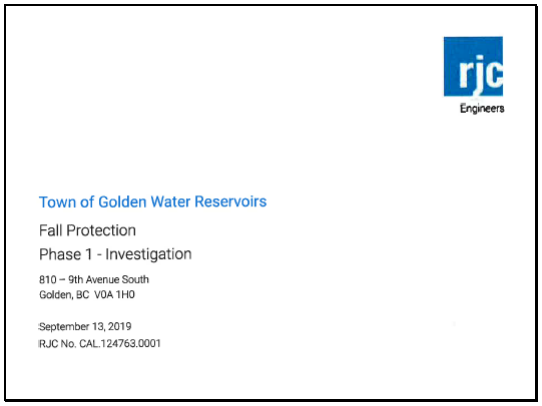
2019 Annual Drinking Water Quality Report
Facility No. 12-098-00001

May 15, 2020

Reservoir ROV Inspections



Reservoir Fall Protection Investigation

Well 6 Capacity Study

Hypalon Reservoir Liner Installation

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1.0 Introduction

The purpose of this report is to provide information on the monitoring and maintenance of the Town of Golden's water distribution system over the course of the last calendar year, as directed in the municipality's Interior Health Water System Operating Permit and mandated by the Drinking Water Protection Act.

The Drinking Water Quality Monitoring program generates data for the continuous trending of the community's water quality, as well as the performance of the entire distribution system in a reliable and systematic way. The program allows for potential health hazards to be quickly identified and corrected and for consumer enquiries to be accurately addressed in a timely manner.

Included in this document is:

- A brief introduction to the Town of Golden's water distribution system;
- 2019 consumption information;
- Drinking water monitoring and testing program information;
- A description of any major improvements made to the system within the last calendar year;
- A brief summary of planned initiatives for the current year; and,
- A summary of all water sample results collected in 2019.

The information contained herein collectively serves to confirm and verify the water system's continued performance in delivering a safe and sufficient supply of drinking water to the community.

2.0 Water Distribution System Overview

Groundwater Wells: There are 5 wells with a combined total pumping capacity of 1478 Imperial Gallons per Minute (Igpm) or 112 Litres per second (Lps) providing water to a common distribution system. Two wells are located on the north side of the Kicking Horse River and three are located on the south side.

Reservoirs: There are 5 reservoirs located at 3 distinct reservoir sites within the municipality. The total available reservoir storage capacity is 1,530,000 Igal or 6.96 Mega Litres (ML). The first site is located in the North East Bench, the second and third sites are both located on the South East Bench.

Pressure Zones: There are 4 pressure zones throughout the system. Two pressure zones service the NE Bench, one services the SE Bench and the remainder of the community comprises the fourth pressure zone.

Distribution System: Pipe sizes range from 150mm to 300mm. The pipe network includes asbestos cement (AC), polyvinylchloride (PVC), yellow jacket ductile iron (YJDI), ductile iron (DI), cast iron (CI) and polyethylene (PE) types. There are 143 fire hydrants included in an annual spring and fall maintenance program. Hydrant reports are forwarded on to operations staff each time a hydrant is used by the fire department. Hydrants are <u>not</u> typically used for filling tankards other than Fire Trucks; however, occasionally, select hydrants are used for the purposes of filling the municipal water truck and street sweeper for street cleaning purposes.

13th Street Well: This well is not connected to the distribution system. It is used for non-potable water use by the municipality as well as authorized contractors.

Consumption Stats:

Year	Total Pumped		Peak Day			Average Day (estimated)	
	(Igal)	Increase/Decrease Over Prior Year	Date	Volume Pumped	Increase/Decrease Over Prior Year	Volume Pumped	Increase/Decrease Over Prior Year
2012	196,502,771	5.8% decrease	Aug-17	1,075,222	4.8% increase	536,892	6.0% decrease
2013	220,261,364	12.1% increase	Aug-11	1,093,064	1.7% increase	603,056	12.3% increase
2014	228,361,075	3.7% increase	Jul-13	1,304,971	19.4% increase	625,232	3.7% increase
2015	223,125,807	2.3% decrease	Jul-05	1,325,686	1.6% increase	611,394	2.2% decrease
2016	240,422,993	7.8% increase	Aug-17	1,188,284	11.6% decrease	658,693	7.8% increase
2017	277,272,091	15.3% increase	Jul-09	1,434,451	20.7% increase	759,650	15.3% increase
2018	222,444,280	24.6% decrease	Jul-29	1,244,857	13.2% decrease	609,436	24.6% decrease
2019	213,660,331	4.1% decrease	Aug-11	1,107,329	12.4% decrease	585,371	4.1% decrease

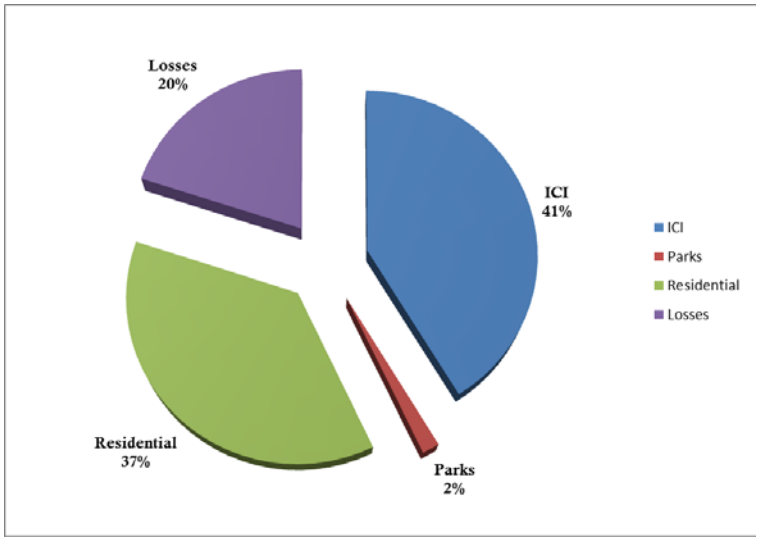
In 2019, Peak Day demand decreased by 12.4%, while overall consumption decreased by 4.1% from 2018. The 2019 Peak Day figure is typically assumed to be reflective of residential and municipal irrigating as extensive irrigating on a given day would be a main contributor to Peak Day consumption. Weather conditions leading up and occurring on the Peak Day are thought to be a main factor influencing this demand figure as well. Ongoing leak detection and repair, as well as conservation awareness are believed to be contributing factors in the overall decreases noted.

