CHARTERS TOWERS
REGIONAL COUNCIL

Drinking Water Service
Charters Towers Regional Council
SPID 479

Annual Report 2022/2023

Contents

Water Service Provider Details

Detail	Information
SPID	479
Name	Charters Towers Regional Council
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Water Service Areas covered by this plan	Charters Towers, Greenvale, Ravenswood, Pentland

Glossary of terms

ADWG 2011	Australian Drinking Water Guidelines (2011). Published by the National Health and Medical Research Council of Australia
Cfu/100mL	Colony forming units per 100 millilitres
CTRC	Charters Towers Regional Council
DWQMP	Drinking Water Quality Management Plan
E. coli	Escherichia coli, a bacterium which is considered to indicate the presence of faecal contamination and therefore potential health risk
mg/L	Milligrams per litre
NTU	Nephelometric Turbidity Units
MPN/100mL	Most probable number per 100 millilitres
RG	Ravenswood Gold
SCADA	Supervisory Control and Data Acquisition
WTP	Water Treatment Plant
WSP	Water Service Provider

1. Introduction

This is the Drinking Water Quality Management Plan (DWQMP) report for Charters Towers Regional Council (CTRC) for the financial year 2022/23.

CTRC is a registered service provider with identification (SPID) number 479, operating under an approved DWQMP to ensure consistent supply of safe quality drinking water in order to protect public health. This is done through proactive identification and minimisation of public health related risks associated with drinking water.

This DWQMP annual report includes:

- the activities undertaken over the financial year in operating our drinking water service
- drinking water quality summary
- summary of our performance in implementing our approved DWQMP

This report is submitted to the Regulator to fulfil our regulatory requirement and is also made available to our customers through our website or for inspection upon request at a Council office.

2. Summary of schemes operated

CTRC Regional Council has four Water Service Areas (WSA's), including Charters Towers, Greenvale, Ravenswood and Pentland.

Charters Towers WSA

Drinking water for Charters Towers is provided from surface water sourced from the Burdekin River via the Charters Towers Weir and pumped from the Phil Mathews pump station to the Charters Towers Water Treatment Plant (WTP). The WTP is a conventional plant utilising coagulation, flocculation, clarification, sedimentation, filtration and disinfection. The treated water is delivered to two reservoirs, each having a common inlet/outlet. Connected population is approximately 8,520 persons.

Greenvale WSA

Water is sourced from the Burdekin River from bed-sand spears. Four spears are currently installed, of which three are operational. There is the ability for water to be injected with chlorine for iron/manganese control before being pumped to storage where further chlorine injection is implemented for disinfection. Connected population is approximately 180 persons.

Ravenswood WSA

Water is sourced from the Burdekin River by Ravenswood Gold (RG). The water is pumped to a turkey nest dam and then to Suhrs Ck Dam. Water is then pumped to the mining operations with a portion (less than 10%) diverted to a Water Treatment Plant which supplies potable water to the town and the mining operations. Connected population is approximately 200 in the township plus a variable population in the accommodation camp and the mining administration.

Pentland WSA

Pentland is serviced by ground water from the Glen Houghton bore field which is a groundwater recharge system. Two bores pump water to a small tank for settlement where water is disinfected with chlorine before reticulation to the township via a reservoir. Connected population is approximately 200 persons.

Water Service Area	Water Source	Treatment Processes	Treatment Capacity	Towns Supplied
Charters Towers	Charters Towers Weir on the Burdekin River	Coagulation, flocculation, clarification, sedimentation, filtration and disinfection.	22ML/day	Charters Towers
Pentland	Ground water via Bore field	Settlement, disinfection	0.73ML/day	Pentland
Greenvale	Burdekin River via 4 spears	Disinfection	1ML/day	Greenvale
Ravenswood	Burdekin River via turkey nest dam	Coagulation, clarification, filtration, disinfection	0.5ML/day	Ravenswood

