
- Backwash affected filters
- Contact Water and Sewerage Supervisor

Target Turbidity
< 0.25 NTU

- WTP water sampling and testing
- Plant walkaround and visual inspection
- Equipment checks
- Dosing rate checks
- Instrument calibration
- Routine backwashing of filters

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Yaraka Clarification Operational Control Point Procedure

OCP 1

What is measured	Where or how is it measured	What is the control point	What are the hazards	Record Keeping
Turbidity, and Colour of clarified water	Daily grab samples	Coagulant dosing	Turbidity, Pathogens	Daily records in plant diary

Alert Level
Turbidity > 5 NTU
Colour > 15 HU

Turbidity
- Inspect clarifier and floc size
- Inspect dosing system, drop test dosing pump(s) to confirm correct dosing
- Ensure dosing lines are not blocked/ damaged
- Carry out jar test if pumps operating correctly
- Contact Water and Sewerage Supervisor
- Consider if there is a need to stop production
- Adjust coagulant dosages if necessary
- Test combined filtered water turbidity and pH hourly, and other parameters as needed
- Record details in the WTP diary

Colour
- If colour > 15 HU in clarified water jar test and adjust coagulant dose as required

Adjustment
Turbidity > 2.5 NTU
Colour > 10 HU

Turbidity
- Inspect clarifier and floc size
- Inspect dosing system, drop test dosing pump(s) to confirm correct dosing
- Ensure dosing lines are not blocked/ damaged
- Carry out jar test if pumps operating correctly
- Adjust coagulant and flocculant dosages if necessary
- Test combined filtered water turbidity and pH hourly, and other parameters as needed
- Record details in the WTP diary
-

Colour
- If colour > 10 HU in clarified water jar test and adjust coagulant dose as required

Target
Turbidity < 2 NTU
Colour < 5 HU

- WTP water sampling and testing
- Plant walkaround and visual inspection
- Equipment checks
- Dosing rate checks
- Instrument calibration

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Yaraka Reticulation Operational Control Point Procedure

OCP 2

What is measured	Where or how is it measured	What is the control point	What are the hazards	Record Keeping
Free chlorine in reticulation	2/ week grab samples at various reticulation sample points	Chlorine leaving the WTP	Bacteria and viruses	Daily records in plant diary

Alert Level
Free chlorine
< 0.2 mg/L or > 1.5 mg/L

- Flush downstream hydrant for 10 minutes and retest
- If chlorine level has been re-established at the normal level for that site, note need to flush in daily operational sheet
- If chlorine is not at normal levels, check CCP 2 Disinfection to ensure proper dosing
- Check chlorine residual in reservoir to ensure adequate chlorine in reservoir
- If chlorine dosing and reservoir chlorine are normal, flush for a further 10 minutes and retest.
- If chlorine returns to normal, record in daily operational sheet
- If chlorine is not back to normal, contact Water and Sewerage Supervisor

Target
Free chlorine
> 0.2 mg/L

- Routine weekly sampling of chlorine in reticulation
- Sampling locations include
  - Residence beside WTP - closest connection
  - School - End of main
  - Hall- End of main
  - LRC Depot Jarley St End of Main

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6 OPERATIONAL AND VERIFICATION MONITORING

6.1 Raw water Information monitoring

Raw water is monitored to ensure that the level of risk of particular hazards is supported by data. This includes routine *E. coli* testing, 6 monthly standard water analysis, and metals suites, and event-based monitoring of other parameters (e.g. pesticides around spraying activities, or if a fish kill is observed).

6.2 Operational monitoring

Operational monitoring refers to the monitoring undertaken by operators on a routine basis to ensure that all the preventive measures are operating correctly. Operational monitoring is the focus of the DWQMP as it represents the first opportunity for an operator to intervene and ensure that the drinking water being produced should be expected to meet the standards of the ADWG.

The key parameters to measure are listed in the CCP documents on the previous pages of the DWQMP and included in the table below in green.

If the treatment process is monitored effectively, failures should be identified prior to poor quality water entering the reticulation network.

6.3 Verification Monitoring

Verification monitoring is undertaken to demonstrate that the water quality that was sent to consumers was safe. Verification monitoring is undertaken at each water supply, at a frequency that ensures the minimum public health regulation requirements are met in each scheme. The Verification monitoring is indicated below in blue.

Table 21 Summary of manual monitoring activities – online additional, see CCPs.

Type of monitoring	Information	Operational				Verification
Parameters	Raw water	**Clarified**	**Filtered**	**Chlorination**	**Treated Water**	**Town Locations**
pH	D				D	W/M*
Turbidity	D	D	D		D	W/M*
Colour					D	
Free Chlorine				D	D	W/M*
Total Chlorine				D	D	M
E. coli	Q**					W - Longreach Monthly – other schemes
THMs/HAAs/Chlorates						3M
Standard Water Analysis	6M					6M
Metals	6M					6M
Algae	Oct, Dec, Feb, April (Isisford & Ilfracombe)					
Pesticides/Herbicides	Event (Fish kill / specific spraying / known spill)					

*pH, Turbidity and free chlorine tested in field at same time as *E.coli* sample is taken
**In house *E.coli* provides QA that colilert working correctly. Samples also sent to QH 3 times per year for QA

The locations for testing are as follows (rotated, with one sample per week in Longreach, and at least one per month in the other communities – which either matches or exceeds the PHR requirements). As seen from the locations, the verification monitoring program is appropriate as it samples from the points representing the water delivered to consumers, and from mains that are most likely to indicate problems due to low turnover (e.g. racecourses and end of long mains).

Testing is routinely done in house for *E coli*, with periodic samples tested in duplicate between the internal and an external laboratory.

Longreach

- Cramsie/ Muttaburra road – extreme end of long water main
- Edkins Park – First Point after WTP
- DPI – end of new large water main
- Youth Club – existing point
- Wren Street – end of main
- Racecourse – Gull Street – end of main

Ilfracombe

- Church and Scour Road – First Point after WTP
- Oval – End Water Main
- Racecourse – End Water Main
- Leichardt Street and Murray Street

Isisford

- St Bee's/ St Helena Street – First Point after WTP
- Racecourse - end of main
- Golf Club - end of main
- Park – General Community Area

Yaraka

- School – End of main
- Hall – End of Main
- Residence beside WTP – closest connection.
- LRC Depot Jarley Street – End of Main

6.3.1 Review of Results

External results from the laboratory are sent to the LRC group comprising of water treatment operators, Water & Sewerage Supervisor and the works administrative team. It is the responsibility of the operators, supervisor and manager to review the data (and in Longreach enter into SWIM Local). For the other schemes, the works administrative team then ensure that the electronic results are saved, and imported into SWIM Local.

6.3.2 Response to Exceedance

If a value determined in operational or verification monitoring is above the ADWG health guideline value, then an incident is raised as per the emergency response plan on the following pages. Operators are trained in the corrective actions required in the event of CCP or OCP exceedance. In addition, LRC has identified and implemented an improvement action to undertake a formal

quarterly review of water quality and RMIP action status, to help build capacity across the operator and water quality team.

7 EMERGENCY RESPONSE PLAN

Longreach Regional Council uses a 3-stage emergency response process.

7.1.1 Low

As indicated previously, operators are responsible for implementing the normal preventive measures at the water treatment plants. For example, when a CCP action limit is reached, the operator intervenes to ensure that the treatment plant is brought back into control.

This operator intervention to an operational exceedance is the lowest level of the incident response.

7.1.2 Medium

Medium Incidents are any occurrence where there is a potential for an adverse public health impact. All detections of parameters above ADWG health guideline levels are Medium incidents. In some, but not all cases, CCP critical limit exceedances may also trigger this level. For example, if high levels of chlorine are detected (above the health guideline) the CCP exceedance is also a medium incident.

These issues are identified through either operational or verification monitoring of the processes and water quality, or where there has been a significant widespread treatment or reticulation network failure resulting in the loss (or likely loss) of water supply for a period >6 hours.

When identified, these issues are immediately communicated to the Director of Infrastructure Services. Medium incidents are most likely to be managed by the Manager. Health advice may also be directly requested from the Public Health Unit.

Appropriate corrective actions will be identified and implemented as soon as practicable to minimise the effect of the incident.

7.1.3 High

Emergency or Declared Natural Disaster

This level emergency or disaster requires coordination across departments and may require external resourcing and support from agencies, such as Department of Emergency Services, Department of Health, Department of Primary Industries and emergency responders. Level 3 emergencies are dealt with at the CEO level.

