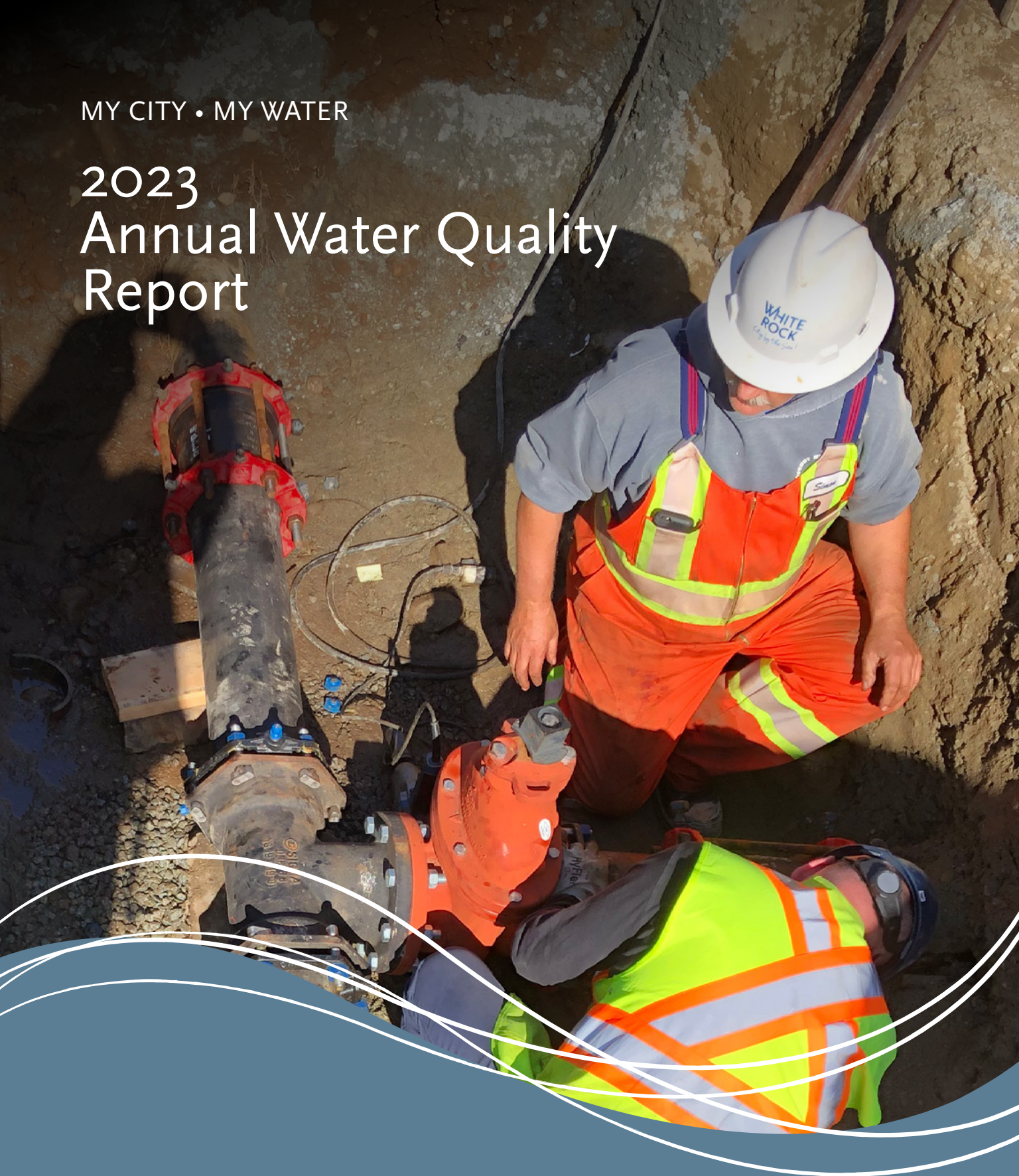
MY CITY • MY WATER

2023 Annual Water Quality Report



WHITE ROCK
City by the Sea

Table of contents

Introduction

The City of White Rock (CoWR) is a unique, ocean-side community of nearly 21,000 citizens known for its sunny weather, expansive beach, historic pier, delightful restaurants, and sense of community. The City is located half an hour south of Vancouver on the shore of Semiahmoo Bay.