Table 1 - Sources and Treatment Capability

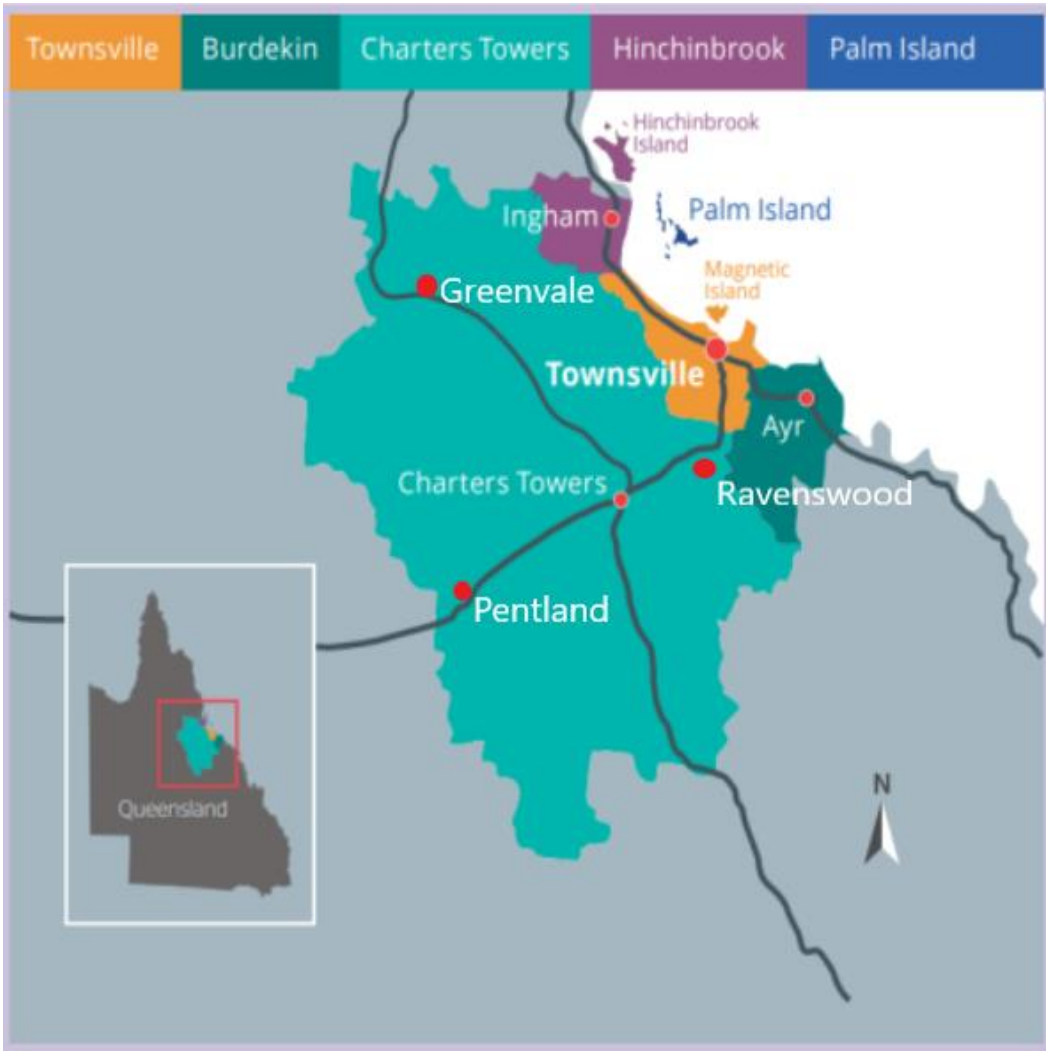

Figure 1: WSA Locations

3. DWQMP Implementation

The focus for management of water quality this year has been improving water sampling, compliance with the DWQMP and addressing the Risk Management Improvement Plan requirements. The Water Infrastructure Upgrade Program has continued with planning and design works for duplication of the 525mm AC trunk main and selection of a location for an intermediate reservoir to reduce the impact of surge pressures at the low end of the main. The DWQMP has been reviewed and the updated version was submitted to the Regulator and has been approved.

4. Verification monitoring – water quality information and summary

The results from the drinking water quality monitoring program conducted by CTRC have been compared against the Australian Drinking Water Guideline levels.

Testing for the presence of *Escherichia coli* is conducted at each of the four schemes within CTRC. Charters Towers has a population of 8,520 and therefore the required frequency is one sample per week plus one additional sample per month. Weekly Samples are collected at the reservoir and at a sampling location in the town. In addition, monthly samples are collected at three sites at the extremities of the network. In the 2022/23 financial year 154 samples were tested for E. coli, with an 'annual value' of 100.0% compliance on roll percentage.

Pentland, Greenvale, and Ravenswood all have populations less than 1000 persons, so the required minimum frequency is one sample per month for each of these schemes. In the 2022/23 financial year 36 samples from Greenvale, 24 samples from Pentland and 36 samples from Ravenswood were tested for the presence of E. coli. Greenvale, Pentland, and Ravenswood returned 'annual values' of 100%.

A summary of the key parameters for the CTRC Drinking Water Quality Verification testing program is shown in Table 2.

The compliance results for E. coli testing are shown in Tables 3-6.

A complete listing of verification results is provided in Appendix A.

Scheme name	Parameter	Number Required	Number tested	ADWG Water quality criteria	No. Non-compliant samples	Comments
Charters Towers	E. coli	152	154	0	0	
Charters Towers	pH	152	154	6.5-8.5 aesthetic	0	
Charters Towers	Free Chlorine	152	154	0.5<>5.0	0	
Charters Towers	Trihalomethanes	4	8	0.25 mg/L	0	
Charters Towers	Turbidity	12	36	5 NTU aesthetic	0	
Charters Towers	True Colour	12	12	15 HU aesthetic	0	
Greenvale	E. coli	36	36	0	0	
Greenvale	pH	36	36	6.5 – 8.5 aesthetic	0	
Greenvale	Free Chlorine	36	36	0 5<>5.0	1	>5.00mg/l 16/12/2023 over chlorination incident
Greenvale	Trihalomethanes	4	5	0.25 mg/L	5	Very high Chlorates due to Sodium Hypochlorite Disinfection.
Greenvale	Turbidity	36	36	5 NTU aesthetic	12	Ongoing turbidity issues “Boil Water” Alert in place
Greenvale	True Colour	12	12	15 HU aesthetic	0	
Pentland	E. coli	36	36	0	0	
Pentland	pH	36	36	6.5 – 8.5 aesthetic	0	
Pentland	Free Chlorine	36	38	< 5	1	
Pentland	Turbidity	12	12	5 NTU aesthetic	0	
Pentland	True Colour	12	12	15 HU aesthetic	0	
Ravenswood	E. coli	36	36	0	0	
Ravenswood	pH	36	36	6.5 – 8.5 aesthetic	0	
Ravenswood	Free Chlorine	36	36	< 5	0	
Ravenswood	Turbidity	36	36	<5 NTU aesthetic	0	
Ravenswood	Trihalomethanes	4	8	0.25 mg/L	0	
Ravenswood	True Colour	12	12	15 HU aesthetic	0	

Table 2 - Verification Summary

WSA	Charters Towers											
Year	2022 – 2023											
Month	**July**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**
No. of samples collected	12	15	13	11	14	12	12	12	11	12	14	11
No. of samples collected in which E. coli is detected (i.e. a failure)	0	0	0	0	0	0	0	0	0	0	0	0
No. of samples collected in previous 12 month period	150	153	154	153	155	154	158	154	151	151	150	149
No. of failures for previous 12 month period	0	0	0	0	0	0	0	0	0	0	1	0
% of samples that comply	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Compliance with 98% annual value	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**

Table 3 – Charters Towers E. coli Compliance

WSA	Greenvale											
Year	2022 – 2023											
Month	**July**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**
No. of samples collected	2	2	2	2	2	2	2	2	2	1	2	2
No. of samples collected in which E. coli is detected (i.e. a failure)	0	0	0	0	0	0	0	0	0	0	0	0
No. of samples collected in previous 12 month period	24	24	24	24	24	24	24	25	24	23	23	23
No. of failures for previous 12 month period	0	0	0	0	0	0	0	0	0	0	0	0
% of samples that comply	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Compliance with 98% annual value	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**

Table 4 - Greenvale E. coli Compliance

WSA	Pentland											
Year	2022 – 2023											
Month	**July**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**
No. of samples collected	4	3	2	3	3	3	3	3	3	3	3	3
No. of samples collected in which E. coli is detected (i.e. a failure)	0	0	0	0	0	0	0	0	0	0	0	0
No. of samples collected in previous 12-month period	37	37	36	36	36	36	36	36	36	36	36	36
No. of failures for previous 12-month period	0	0	0	0	0	0	0	0	0	0	0	0
% of samples that comply	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Compliance with 98% annual value	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**

Table 5 - Pentland E. coli Compliance

WSA	Ravenswood											
Year	2022 – 2023											
Month	**July**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**
No. of samples collected	2	2	3	3	3	3	3	3	3	3	1	3
No. of samples collected in which E. coli is detected (i.e. a failure)	0	0	0	0	0	0	0	0	0	0	0	0
No. of samples collected in previous 12 month period	38	37	37	37	37	37	37	37	34	34	32	32
No. of failures for previous 12 month period	0	0	0	0	0	0	0	0	0	0	0	0
% of samples that comply	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Compliance with 98% annual value	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**

Table 6 - Ravenswood E. coli Compliance

5. Incidents reported to the Regulator

For the reporting year 2022/23 the following incidents were notified to the Regulator under Section 102 or 102A of the Act for noncompliance issues that occurred:

DWI-7-479-00030 High Turbidity Event – Greenvale 20 Aug 2018 (Continuation of this event): The Greenvale water system draws raw water from the Burdekin River via bed-sand spears. A rain event caused the turbidity to rise above the 1 NTU threshold, which required an incident report to be raised and for the residents to be advised to boil any water which was to be consumed. The turbidity has remained at an elevated level for the entire reporting period. There is no easy resolution to this issue. The bed-sand spears have been cleaned out, the filter tank at the reservoir has been cleaned and the reservoir itself has been cleaned, however the water remains turbid.

