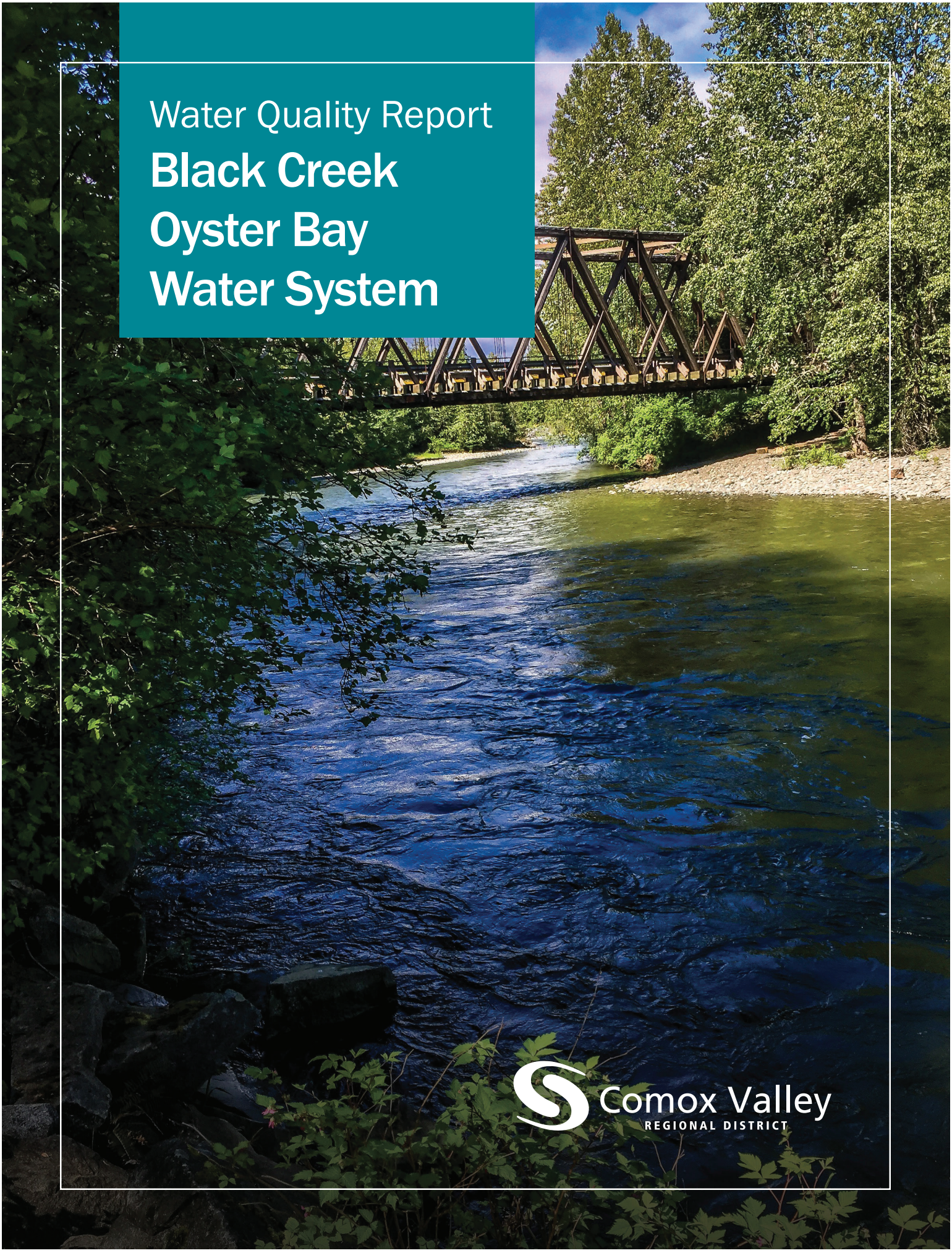

Water Quality Report

Black Creek Oyster Bay Water System

Comox Valley
REGIONAL DISTRICT

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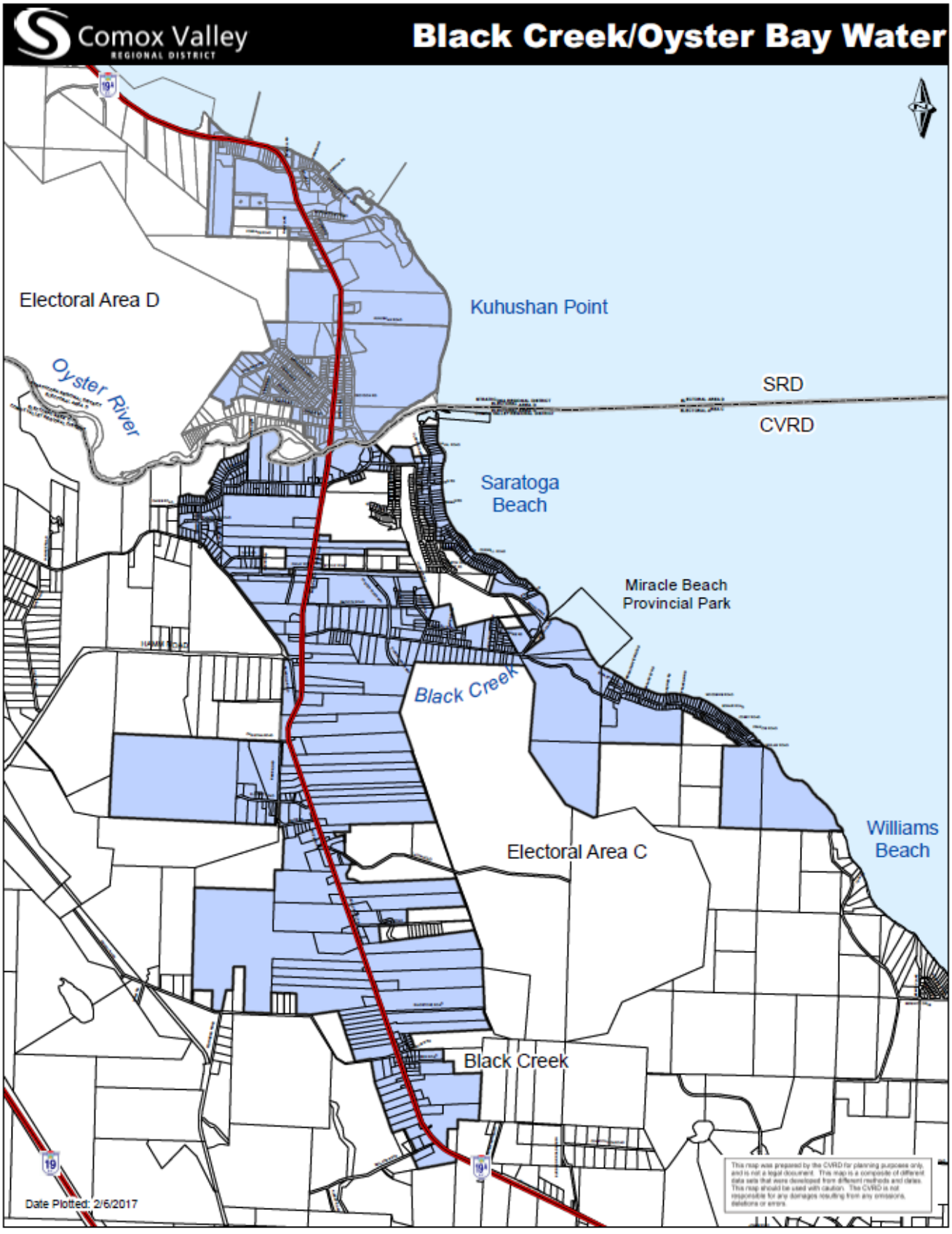
Map of Service Area



Introduction

The Comox Valley Regional District (CVRD) strives to provide high quality drinking water to the Black Creek/Oyster Bay (BCOB) Service Area, through responsible operation, monitoring and management of the water system. The CVRD is regulated by Island Health as part of the Ministry of Health for its activities as a potable water supplier. Under the *Drinking Water Protection Act* (DWP Act), the CVRD is required to report annually on water quality for the BCOB Drinking Water System. This report covers the period from January 1 to December 31, 2022 and includes information on water quality, consumption, maintenance and capital projects.