In 2019, Industrial, Commercial, Institutional (ICI) demand accounted for about 41.3% of the total water pumped (in 2018 ICI demand was recorded as 39.0% of the total water pumped; overall, the 2019 ICI demand component of total water pumped increased 2.3% compared to 2018).

Municipal parks demand accounted for about 1.6% of the total water pumped (in 2018 municipal irrigation demand was recorded as 2.1% of the total water pumped; overall, the 2019 irrigation component of total water pumped decreased 0.5% compared to 2018).

The remaining portion of the total volume pumped, represented as 57.1%, is in large part residential demand; of that percentage about 20%[1] is considered attributable to leakage and other unaccounted for water usage (such as fire flow demand or contractor usage from hydrants for example). Therefore, approximately 37.1% of the total water pumped is residential demand (in 2018 residential demand was reported as being approximately 36.6% of the total water pumped; overall, 2019 residential demand is assumed to have increased by approximately 0.5%).

[1] Based on the 2019 Total Pumped volume, 20% represents about 117,000 Igpd or about 81 Igpm.



3.0 Testing and Monitoring Program

The water quality monitoring program includes source and distribution system monitoring.

Routine weekly samples are collected at each well head and alternating reservoir sites. These samples are collected by Town of Golden staff and forwarded to a private lab for microbiological testing. Lab results along with consumption and turbidity are reported to the Public Health inspector on a monthly basis.

In 2019 a total of 250 samples were analyzed for total coliforms and E.coli. with four samples testing positive with a total coliform count greater than one (1). The TC>1 samples were related to sample sets taken from the NE Yellow Reservoir in three instances and the NE Green Reservoir in one case. As per schedule B of the Drinking Water Protection Act, the Town of Golden is required to analyze four (4) samples per month. To emphasize the commitment to providing safe drinking water the number of samples analyzed in 2019 exceeded twenty (20) per month.

The Town of Golden also conducts full spectrum analyses on each well source on an annual basis for physical and chemical parameters; there results are summarized in the appendix.

4.0 System Maintenance and Repairs

The Town of Golden has adopted an operations and maintenance (O&M) program that includes reservoir disinfections, reservoir draining, cleaning and Remotely Operated Vehicle (ROV) inspections on an approximate 5-year cycle; and, annual hydrant inspections, maintenance and flushing, valve exercising, and dead end main flushing.

Current and historic maintenance records are available. The Town of Golden has a GIS Mapserver which is under continuous development and is intended to be used to access maintenance information by Systems staff. All of the Town's visible water infrastructure (i.e. water main valves, fire hydrant service valves and fire hydrants) were surveyed by Global Position Satellite (GPS) and added to the mapping data base.

5.0 System Improvements

Well 6 Capacity Study - Continued:

Since last reporting on this initiative, further investigation into the chronic turbidity issue following the September 2018 acid treatment with surging and bailing has uncovered a damaged secondary K-packer.

While being extracted from the well casing, brushes used in the acid cleaning of the well screens damaged a secondary K-packer installed during construction in 2000.

A well drilling contractor has successfully retrieved and replaced the damaged K-packer and airlift development was undertaken for approximately two days to address turbidity. Turbidity has been considerably reduced but additional pumping to waste will be required under a developed pumping program to achieve NTU < 1. Following that the well can be returned to service and the originally planned extended duration pumping test will take place.

Kicking Horse River Watermain Crossing:

Detailed design and project cost estimate based on final design were completed in 2019. This initiative was pursued in the interest of system risk reduction (increased distribution system redundancy) as well as to preemptively provide increased water supply to developable lands adjacent to Fisher Road. The municipality will endeavor to pursue appropriate granting for this project and may defer construction until a suitable funding program is available or development need arises.

Hypalon Reservoir Relining:

Relining of the Hypalon Reservoir was completed in 2019. Work included installation of a new liner and pipe connections, wall insulation and cover hardware. The existing cover was reused.

Metering/Cross Connection Control:

In 2019 work continued with the replacement of non-radio frequency (RF) compatible water meters. Meters were either installed in new development (5), retrofitted with new RF register heads (14), or completely replaced (3) in industrial/commercial/institutional (ICI) facilities. With the exception of register head replacements, for each new install or meter replacement, premise-isolation cross connection control devices were also installed according to assessed cross connection hazard level. Work continues with meter updating with priority given to meters which are difficult to access or where high hazard cross connection control can be addressed along with a meter update/retrofit.

Improvements to Worker Safety for Working Heights Above 7.6m (25 feet):

In 2019 an initiative was undertaken to investigate and prepare designs for equipment intended to increase worker safety while accessing reservoir roof-tops.

Detailed design and project cost estimate based on final design were completed in 2019. Required improvements are intended to commence in 2020 under an approved capital budget.

Source Protection Plan:

Work continued with Golder and Associates on source protection in 2019.

Golder provides the annual update to the Municipal Water Supply Contingency Plan, and provides sentry well monitoring support with lab analysis data review. Golder is also available for ongoing contaminated site report reviews, as well as development reviews with groundwater resource impact potential on an as needed basis.

Emergency Response Plan (ERP):

The ERP is integral to the overarching Water Supply Contingency Plan. Both are reviewed annually with all contacts updated as necessary. The Municipal Water Supply Contingency Plan Report is appended for information.

Leak Detection Work:

Over the course of 2019 construction season, three service connection leaks were repaired and a leak in a Pressure Reducing Valve (PRV) station was repaired. A significant continuous-flow leak on a private side service was identified and the property owner was notified to affect necessary repairs. Lastly, a main break discovered late in 2018 was repaired in spring 2019. System leak repairs collectively contribute towards the overall measured demand reduction.