DWI-479-22-09705 Microorganisms - **Charters Towers 2 August 2022:** A non-compliant sample (Registration No. 22-2251) for CTRC City Monthly at Josh Ck Rd was returned from the Townsville Lab as an Interim Result on 19/5/2022, referring to a sample collected on 17/5/2022. The completed result confirming the non-compliance (1 E.coli/100mL) was returned on 20/5/2022. Results of the follow up sample for Josh Ck were collected and returned a result of nil E.coli but 1 HPC (Registration No. 22-2345). As this result was compliant, no further action was taken.

DWI-479-22-09824 Greenvale Chlorates 28 September 2022: During the 2021-22 Financial Year the Regulator advised Council of the need to monitor the levels of Chlorates generated by degradation of Sodium Hypochlorite. Council use Sodium Hypochlorite at the Greenvale Reservoir. While no testing for Chlorates was carried out in the 2021-22 Financial Year, analysis was included for samples collected on 28 September 2022, and an exceedance was found. This was confirmed by follow-up testing. A Management Plan has been submitted to the Regulator, and Council is considering options to address the issue. It is likely that funding for this will have to be obtained under the 2023-24 Capital Works budget.

DWI-479-22-10012 – Greenvale 15 December 2022: Senior Operator received a notification of a Low Chlorine alarm for 0.0mg/L on remote telemetry testing unit. Initial investigation revealed that there was a failure on remote monitoring device at the reservoir and that the disinfection controller continued to dose. Disinfection unit has been taken off line for inspection, initial testing of reservoir water was >11.00mg/L. At 14:30hrs completed a reservoir drain down and refilled with non-chlorinated water to dilute and restore free chlorine to >5mg/L. This was achieved at @21:00hrs. Laboratory analysis dated 9 December 2022 also showed that chlorate level was 3.6mg/L. This is the third sample that has exceeded the Regulator's compliance limit. Advice has previously been provided to the Regulator on actions intended to address this issue.

Actions Taken:

1. Scada monitoring retest completed at 06:13am, test results was 3.1mg/L
2. Completed inspection and rectification service and calibration on Remote chlorine monitoring unit.
3. Retested reservoir water to confirm disinfectant reduction to below 5.0mg/L
4. Follow-up chlorine testing by NATA Lab to be completed on Monday 19/12/2022.
5. Public Notice issued on Social Media Thursday 15/12/2022 Re: Quality Incident

Field re-testing completed 16/12/2022 @ 11:30am
Chlorine Field Testing Results:
1. Pool Reticulation – 3.63 free 4.04 total
2. Reservoir – 2.5 free 3.6 total
3. Depot Reticulation – 4.19 free 5.00 total

DWI-479-22-10023 – Ravenswood 16 December 2022: Minor interruption to water production was investigated by Ravenswood Gold as soon as the operations team became aware of the issue. The root cause was determined to be a failure of the automated control valve on the raw water supply pipeline into the treatment plant, which prevented water from entering the treatment plant for a prolonged period.

A number of other contributing factors during the period were identified, including: a software update of the control (SCADA) system that resulted in communications failures, intermittent power outages associated with a combination of local lightning storms requiring unplanned electrical maintenance that caused internal disruptions to the SCADA system, breakdown of the alarm response and manual checking process, and a leak in the reticulation system that increased demand during the period. For note – the treatment plant has a dedicated back-up generator to run the plant manually. The SCADA system is powered through a separate system which also has generator back-up. Ravenswood Gold's information technology (IT), processing plant, maintenance and electrical staff, supported by an external service provider, troubleshooted and managed the various contributing factors over a number of days to rectify the issues, which were not isolated only to the water treatment plant.

In order to replenish the depleted potable water stocks and meet consumption demand, throughput was increased. Increased throughput requires adjustments to backwash and solids dumping frequency. It was during this adjustment process the multi-media filters' (MMFs) throughput rate diminished due to an increased load of suspended solids. With further operational adjustments as per operational procedures the MMFs performance was subsequently restored and treatment returned to steady state.

During the process of restoring stocks, demand cycled between 645 m^3/hr and 135 m^3/hr, but there were short term peaks in excess of 1500 m3/hr for periods up to 15 minutes. The lack of stocks meant that water supply was interrupted during peak demand times. Ravenswood also trucked in water potable water to alleviate demand. After approximately 5.5 days contingency stocks were fully replenished and supply interruptions ceased. Sampling results from the treatment plant and reticulation were provided showing no water quality issues. Production rates and potable water stocks have remained consistent since rectification of the matter.

6. Customer feedback

Month	*Suspected Illness*	*Dirty Water*	*Taste and odour*	*Supply*
Jul 2022	0	0	1	1
Aug 2022	0	2	0	1
Sep 2022	1	0	0	0
Oct 2022	0	0	0	2
Nov 2022	0	1	0	0
Dec 2022	0	3	0	0
Jan 2023	1	1	0	3
Feb 2023	0	1	0	1
Mar 2023	0	0	0	0
Apr 2023	0	0	0	3
May 2023	0	0	0	0
Jun 2023	0	0	0	0
Total	2	8	1	9

Table 7 - Customer Feedback

Date	*Complaint*	*Resolution*
12/01/2023	Greenvale Dirty Water – Health Concerns	A response letter was sent and it explained all the below. Council would be interested to understand what medical advice has been provided, that would link her current illness to the Greenvale Water. It explained that all microbiological testing completed to date by Council, was compliant. Reminded the customer about the Boil Water Alert and that Council is providing free bottled water to all Greenvale Residents. Final paragraph detailed Councils ongoing investigations into trying to find a solution to improve the quality, in conjunction with the Defences plans to expand in the area and install a new water treatment plant.
02/05/2023	Greenvale Water Supply	All correspondence for this and the ongoing complaints (3 in total about same issue) from this customer were handled by our OCEO department. Letter was signed by the Mayor. It explained the Boil Water Alert and that Council is providing free bottled water to all Greenvale Residents. Final paragraph detailed Councils ongoing investigations into trying to find a solution to improve the quality, in conjunction with the Defences plans to expand in the area and install a new water treatment plant.