The City of White Rock provides safe and clean drinking water to its residents and is responsible for the maintenance, repair and upgrades of the water supply and distribution system.

The Permit to Operate was issued by Fraser Health on November 27, 2023. Refer to *Appendix A* for a copy of the permit, which includes the following conditions:

- **The drinking water must be treated** to provide an acceptable secondary disinfectant to the whole system that meets requirements of the Guidelines for Canadian Drinking Water Quality and is acceptable to Fraser Health Authority.
- **Arsenic and Manganese levels of the treated water must be monitored** on a quarterly basis as a minimum. The results are to be provided to Fraser Health.

The City of White Rock has a Level 4 certified water Treatment Operator. The operator has been certified by the Environmental Operators Certification Program (EOCP).

Overview: Water Quality Milestones

This is the City of White Rock's 8th year of operating the Water Utility. The City has accomplished some substantial milestones, with significant past milestones listed below.

- **May 31, 2019 -** Water Treatment Plant achieved Notice of Completion.
- **October 26, 2020 -** The water utility was moved under the Engineering & Municipal Operations umbrella to better utilize resources.

While our water quality meets Canadian Drinking Water Guidelines, we are always striving to improve water quality beyond what is mandated, enhance the reliability and resiliency of our water infrastructure, and plan for our future.

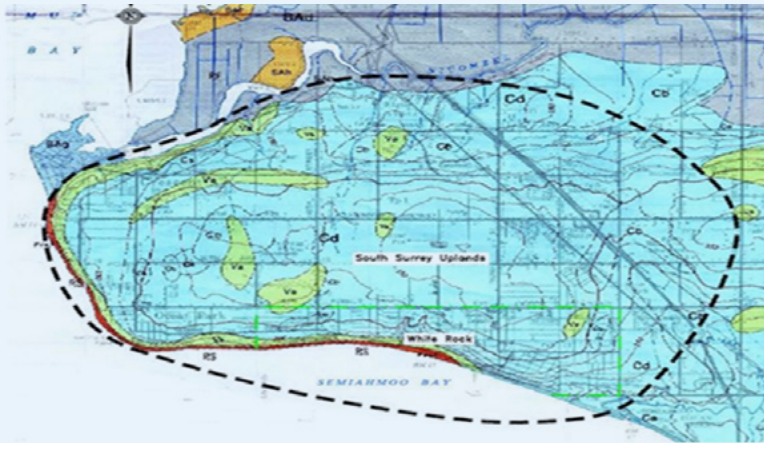
Stay up to date with water related initiatives in White Rock at *https://www.whiterockcity.ca/230/Water-Sewers*

Source Water

Drinking water is obtained from the Sunnyside Uplands Aquifer and distributed through seven wells located throughout the City. Refer to Figure-1 for a plan of the aquifer extents.

The Sunnyside Aquifer is an important natural resource that is used as the water supply source for the CoWR. Population growth, climate change, sea level rise, and other users of the aquifer may put increasing pressure on the water supply system.