6.0 Operator Education and Training

The Town of Golden has an established training program that follows EOCP guidelines for required training and certification maintenance. Operators maintain EOCP certifications through a variety of EOCP accredited and relevant training opportunities typically available on an annual basis.

EOCP Current Certification:

Employee	***Certification #***	***Level***
Lorne Pickering - Public Works Foreman	3879	WD-III, CCC Tester
Alan Taylor - Systems Chief Operator	6101	WD-III, CCC Tester
Ryan Robison – Systems Operator	1000185	WD-1, CCC Tester

7.0 Cross Connection Control (CCC)

Both Systems operators are certified tester's and carry out tests on all municipally-owned backflow assemblies. The Town of Golden currently tests and tracks 34 backflow assembly devices (all testable devices) located on various Town owned/operated facilities.

It is policy that the Town confirms the proper device for any new construction. After construction, backflow devices installed in private buildings are added to our database so that we can track and record the testing history of each assembly installed within the Town.

The Town is a client with Maintenance Training Systems (MTS) and is using their FAST software for our CCC program. More information on this software can be found at:

http://www.mtsinc.ca/index.php?m=public&p=software&s=fast&v=features

In 2018 the Town of Golden advanced its CCC program and installed or replaced existing backflow devices on an additional thirteen (13) ICI service connections. Work continues with the CCC program with priority given to all high and prioritized medium-hazard service connections.

8.0 SCADA System

Within the Supervisory Control and Data Acquisition (SCADA) system numerous control parameters are in place allowing Town of Golden staff to make changes on an as-needed basis according to ongoing process changes. The following facilities listings itemize all currently in-place SCADA control parameters.

SE Booster Station:
Discharge flow in GPM's as well as total flow
Discharge pressure
Room temperature
Reservoir Levels
Reservoir Hatch Intrusion alarm
Booster Pump Run Times
Flood alarm

NE Booster Station:
Discharge flow in GPM's
Room Temperature
Suction Pressure
Booster Pump Run Times
Reservoir Levels
Reservoir Hatch Intrusion alarm
Discharge Pressure
Flood alarm
Generator Run Status

Well Stations:
Flow totalizers in Gallons
Pump Run Times
Distribution system Pressure Transducers in "psi" at all wells
Level Transducers at Wells 4, 5, and 6
Room Temperatures
Flood alarms
Generator Run Status (where applicable)

All trending is done on a daily basis and is in "real time". Trending and reporting continues to be compiled into monthly and yearly reports.

9.0 Events/Emergency Response

Over the course of 2019 (during the construction season) four public-side system leaks were detected and repaired. One main break repair occurred in April 2019.

10.0 Plans for 2020

- Continue to conduct leak detection work as needed;
- Continue with CCC Program and prioritize installs of back flow devices, concentrating first on those facilities with a high hazard rating. Remove and replace existing water meters with new meters that use e-coders for totalizing and billing;
- Continue with public education campaign relating to source-to-tap education, water conservation tips and tricks, education and enforcement relating to sprinkling bylaw regulations through newspaper advertising, social media and the Town website;
- Continue with school classroom visits and/or systems tours by staff – pending COVID-19 allowances;
- Confirm final station pumping capacity though an extended duration pump test at Well 6, following the station's returned to service.
- Minor system upgrades and service repairs on an as-required basis;
- Continue to advance the Groundwater Protection Program; proceed with recommendations contained within the Groundwater Monitoring Plan, Protection Strategy, and Screening Study for Potential Groundwater at Risk of Pathogens (GARP) where and when practicable to do so;
- Commence a 5-year program of updating the current telemetry radio system and SCADA hardware and software systems;
- Undertake enhancements for improved worker safety for accessing reservoir roof-tops.

11.0 Sample Analysis Results

DATE	WELLS					RESERVOIRS		
	#2	#3	#4	#5	#6	NE (yellow)	NE (green)	BEARS PAW
Jan 7	<1	<1	<1	<1	offline		<1	<1
Jan 14	<1	<1	<1	<1		<1		<1
Jan 21	<1	<1	<1	<1			<1	<1
Jan 28	<1	<1	<1	<1		<1		<1
Feb 4	<1	<1	<1	<1			<1	<1
Feb 11	<1	<1	<1	<1		<1		<1
Feb 25	<1	<1	<1	<1			<1	<1
Mar 4	<1	<1	<1	<1		<1		<1
Mar 11	<1	<1	<1	<1			<1	<1
Mar 18	<1	<1	<1	<1		<1		<1
Mar 25	<1	<1	<1	<1			<1	<1
Apr 1	<1	<1	<1	<1		<1		<1
Apr 8	<1	<1	<1	<1			<1	<1
Apr 15	<1	<1	<1	<1		<1		<1
Apr 29	<1	<1	<1	<1			<1	<1
May 6	<1	<1	<1	<1		<1		<1
May 13	<1	<1	<1	<1			<1	<1
May 27	<1	<1	<1	<1		<1		<1
Jun 3	<1	<1	<1	<1			<1	<1
Jun 10	<1	<1	<1	<1		<1		<1

Jun 17	<1	<1	<1	<1			<1	<1
Jun 24	<1	<1	<1	<1		<1		<1
Jul 08	<1	<1	<1	<1			<1	<1
Jul 15	<1	<1	<1	<1		<1		<1
Jul 22	<1	<1	<1	<1			<1	<1
Jul 29	<1	<1	<1	<1		T-5 E<1		<1
Aug 19	<1	<1	<1	<1		<1	<1	<1
Aug 26	<1	<1	<1	<1		<1		<1
Sep 9	<1	<1	<1	<1			<1	<1
Sep 16	<1	<1	<1	<1		<1		<1
Sep 23	<1	<1	<1	<1			<1	<1
Sep 30	<1	<1	<1	<1		T>=1 E<1		<1
Oct 7	<1	<1	<1	<1			T-1 E<1	<1
Oct 21	<1	<1	<1	<1		<1	<1	<1
Oct 28	<1	<1	<1	<1		<1		<1
Nov 4	<1	<1	<1	<1			<1	<1
Nov 18	<1	<1	<1	<1		<1		<1
Nov 25	<1	<1	<1	<1			<1	<1
Dec 2	<1	<1	<1	<1		<1		<1
Dec 9	<1	<1	<1	<1			<1	<1
Dec 16	<1	<1	<1	<1		T-1 E<1		<1