In these cases the Council Business Continuity Plan, EMPLAN, or DISPLAN will be activated.

Incidents and emergencies are managed as per the tables below

Table 22 Incident and Emergency Response Levels

Level	Description	Key management response(s)	Position(s) responsible
High: Emergency	• Confirmed outbreak of waterborne disease • Declared disaster or emergency by the Council or state/national government • All cyber security incidents *Requires coordination across Council, and is likely to require external resourcing and support from agencies, such as Water Supply Regulation, Queensland Health, local disaster management groups, emergency responders, QFRS, Police* *For cyber security incidents, the cyber security hotline (for the Queensland Government Chief Information Office (QGCIO)) is 07 3215 3951 or email to qgisvrt@chde.qld.gov.au.*	Activate emergency response plan / disaster management plan *Refer to summary of actions and procedures*	• CEO (advised by Director Infrastructure Services)
Medium: Incident	• non-compliance with water quality criteria (Detection of *E. coli* or exceed other ADWG Health guideline value) • Event (anything that has happened or is likely to happen, in relation to a drinking water service that may have an adverse effect on public health where the issue is not able to be managed under the DWQMP). • Loss (or likely loss) of supply for > 6 hours (includes where this occurs due to a loss of computer control systems for Isisford/ Longreach WTPs) *In some cases, it may require coordination across the different Council departments and external resources and support, such as from RDMW, Queensland Health.*	Activate drinking water incident response and reporting protocols. **1300 596 709** Ensure all control measures identified in the DWQMP are functioning effectively. *Refer to summary of actions and procedures*	• Director Infrastructure Services • Water & Sewerage Supervisor
Low: Operational exceedance	• Exceedances of operational limits *Managed by Operators or Treatment Supervisor.*	Ensure all operational actions identified in the CCPs and OCPs in the DWQMP are functioning effectively. Implement relevant procedures. *Refer to summary of actions and procedures*	Water & Sewerage Supervisor

Table 23 Incident and Emergency Response summary of actions

Alert Level	Key management response(s)	Brief summary of actions	Documented Plans & Procedures
High: Emergency	Activate emergency response plan / disaster management plan	• Notify CEO • Coordinate notification, investigation and response of water related aspects • Consider what community notification / messaging is needed (e.g. do not drink alert, boil water alert or bottled/emergency water distribution) • Coordinate community messaging, for e.g. boil water alert, do not drink alert as required • Notify RDMW as soon as practicable	Disaster management plan, including communications protocols, alert templates (boil water as applicable).
Medium: Incidents	Activate drinking water incident response and reporting protocols. Ensure all control measures identified in the DWQMP are functioning effectively.	• Supervisor to notify Director Infrastructure Services • Notify Water & Sewerage Supervisor • Report incident to RDMW within the required timeframe (3 hours) **1300 596 709** • Contact PHU if health advice required • Ensure all control measures identified in the CCPs are functioning effectively. • Commence investigation to determine cause • Arrange for re-samples to be taken • Instigate immediate remediation actions, including isolation of affected area where possible • Review associated laboratory reports and operational records. • In case of customer complaints, coordinate investigation and resolution, including obtaining water samples as and where required • Ensure emergency response plan / disaster management plan is on standby if the need arises.	Incident response and reporting protocols. DEWS Water Quality and Reporting Guideline. Community messaging may be required (e.g. Boil Water Alerts)
Low: Operational exceedance	Ensure all control measures identified in the CCPs are functioning effectively. Check and act upon operations and maintenance records and procedures.	• Notify Water & Sewerage Supervisor • Check CCPs are implemented effectively • Review operations and maintenance records for anomalies • Instigate immediate remediation actions • Ensure all control measures identified in the DWQMP are functioning effectively.	Operations and maintenance procedures.

7.2 Incident communications

For water quality incidents at the Low level, it will typically be the Water and Sewerage Supervisor who responsible for the reporting the incident upwards internally. For Incidents and Emergencies, the Director of Infrastructure Services would normally be the lead communicator, including reporting incidents to the Regulator as required.

Council management are informed as required. Other Council staff will be engaged at the appropriate level (for example for communicating incident response actions for public notification as required).

7.2.1 Emergency Contact Lists

Emergency contact lists have been developed for each scheme. The documents are live documents that are updated as necessary.

- Water Reporting Incident Contact List_Longreach MagiQ Doc ID 255290
- Water Reporting Incident Contact List_Isisford MagiQ Doc ID 255933
- Water Reporting Incident Contact List_Ilfracombe MagiQ Doc ID 201200

Yaraka is a sufficiently small community that every resident can be door knocked to pass on emergency notifications.

7.2.2 Boil Water Alert Template.

A boil water alert template is provided on the following page.

7.3 Incident training

Training for water quality incidents has not been routinely implemented in the past. LRC are committed to implementing an annual incident response training exercise for water quality incidents into the future.

Longreach Regional Council
Ilfracombe Isisford Longreach Yaraka

Address all correspondence to:
Chief Executive Officer
PO Box 144, Ilfracombe QLD 4727
Tel: (07) 4658 4111 | **Fax:** (07) 4658 4116
Email: assist@longreach.qld.gov.au
ABN: 16 834 804 112

INSERT TOWN Boiled Water Alert

For immediate release – DATE

Detection of *E. coli* bacteria means that drinking water in TOWN is unsafe.

E. coli in drinking water shows that the water may be contaminated with faeces and organisms that may cause gastrointestinal illness.

Water used for drinking or food preparation should be brought to a rolling boil to make it safe. Kettles with automatic shut off switches can do this. Water should then be allowed to cool and stored in a clean container with a lid and refrigerated.

Bottled water or cool boiled water should be used for drinking, washing uncooked food (e.g. salad vegetables and fruit), making ice, cleaning teeth and gargling.

Dishes should be washed in hot soapy water or in a dishwasher. Children should take bottled water or cool boiled water to school.

This advice should be followed until further notice.

Longreach Regional Council is working to fix the problem.

Ian Bodill

Chief Executive Officer

8 DOCUMENTATION AND REPORTING

All employees receive on-the-job training to ensure that they understand operating procedures, document management and record keeping requirements. This includes training to ensure implementation of CCP and OCP corrective actions.

8.1.1 Operational documentation

Each water treatment plant has written daily log sheets that are subsequently entered into SWIM Local. This is supported by WTP diaries where key issues are noted.

The table below lists the procedures which support drinking water operations.

Table 24 LRC WTP's - List of Procedures

Doc #	Procedure Name	Implementation Date	Responsible Person/Department
308280	Manifest for Hazardous Chemicals	01/11/2019	Safety
113576	Excavating & Trenching	30/06/2020	Safety
113577	Using Hazardous Chemicals	25/08/2020	Safety
113909	Water Repairs	30/04/2016 (under review)	Water & Sewerage Supervisor
113911	Water Mains & Water Services	30/04/2016 (under review)	Water & Sewerage Supervisor
113752	Chlorine Pump Maintenance	30/04/2019 (under review)	Water & Sewerage Supervisor
113757	Confined Space Safety	30/04/2019 (under review)	Water & Sewerage Supervisor
TBC	Jar Testing Procedure	Under review	Water & Sewerage Supervisor
113797	Generator Operating Procedure	30/04/2016 (under review)	Water & Sewerage Supervisor
TBC	Reservoir Inspection Procedure	In progress	Water & Sewerage Supervisor
TBC	Mains Flushing Procedure	In progress	Water & Sewerage Supervisor
TBC	Water Storage Facility Inspections (dams, fencing, animal exclusion etc.) Procedure	In progress	Water & Sewerage Supervisor
126345	Water Restrictions	Implemented 10/12/2015 due for review 30/09/2022	Outlined in Drought Management Plan

8.1.2 Verification monitoring data

Verification monitoring results are sent to the WTP operators, supervisor and Manager as well as the Engineering administrative staff. These are also entered into SWIM Local.

Internal *E. coli* results are similarly entered into SWIM Local.

Other information that is retained by council includes details of customer complaints, and all incident reporting communications.

Emails and files are saved in Councils record keeping system InfoXpert, according to council's record retention requirements. This is a Record keeping system and the search functionality is hard to navigate. As a result most staff retain key documents on their desktops. While this poses a risk that outdated documents are used, we are a small council, so verbal communication of changes to documents and replacement by individuals is normally effective.

8.2 Reporting

8.2.1 Internal Reports

The Director of Infrastructure Services provides routine (normally monthly) reports to Council detailing water related issues.

8.2.2 External Reports

Annual Reports are produced and published annually. These reports are submitted to the Regulator and published on Councils website as required under the Act.