The BCOB Water Service provides domestic water to approximately 2,100 residents and 30 local businesses located in both the CVRD Puntledge – Black Creek (Electoral Area C) and the Strathcona Regional District Electoral Area D. The service is owned and operated by the CVRD for the benefit of both regional districts and is funded through a combination of frontage tax and user rates.

The service consists of four groundwater supply wells and one surface water infiltration gallery adjacent to the Oyster River. The water treatment facility utilizes chlorination, pH control systems, a chlorine gas scrubber, ultraviolet light (UV) disinfection and emergency backup power. The system also includes one pump station and two reservoirs located on Macaulay and Kelland Road.

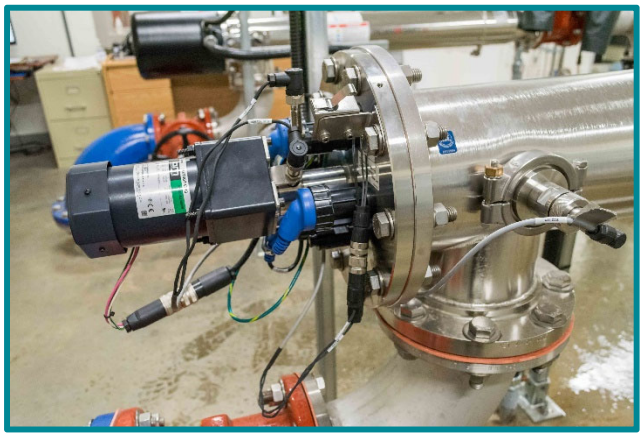


Figure No.1: UV Maintenance inside the BCOB Water Treatment Facility.