Reservoir Disinfection Post Construction		
	Hypalon 1	Hypalon 2
Aug 26	TC<1 E<1	TC<1 E<1

12.0 Turbidity Analysis (NTU)

DATE	WELL#2	WELL#3	WELL#4	WELL#5	WELL#6
Jan 7	0.10	0.06	0.07	0.07	offline
Jan 21	0.10	0.09	0.10	0.11	
Jan 28	0.09	0.08	0.07	0.07	
Feb 4	0.09	0.15	0.16	0.13	
Feb 11	0.07	0.07	0.07	0.07	
Feb 25	0.06	0.07	0.13	0.06	
Mar 4	0.06	0.06	0.08	0.06	
Mar 11	0.06	0.09	0.07	0.06	
Mar 18	0.07	0.08	0.07	0.10	
Mar 25	0.07	0.06	0.07	0.05	
Apr 8	0.09	0.10	0.09	0.10	
Apr 15	0.06	0.06	0.09	0.05	
May 6	0.07	0.06	0.09	0.07	
May 27	0.06	0.06	0.07	0.06	
Jun 03	0.06	0.05	0.06	0.06	
Jun 10	0.05	0.06	0.09	0.09	
Jun 17	0.05	0.06	0.07	0.06	
Jul 8	0.07	0.05	0.06	0.06	

Jul 15	0.05	0.07	0.05	0.05	
Jul 22	0.05	0.05	0.07	0.05	
Jul 29	0.10	0.07	0.07	0.07	
Aug 19	0.09	0.07	0.09	0.08	
Aug 26	0.06	0.05	off	0.06	
Sept 9	0.08	0.05	0.11	0.06	
Sept 16	0.07	0.06	0.08	0.06	
Sept 23	0.07	0.05	0.06	0.05	
Oct 7	0.05	0.06	0.09	0.07	
Oct 21	0.07	0.05	0.07	0.07	
Oct 28	0.06	0.06	0.06	0.08	
Nov 04	0.06	0.06	0.14	0.06	
Nov 18	0.07	0.06	0.08	0.09	
Nov 25	0.08	0.06	0.08	0.07	
Dec 2	0.06	0.06	0.12	0.06	
Dec 9	0.08	0.06	0.11	0.06	
Dec 16	0.08	0.06	0.06	0.05	
Dec 30	0.09	0.06	0.07	0.10	
Average	0.07	0.07	0.08	0.07	
Hi	0.10	0.15	0.16	0.13	
Low	0.05	0.05	0.05	0.05	

13.0 Summary

The Town of Golden has worked with Interior Health Officials since 2002 to develop a water quality monitoring program that exceeds the Drinking Water Regulation. The Town will continue with this monitoring program as part of its commitment to deliver a safe potable water supply to the community.

This report will be posted on the Town of Golden's website for public information after it has been received by Council for information.

Respectfully,

Chris Cochran, AScT,
Manager of Operations

Attachment

Drinking Water Package - ALS Environmental

Well #2										
Year	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**RDL**	**Units**	**GCDWQ**
Misc. Inorganics										
Fluoride (F)	0.09	0.09	0.08	0.09	0.09	0.09	0.070	0.02	mg/L	1.5
ANIONS										
Nitrite (N)	<0.005	<0.005	<0.005	<0.005	<0.005	<0.010	<0.0010	0.001	mg/L	1
Calculated Parameters										
Total Hardness (CaCO3)	143	130	148	147	142		138	0.50	mg/L	
Nitrate (N)	0.26	0.2	0.27	0.25	0.24	0.21	0.22	0.005	mg/L	10
Misc. Inorganics										
Alkalinity (Total as CaCO3)	126	127	121	130	141	130	142	1.0	mg/L	
Alkalinity (PP as CaCO3)	<0.5	<0.5	<0.5	<0.5	<1.0	<1.0	<2.0	2.0	mg/L	
Bicarbonate (HCO3)	154	155	148	159	172	160	142	1.0	mg/L	
Carbonate (CO3)	<0.5	<0.5	<0.5	<0.5	<1.0	<1.0	<1.0	0.5	mg/L	
Hydroxide (OH)	<0.5	<0.5	<0.5	<0.5	<1.0	<1.0	<1.0	0.5	mg/L	
Anions										
Dissolved Sulphate (SO4)	16.3	16	16	19.8	19.7	20	18.5	0.3	mg/L	500
Dissolved Chloride (Cl)	9	6	11	9.8	8.4	11	10.4	0.5	mg/L	250
MISCELLANEOUS										
True Colour	5	<5	<5	<5	<5	<2	<5	5.0	TCU	15
Nutrients										
Nitrate plus Nitrite (N)	0.26	0.2	0.27	0.25	0.24	0.21	0.216	0.005	mg/L	
Physical Properties										
Conductivity	302	286	312	308	314	310	303	2.0	uS/cm	
pH	8.26	8.21	8.3	8	8.2	8.2	8.15	0.1	pH Units	7.0-10.5
Physical Properties										
Total Dissolved Solids	150	198	192	186	156	200	174	20	mg/L	500
Turbidity	<0.1	<0.1	<0.1	0.1	0.3	<0.1	<0.1	0.1	NTU	1
Total Metals by Atomic Spectroscopy										
Total Aluminum (Al)	<0.003	<0.004	<0.003	<0.003	0.012	0.012	0.0041	0.003	mg/L	0.1
Total Antimony (Sb)	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0006	<0.0001	0.0001	mg/L	0.006
Total Arsenic (As)	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0002	<0.0001	0.0001	mg/L	0.01
Total Barium (Ba)	0.053	0.047	0.053	0.054	0.054		0.0552	0.0001	mg/L	1
Total Boron (B)	<0.05	<0.05	<0.05	<0.05	<0.05		<0.010	0.01	mg/L	5
Total Cadmium (Cd)	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	0.00003	<0.000005	0.000005	mg/L	0.005
Total Chromium (Cr)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.00019	0.0001	mg/L	0.05
Total Cobalt (Co)	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0003	<0.00010	0.00010	mg/L	
Total Copper (Cu)	0.0008	0.001	0.001	0.0007	0.0011	0.0009	0.00112	0.00050	mg/L	1
Total Iron (Fe)	<0.005	<0.005	<0.005	<0.005	<0.005		<0.010	0.010	mg/L	0.3
Total Lead (Pb)	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.000056	0.000050	mg/L	0.01
Total Manganese (Mn)	<0.001	<0.001	<0.001	<0.001	<0.001		<0.00010	0.00010	mg/L	0.05
Total Mercury (Hg)	<0.00005	<0.00001	<0.00001	<0.00001	<0.00001	<0.0020	<0.0000050	0.0000050	mg/L	0.001
Total Molybdenum (Mo)	<0.001	<0.001	<0.001	<0.001	<0.001	0.00076	0.000575	0.000050	mg/L	
Total Nickel (Ni)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0005	<0.00050	0.00050	mg/L	
Total Selenium (Se)	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0002	<0.000050	0.000050	mg/L	0.05
Total Silver (Ag)	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002	<0.0001	<0.000010	0.000010	mg/L	
Total Uranium (U)	0.0005	0.0005	0.0005	0.0005	0.0005	0.00054	0.000481	0.000010	mg/L	0.02
Total Vanadium (V)	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.00050	0.00050	mg/L	
Total Zinc (Zn)	<0.005	<0.005	<0.005	<0.005	<0.005	<0.003	<0.0030	0.0030	mg/L	5
Total Calcium (Ca)	35.1	31.5	35.7	35.4	34.9		32.7	0.050	mg/L	
Total Magnesium (Mg)	13.4	12.5	14.3	14.2	13.4		13.7	0.0050	mg/L	
Total Potassium (K)	0.57	0.46	0.56	0.54	0.55		0.562	0.050	mg/L	
Total Sodium (Na)	6.01	3.72	7.3	6.4	5.9		6.74	0.050	mg/L	200
Total Sulphur (S)	6	7	6.3	6.3	6.7		6.01	0.50	mg/L	