7. DWQMP Audit

An audit of the DWQMP was conducted in September 2022, and a copy of the Audit Report has been submitted to the Regulator. While the report found that most areas showed compliance it found that improvements to processes and systems could be made in a number of areas. Two major non-compliances were observed. These related to the methodology for collecting samples at the townships. Operators were running the sample taps for long periods as they attended to other activities. This practice has been addressed and the Operating Procedure for sample collection at the townships has been amended to ensure correct procedures. As a result of the number of Opportunities for Improvement, a working party comprised of team leaders and management which was formed to address issues noted in the Risk Management Improvement Program will also work through the issues noted in the Audit. This group meets regularly and it is expected that the work will take some time to complete.

Appendix A – Summary of compliance with water quality criteria

The reported statistics include results derived from repeat samples, or from emergency or investigative samples undertaken in response to a customer complaint or abnormal results.

External verification monitoring samples are taken internally but processed and analysed by Townsville Laboratories and a summary of the results for critical measures is included below.

Verification monitoring results

Scheme	*Parameter*	*Units*	*Limit of Reporting*	*ADWG Guideline Value (A-Aesthetic; H- Health)*	*Count*	*Exceeded*	*Min*	*Max*	*Avg*
Charters Towers	Alkalinity	mg CaCO3/L	5		12	0	72.26	126.3	102.04
Charters Towers	Aluminium	mg/L	0.01	0.2 (A)	12	0	0.01	0.02	0.03
Charters Towers	Ammonia as N	mg/L as N	0.02	0.5 (A)	24	0	0.06	0.88	0.66
Charters Towers	Anatoxin	µg/L	0.1		1	0	0.1	0.1	0.1
Charters Towers	Antimony	mg/L	0.0005	0.003 (H)	12	0	0.0005	0.0005	0.0005
Charters Towers	Arsenic	mg/L	0.0005	0.01 (H)	12	0	0.001	0.001	0.001
Charters Towers	Barium	mg/L	0.002	2 (H)	12	0	0.026	0.039	0.030
Charters Towers	Bicarbonate	Mg/L as CaCO3	5		12	0	72.3	126	101.93
Charters Towers	Blue Green Algae	cells/mL	0.01mm3/L		9	0	0.01	0.01	0.01
Charters Towers	Boron	mg/L	0.004	4 (H)	12	0	0.014	0.025	0.020
Charters Towers	Bromodichloromethane	µg/L	2		1	0	2	2	2

Scheme	Parameter	Units	Limit of Reporting	ADWG Guideline Value (A-Aesthetic; H- Health)	Count	Exceeded	Min	Max	Avg
Charters Towers	Bromoform	µg/L	2		1	0	2	2	2
Charters Towers	Cadmium	mg/L	0.0004	0.002 (H)	12	0	0.0004	0.0004	0.0004
Charters Towers	Calcium	mg/L	0.7		12	0	10.1	18.1	13.58
Charters Towers	Carbonate	mg/L as CaCO3	5		12	0	5	5	5
Charters Towers	Chloride	mg/L	0.5	250 (A)	12	0	15.9	20.7	18.4
Charters Towers	Chlorine, Free	mg/L	0.05	5 (H)	154	0	0.75	2.21	1.62
Charters Towers	Chlorodibromomethane	µg/L	2		1	0	2	2	2
Charters Towers	Chloroform	µg/L	2		1	0	2	2	2
Charters Towers	Chromium	mg/L	0.0003	0.05 (H)	12	0	0.0003	0.0035	0.0005
Charters Towers	Colour, True	Pt-Co Units	1	15 (A)	12	0	2	13	7.5
Charters Towers	Copper	mg/L	0.002	2 (H)	12	0	0.002	0.002	0.002
Charters Towers	Cylindrospermopsin	µg/L	0.05		1	0	0.05	0.05	0.05
Charters Towers	Cylindrospermopsis (Cyanophyta)	cells/mL	20		9	0	20	20	20
Charters Towers	Diatoms (Bacillariophyta)	cells/mL	20		9	0	20	20	20
Charters Towers	Dolichospermum sp. (Cyanophyta)*	cells/mL	20		9	0	20	20	20
Charters Towers	E. coli	cfu/100mL	1	0 (H)	154	0	0	0	0

Scheme	Parameter	Units	Limit of Reporting	ADWG Guideline Value (A-Aesthetic; H- Health)	Count	Exceeded	Min	Max	Avg
Charters Towers	Electrical Conductivity	µS/cm	1		12	0	174	318	229
Charters Towers	Fluoride	mg/L	0.02	1.5 (H)	12	0	0.077	0.096	0.090
Charters Towers	Hardness	mg/L CaCO3	1		12	0	51.1	102.5	74.68
Charters Towers	Heterotrophic Plate Count	cfu/mL	1		154	0	0	3	1.2
Charters Towers	Hydroxide	mg/L as CaCO3	5		12	0	5	5	5
Charters Towers	Iron	mg/L	0.002	0.3 (A)	12	0	0.002	0.008	0.003
Charters Towers	Lead	mg/L	0.0006	0.01 (H)	12	0	0.0006	0.0006	0.0006
Charters Towers	Magnesium	mg/L	0.5		12	0	6.3	14.1	10.27
Charters Towers	Manganese	mg/L	0.0003	0.5 (H)	12	0	0.0003	0.0006	0.0003
Charters Towers	Mercury	mg/L	0.0003	0.001 (H)	12	0	0.0003	0.0003	0.0003
Charters Towers	Microcystis (Cyanophyta)*	cells/mL	20		12	0	20	20	20
Charters Towers	Molybdenum	mg/L	0.0004	0.05 (H)	12	0	0.0004	0.002	0.008
Charters Towers	Nickel	mg/L	0.001	0.02 (H)	12	0	0.001	0.001	0.001
Charters Towers	Nitrate as N, Calc	mg/L as N	0.01	50 (H)	12	0	0.01	0.09	0.05
Charters Towers	Nitrite as N	mg/L as N	0.01	3 (H)	12	0	0.01	0.01	0.01
Charters Towers	Oxidised Nitrogen as NOx-N	mg/L as N	0.01		12	0	0.01	0.09	0.040