Operations

Goals

To provide high quality drinking water to all customers through efficient and effective disinfection and distribution operations.

Water Quality Summary

Parameter[1]	2021	2022	Target
Source Water			
Source Water Turbidity (average nephelometric turbidity unit (NTU))	0.15	0.13	<1.0
Source Water Temperature (Celsius)	11.2	10.9	<15
Source Water pH Level	6.73	6.5	Raw*
Water Treatment			
Chlorine Dose (mg/L)	1.12	1.10	<2.0
Distribution Water pH Level (after adjustment)	7.5	7.4	7.0-8.5
Distribution System			
Chlorine Residual-Distribution System (mg/L)	0.99	0.91	>0.20
Total Coliforms (positive samples)	1	0	0
E.Coli (positive samples)	0	0	0
Total Trihalomethanes (mg/L)	0.007	0.007	<0.1

[1]More information for each parameter is available later on in the report.

*source water, cannot change parameters until treatment

The Ministry of Health regulates municipal drinking water quality through the DWP Act and the *Drinking Water Protection Regulation* (the Regulation). The DWP Act and Regulation are administered by regional health authorities, and for the CVRD, the administering authority is Island Health. Both the DWP Act and Regulation set out certain requirements for drinking water operators and suppliers to ensure the provision of safe drinking water to their customers.

In the BCOB Water System, raw water enters the Oyster River treatment facility which utilizes UV and chlorine gas for the disinfection process. When water is drawn from the groundwater wells, caustic soda is used for pH adjustment. Once the raw water is treated it proceeds into the distribution system, which consists of two reservoirs and one booster pump station. The CVRD takes weekly water quality samples of the source water and treated water at four fixed locations within the distribution system to ensure that water is meeting provincial objectives. Bi-annual testing for distribution by-products is taken from the Macaulay Road reservoir along with a water chemistry report being completed. A summary of water quality and a description of sampling results can be found below. For detailed water quality results refer to Appendix A.

Disinfection

All water supply systems governed by Island Health that are using surface water are required to adhere to provincial 4-3-2-1-0 surface water treatment objectives to ensure that the water treatment process is effectively killing disease causing viruses, bacteria and parasites. The 4-3-2-1-0 specifications are as follows:

- 4-log (99.99 per cent) removal/inactivation of viruses;
- 3-log (99.9 per cent) removal/inactivation of giardia cysts and cryptosporidium oocysts;
- 2 treatment processes, usually filtration and disinfection;
- 1 NTU turbidity (maximum) in finished water;
- No detectable E.Coli, fecal coliforms and total coliforms in treated water.

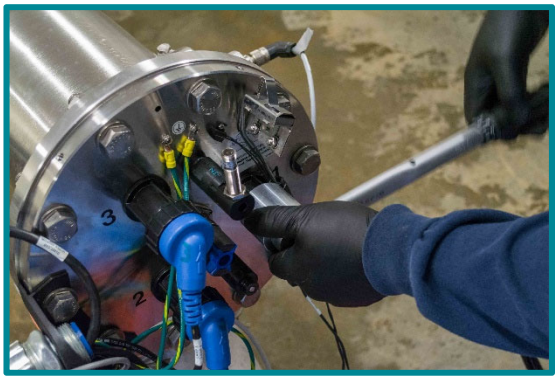


Figure No.2: UV maintenance within BCOB Treatment Facility

The system is fully compliant with Island Health's surface water treatment objectives and has obtained a filtration deferral permit for use of the Oyster River infiltration gallery. Water drawn from the river utilizes a two-step disinfection process for surface water, UV disinfection followed by chlorination. When water is being drawn out of groundwater wells, caustic is also used to help raise the pH of the water.

By dosing the water with chlorine at the treatment plant a free chlorine residual is established throughout the distribution network to help prevent water from bacteriological regrowth. The free chlorine residual is an indicator of the effectiveness of disinfection within the distribution system. The CVRD strives to maintain a free chlorine residual above 0.2mg/L at the end of the system. The CVRD regularly monitors the chlorine residual throughout the distribution network at four fixed locations. Figure No.3 below provides the average chlorine residual at the four sampling kiosks.