9 REVIEW AND CONTINUAL IMPROVEMENT

9.1 Risk management improvement plan

The Risk Management Improvement Program (RMIP) is the responsibility of the Director Infrastructure Services. The RMIP is linked directly to identified risks and has been consolidated into SMART actions in Table 25, from the final three columns of the mitigated risk registers.

Further details on prioritisation of risks improvement items can be found in section 4.1.6.

High priority actions are those that are intended to be implemented within 12 months of this review (depending on the timing of the DWQMP approval, and the linkage to council budget cycles).

Medium priority actions are those that the Director Infrastructure Services intends to include in the next budget cycle, but are likely to be implemented as a staged approach (depending on what Council approves in the budget). While the intent is to propose these items in the next budget, some may not be approved, and they will then be proposed again the following year.

Low priority actions are likely to be implemented beyond a 3-year timeframe. This reflects the operational realities for a small council with limited budget. Nonetheless, these items have been identified and documented so that Council can maintain a focus on these items.

It is intended that, over review cycles of the DWQMP, that as these items are implemented, that the mitigated risk can be reduced to Medium or Low.

Table 25 Risk Management Improvement Plan

Action ID	Action	Schemes	Priority	Timeframe	Responsibility	Rational/Comments
1	Undertake HBT assessment and need for further treatment (eg UV) include supernatant in assessment criteria	All	High	Sep-22	Roger Naidoo	Health Based Target assessment will establish the catchment category for each system and provide justification and a path forward for any necessary additional treatment barriers (eg UV)
2	Implement additional treatment as per HBT assessment (eg UV)	All	Medium	Dec-23	Roger Naidoo	HBTs are expected to become part of the Qld guidelines for development of DWQMPs. This will ensure that LRC meets the HBT criteria for treatment barriers.
3	Masterplan for full amenities at camping area near Thompson River	Longreach	Low	TBA	LRC	LRC is master planning for upgrades to camping area and a new caravan park. Full septic /sewage treatment will be implemented. There is currently a septic trench at camping ground downstream from inlet pumps which can be inundated during events and potentially flow back to the inlet pumps
4	Review Drought Management Plan	All	Medium	Sep-22	Roger Naidoo	DMP last reviewed in 2015. New guidelines for DMP 2021. Review required every 10 yrs or if DMP triggered (which ever is sooner)
5	Undertake condition assessment on inlet pumps.	Longreach	Medium	Jan-23	Roger Naidoo	The inlet pumps are estimated at 15 years old. Current condition is unknown and there is no maintenance schedule on these pumps (as per assumed design of pumps). Failure of both pumps will lead to failure of supply
6	Develop contingency plan for pump failure as replacement will take long lead time, and operating one pump only could lead to second failure	Longreach	Medium	Jan-24	Roger Naidoo	The inlet pumps are estimated at 15 years old. Current condition is unknown and there is no maintenance schedule on these pumps (as per assumed design of pumps). Failure of both pumps will lead to failure of supply
7	Prepare SCADA /telemetry & online monitoring specification through RAPAD group	All	High	Jun-22	Roger Naidoo	For all schemes (except Longreach) all critical processes and monitoring is manual, therefore detections of failure of an OCP or CCP or process relies on operators been available. SCADA will allow operators to see systems remotely and receive alarms when processes are deviating from targets. It will also enable auto shutdown of processes/plant in case of failure.
8	Assess need to upgrade clarifier to meet OCP limits	Longreach	Medium	Jan-23	Roger Naidoo	Longreach clarifier routinely does not meet the OCP targets. This assessment will identify costs/ feasibility of upgrading this process to meet OCP limits. Note that the filters are effectively meeting CCP targets
9	Implementation of SCADA upgrades, including accessing funding	All	Medium	Jun-25	Roger Naidoo	For all schemes (except Longreach) all critical processes and monitoring is manual, therefore detections of failure of an OCP or CCP or process relies on operators been available. SCADA will allow operators to see systems remotely and receive alarms when processes are deviating from targets. It will also enable auto shutdown of processes/plant in case of failure.
10	Implement upgrades if appropriate as per outcomes of clarifier assessment	Longreach	Low	Jun-27	Roger Naidoo	Longreach clarifier routinely does not meet the OCP targets. This assessment will identify costs/ feasibility of upgrading this process to meet OCP limits. Note that the filters are effectively meeting CCP targets
11	Incorporate reservoir security/vermin inspections into routine operational Safety Hazard inspections	All	Medium	Aug-22	Roger Naidoo	Operators do routinely inspect reservoir sites. This action will formalise the checks and allow for documentation of the findings and any actions required.

Action ID	Action	Schemes	Priority	Timeframe	Responsibility	Rational/Comments
12	Implement chlorine monitoring from the water tower to determine if there is loss of FCR in the tower	Longreach	High (has been on action list for some time)	Jul-22	Roger Naidoo	There is concern that the water does not turn over effectively in the water tower leading to loss of FCR. Monitoring required to determine if this is an issue.
13	Develop documentation (SOP) for routine flushing program	All	Medium	Jan-23	Roger Naidoo	Routine flushing ios undertaken in the schemes however not documented. This will documents the triggers for flushing and how to do it.
14	Develop BGA manual/SOP and PAC dosing decision flowchart	Ilfracombe	High (has been on action list for some time)	Dec-22	Roger Naidoo	PAC dosing is currently triggered by taste & odour events for 3 months of year based on operator knowledge. An SOP/manual will document this decision process and capture operator knowledge in the document management system.
15	Review current operational monitoring and implement a formal quarterly review of water quality data with key stakeholders	All	High	July-22	Roger Naidoo	Until SCADA project is implemented this helps alleviate risks associated with manual process monitoring, develop transparency and build team capacity to interpret and respond to emerging WQ. To be budgeted in FY 22/23
16	Determine flow rate and validate chlorine contact time to determine minimum critical limit	Ilfracombe, Isisford,	High	Jul-22	Roger Naidoo	The CT for these systems is difficult to calculate. Under normal operating circumstances, 1 mg/L maintains adequate CT until the CWT level drops to 40% assuming a baffle factor of 0.3. As this would potentially occur in a firefighting scenario, in which case continuity of supply is critical, it is not appropriate to shut down the WTP. Understanding Ct is necessary to develop appropriate responses if this happens.
17	Develop SOP for fire flows, incorporating any chlorine Ct actions	Ilfracombe, Isisford,	Medium	Sep-22	Roger Naidoo	The CT for these systems is difficult to calculate. Under normal operating circumstances, 1 mg/L maintains adequate CT until the CWT level drops to 40% assuming a baffle factor of 0.3. As this would potentially occur in a firefighting scenario, in which case continuity of supply is critical, it is not appropriate to shut down the WTP. In this scenario, the Manager will need to decide when to call the PHU. This SOP will provide the necessary guidance for appropriate responses if this happens.
18	Undertake asset criticality assessment to ensure all critical assets and spares are identified and documented (Qld Water Directorate have a tool available for WSP)	All	High	TBA	Roger Naidoo	LRC have critical spares available however this has not been formally assessed and documented therefore there is a risk that some critical assets/process have been missed.
19	Ensure AMS captures water critical spares in development of the AMS	All	Medium	TBA	Roger Naidoo	Development of a AMS is best practice and for this reason LRC have employed and Asset Manager to develop AMS.
20	Complete fencing of offline storage	Isisford	High	Jun-22	Roger Naidoo	To stop livestock from entering offline storage area and prevent unauthorised access to the area, minimising additional contamination of the raw water.