Figure 1 - Sunnyside Uplands Aquifer



Water Distribution System

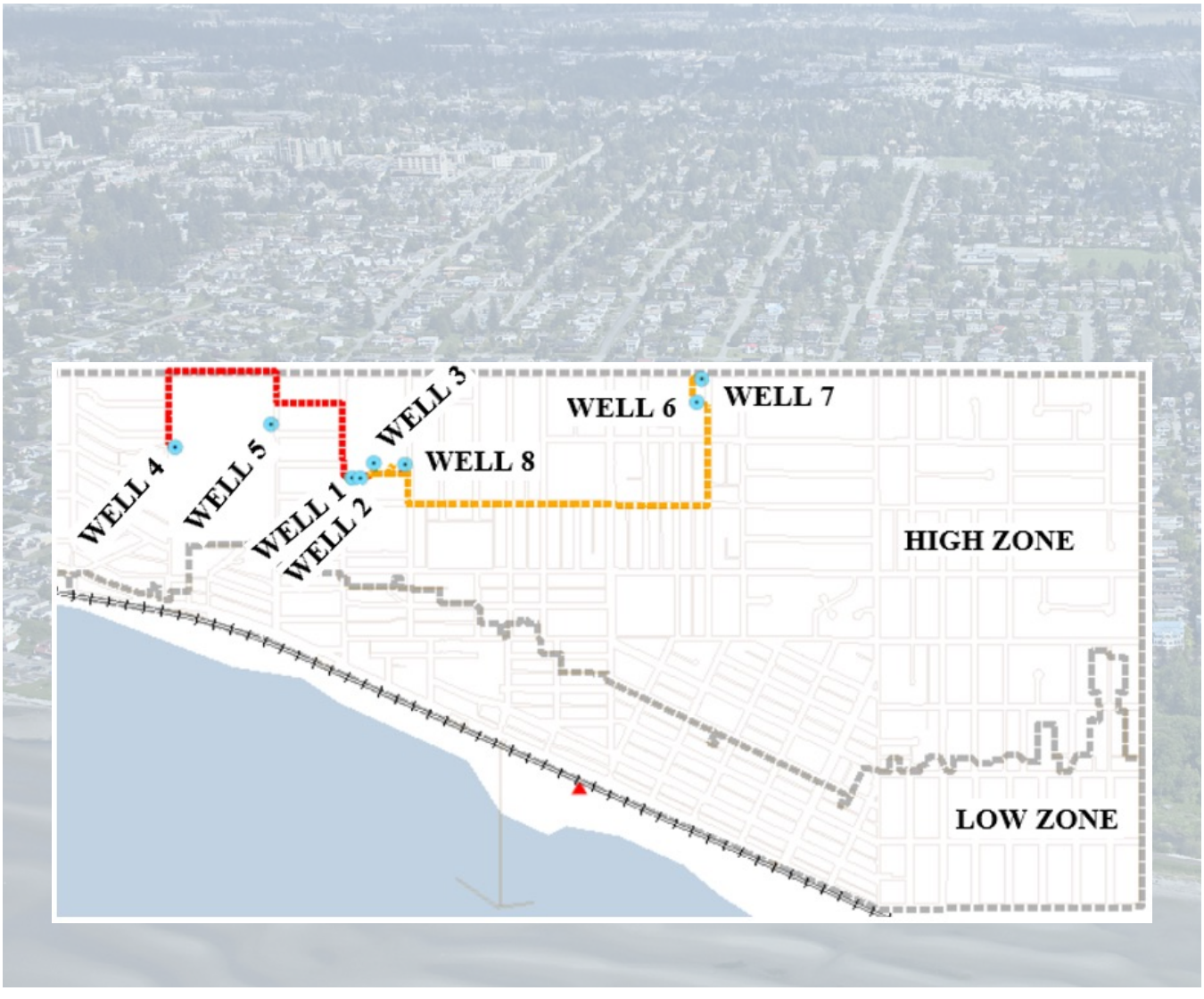
The CoWR developed an Aquifer Protection Plan in 2018, as a key component in protecting the community's water supply source. Groundwater protection goals include stakeholder engagement, advancing the understanding of the aquifer characteristics, protecting groundwater quality from contamination, and ensuring future withdrawals sustainably meet future demands.

The existing well network includes seven groundwater wells located at three different sites as shown in Figure-2.

The wells can provide a combined supply of approximately 12 ML per day. These wells provide adequate water supply for the CoWR community even at peak consumption during the summer months, when consumption has risen to 11 ML per day in recent years.

Wells 1, 2, 3, and 8 are located at the Oxford Site. In previous years Well 4 was a seasonal well utilized during the months of June, July and August and is located at High Street. It is now connected to the Water Treatment Plant, which provides one common treatment plant for all wells. Wells 6 and 7 are located at the Merklin Site. The new Well 5 is expected to be in production in the Fall 2024.