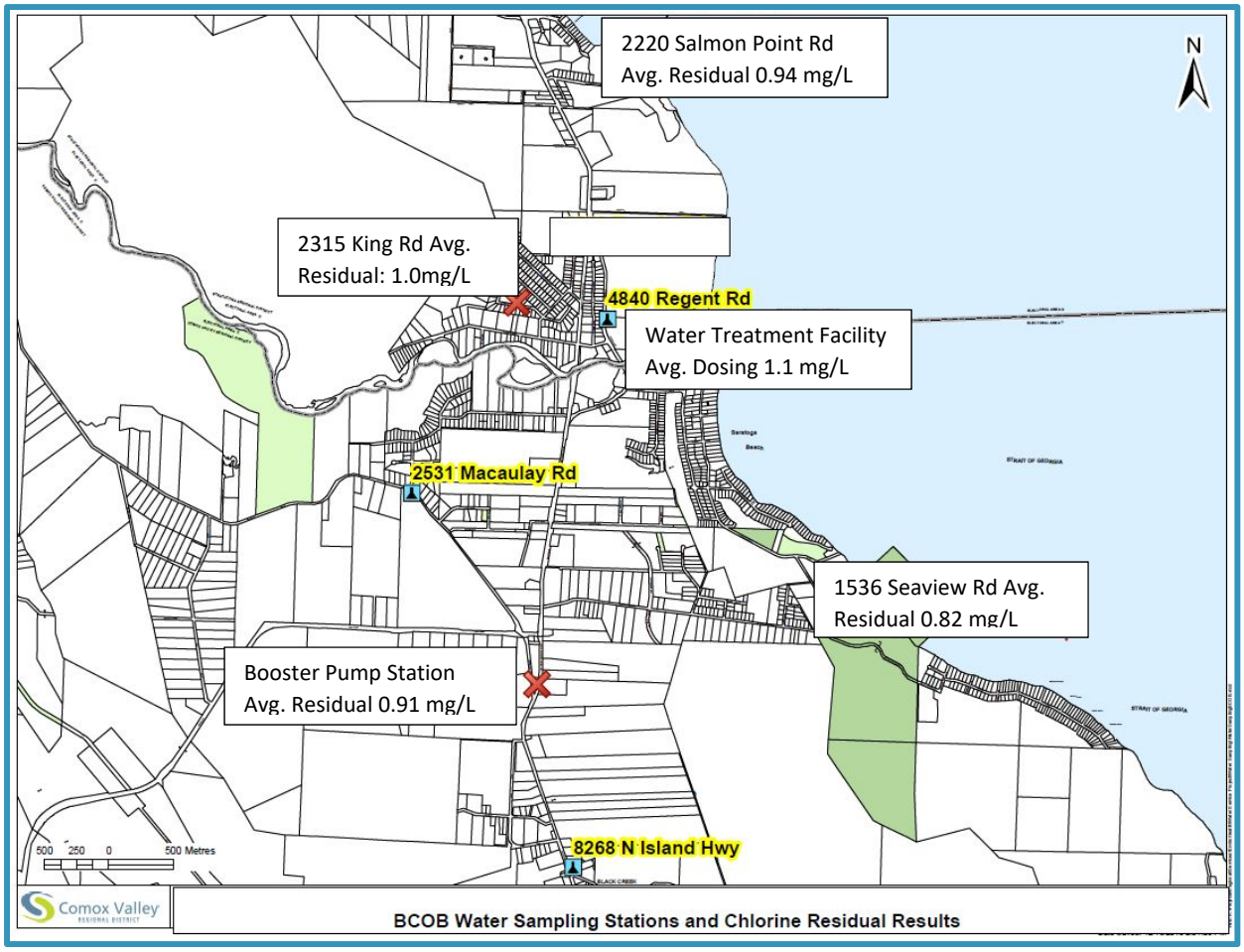


Figure No.3: Average Chlorine Residual at the BCOB Sampling Locations

A by-product of chlorination can be Trihalomethanes (THM). There are four types of THM's that contribute to total THM's. Chloroform is the most common THM and is formed when natural organic matter reacts with chlorine and/or bromine in disinfected water. The guidelines require that the total THM's for drinking water must be less than 0.1mg/L. Samples for THM's are taken Bi-annually at the Macaulay Road reservoir Table No.1 below shows the average THM's at the Macaulay reservoir.

Table No.1: Total THM Concentration at the Macaulay Road Reservoir 2022

Trihalomethanes	Macaulay Reservoir
Chloroform	0.003
Bromodichloromethane	0.002
Chlorodibromomethane	0.002
Bromoform	<0.001
Average Total THMs (mg/L)	**0.007**

Bacteria

E.Coli and total coliform bacteria are microorganisms that if present in water samples indicate possible contamination with sewage or animal waste. Chlorination helps to remove harmful pathogens within the water supply network. Table No.2 below, shows that within the BCOB water

distribution system for 2022, there were zero positive results found for E.Coli and zero total coliforms.