Action ID	Action	Schemes	Priority	Timeframe	Responsibility	Rational/Comments
21	Upgrade/refurbishment of clarifiers	Isisford	High	Jun-22	Roger Naidoo	Clarifiers don't currently meet OCP limits, meaning filters can become overloaded more easily, which leads to Boil Water Alerts in Isisford. Upgrade to clarifiers will help to alleviate filter overload and assist in removal of the periodic BWAs.
22	Supplier to review pressure filter operation to provide advice on if it able to meet CCP	Isisford	High	Jun-22	Roger Naidoo	Contractor to review pressure filter operation. Plant was commissioned and manuals received, however still experiencing issues.
23	Implement THM and HAA testing every quarter with Longreach sampling. Implement chlorate testing all schemes	All	High (has been on action list for some time)	Mar-22	Roger Naidoo	THMs & HAAs currently monitored in Longreach only, with some potential for formation (close to but not above ADWG limits). Potential for formation of DBPs is not understood for other schemes. The risk of chlorates is not well understood. This quarterly regime will address this gap for future risk assessments.
24	Implement mains replacement program	Isisford	High	Dec-22	Roger Naidoo	To remove dead ends and potential for stagnation of water
25	Assess removal of raw water system once mains replacement is complete	Isisford	Medium	Jun-25	Roger Naidoo	The raw water system runs parallel to the DW system in places and there is the potential for unauthorised or accidental connection to the system.
26	Implement chlorine testing at outskirts/dead ends in Yaraka and establish flushing regime if necessary	Yaraka	High	Mar-22	Roger Naidoo	Yaraka has a very small population (16), low flows and straight main. There is potential for dead ends and stagnant water. Monitoring chlorine at dead ends will help identify if this is an issue
27	Assess opportunities to eliminate dead end mains if needed	Yaraka	Medium	Jan-24	Roger Naidoo	If the Chlorine monitoring at dead ends identifies low chlorines then an assessment should be undertaken to identify is elimination of dead ends if feasible.
28	Succession planning for a new operator -as part of succession planning LRC will assess automation of plant. In interim back-up operators from other systems are available	Yaraka	Medium	Jan-25	Roger Naidoo	Yaraka is approximately 2.5 hrs away from Longreach. The current operator is very reliable however approaching retirement. A long-term approach to operation Yaraka should consider SCADA upgrades and plant automation, remote operation and operator availability
29	At least two operators to be trained in use & calibration of monitoring equipment for all systems	All	High	Dec-22	Roger Naidoo	Turbidity monitoring equipment is unserviceable at Isisford. Operators should be capable of operating, calibrating & trouble shooting monitoring equipment, including knowing when to call in specialist technician assistance.

10 TRAINING AND AWARENESS

All current operators either have Certificate III in Water and Wastewater, or are being trained to that level. It is intended that this training be maintained, such that any new staff will be trained to a suitable level over time. As such, a training needs analysis (TNA) and training matrix have been completed and ongoing training is managed through Human Resources processes.

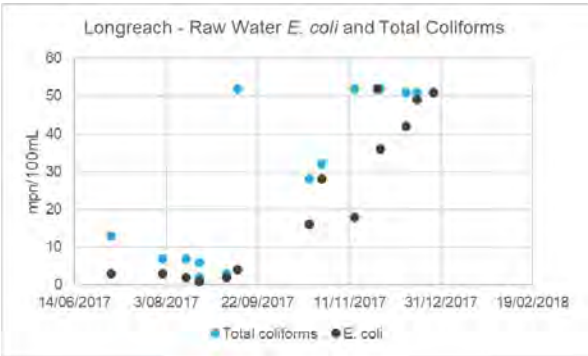
APPENDIX A
PREVIOUS WATER QUALITY ANALYSIS

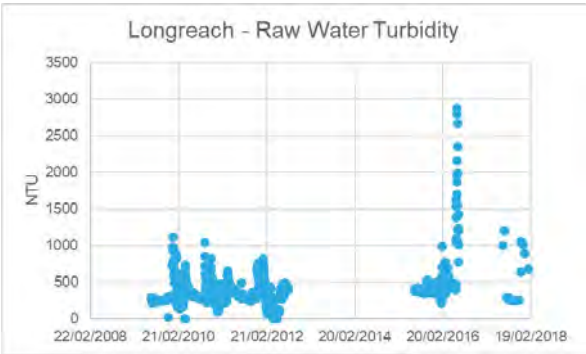
3 WATER QUALITY DATA

There have been numerous methods for capturing water quality data over the past 15 years. As such there are now some data gaps for some parameters. Nonetheless, it is valuable to include as much of the record as possible. The following graphs and tables provide raw, treatment and treated water quality for each of the schemes.

3.1 Longreach Water Quality

Figure 10 Longreach Raw Water Graphs





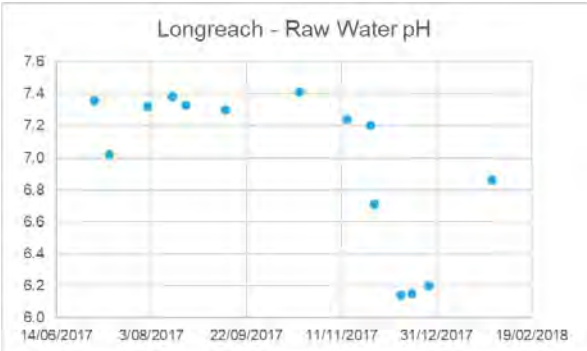
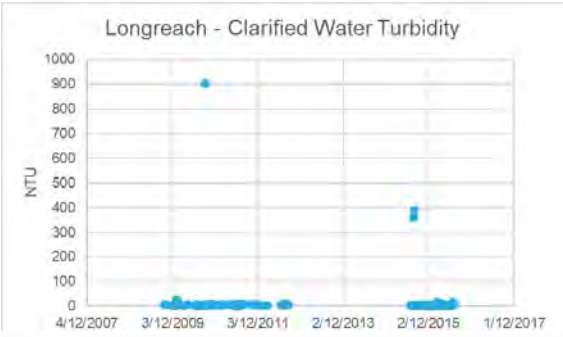
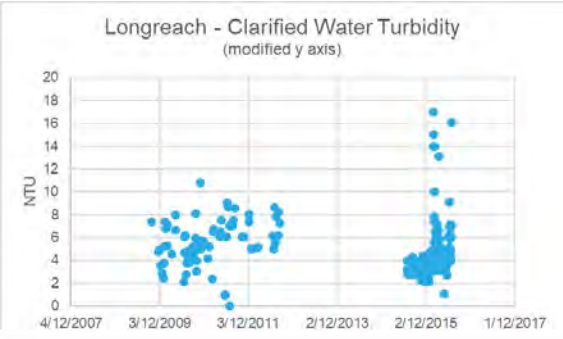