Scheme	Parameter	Units	Limit of Reporting	ADWG Guideline Value (A-Aesthetic; H- Health)	Count	Exceeded	Min	Max	Avg
Charters Towers	pH	pH units		8.5 (A)	154	0	7.11	8.21	7.76
Charters Towers	Phosphate as P	mg/L as P	0.01		14	0	0.01	0.86	0.25
Charters Towers	Planktolyngbya sp	cells/mL	20		9	0	20	20	20
Charters Towers	Potassium	mg/L	0.5		12	0	2.4	4.8	3.63
Charters Towers	Pseudoanabaena sp (Cyanophyta)	cells/mL	20		9	0	20	20	20
Charters Towers	Selenium	mg/L	0.001	0.01 (H)	12	0	0.001	0.001	0.001
Charters Towers	Silica as SiO2	mg/L	0.1		12	0	18.9	27.0	23.32
Charters Towers	Silver	mg/L	0.0004	0.1 (H)	12	0	0.0004	0.0004	0.0004
Charters Towers	Sodium	mg/L	1.2	180 (A)	12	0	11.1	23	16.77
Charters Towers	Sulphate	mg/L	0.5	250 (A)	12	0	1.1	4.6	2.48
Charters Towers	Thermotolerant Coliforms	cfu/100mL	1	0 (H)	154	0	0	0	0
Charters Towers	Total Coliforms	cfu/100mL	1		154	0	0	0	0
Charters Towers	Total Dissolved Solids by EC	mg/L		600 (A)	12	0	112	204	146.83
Charters Towers	Trihalomethanes, Total	µg/L	8	250 (H)	1	0	8	8	8
Charters Towers	Turbidity	NTU	0.1	5 (A)	12	0	0.2	0.3	0.26
Charters Towers	Uranium	mg/L	0.0004	0.02 (H)	12	0	0.0004	0.0004	0.0004

Scheme	Parameter	Units	Limit of Reporting	ADWG Guideline Value (A-Aesthetic; H- Health)	Count	Exceeded	Min	Max	Avg
Charters Towers	Zinc	mg/L	0.001	3 (A)	12	0	0.001	0.004	0.002
Greenvale	Alkalinity	mg CaCO3/L	5		12	0	89.10	366.80	239.37
Greenvale	Aluminium	mg/L	0.01	0.2 (A)	12	2	0.011	0.358	0.146
Greenvale	Ammonia as N	mg/L as N	0.02	0.5 (A)	12	5	0.030	0.790	0.543
Greenvale	Antimony	mg/L	0.0005	0.003 (H)	12	0	0.0005	0.0005	0.0005
Greenvale	Arsenic	mg/L	0.0005	0.01 (H)	12	0	0.001	0.002	0.002
Greenvale	Barium	mg/L	0.002	2 (H)	12	0	0.039	0.140	0.066
Greenvale	Bicarbonate	mg as CaCO3/L	5		12	0	89.10	342.00	231.48
Greenvale	Boron	mg/L	0.004	4 (H)	12	0	0.012	0.032	0.022
Greenvale	Bromodichloromethane	µg/L	2		6	0	2	7	5.25
Greenvale	Bromoform	µg/L	2		6	0	2	2	2
Greenvale	Cadmium	mg/L	0.0004	0.002 (H)	12	0	0.0004	0.0004	0.0004
Greenvale	Calcium	mg/L	0.7		12	0	8.9	24.9	20.8
Greenvale	Carbonate	mg as CaCO3/L	5		12	0	9.20	9.70	9.45
Greenvale	Chloride	mg/L	0.5	250 (A)	12	0	26.6	41.9	35.5
Greenvale	Chlorine, Free	mg/L	0.05	5 (H)	36	1	1.04	>5.00	2.35
Greenvale	Chlorodibromomethane	µg/L	2		5	0	4.00	7.00	5.25
Greenvale	Chloroform	µg/L	2		5	0	71	279	142
Greenvale	Chromium	mg/L	0.0003	0.05 (H)	12	0	0.0003	0.005	0.002
Greenvale	Colour, True	Pt-Co Units	1	15 (A)	12	0	1	85	15
Greenvale	Copper	mg/L	0.002	2 (H)	12	1	0.002	0.066	0.022
Greenvale	E. coli	cfu/100mL	1	0 (H)	36	0	0	0	0
Greenvale	Electrical Conductivity	µS/cm	1		12	0	337.0	646.0	521.3
Greenvale	Fluoride	mg/L	0.02	1.5 (H)	12	0	0.049	0.064	0.053

Scheme	Parameter	Units	Limit of Reporting	ADWG Guideline Value (A-Aesthetic; H- Health)	Count	Exceeded	Min	Max	Avg
Greenvale	Hardness	mg $CaCO_3$/L	1		12	0	79.	214.	175
Greenvale	Heterotrophic Plate Count	cfu/mL	1		36	0	0	36.0	10.8
Greenvale	Hydroxide	mg/L as $CaCO_3$	5		12	0	5	5	5
Greenvale	Iron	mg/L	0.002	0.3 (A)	12	2	0.002	3.100	0.637
Greenvale	Lead	mg/L	0.0006	0.01 (H)	12	0	0.0006	0.0006	0.0006
Greenvale	Magnesium	mg/L	0.5		12	0	12.50	37.70	29.88
Greenvale	Manganese	mg/L	0.0003	0.5 (H)	12	0	0.003	0.07	0.036
Greenvale	Mercury	mg/L	0.0003	0.001 (H)	12	0	0.0003	0.0003	0.0003
Greenvale	Molybdenum	mg/L	0.0004	0.05 (H)	12	0	0.0004	0.0008	0.0006
Greenvale	Nickel	mg/L	0.001	0.02 (H)	12	0	0.001	0.001	0.001
Greenvale	Nitrate as N, Calc	mg/L as N	0.01	50 (H)	12	0	0.02	0.05	0.04
Greenvale	Nitrite as N	mg/L as N	0.01	3 (H)	12	0	0.01	0.01	0.01
Greenvale	Oxidised Nitrogen as NOx-N	mg/L as N	0.01		12	0	0.02	0.06	0.04
Greenvale	pH	pH units		8.5 (A)	36	0	7.46	8.46	8.13
Greenvale	Phosphate as P	mg/L as P	0.01		12	0	0.03	0.05	0.04
Greenvale	Potassium	mg/L	0.5		12	0	4	6.1	5.2
Greenvale	Selenium	mg/L	0.001	0.01 (H)	12	0	0.001	0.001	0.001
Greenvale	Silica as SiO2	mg/L	0.1		12	0	28.1	51.9	33.9
Greenvale	Silver	mg/L	0.0004	0.1 (H)	12	0	0.0004	0.001	0.0004
Greenvale	Sodium	mg/L	1.2	180 (A)	12	0	28.2	47.1	38.4
Greenvale	Sulphate	mg/L	0.5	250 (A)	12	0	0.65	2.8	1.26
Greenvale	Thermotolerant Coliforms	cfu/100mL	1	0 (H)	36	0	0	0	0
Greenvale	Total Coliform	cfu/100mL	1		36	0	0	0	0