Maximum Acceptable Concentration
Interem Maximum Allowable Concentration
Operation Guidline
Asthetic Objective

RDL - Reported Detection Limit
mg/L - Milligrams Per Litre
TCU - True Colour Unit
mS/cm - Microsiemens Per Centimeter
NTU - Nephelometric Colour Unit

Well #3										
Year	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**RDL**	**Units**	**GCDWQ**
Misc. Inorganics										
Fluoride (F)	0.09	0.09	0.08	0.09	0.09	0.10	0.071	0.02	mg/L	1.5
ANIONS										
Nitrite (N)	<0.005	<0.005	<0.005	<0.005	<0.005	<0.010	<0.0010	0.001	mg/L	1
Calculated Parameters										
Total Hardness (CaCO3)	165	158	167	165	165		163	0.50	mg/L	
Nitrate (N)	0.5	0.53	0.54	0.54	0.55	0.61	0.589	0.005	mg/L	10
Misc. Inorganics										
Alkalinity (Total as CaCO3)	145	148	139	149	152	150	159	1.0	mg/L	
Alkalinity (PP as CaCO3)	<0.5	<0.5	1.24	<0.5	<1.0	<1.0	<2.0	2.0	mg/L	
Bicarbonate (HCO3)	177	181	167	182	185	180	159	1.0	mg/L	
Carbonate (CO3)	<0.5	<0.5	1.49	<0.5	<1.0	<1.0	<1.0	0.5	mg/L	
Hydroxide (OH)	<0.5	<0.5	<0.5	<0.5	<1.0	<1.0	<1.0	0.5	mg/L	
Anions										
Dissolved Sulphate (SO4)	18.1	15.4	16.7	19.1	18.1	20.0	18.4	0.3	mg/L	500
Dissolved Chloride (Cl)	12	19	12	12	13	19	15.3	0.5	mg/L	250
MISCELLANEOUS										
True Colour	5	<5	<5	<5	9.2	<2	<5	5.0	TCU	15
Nutrients										
Nitrate plus Nitrite (N)	0.5	0.53	0.54	0.54	0.55	0.61	0.589	0.005	mg/L	
Physical Properties										
Conductivity	346	377	349	346	349	360	303	2.0	uS/cm	
pH	8.28	8.2	8.3	8.1	8.3	8.1	8.20	0.1	pH Units	7.0-10.5
Physical Properties										
Total Dissolved Solids	202	196	216	182	182	220	189	20	mg/L	500
Turbidity	<0.1	0.1	0.1	<0.1	0.26	<0.1	<0.1	0.1	NTU	1
Total Metals by Atomic Spectroscopy										
Total Aluminum (Al)	<0.003	<0.003	<0.003	<0.003	0.011	0.004	0.0049	0.003	mg/L	0.1
Total Antimony (Sb)	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0006	<0.0001	0.0001	mg/L	0.006
Total Arsenic (As)	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0002	<0.0001	0.0001	mg/L	0.01
Total Barium (Ba)	0.012	0.125	0.121	0.118	0.117		0.1290	0.0001	mg/L	1
Total Boron (B)	<0.05	<0.05	<0.05	<0.05	<0.05		<0.010	0.01	mg/L	5
Total Cadmium (Cd)	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00002	<0.000005	0.000005	mg/L	0.005
Total Chromium (Cr)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0010	0.00057	0.0001	mg/L	0.05
Total Cobalt (Co)	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0003	<0.00010	0.00010	mg/L	
Total Copper (Cu)	0.0007	0.0006	0.001	0.0006	0.0009	0.0009	0.00132	0.00050	mg/L	1
Total Iron (Fe)	<0.005	<0.005	<0.005	<0.005	<0.005		<0.010	0.010	mg/L	0.3
Total Lead (Pb)	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.000065	0.000050	mg/L	0.01
Total Manganese (Mn)	<0.001	<0.001	<0.001	<0.001	<0.001		<0.00010	0.00010	mg/L	0.05
Total Mercury (Hg)	<0.00005	<0.00001	<0.00001	<0.00001	<0.00001	<0.0020	<0.0000050	0.0000050	mg/L	0.001
Total Molybdenum (Mo)	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.000573	0.000050	mg/L	
Total Nickel (Ni)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0005	<0.00050	0.00050	mg/L	
Total Selenium (Se)	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0002	<0.000050	0.000050	mg/L	0.05
Total Silver (Ag)	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002	<0.0001	<0.000010	0.000010	mg/L	
Total Uranium (U)	0.0006	0.0007	0.0007	0.0007	0.0007	0.00070	0.000656	0.000010	mg/L	0.02
Total Vanadium (V)	<0.005	<0.005	<0.005	<0.005	<0.005	0.0014	<0.00050	0.00050	mg/L	
Total Zinc (Zn)	<0.005	<0.005	<0.005	<0.005	<0.005	<0.003	<0.0030	0.0030	mg/L	5
Total Calcium (Ca)	32.6	30.4	33.2	31.5	31.3		30.8	0.050	mg/L	
Total Magnesium (Mg)	20.3	19.9	20.4	20.9	21.2		20.8	0.0050	mg/L	
Total Potassium (K)	0.76	0.75	0.79	0.73	0.73		0.817	0.050	mg/L	
Total Sodium (Na)	7.3	12.1	7.6	7.2	7.0		9.85	0.050	mg/L	200
Total Sulphur (S)	5	7	6.5	6.1	6.4		6.17	0.50	mg/L	