Figure 11 Longreach Treated Water Graphs





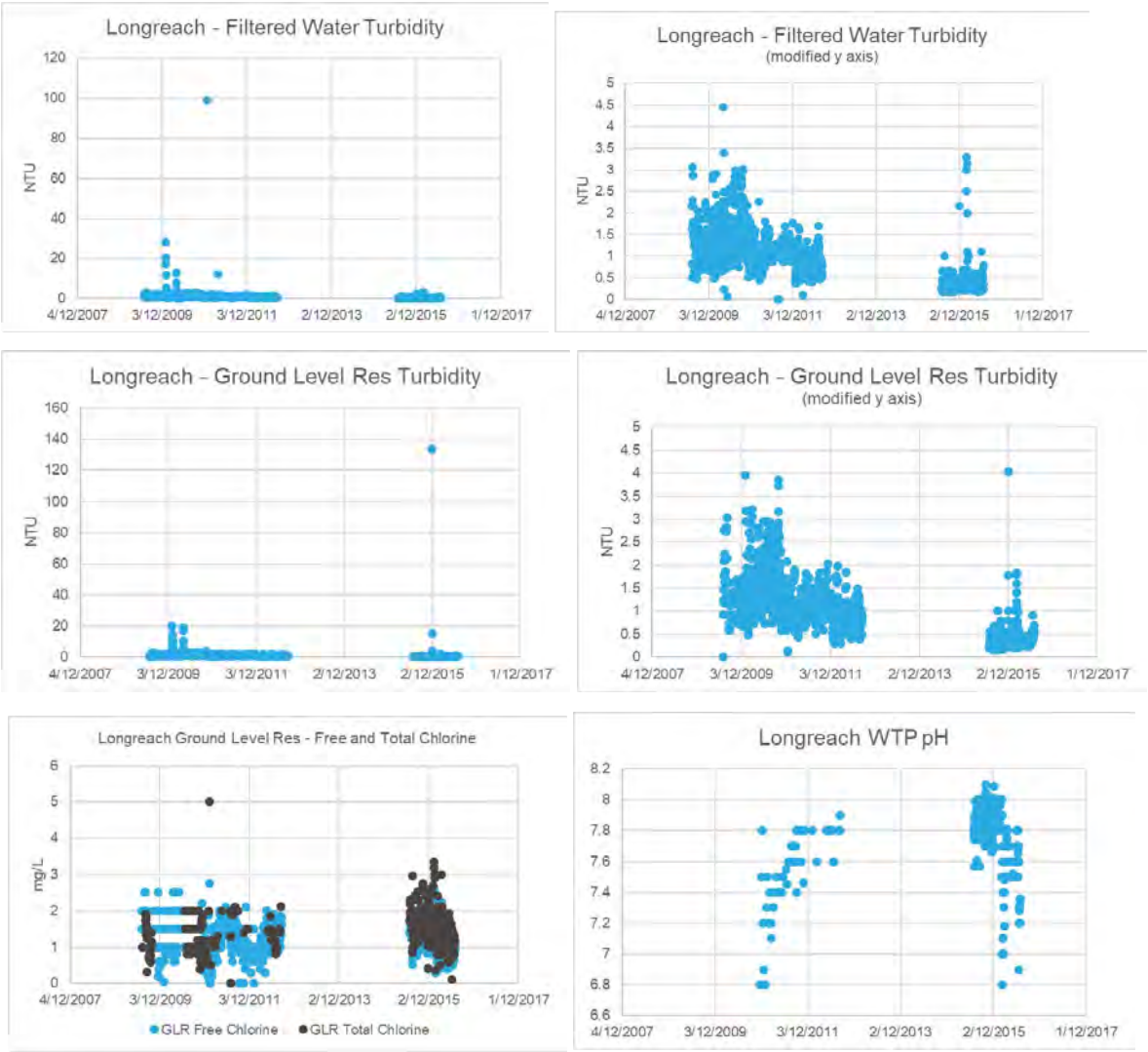
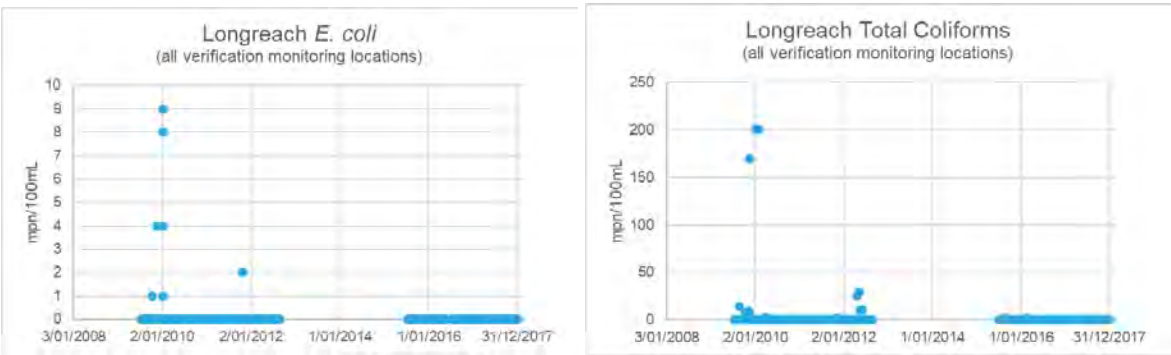
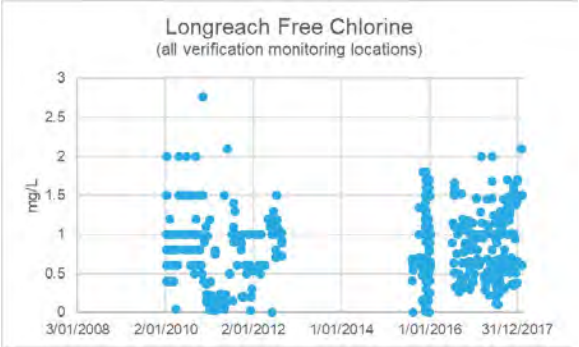
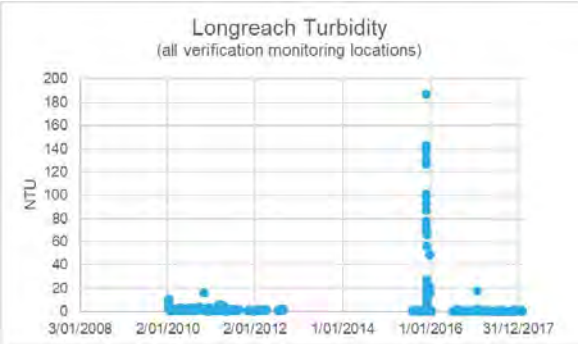
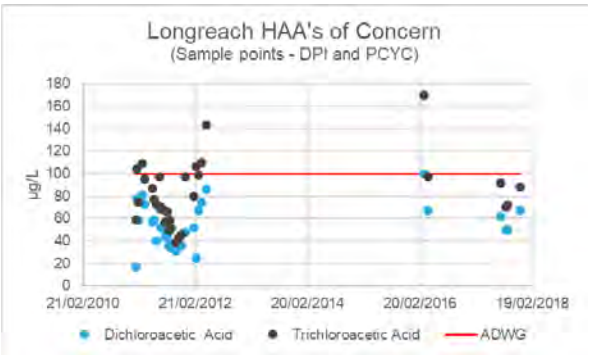


Figure 12 Longreach Reticulation Water Quality Graphs









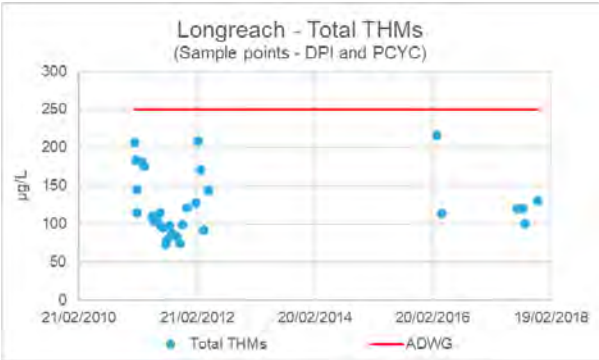


Table 6 Longreach Verification monitoring data (2009-2018)

	Coliforms (mpn/100mL)	*E. coli* (mpn/100mL)	pH	Free chlorine (mg/L)	Turbidity (NTU)
Count	608	612	202	507	465
Maximum	201	9	8.01	2.77	187
Average	2.14	0.05	7.44	0.83	5.27
Minimum	0	0	6.5	0	0
Count if	#>0 = 20	#>0 = 7		#<0.2 = 54	#>5 = 42
Count if					#>1 = 194

There have been 8 reported incidents since 2011 in Longreach. These are detailed in the table overleaf.

Longreach RC has periodically tested for pesticides. In 2012 no traces were detected, while in 2018, trace tebuthiuron was detected. Queensland Health has confirmed the result was well below any threshold of concern.

Table 7 Incidents reported for the Longreach Scheme

Date	Parameter	Cause
22/02/2011	Trichloroacetic Acid	Routine Testing for THA & HAA in Water.
27/10/2011	Detection of E-Coli	Checked Records - Took more tests (both In-House & QLD Health). Test results came back clean.
24/09/2012	Raw Water pumped into Town Water Reticulation System.	Plant Fault due to a filter valve issue. The Raw Water pumps were switched to manual but not flowing at the correct flow rate.
21/06/2013	Detection of E-Coli	After Various Testing (In-House & QLD Health) Identified labelling error in samples.
12/12/2014	Detection of E-Coli	Contamination of Samples. Re-Training of Staff to be undertaken.
25/12/2014	High Turbidity	Dosing Pump burnt out (Mechanical Fault)
28/11/2015	Partially Treated Water pumped into Town Water Reticulation System.	WTP Fault - Dosing line for the coagulant was switched off. further investigations confirmed that the online turbidity meter did not shut the plant down nor did it raise an alarm.
25/01/2017	High Turbidity	Online Turbidity Meter shut WTP Down. A Run in the river has resulted in higher than expected turbidity. Dosing has been adjusted to correct issue.