Table No.2: Bacteriological Standards and Sampling Results 2022

Results	E.Coli		Total Coliform Bacteria	
	Exceedances[1]	# of Samples	Exceedances[2]	# of Samples
January	0	8	0	8
February	0	8	0	8
March	0	8	0	8
April	0	9	0	9
May	0	8	0	8
June	0	9	0	9
July	0	6	0	6
August	0	8	0	8
September	0	9	0	9
October	0	8	0	8
November	0	8	0	8
December	0	7	0	7
Totals	**0 exceedances per 95 samples**		**0 exceedances per 95 samples**	

[1]Standard-No detectable E.Coli per 100mL

[2]Standard-At least 90 per cent of samples have no detectable total coliform bacteria per 100 ml and no sample has more than 10 total coliform bacteria per 100 ml

Canadian Drinking Water Guidelines

Health Canada develops the *Canadian Drinking Water Guidelines*. These are guidelines for limits on microbial, chemical, physical and radiological substances in drinking water. In the guidelines, there are health-based limits on a substance maximum allowable concentration. The guidelines also assign aesthetic objectives to substances that do not cause risk to human health, but will influence consumer acceptance of the water based on factors such as taste, odour and colour. Samples are taken bi-annually at the Macaulay Road reservoir. Table No.3 shows the average concentration for multiple parameters compared to the guideline concentrations. In 2022, the system was below all maximum allowable concentrations.

More information on the parameters listed below, including common sources and health considerations, can be found on the Health Canada website.

Table No.3: Chemical and Physical Parameters at Macaulay Reservoir Compared to Guideline Concentrations

Parameter	Macaulay Reservoir (mg/L)	Guideline Concentration (mg/L)
Aluminum	0.003	≤0.1
Arsenic	<0.0001	≤0.01
Barium	0.0012	≤1.0
Boron	<0.05	≤5.0
Chloride	9.0	250
Chromium	<0.001	≤0.05
Colour	<5 (TCU)	<15(TCU)
Copper	0.0012	1
Fluoride	<0.050	≤1.5
Iron	0.0069	≤0.30
Lead	<0.0002	≤0.01
Manganese	<0.001	≤0.05
Nitrite (as N)	<0.005	10
Selenium	0.0011	≤0.05
Sodium	33.1	≤200
Zinc	<0.005	≤5

Turbidity

The *Canadian Drinking Water Guidelines* also require the turbidity to be below 1 NTU. Turbidity is the measure of relative clarity of a liquid. Clarity is important when producing drinking water for human consumption. The average source water turbidity was 0.13 NTU.

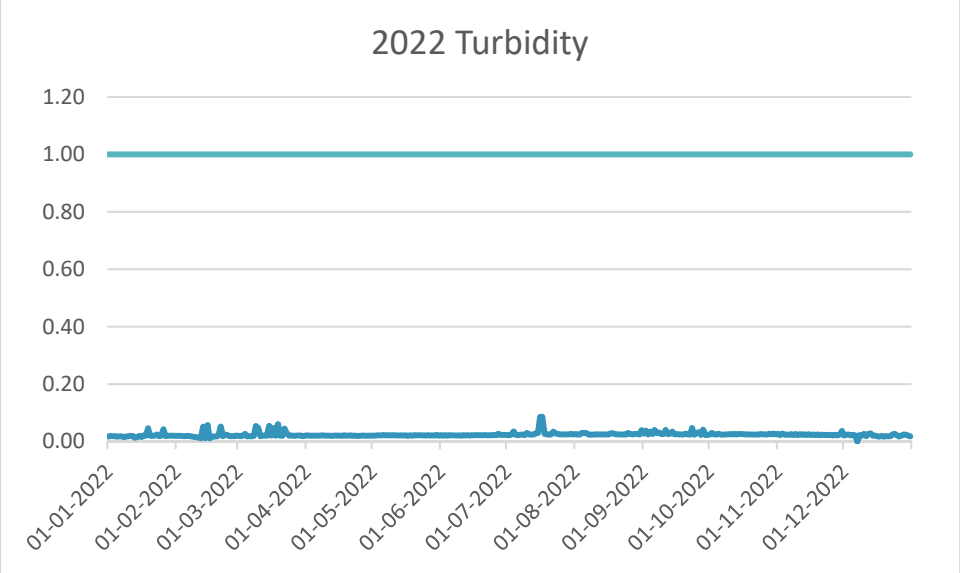


Figure No.4: Source Water Turbidity

Temperature

Temperature is described as an aesthetic objective (a parameter that may impair the taste, smell or colour of water) and physical characteristic of water. Gradual variations in water temperature occur throughout the seasons, however signifcant changes in water temperature can upset chlorination and chemical water treatment processess. The guidelines recommend water temperature to be less than 15 degrees celsius. The average temperature for the incoming source water was 10.9 degrees celsius and within the distribution was 11.7 degrees celsius.

pH

The pH of water is a measure of water acidity. pH has minimal impact for water consumers and varies greatly depending on the water source. However, pH is very important for many operational water quality parameters. The *Canadian Drinking Water Guidelines* recommend the finished water pH ranging between 7 to 10.5. In 2022, the average pH of the source water was 6.5 and the average pH within the distribution system was 7.4.