Maximum Acceptable Concentration
Interem Maximum Allowable Concentration
Operation Guidline
Asthetic Objective

RDL - Reported Detection Limit
mg/L - Milligrams Per Litre
TCU - True Colour Unit
mS/cm - Microsiemens Per Centimeter
NTU - Nephelometric Colour Unit

Well #4										
Year	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**RDL**	**Units**	**GCDWQ**
Misc. Inorganics			OFFLINE							
Fluoride (F)	0.06	0.06		0.06	0.06		0.036	0.02	mg/L	1.5
ANIONS										
Nitrite (N)	<0.005	<0.005		<0.005	<0.005	<0.03	<0.0010	0.001	mg/L	1
Calculated Parameters										
Total Hardness (CaCO3)	370	344		383	396		420	0.50	mg/L	
Nitrate (N)	1.46	1.42		1.44	1.64	7.8	1.76	0.005	mg/L	10
Misc. Inorganics										
Alkalinity (Total as CaCO3)	312	323		338	356	370	362	1.0	mg/L	
Alkalinity (PP as CaCO3)	<0.5	<0.5		<0.5	<1.0	<1.0	<2.0	2.0	mg/L	
Bicarbonate (HCO3)	380	395		412	434	450	362	1.0	mg/L	
Carbonate (CO3)	<0.5	<0.5		<0.5	<1.0	<1.0	<1.0	0.5	mg/L	
Hydroxide (OH)	<0.5	<0.5		<0.5	<1.0	<1.0	<1.0	0.5	mg/L	
Anions										
Dissolved Sulphate (SO4)	39.4	33.8		41.5	42.8	41	39.2	0.3	mg/L	500
Dissolved Chloride (Cl)	72	78		97	110	110	101.0	0.5	mg/L	250
MISCELLANEOUS										
True Colour	<5	<5		<5	17.3	2.2	<5	5.0	TCU	15
Nutrients										
Nitrate plus Nitrite (N)	1.46	1.42		1.44	1.64	1.8	1.760	0.005	mg/L	
Physical Properties										
Conductivity	869	896		959	1050	1000	968	2.0	uS/cm	
pH	8.21	8		7.77	8.26	7.9	7.95	0.1		7.0-10.5
Physical Properties										
Total Dissolved Solids	486	490		506	580	560	544	20	mg/L	500
Turbidity	<0.1	<0.1		0.15	1.03	<0.1	0.17	0.1	NTU	1
Total Metals by Atomic Spectroscopy										
Total Aluminum (Al)	<0.003	<0.003		<0.003	0.010	0.0035	<0.003	0.003	mg/L	0.1
Total Antimony (Sb)	<0.0005	<0.0005		<0.0005	<0.0005	<0.0006	<0.0001	0.0001	mg/L	0.006
Total Arsenic (As)	<0.0001	<0.0001		<0.0001	<0.0001	<0.0002	<0.0001	0.0001	mg/L	0.01
Total Barium (Ba)	0.196	0.179		0.21	0.24		0.2290	0.0001	mg/L	1
Total Boron (B)	<0.05	<0.05		<0.05	<0.05		0.014	0.01	mg/L	5
Total Cadmium (Cd)	<0.00001	<0.00001		<0.00001	<0.00001	<0.00002	<0.000005	0.000005	mg/L	0.005
Total Chromium (Cr)	<0.001	<0.001		<0.001	<0.001	<0.001	0.00012	0.0001	mg/L	0.05
Total Cobalt (Co)	<0.0005	<0.0005		<0.0005	<0.0002	<0.0003	<0.00010	0.00010	mg/L	
Total Copper (Cu)	0.0011	0.0008		0.0012	0.0016	0.0023	0.00654	0.00050	mg/L	1
Total Iron (Fe)	<0.005	<0.005		<0.005	<0.005		<0.010	0.010	mg/L	0.3
Total Lead (Pb)	<0.0002	<0.0002		<0.0002	<0.0002	<0.0002	0.000697	0.000050	mg/L	0.01
Total Manganese (Mn)	<0.001	<0.001		<0.001	<0.001		<0.00010	0.00010	mg/L	0.05
Total Mercury (Hg)	<0.00005	<0.00001		<0.00001	<0.00001	<0.0020	<0.0000050	0.0000050	mg/L	0.001
Total Molybdenum (Mo)	<0.001	<0.001		<0.001	<0.001	<0.0002	0.000243	0.000050	mg/L	
Total Nickel (Ni)	<0.001	<0.001		<0.001	<0.001	<0.0005	<0.00050	0.00050	mg/L	
Total Selenium (Se)	0.0001	0.0001		<0.0001	<0.0001	<0.0002	0.000101	0.000050	mg/L	0.05
Total Silver (Ag)	<0.00002	<0.00002		<0.00002	<0.00002	<0.0001	<0.000010	0.000010	mg/L	
Total Uranium (U)	0.0012	0.0011		0.0012	0.0013	0.0014	0.00128	0.000010	mg/L	0.02
Total Vanadium (V)	<0.005	<0.005		<0.005	<0.005	0.001	<0.00050	0.00050	mg/L	
Total Zinc (Zn)	<0.005	<0.005		<0.005	<0.005	0.005	0.0217	0.0030	mg/L	5
Total Calcium (Ca)	87.8	81.4		85.4	89.7		95.1	0.050	mg/L	
Total Magnesium (Mg)	36.5	34.3		41.2	41.7		44.3	0.0050	mg/L	
Total Potassium (K)	1.69	1.48		1.89	1.96		2.02	0.050	mg/L	
Total Sodium (Na)	40.4	38.8		51.1	59.0		62.0	0.050	mg/L	200
Total Sulphur (S)	13	13		14.1	15.5		14.6	0.50	mg/L	