Scheme	Parameter	Units	Limit of Reporting	ADWG Guideline Value (A-Aesthetic; H- Health)	Count	Exceeded	Min	Max	Avg
Greenvale	Total Dissolved Solids by EC	mg/L		600 (A)	12	0	216	413	333.4
Greenvale	Trihalomethanes, Total	µg/L	8	250 (H)	5	0	97	279	142
Greenvale	Turbidity	NTU	0.1	5 (A)	36	12	0.5	56.5	12.9
Greenvale	Uranium	mg/L	0.0004	0.02 (H)	12	0	0.0004	0.0009	0.0005
Greenvale	Zinc	mg/L	0.001		12	0	0.001	0.022	0.005
Pentland	Alkalinity	mg CaCO3/L	5		12	0	57	142	121
Pentland	Aluminium	mg/L	0.01	0.2 (A)	12	0	0.12	0.17	0.15
Pentland	Ammonia as N	mg/L as N	0.02	0.5 (A)	12	0	0.06	0.74	0.29
Pentland	Antimony	mg/L	0.0005	0.003 (H)	12	0	0.0005	0.0005	0.0005
Pentland	Arsenic	mg/L	0.0005	0.01 (H)	12	0	0.0005	0.0007	0.0006
Pentland	Barium	mg/L	0.002	2 (H)	12	0	0.013	0.028	0.020
Pentland	Beryllium	mg/L	0.0004	0.06 (H)	1	0	0.0004	0.0004	0.0004
Pentland	Bicarbonate	mg as CaCO3/L	5		12	0	57.4	142	122
Pentland	Bismuth	mg/L	0.0006		1	0	0.0006	0.0006	0.0006
Pentland	Boron	mg/L	0.004	4 (H)	12	0	0.012	0.031	0.022
Pentland	Bromodichloromethane	µg/L	2		5	0	2	2	2
Pentland	Bromoform	µg/L	2		5	0	2	2	2
Pentland	Cadmium	mg/L	0.0004	0.002 (H)	12	0	0.0004	0.0004	0.0004
Pentland	Calcium	mg/L	0.7		12	0	16.6	23.7	21.3
Pentland	Carbonate	mg as CaCO3/L	5		12	0	5	5	5
Pentland	Chlorate	µg/L	80		4	0	50	50	50
Pentland	Chloride	mg/L	0.5	250 (A)	12	0	13.9	24.1	16.0
Pentland	Chlorine, Free	mg/L	0.05	5 (H)	36	0	1.08	1.40	1.40

Scheme	Parameter	Units	Limit of Reporting	ADWG Guideline Value (A-Aesthetic; H- Health)	Count	Exceeded	Min	Max	Avg
Pentland	Chlorodibromomethane	µg/L	2		5	0	2	2	2
Pentland	Chloroform	µg/L	2		5	0	2	2	2
Pentland	Chromium	mg/L	0.0003	0.05 (H)	12	0	0.0003	0.0007	0.0004
Pentland	Cobalt	mg/L	0.0003		1	0	0.0003	0.0003	0.0003
Pentland	Colour, True	Pt-Co Units	1	15 (A)	12	0	0	1	0.08
Pentland	Copper	mg/L	0.002	2 (H)	12	0	0.002	0.007	0.004
Pentland	E. coli	cfu/100mL	1	0 (H)	36	0	0	0	0
Pentland	Electrical Conductivity	µS/cm	1		12	0	274	367	297
Pentland	Fluoride	mg/L	0.02	1.5 (H)	12	0	0.054	0.31	0.26
Pentland	Geosmin*	ng/L	2		1	0	5	5	5
Pentland	Hardness	mg CaCO3/L	1		12	0	78.5	94.2	88.1
Pentland	Hydroxide	mg/L as CaCO3	5		12	0	5	5	5
Pentland	Iron	mg/L	0.002	0.3 (A)	12	0	0.002	0.010	0.005
Pentland	Lead	mg/L	0.0006	0.01 (H)	12	0	0.0006	0.0006	0.0006
Pentland	Lithium	mg/L	0.0004		1	0	0.0009	0.0009	0.0009
Pentland	Magnesium	mg/L	0.5		12	0	7.4	12.2	8.9
Pentland	Manganese	mg/L	0.0003	0.5 (H)	12	0	0.0004	0.0004	0.0004
Pentland	Mercury	mg/L	0.0003	0.001 (H)	12	0	0.0003	0.0006	0.0004
Pentland	Methyl Isoborneol*	ng/L	2		1	0	5	5	5
Pentland	Molybdenum	mg/L	0.0004	0.05 (H)	12	0	0.0008	0.0020	0.0010
Pentland	Nickel	mg/L	0.001	0.02 (H)	12	0	0.001	0.001	0.001
Pentland	Nitrate as N, Calc	mg/L as N	0.01	50 (H)	12	0	0.12	0.19	0.13
Pentland	Nitrite as N	mg/L as N	0.01	3 (H)	12	0	0.01	0.01	0.01
Pentland	Oxidised Nitrogen as NOx-N	mg/L as N	0.01		12	0	0.12	0.19	0.13
Pentland	pH	pH units		8.5 (A)	36	0	7.08	7.62	7.40

Scheme	Parameter	Units	Limit of Reporting	ADWG Guideline Value (A-Aesthetic; H- Health)	Count	Exceeded	Min	Max	Avg
Pentland	Phosphate as P	mg/L as P	0.01		12	0	0.08	0.94	0.13
Pentland	Potassium	mg/L	0.5		12	0	2.2	3.3	2.6
Pentland	Residual alkali*	index	0.1		12	0	0.1	0.7	0.33
Pentland	Rubidium	mg/L	0.0005		1	0	0.0005	0.0005	0.0005
Pentland	Selenium	mg/L	0.001	0.01 (H)	12	0	0.001	0.001	0.001
Pentland	Silica as SiO2	mg/L	0.1		12	0	9.3	127.0	54.2
Pentland	Silver	mg/L	0.0004	0.1 (H)	12	0	0.0005	0.002	0.0009
Pentland	Sodium	mg/L	1.2	180 (A)	12	0	20.9	26.9	24.6
Pentland	Strontium	mg/L	0.003		1	0	0.184	0.184	0.184
Pentland	Sulphate	mg/L	0.5	250 (A)	12	0	2	72	12.5
Pentland	Thallium	mg/L	0.0004		1	0	0.0004	0.0004	0.0004
Pentland	Thermotolerant Coliforms	cfu/100mL	1	0 (H)	36	0	0	0	0
Pentland	Tin	mg/L	0.0004		1	0	0.0004	0.0004	0.0004
Pentland	Titanium	mg/L	0.001		1	0	0.001	0.001	0.001
Pentland	Total Coliform	cfu/100mL	1		28	0	0	0	0
Pentland	Total Dissolved Solids by EC	mg/L		600 (A)	12	0	175	235	190
Pentland	Trihalomethanes, Total	µg/L	8	250 (H)	5	0	8	8	8
Pentland	Turbidity	NTU	0.1	5 (A)	12	0	0.1	0.6	0.25
Pentland	Uranium	mg/L	0.0004	0.02 (H)	12	0	0.0005	0.0006	0.0005
Pentland	Vanadium	mg/L	0.0006		1	0	0.007	0.007	0.007
Pentland	Zinc	mg/L	0.001	3 (A)	12	0	0.005	0.018	0.010
Ravenswood	Alkalinity	mg CaCO3/L	5		12	0	68.7	106.9	90.0
Ravenswood	Aluminium	mg/L	0.01	0.2 (A)	12	1	0.032	0.52	0.13
Ravenswood	Ammonia as N	mg/L as N	0.02	0.5 (A)	12	0	0.78	0.88	0.82
Ravenswood	Antimony	mg/L	0.0005	0.003 (H)	12	0	0.0005	0.0005	0.0005