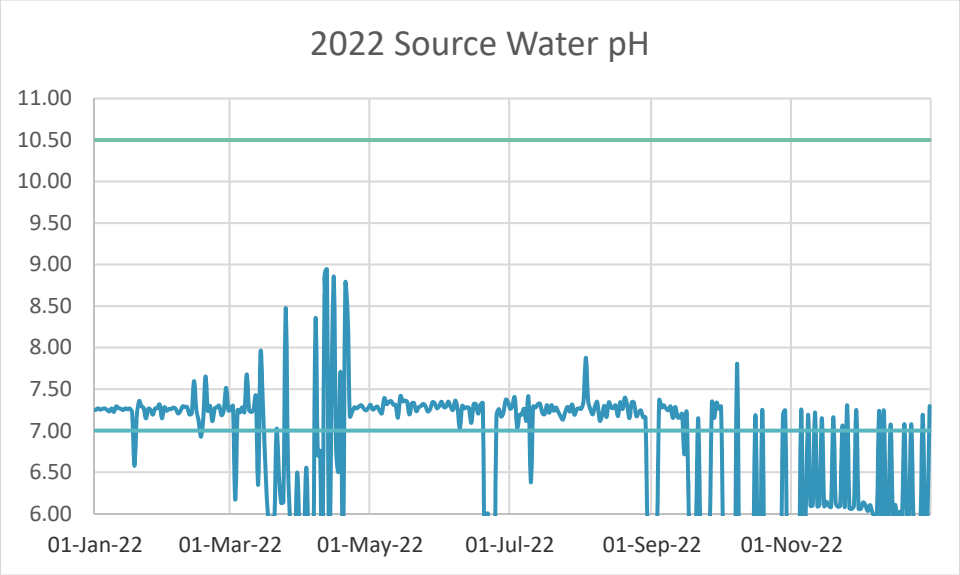


Figure No.5: Source Water pH

Planning

Goals

To ensure effective long-term planning and management programs are in place to meet the needs of all users groups while minimizing operation and infrastructure costs.

Consumption

In 2022, the CVRD treated a total of 349,305 m^3 of water. The average daily water consumption for the system is 1083 m^3/day. For the BCOB Water System, surface water and groundwater sources are typically rotated seasonally depending on turbidity and system demand. A water conservation bylaw was adopted for the BCOB Water System in April 2018. The purpose of the bylaw is to help reduce water use in the summer months when water consumption increases and water availability decreases. There are a number of factors that contribute to system demands and further review of future years will be required to determine the effectiveness of watering restrictions. The maximum day demand was 3,292 m^3 and occurred on July 15, 2022. Stage 1 water restrictions take effect yearly on May 1st

and Stage 2 restrictions take effect yearly on July 1st. However, it can be seen that during the summer months water consumption is increasing approximately two fold from the average day demand, as shown in the Figure No.6 below.

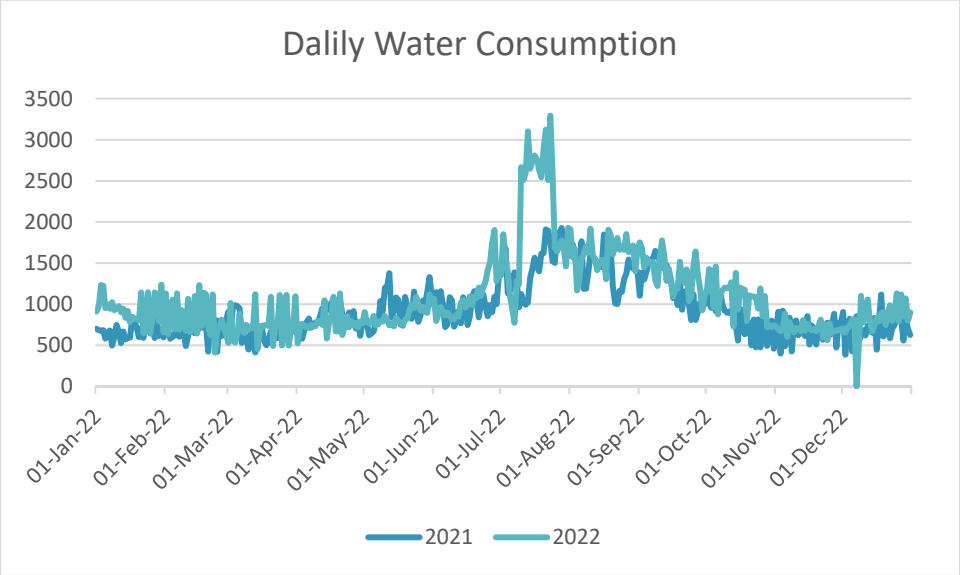


Figure No.6: Daily Water Consumption in BCOB for 2021 and 2022

Maintenance

The BCOB Water System is owned and operated by the CVRD. The water services staff consists of ten operators with varying ranges of certification. Each operator is registered with the Environmental Operator's Certification Program within BC and is required to remain in good standing by taking yearly continuing education courses.