3.2 Ilfracombe Water Quality

Figure 13 Ilfracombe Raw Water Graphs

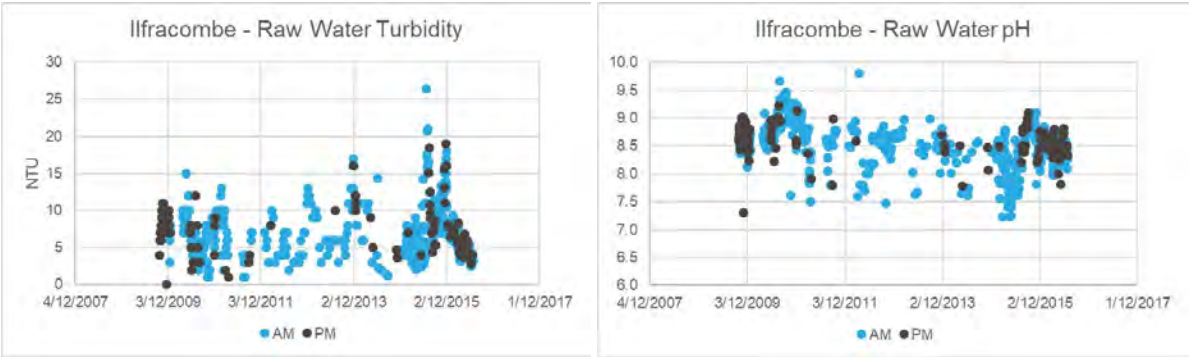


Figure 14 Ilfracombe Treated Water Quality Graphs

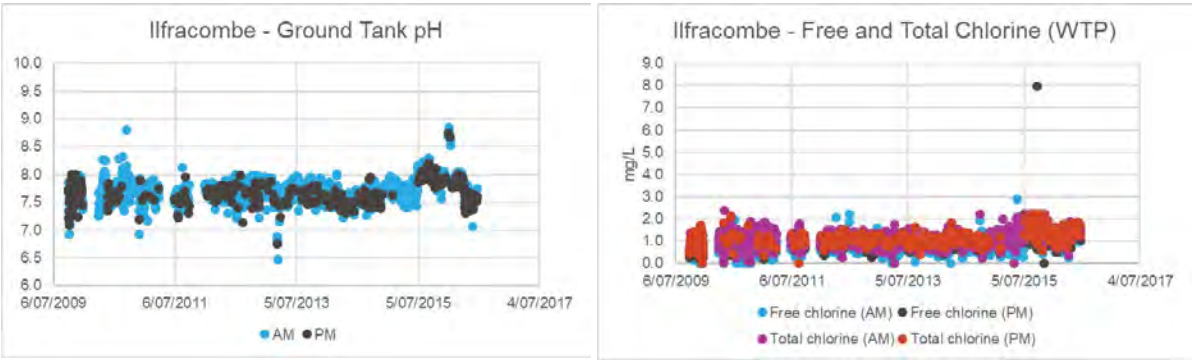


Figure 15 Ilfracombe Reticulation Water Quality Graphs

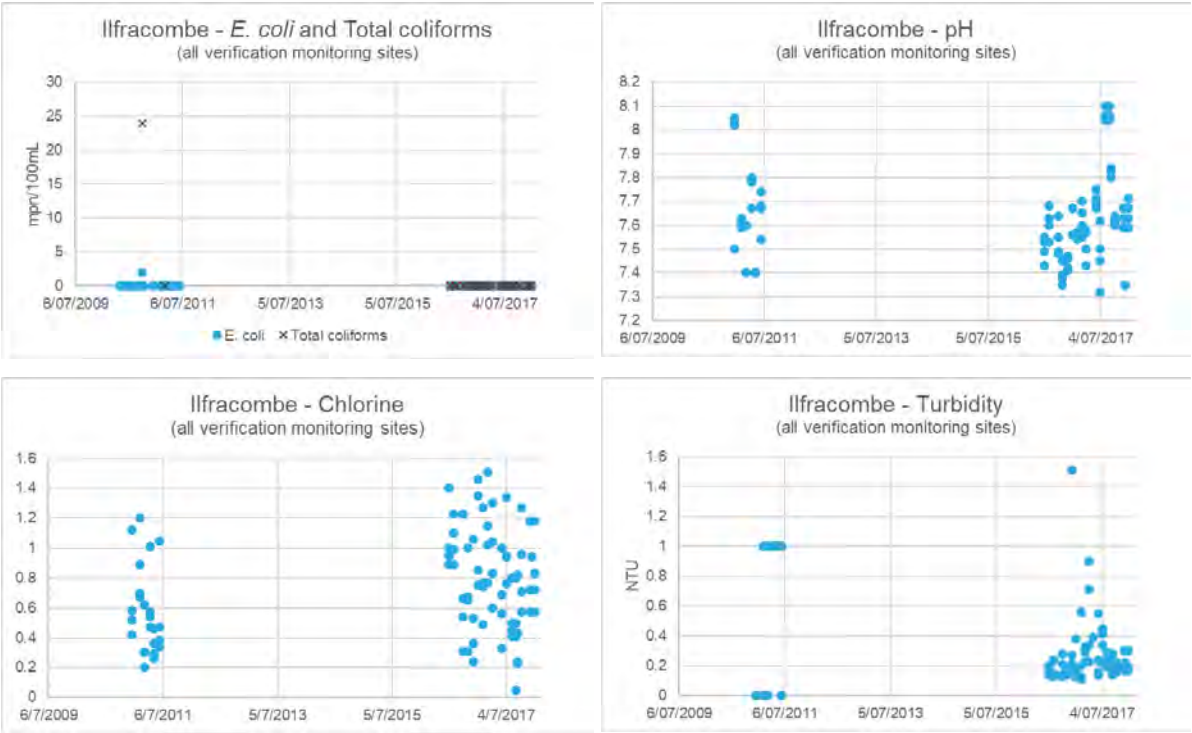


Table 8 Ilfracombe Verification monitoring data (2009-2018)

	Coliforms (mpn/100mL)	*E. coli* (mpn/100mL)	pH	Free chlorine (mg/L)	Turbidity (NTU)
Count	71	129	93	93	94
Maximum	24	2	8.10	1.51	1.51
Average	0.34	0.02	7.63	0.74	0.35
Minimum	0	0	7.32	0.05	0.00
Count if	#>1 = 2	#>1 = 2		#<0.2 = 1	#>1 = 2

There is typically good penetration of chlorine into the reticulation site. The turbidity at Ilfracombe WTP is typically < 1 NTU, as reflected in the reticulation turbidity graphs, but the turbidity is measured by grab sample, not continuously online. While the turbidity is generally low enough to confirm effective disinfection (as also shown by infrequent detections of *E coli*), there are concerns that protozoan pathogens, if present, may not be removed.

However, as the water supply is off-stream, and there is limited access to the dams by people or cattle, the protozoan risk, is significantly lower than Longreach or Isisford.

Table 9 Incidents reported for Ilfracombe

Date	Parameter	Cause
8/10/2010	Detection of *E-Coli*	*E Coli* Result from Test Sample
8/03/2016	Detection of *E-Coli*	Mis-Labelling of Samples. Re-training of Staff to be undertaken.

3.3 Isisford Water Quality Data

Figure 16 Isisford Raw Water Quality Graphs

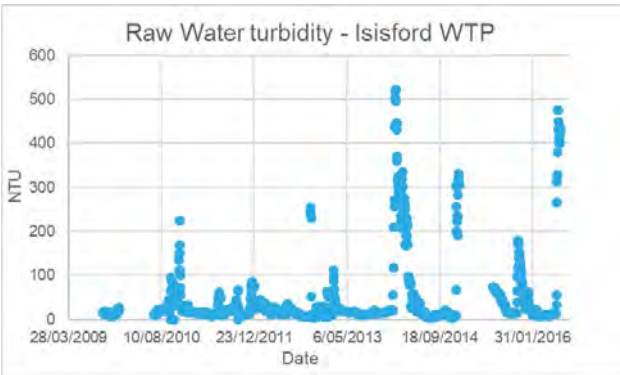
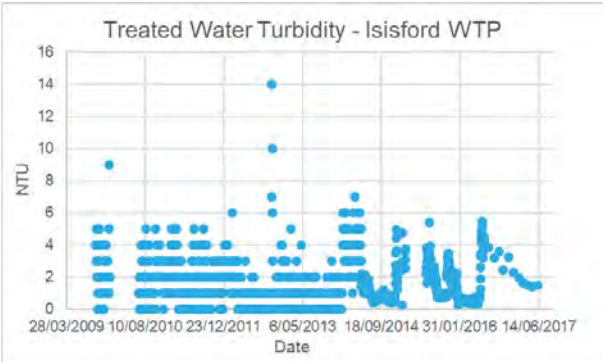
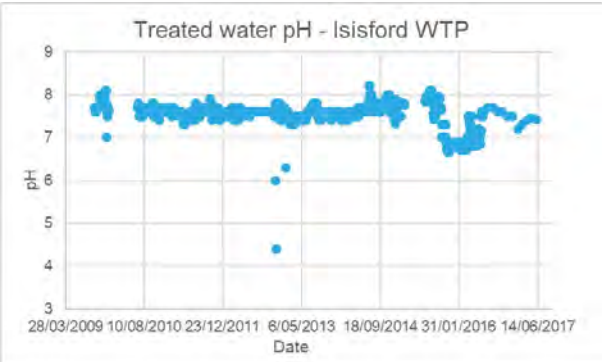