Figure 2 - City of White Rock Water Wells

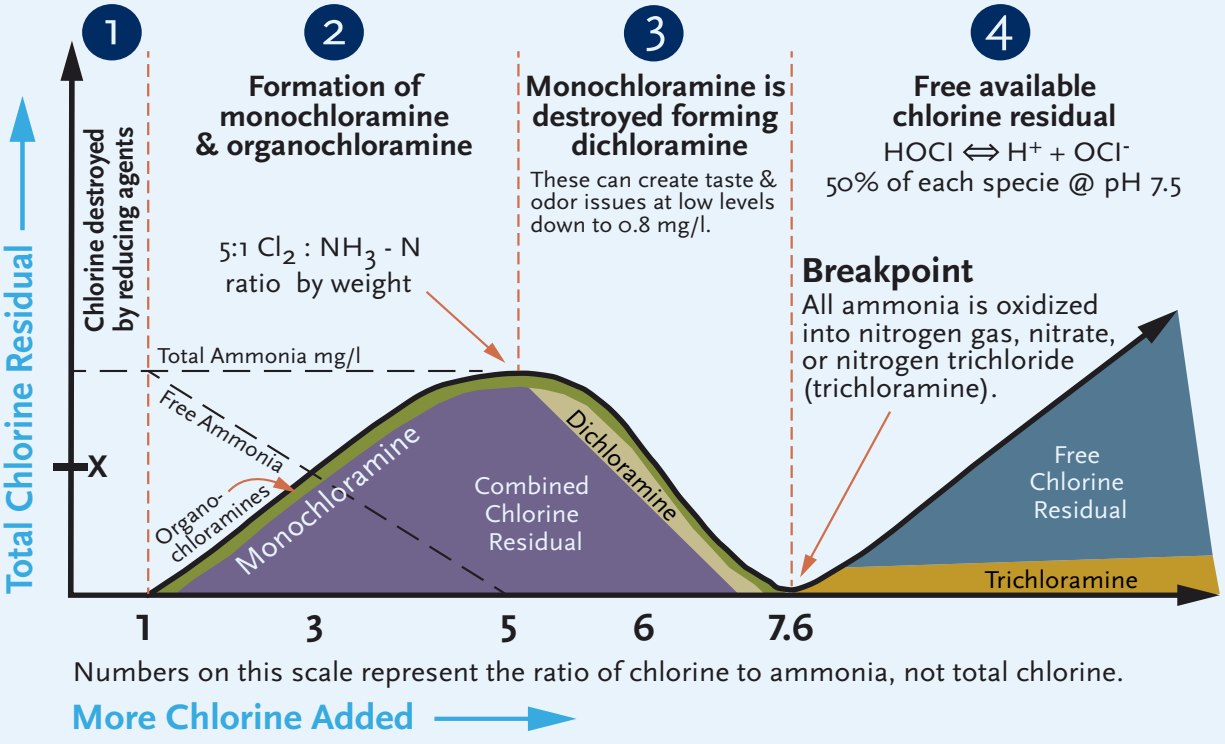


Disinfection Process

Chloramination

Chloramination is an acceptable method used for secondary disinfection of the distribution system. This is achieved by adding sodium hypochlorite and ammonium sulphate to the water before it enters the reservoirs and distribution system. The ratio is 4 to 5 parts of sodium hypochlorite to 1 part ammonia sulphate. Residuals can be measured in mg/L at the reservoir site and in the distribution system. The target is to achieve a minimum monochloramine residual of 0.5 mg/l at all locations within the distributions system as required by Fraser Health. Operators test this daily at the booster stations and weekly in the distribution system. Currently we have a residual of between 0.9 mg/l to 1.0 mg/l leaving the reservoir site and above 0.5 mg/l at the far reaches of the distribution system. If the operators receive lower or higher results than what are acceptable, they can adjust the dosage up or down depending on the results.

Figure 3 – Relationship between ammonia and chlorine to treat water



The graph above is a general representation of the chemical dosing process. Each water system has a unique water chemistry, so this graph is determined through testing on each system.

White Rock doses ammonia and chlorine at the peak between section 2 and 3 so does not have dichloramine or trichloramine in the water. If the dosing goes into section 3 the water taste and smell is affected.