Scheme	Parameter	Units	Limit of Reporting	ADWG Guideline Value (A-Aesthetic; H- Health)	Count	Exceeded	Min	Max	Avg
Ravenswood	Arsenic	mg/L	0.0005	0.01 (H)	12	0	0.0008	0.002	0.001
Ravenswood	Barium	mg/L	0.002	2 (H)	12	0	0.009	0.050	0.029
Ravenswood	Bicarbonate	mg as CaCO3/L	5		12	0	68.6	107.0	90.0
Ravenswood	Boron	mg/L	0.004	4 (H)	12	0	0.017	0.030	0.024
Ravenswood	Cadmium	mg/L	0.0004	0.002 (H)	12	0	0.0004	0.0004	0.0004
Ravenswood	Calcium	mg/L	0.7		12	0	15.9	21.3	18.3
Ravenswood	Carbonate	mg as CaCO3/L	5		12	0	5	5	5
Ravenswood	Chlorate	µg/L	80		2	2	353	427	395
Ravenswood	Chloride	mg/L	0.5	250 (A)	12	0	23.0	27.9	25.16
Ravenswood	Chlorine, Free	mg/L	0.05	5 (H)	36	0	0.55	1.77	1.15
Ravenswood	Chromium	mg/L	0.0003	0.05 (H)	12	0	0.0003	0.0004	0.0003
Ravenswood	Colour, True	Pt-Co Units	1	15 (A)	12	0	0	1	1
Ravenswood	Copper	mg/L	0.002	2 (H)	12	0	0.002	0.002	0.002
Ravenswood	E. coli	cfu/100mL	1	0 (H)	36	0	0	0	0
Ravenswood	Electrical Conductivity	µS/cm	1		12	0	355	401	380
Ravenswood	Fluoride	mg/L	0.02	1.5 (H)	12	0	0.038	0.092	0.070
Ravenswood	Hardness	mg CaCO3/L	1		12	0	85.0	114.3	103.3
Ravenswood	Heterotrophic Plate Count	cfu/mL	1		36	0	0	0	0
Ravenswood	Hydroxide	mg/L as CaCO3	5		12	0	5	5	5
Ravenswood	Iron	mg/L	0.002	0.3 (A)	12	0	0.006	0.060	0.081
Ravenswood	Lead	mg/L	0.0006	0.01 (H)	12	0	0.0006	0.0006	0.0006
Ravenswood	Magnesium	mg/L	0.5		12	0	11.0	16.9	14.2
Ravenswood	Manganese	mg/L	0.0003	0.5 (H)	12	0	0.0007	0.03	0.005
Ravenswood	Mercury	mg/L	0.0003	0.001 (H)	12	0	0.0003	0.0003	0.0003

Scheme	Parameter	Units	Limit of Reporting	ADWG Guideline Value (A-Aesthetic; H- Health)	Count	Exceeded	Min	Max	Avg
Ravenswood	Molybdenum	mg/L	0.0004	0.05 (H)	12	0	0.001	0.003	0.002
Ravenswood	Nickel	mg/L	0.001	0.02 (H)	12	0	0.001	0.001	0.001
Ravenswood	Nitrate as N, Calc	mg/L as N	0.01	50 (H)	12	0	0.01	0.05	0.02
Ravenswood	Nitrite as N	mg/L as N	0.01	3 (H)	12	0	0.01	0.01	0.01
Ravenswood	Oxidised Nitrogen as NOx-N	mg/L as N	0.01		12	0	0.01	0.05	0.02
Ravenswood	pH	pH units		8.5 (A)	36	0	7.10	7.50	7.30
Ravenswood	Phosphate as P	mg/L as P	0.01		12	0	0.01	0.05	0.02
Ravenswood	Potassium	mg/L	0.5		12	0	3.0	4.4	3.7
Ravenswood	Selenium	mg/L	0.001	0.01 (H)	12	0	0.001	0.001	0.001
Ravenswood	Silica as SiO2	mg/L	0.1		12	0	11.3	19.6	13.4
Ravenswood	Silver	mg/L	0.0004	0.1 (H)	12	0	0.0008	0.0008	0.0008
Ravenswood	Sodium	mg/L	1.2	180 (A)	12	0	24.7	44.0	31.9
Ravenswood	Sulphate	mg/L	0.5	250 (A)	12	0	53.1	69.3	62.0
Ravenswood	Thermotolerant Coliforms	cfu/100mL	1	0 (H)	36	1	0	12	1
Ravenswood	Total Coliform	cfu/100mL	1		36	0	0	0	0
Ravenswood	Total Dissolved Solids by EC	mg/L		600 (A)	12	0	227	256	243
Ravenswood	Turbidity	NTU	0.1		36	0	0.2	1.0	0.43
Ravenswood	Uranium	mg/L	0.0004	0.02 (H)	12	0	0.0004	0.0004	0.0004
Ravenswood	Zinc	Mg/L	0.001	3 (A)	12	0	0.005	0.008	0.058