Figure 17 Isisford Treated Water Quality Graphs





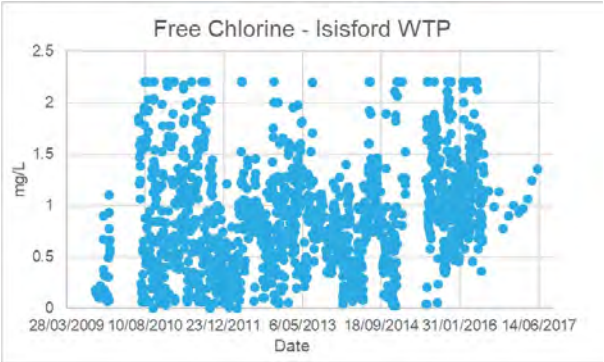
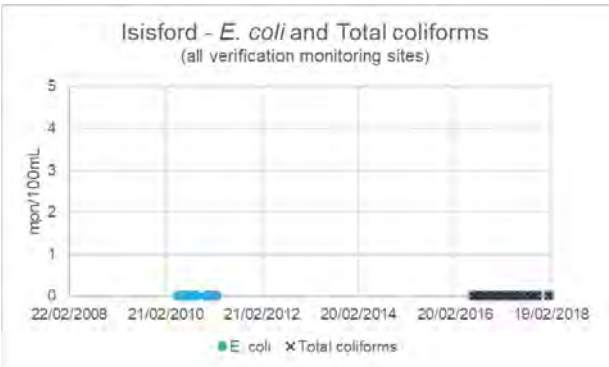
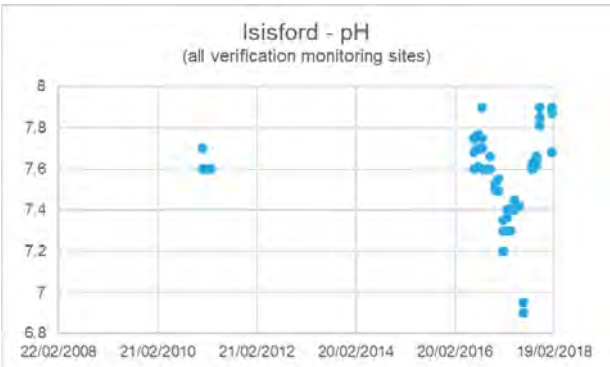
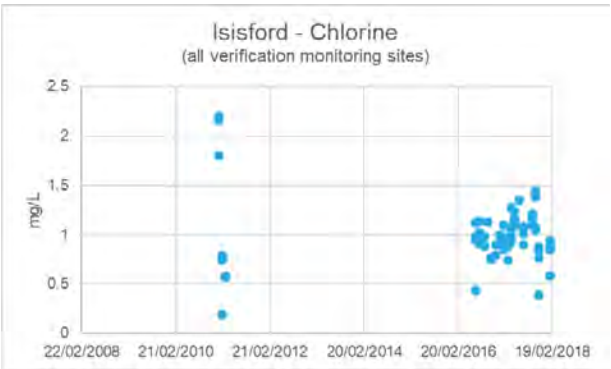


Figure 18 Isisford Reticulated Water Quality Graphs







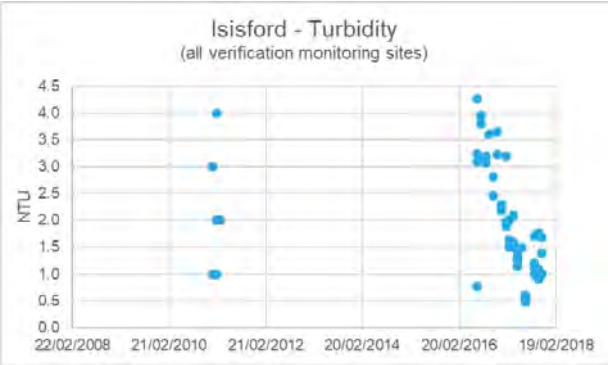


Table 10 Isisford Verification monitoring data (2009-2018)

	Coliforms (mpn/100mL)	*E. coli* (mpn/100mL)	pH	Free chlorine (mg/L)	Turbidity (NTU)
Count	69	111	66	65	61
Maximum	0	0	7.9	2.2	4.28
Average	0	0	7.54	1.01	2.02
Minimum	0	0	6.9	0.19	0.48
Count if	#>1 = 0	#>1 = 0		#<0.2 = 1	#>1 = 50

The Barcoo River can be highly turbid, and the water out of the Dam is often well settled. Regardless, the clarifier at Isisford struggles to achieve water quality of <5 NTU, and the old filtration plant (now replaced) did not effectively reduce turbidity.

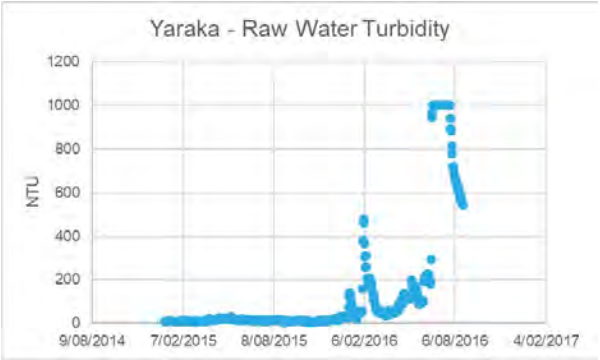
Council attempted to rectify this situation by the construction of the new water treatment plant. However, the new filtration plant is also unable to reduce the turbidity below 1 NTU. In discussion with Qld Health, it has been determined that unless the turbidity is sustained below 0.5 NTU that protozoan pathogens, which are considered likely to almost certain in the Barcoo River, will not be effectively removed.

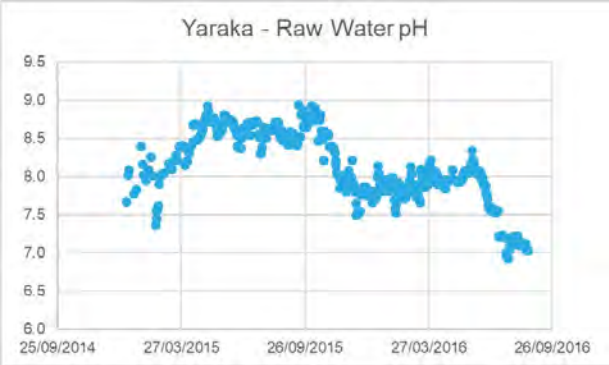
Table 11 List of incidents - Isisford

Date	Parameter	Cause
17/02/2009	Detection of *E-Coli* & Pathogen	Concerns from Operator regarding potential contamination of samples which arrived at Isisford & Sample jar not sealed. Sampled received by QLD Health > 18Hrs Old.
17/12/2009	Detection of *E-Coli* & Pathogen	Concerns from Operator regarding potential contamination of samples which arrived at Isisford & Sample jar not sealed. Sampled received by QLD Health > 18Hrs Old.
31/03/2013	Free Chlorine & Turbidity	Coagulant Pump not working properly causing partially treated water to be pumped through the Isisford Town Water Reticulation System.
31/03/2014	Event	WTP Fault - Internal Issue involving the appropriate training of staff.
5/09/2018	High Turbidity	WTP Failure - Mechanical Issue.