Maximum Acceptable Concentration
Interem Maximum Allowable Concentration
Operation Guidline
Asthetic Objective

RDL - Reported Detection Limit
mg/L - Milligrams Per Litre
TCU - True Colour Unit
mS/cm - Microsiemens Per Centimeter
NTU - Nephelometric Colour Unit

Well #5										
Year	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**RDL**	**Units**	**GCDWQ**
Misc. Inorganics										
Fluoride (F)	0.10	0.10	0.08	0.09	0.09		0.065	0.02	mg/L	1.5
ANIONS										
Nitrite (N)	0.005	<0.005	<0.005	<0.005	<0.005	<0.033	<0.0010	0.001	mg/L	1
Calculated Parameters										
Total Hardness (CaCO3)	178	169	181	182	174		177	0.50	mg/L	
Nitrate (N)	0.50	0.45	0.46	0.45	0.52	2.1	0.497	0.005	mg/L	10
Misc. Inorganics										
Alkalinity (Total as CaCO3)	157	156	150	162	168	160	174	1.0	mg/L	
Alkalinity (PP as CaCO3)	<0.5	<0.5	0.83	<0.5	<1.0	<1.0	<2.0	2.0	mg/L	
Bicarbonate (HCO3)	191	190	181	198	205	190	174	1.0	mg/L	
Carbonate (CO3)	<0.5	<0.5	1	<0.5	<1.0	<1.0	<1.0	0.5	mg/L	
Hydroxide (OH)	<0.5	<0.5	<0.5	<0.5	<1.0	<1.0	<1.0	0.5	mg/L	
Anions										
Dissolved Sulphate (SO4)	21.3	19.5	18.8	22.6	21.2	23	20.8	0.3	mg/L	500
Dissolved Chloride (Cl)	15	14	14	14	15	16	17.0	0.5	mg/L	250
MISCELLANEOUS										
True Colour	<5	<5	<5	<5	5		<5	5.0	TCU	15
Nutrients										
Nitrate plus Nitrite (N)	0.50	0.45	0.46	0.45	0.52	0.47	0.497	0.005	mg/L	
Physical Properties										
Conductivity	386	373	379	382	390	390	391	2.0	uS/cm	
pH	8.23	8.17	8.32	8.06	8.29	8.13	8.23	0.1		7.0-10.5
Physical Properties										
Total Dissolved Solids	238	198	228	206	200	190	222	20	mg/L	500
Turbidity	<0.1	<0.1	0.14	<0.1	0.3		<0.1	0.1	NTU	1
Total Metals by Atomic Spectroscopy										
Total Aluminum (Al)	<0.003	<0.003	<0.003	<0.003	0.012	0.005	0.0088	0.003	mg/L	0.1
Total Antimony (Sb)	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0006	<0.0001	0.0001	mg/L	0.006
Total Arsenic (As)	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0002	<0.0001	0.0001	mg/L	0.01
Total Barium (Ba)	0.076	0.069	0.074	0.073	0.076		0.0762	0.0001	mg/L	1
Total Boron (B)	<0.05	<0.05	<0.05	<0.05	<0.05		<0.010	0.01	mg/L	5
Total Cadmium (Cd)	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00002	<0.000005	0.000005	mg/L	0.005
Total Chromium (Cr)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.00033	0.0001	mg/L	0.05
Total Cobalt (Co)	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0003	<0.00010	0.00010	mg/L	
Total Copper (Cu)	0.0013	0.0008	0.0006	0.0006	0.0007	0.0007	0.00142	0.00050	mg/L	1
Total Iron (Fe)	<0.005	<0.005	<0.005	<0.005	<0.010		0.011	0.010	mg/L	0.3
Total Lead (Pb)	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.000057	0.000050	mg/L	0.01
Total Manganese (Mn)	<0.001	<0.001	<0.001	<0.001	<0.001		0.00012	0.00010	mg/L	0.05
Total Mercury (Hg)	<0.00005	<0.00001	<0.00001	<0.00001	<0.00001	<0.0020	<0.0000050	0.0000050	mg/L	0.001
Total Molybdenum (Mo)	<0.001	<0.001	<0.001	<0.001	<0.001	0.0005	0.000528	0.000050	mg/L	
Total Nickel (Ni)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0005	<0.00050	0.00050	mg/L	
Total Selenium (Se)	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0002	0.000055	0.000050	mg/L	0.05
Total Silver (Ag)	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002	<0.0001	<0.000010	0.000010	mg/L	
Total Uranium (U)	0.0006	0.0006	0.0006	0.0006	0.0006	0.00063	0.00058	0.000010	mg/L	0.02
Total Vanadium (V)	<0.005	<0.005	<0.005	<0.005	<0.005	0.002	<0.00050	0.00050	mg/L	
Total Zinc (Zn)	<0.005	<0.005	<0.005	<0.005	<0.005	<0.003	0.0038	0.0030	mg/L	5
Total Calcium (Ca)	42.9	41.1	43.6	42.6	41.0		40.9	0.050	mg/L	
Total Magnesium (Mg)	17.2	16.1	17.4	18.3	17.3		18.3	0.0050	mg/L	
Total Potassium (K)	0.95	0.82	0.92	0.92	0.91		0.98	0.050	mg/L	
Total Sodium (Na)	9.42	8.26	9.46	9.66	9.23		10.6	0.050	mg/L	200
Total Sulphur (S)	7	7	7.1	7.6	6.4		7.04	0.50	mg/L	