Appendix B - Risk Management Improvement Program

Scheme	Risk	Action Requirement	Interim Action	Long Term Plan	Target Date for Long Term Action	Actions to Date
Charters Towers	Very High	Replace the concrete reservoir as it is not in good condition	Monitor roof condition, Seal off points of entry	Reservoir and rising main project is currently in the design phase - this will result in the decommissioning of the concrete reservoir	2025	Planning Stage Complete. Currently in preliminary design as per GHD planning report 16/12/2022.
Charters Towers	Very High	Investigate options to create a larger roofed treated water storage	Monitor for evidence of possums or birds gathering above the tank	The WIUP has made available the Mod 2 clarifier tank. Previous consideration of turning it into a treated water storage has now been developed into a requirement, as the existing CWT has developed serious leakage around its base.	2022	24/11/22 In progress. Investigations complete. RFT issued. Module 2 to be converted to a covered Clear Water Tank. Expect construction early 2023, completion by EOFY
Charters Towers	High	Conduct Health Based Targets assessment of the raw water and treatment to determine if UV treatment is warranted	Increase sampling of raw water for E. coli as an indicator for crypto to form baseline data for the study	Conduct a health-based targets assessment of the raw water	2023	To be commenced early 2023
Charters Towers	High	Dedicated inlet and outlet mains at the reservoir to ensure adequate turnover	Utilise re-chlorination system to maintain residual in the reservoirs	This forms part of the rising main and reservoir replacement project	2025	Rechlorination system is in place. Duplication of trunk main and reconfiguration of reservoir to be completed as stages of upgrade. Still in Planning stage with Consultancy

Scheme	Risk	Action Requirement	Interim Action	Long Term Plan	Target Date for Long Term Action	Actions to Date
Charters Towers	High	Periodic check of chemical purity through supplier		Implement QA process by sending samples to the lab	2021	Not started To be arranged by Tech Officer W&WW Treatment Early 2023
Charters Towers	Moderate	Minor upgrades to ensure the old module can still run without compromising water quality		The closeout of WIUP will deliver a range of minor upgrades to allow Mod 1 to continue to operate with the new plant	30-Jun-21	Module 1 still functional. Test runs performed October 2022
Greenvale	Very High	Document and label pipework. Document processes. Establish control over changes to infrastructure configuration	Work performed at Greenvale is under review in light of future upgrades.	On hold until Defence requirements in Greenvale are finalised as the water system will be upgraded	2023	On hold
Greenvale	Very High	Full Health Based Target Assessment required to determine suitable level of treatment required for crypto/giardia		It is expected that this work will form part of the baseline for possible defence upgrades of the water system at Greenvale	2023	On hold
Greenvale	Very High	Investigation of full water treatment system		On hold until Defence requirements in Greenvale are finalised as the water system will be upgraded	2023	With consultants

Scheme	Risk	Action Requirement	Interim Action	Long Term Plan	Target Date for Long Term Action	Actions to Date
Greenvale	High	Review hypo stock management, holding times, consider possibility of moving to gas chlorination. Consider carrying out a Chlorates investigation to form a baseline if an ADWG limit is brought in.	Hypo management protocols to be developed	High Chlorate level (1.6mg/L) detected in treated water. Investigate short-term use of 70kg Gas Cylinders for disinfection	2023	Researching potential suppliers of transportable dosing systems. Will need Capital funding.
Greenvale	High	Reservoir roof improvement program to ensure they are sealed against vermin and runoff		Complete review of all reservoirs is to be conducted (currently resource constrained)	2023	On Hold
Greenvale	High	Improve asset mapping capability to reduce the risk of cross connections		Corporate system is moving towards asset mapping.	2023	On Hold
Greenvale	High	Long term plan for Greenvale water treatment will need to include redundancy of dosing systems		On hold until Defence requirements in Greenvale are finalised as the water system will be upgraded	2023	On Hold
Greenvale	High	Consider having a generator for chlorine dosing system to maintain the residual in the reservoir		On hold until Defence requirements in Greenvale are finalised as the water system will be upgraded	2023	On Hold

Scheme	Risk	Action Requirement	Interim Action	Long Term Plan	Target Date for Long Term Action	Actions to Date
Greenvale	High	Consider changing to chlorine gas so that longer lasting stock can be held without deterioration.		To be replaced by gaseous system as part of new WTP	2023	Investigating options for short-term, to operate until new treatment system is installed.
Greenvale	High	Dual chlorine analysers would be beneficial due to the remote location		On hold until Defence requirements in Greenvale are finalised as the water system will be upgraded	2023	On Hold
Greenvale	Moderate	Consider installation of a chlorine analyser for the raw water arriving at the reservoir installed so that it can become a backup analyser for the treated water if needed.		On hold until Defence requirements in Greenvale are finalised as the water system will be upgraded	2023	On Hold
Greenvale	Low	Perform analysis on pH, iron and manganese at the river pump station to determine if the dosing is effective		On hold until Defence requirements in Greenvale are finalised as the water system will be upgraded	2023	On Hold
Pentland	Very High	Document treatment process, identify failure modes, label equipment and pipework. Implement a maintenance authorisation system.		Conduct complete review of infrastructure and procedures	2023	Not Started
Pentland	Very High	Clean tanks at the pump station and replace/rectify roofs		Pentland tank review program	2023	To be completed FY 22-23, in conjunction with water main duplication

Scheme	Risk	Action Requirement	Interim Action	Long Term Plan	Target Date for Long Term Action	Actions to Date
Pentland	High	Disconnect Meatworks tanks from the system		Reticulation task	2024	To be completed FY 23-24
Pentland	High	Consider installation of Duty/Standby dosing systems		Conduct complete review of infrastructure and procedures	2024	To be completed FY 23-24
Pentland	High	Formal system to manage chlorine stocks for Pentland		Operators to establish management system	2023	In progress
Pentland	Moderate	Regular flushing program for Pentland Reticulation		Reticulation to establish flushing program for townships	2023	Not started
Ravenswood	Very High	Produce updated drawings of the water and sewerage systems		Reticulation task to confirm main locations	2023	To be completed under new agreement with Ravenswood Gold
Ravenswood	Very High	Consider plant upgrade to address shortfalls		Ravenswood Gold is considering moving the water treatment plant as part of a mine expansion. Requirements for the new plant will address these deficiencies	2023	In progress. Relocated WTP design proceeding.
Ravenswood	High	Improvement in the management and oversight of the WTP processes	Transfer of infrastructure has been negotiated. Agreement on a water supply contract proceeding.	Ravenswood Gold is considering moving the water treatment plant as part of a mine expansion. Requirements for the new plant will address deficiencies in current systems	2023	In progress CTRC to request involvement in planning and design of the new WTP

Scheme	Risk	Action Requirement	Interim Action	Long Term Plan	Target Date for Long Term Action	Actions to Date
Ravenswood	High	Consider changing to gas chlorination in order to avoid long holding times for hypo		To be addressed in the design of the relocated WTP	2023	Ravenswood Gold has advised that the Sodium Hypochlorite storage system will be air conditioned to minimise formation of decay products Issues for agreement include potential Stamp Duty ~ $1M, and risk management.
Ravenswood	High	Consider addition of a second chlorine analyser		To be addressed in the design of the relocated WTP	2023	Not started. To be discussed as part of relocation of WTP
All Schemes	High	Training for maintenance staff in water quality when dealing with water main breaks		Provide training opportunities Update SOP's for Reticulation	2022	Consultant has been engaged to review and update Reticulation Team SOP's.