3.1 Yaraka Water Quality Data

Figure 19 Yaraka Raw Water Quality





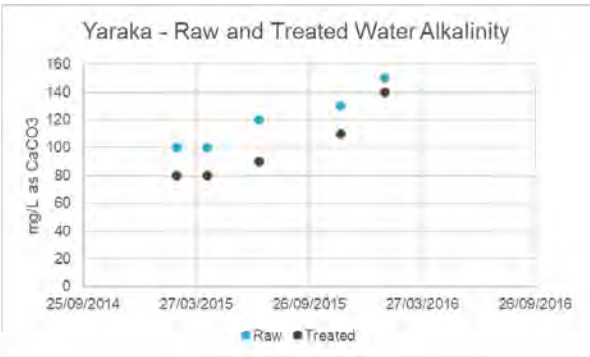
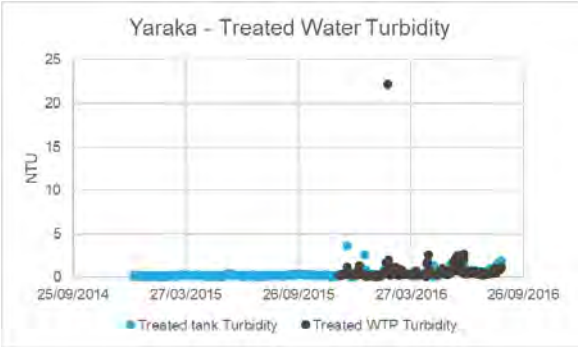
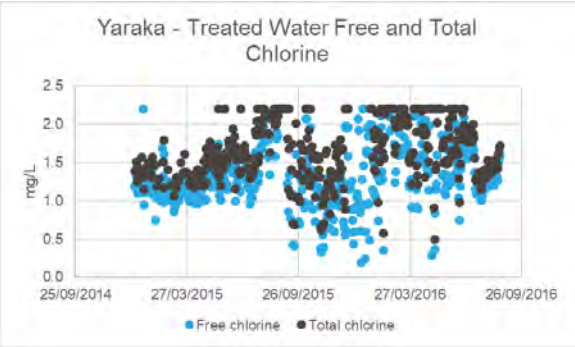
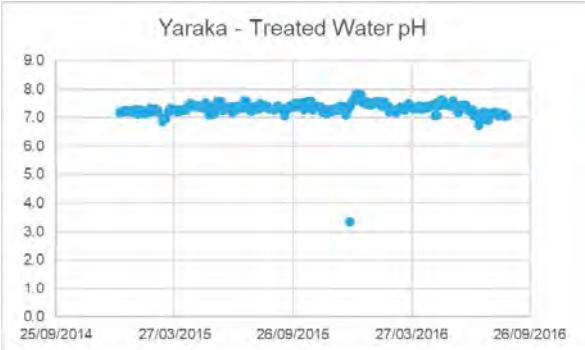


Figure 20 Yaraka Treated Water Quality







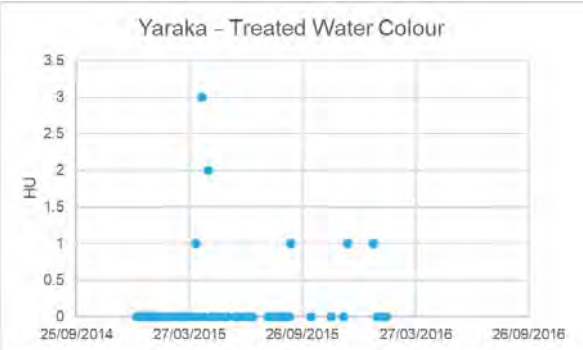


Figure 21 Yaraka Reticulated Water Quality

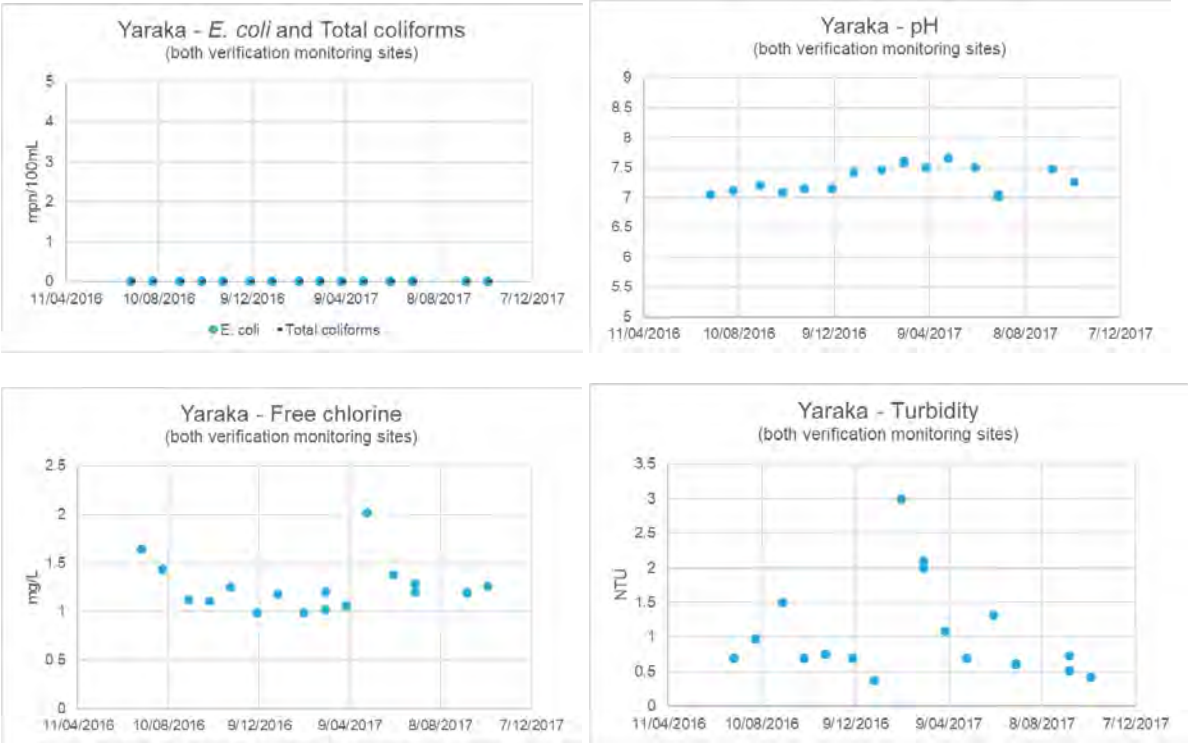


Table 12 Yaraka Verification monitoring data (2009-2018)

	Coliforms (mpn/100mL)	*E. coli* (mpn/100mL)	pH	Free chlorine (mg/L)	Turbidity (NTU)
Count			554	599	272
Maximum			7.84	2.20	22.23
Average			7.33	1.38	0.66
Minimum			3.35	0.20	0.10
Count if	#>1 =	#>1 =		#>1 0	#>5 = 1
Count if					#>1 = 29

3.1.1 Water Quality Incidents

There have been 19 water quality incidents reported to the regulator since the commencement of reporting. These highlight the treatment processes are not fully monitored, and this has at times resulted in poor quality water entering the reticulation networks. These are detailed in the tables above.

In 2015 the Longreach WTP the coagulant dosing line was turned off, and partially treated water released into the network. This resulted in a Boil Water Alert. A similar incident occurred in 2017 due to a dosing pump failure.

However, there have been few confirmed *E. coli* detections – for example, in Ilfracombe, there was a positive laboratory sample (*E coli* detected with no free chlorine), where the in house sample had 1.42 mg/L chlorine and no detectable *E. coli*). This is considered by council to have been a case of mislabelling the laboratory sample. A similar incident occurred in 2016. Operators have been retrained in sample collection.

Disinfection by-products have been detected in the Longreach supply, with trichloroacetic acid the main DBP of concern. However, THMs are also elevated, and approach the guideline value.

While it is likely that disinfection by-products also occur in Isisford given the poor coagulation/ filtration process, council does not intend to commence testing until after the water treatment plant can produce water that is microbiologically safe as to do so will take the focus off the immediate acute public health risk.

Most recently, following the upgrade of the filtration at the Isisford WTP, there was a high turbidity spike that resulted in the need for a Boil Water Alert. As a result of the development of this plan, where it was clearly articulated that we believe that there is a protozoan risk, QH has requested that the BWA remain until we can consistently demonstrate <0.5 NTU at the WTP. At this stage, that has not been achieved.

Following this, Council has undertaken *Bacteroides* typing using PCR methods, and this confirms the human and bovine origins of the faecal sources in both the Barcoo and the Dam. That is to say, the uncertainty in our assessment of the protozoan risk has reduced, but the risk itself has not.

APPENDIX B
SAMPLING SCHEDULE

LRC WTP Plants – FWA / THM's / HAA's / Chlorates / Blue Green Algae

Date due by:	*FWA*	*THM/HAAs*	*Chlorates*	*Blue Green Algae*
21st Jan				✓ *(Ilf & Isis)*
21st Feb	✓			
21st March		✓	✓	✓ *(Ilf & Isis)*
21st June		✓	✓	
21st August	✓			
21st September				✓ *(Ilf & Isis)*
21st October		✓	✓	
21st November				✓ *(Ilf & Isis)*
21st December		✓	✓	

Tests to be sent to the Longreach WTP PRIOR to the 21st of month. (All tests will be sent from Longreach to Brisbane)

All Sites - FWA – on treated and raw water (2 x 1lt plastic QH bottles)

THM/HAAs – 2 selected test points from around town (2 x brown glass bottles with ammonium chloride to be provided per location).

Chlorates – 2 selected test points from around town (2 x 125ml HDPE plastic bottle with Ethylene Diamine 1mL to be provided per location).

Blue Green Algae – raw and treated samples collected from Ilfracombe & Isisford

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