Maximum Acceptable Concentration
Interem Maximum Allowable Concentration
Operation Guidline
Asthetic Objective

RDL - Reported Detection Limit
mg/L - Milligrams Per Litre
TCU - True Colour Unit
mS/cm - Microsiemens Per Centimeter
NTU - Nephelometric Colour Unit

Well #6										
Year	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**RDL**	**Units**	**GCDWQ**
Misc. Inorganics						OFFLINE	OFFLINE			
Fluoride (F)	0.05	0.05	0.05	0.05	0.05			0.02	mg/L	1.5
ANIONS										
Nitrite (N)	<0.005	<0.005	<0.005	<0.005	<0.005			0.001	mg/L	1
Calculated Parameters										
Total Hardness (CaCO3)	292	300	323	339	319			0.50	mg/L	
Nitrate (N)	0.9	0.93	1.1	1.4	1.5			0.005	mg/L	10
Misc. Inorganics										
Alkalinity (Total as CaCO3)	272	285	277	313	294			1.0	mg/L	
Alkalinity (PP as CaCO3)	<0.5	<0.5	<0.5	<0.5	<1.0			2.0	mg/L	
Bicarbonate (HCO3)	332	347	337	382	359			1.0	mg/L	
Carbonate (CO3)	<0.5	<0.5	<0.5	<0.5	<1.0			0.5	mg/L	
Hydroxide (OH)	<0.5	<0.5	<0.5	<0.5	<1.0			0.5	mg/L	
Anions										
Dissolved Sulphate (SO4)	24.6	24.6	24	27.4	27.3			0.3	mg/L	500
Dissolved Chloride (Cl)	25	27	28	31	40			0.5	mg/L	250
MISCELLANEOUS										
True Colour	5	<5	<5	<5	<5			5.0	TCU	15
Nutrients										
Nitrate plus Nitrite (N)	0.90	0.93	1.10	1.37	1.50			0.005	mg/L	
Physical Properties										
Conductivity	628	638	664	712	702			2.0	uS/cm	
pH	8.26	7.98	8.26	7.79	8.26			0.1		7.0-10.5
Physical Properties										
Total Dissolved Solids	359	352	396	408	394			20	mg/L	500
Turbidity	0.1	<0.1	0.15	0.13	0.34			0.1	NTU	1
Total Metals by Atomic Spectroscopy										
Total Aluminum (Al)	<0.003	<0.003	<0.003	<0.003	0.011			0.003	mg/L	0.1
Total Antimony (Sb)	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005			0.0001	mg/L	0.006
Total Arsenic (As)	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001			0.0001	mg/L	0.01
Total Barium (Ba)	0.129	0.13	0.14	0.16	0.15			0.0001	mg/L	1
Total Boron (B)	<0.05	<0.05	<0.05	<0.05	<0.05			0.01	mg/L	5
Total Cadmium (Cd)	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001			0.000005	mg/L	0.005
Total Chromium (Cr)	<0.001	<0.001	<0.001	<0.001	<0.001			0.0001	mg/L	0.05
Total Cobalt (Co)	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002			0.00010	mg/L	
Total Copper (Cu)	0.0013	0.0014	0.0014	0.001	0.001			0.00050	mg/L	1
Total Iron (Fe)	0.010	0.008	0.01	0.009	<0.005			0.010	mg/L	0.3
Total Lead (Pb)	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002			0.000050	mg/L	0.01
Total Manganese (Mn)	0.0013	<0.001	<0.001	<0.001	<0.001			0.00010	mg/L	0.05
Total Mercury (Hg)	<0.00005	<0.00001	<0.00001	<0.00001	<0.00001			0.0000050	mg/L	0.001
Total Molybdenum (Mo)	<0.001	<0.001	<0.001	<0.001	<0.001			0.000050	mg/L	
Total Nickel (Ni)	<0.001	<0.001	<0.001	<0.001	<0.001			0.00050	mg/L	
Total Selenium (Se)	0.0001	0.0001	0.0001	<0.0001	0.0001			0.000050	mg/L	0.05
Total Silver (Ag)	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002			0.000010	mg/L	
Total Uranium (U)	0.0010	0.0011	0.0011	0.0011	0.0011			0.000010	mg/L	0.02
Total Vanadium (V)	<0.005	<0.005	<0.005	<0.005	<0.005			0.00050	mg/L	
Total Zinc (Zn)	<0.005	<0.005	<0.005	<0.005	<0.005			0.0030	mg/L	5
Total Calcium (Ca)	76.2	78.6	83.4	87.3	84.2			0.050	mg/L	
Total Magnesium (Mg)	24.7	25.1	27.8	29.5	26.5			0.0050	mg/L	
Total Potassium (K)	0.852	0.795	0.89	0.92	0.94			0.050	mg/L	
Total Sodium (Na)	14	13	16.2	17.5	18.8			0.050	mg/L	200
Total Sulphur (S)	9	8	8.4	8.7	8.4			0.50	mg/L	

Maximum Acceptable Concentration
Interem Maximum Allowable Concentration
Operation Guidline
Asthetic Objective

RDL - Reported Detection Limit
mg/L - Milligrams Per Litre
TCU - True Colour Unit
mS/cm - Microsiemens Per Centimeter
NTU - Nephelometric Colour Unit

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