The CVRD carries out regular and routine maintenance of the entire BCOB Water System, to ensure continued operation and supply of safe and clean water to all users. The treatment facility, wells, distribution lines and reservoirs are regularly inspected and maintained.

A total of 264 Work Orders within the system were investigated by CVRD Waterworks Operations Staff. Figure No.7 identifies the various types of service requests received by waterworks staff.

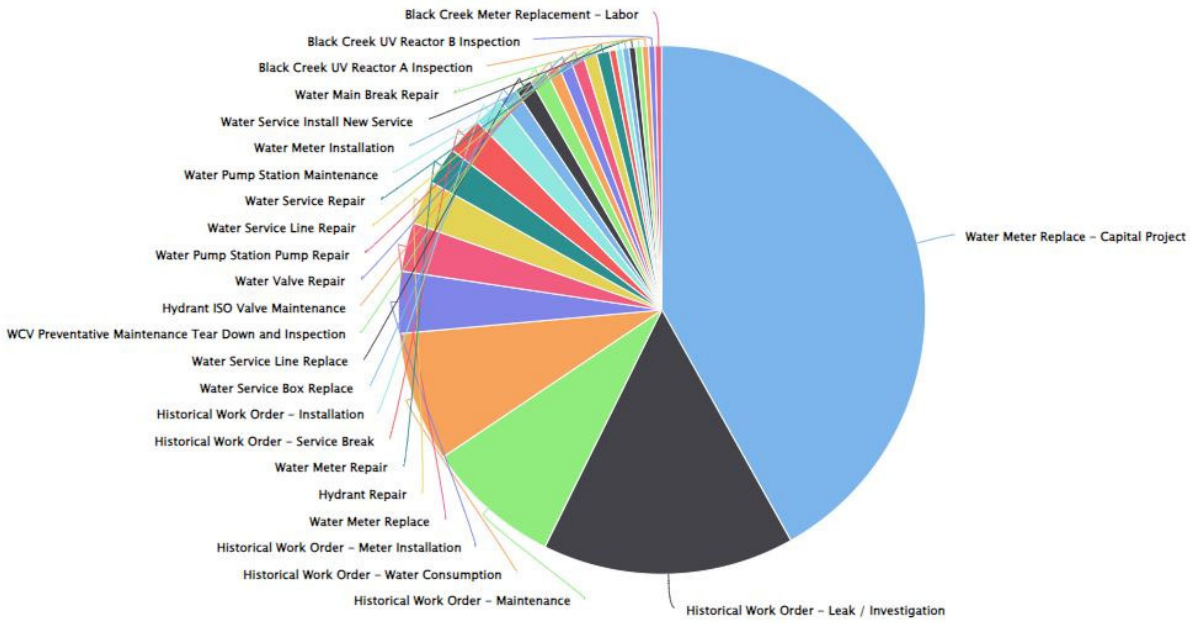


Figure No.7: Work Orders by Category

Financial

The primary driver for capital spending for the BCOB WLSA is the need for increased capacity for the system. The third production well project completed in early 2021 did not deliver the expected groundwater extraction capacity. The five-year financial plan includes an average capital works reserve contribution of approximately $128,374 per year. User rates and frontage tax will be reviewed along with the asset management plan for this service as part of a comprehensive rate review in the future to ensure reserve contributions are sufficient for sustainable service delivery.

Year over year operating costs for the BCOB WLSA are down significantly due to large reductions in legal costs and professional fees from the new production well project property acquisition, and completion of the bulk of analysis on the water master plan in 2022.

2022 Accomplishments

- ✓ Annual preventative maintenance complete, focusing on repairing fire hydrants.
- ✓ First full year utilizing the CityWorks asset inventory software.
- ✓ Installation and testing of the new groundwater production well (well #6).
- ✓ Completion of year 3 of the 5-year residential meter replacement program.
- ✓ Fiber optic connection and meter upgrades for groundwater well 2A and B upgrades.
- ✓ Repair of a major leak on a large diameter transmission main.

2023 Objectives

- Complete chlorine gas to sodium hypochlorite conversion at the treatment facility
- Complete of year 4 of the 5-year residential meter replacement program.
- Complete the pipeworks associated with connecting groundwater well #6 to system.
- Lift the water connection suspension.

	Distribution System																	
	Chlorine Residual (mg/L)					Total Coliform						E.Coli						
Date	2220 Salmon Point Road	2315 King Road	8527 Island Hwy Black Creek Booster	Macaulay Reservoir	1536 Seaview Road	1812 Miracle Beach Road	2220 Salmon Point Road	2315 King Road	8527 Island Hwy Black Creek Booster	Well 1 & 4 RAW Combined	1536 Seaview Road	1812 Miracle Beach Road	2220 Salmon Point Road	2315 King Road	8527 Island Hwy Black Creek Booster	Well 1 & 4 RAW Combined	1536 Seaview Road
2022-01-04	1.04				0.69	< 1						< 1					
2022-01-10		0.99	0.86					< 1	< 1					< 1	< 1		
2022-01-17	0.94				0.87	< 1	< 1					< 1	< 1				
2022-01-24		1.1	0.96					< 1	< 1					< 1	< 1		
2022-02-07	0.88				0.75	< 1	< 1					< 1	< 1				
2022-02-14	0.9				0.85	< 1	< 1					< 1	< 1				
2022-02-22	1.07				0.85	< 1	< 1					< 1	< 1				
2022-02-28		1.03	0.87														
2022-03-07	0.93				0.79	< 1	< 1					< 1	< 1				
2022-03-14								< 1	< 1					< 1	< 1		
2022-03-21	0.91				0.78		< 1						< 1				
2022-03-28		0.9	0.83					< 1	< 1					< 1	< 1		
2022-04-04	0.89				0.8		< 1						< 1				
2022-04-11		0.92	0.82					< 1	< 1					< 1	< 1		
2022-04-19	0.85				0.89		< 1				< 1		< 1				< 1
2022-04-25		0.99	0.64					< 1	< 1					< 1	< 1		
2022-05-02	0.81				0.82												
2022-05-09		0.94	0.98					< 1	< 1					< 1	< 1		
2022-05-16	0.91				0.87		< 1				< 1		< 1				< 1
2022-05-24		0.95	0.93					< 1	< 1					< 1	< 1		
2022-06-06	0.95				0.8		< 1				< 1		< 1				< 1
2022-06-07				0.89													
2022-06-13		0.92	0.85														
2022-06-20	0.92				0.85						< 1						< 1

	Chlorine Residual (mg/L)					Total Coliform						E.Coli					
Date	2220 Salmon Point Road	2315 King Road	8527 Island Hwy Black Creek Booster	Macaulay Reservoir	1536 Seaview Road	1812 Miracle Beach Road	2220 Salmon Point Road	2315 King Road	8527 Island Hwy Black Creek Booster	Well 1 & 4 RAW Combined	1536 Seaview Road	1812 Miracle Beach Road	2220 Salmon Point Road	2315 King Road	8527 Island Hwy Black Creek Booster	Well 1 & 4 RAW Combined	1536 Seaview Road
2022-06-27		1.02	1.12					< 1	< 1					< 1	< 1		
2022-07-04	0.84				0.74		< 1				< 1		< 1				< 1
2022-07-11		1.05	0.88					< 1	< 1	< 1				< 1	< 1	< 1	
2022-07-18	0.83				0.53						< 1						< 1
2022-07-25								< 1	< 1	< 1				< 1	< 1	< 1	
2022-08-02	1.69				1.43						< 1						< 1
2022-08-08		1.48	1.31						< 1						< 1		
2022-08-15	0.9				0.81		< 1				< 1		< 1				< 1
2022-08-22	0.93				0.83												
2022-08-25		0.95	0.85														
2022-09-06	0.91				0.71		< 1				< 1		< 1				< 1
2022-09-12									< 1						< 1		
2022-09-20							< 1				< 1		< 1				< 1
2022-09-26								< 1	< 1					< 1	< 1		
2022-10-03	0.79				0.73		< 1				< 1		< 1				< 1
2022-10-11		1.02	0.91					< 1	< 1					< 1	< 1		
2022-10-17	0.99				0.87		< 1				< 1		< 1				< 1
2022-10-24		0.96	0.93						< 1						< 1		
2022-11-07	0.92				0.78		< 1				< 1		< 1				< 1
2022-11-14		0.98	0.88					< 1	< 1					< 1	< 1		
2022-11-21	0.92				0.82		< 1				< 1		< 1				< 1
2022-11-28		0.65	0.94					< 1	< 1					< 1	< 1		
2022-12-05	0.95				0.83		< 1				< 1		< 1				< 1
2022-12-12		0.99	0.81					< 1	< 1					< 1	< 1		
2022-12-19					0.92						< 1						< 1
2022-12-28		1.10	0.83						< 1						< 1		
Count	**24**	**19**	**19**	**1**	**25**	**6**	**19**	**16**	**20**	**2**	**16**	**6**	**19**	**16**	**20**	**2**	**16**
Average	**0.94**	**1.00**	**0.91**	**0.89**	**0.82**	**< 1**	**< 1**	**< 1**	**< 1**	**< 1**	**< 1**	**< 1**	**< 1**	**< 1**	**< 1**	**< 1**	**< 1**