Total Coliform & E-coli

Total coliforms (TC) are a group of bacteria commonly found in the environment, for example in soil or vegetation, as well as the intestines of mammals, including humans. Total coliform bacteria are not likely to cause illness, but their presence indicates the water supply may be vulnerable to contamination by more harmful microorganisms. Escherichia coli (E.coli) is the only member of the total

coliform group of bacteria that is found only in the intestines of mammals, including humans. The presence of E.coli in water indicates recent fecal contamination and may indicate the possible presence of disease-causing pathogens, such as bacteria, viruses, and parasites. Although most strains of E.coli bacteria are harmless, certain strains, such as E.coli 0157:H7, may cause illness

The acceptable maximum allowable concentration (MAC) for both TC bacteria and e-coli in drinking is none. White Rocks water comes from the Sunnyside Aquifer deep underground. This source water has less organics than surface water from lakes and rivers.

If the water utility receives results that are not acceptable from the weekly samples. Water mains are immediately flushed and resamples retaken. All results are shared with the Fraser Health authority. In 2023 there were 6 different samples which came back with TC positive results. All locations were flushed and resampled and all resamples testing came back with no coliform. None of the 2023 samples came back with any e-coli positive result.

Disinfection By Products

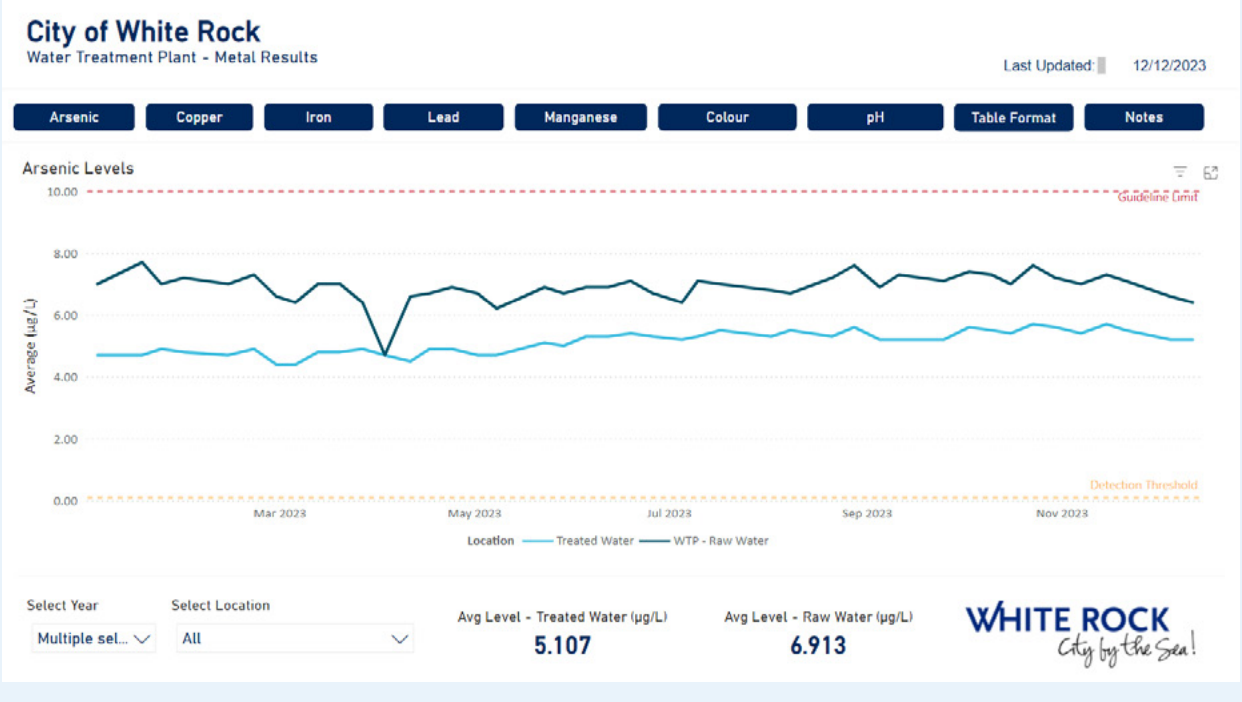
Disinfection by-products (DBPs) are chemicals that form when chlorine is used for disinfecting drinking water to prevent disease. The chlorine reacts with decaying organic matter, like leaves or vegetation, from lakes and rivers to form DBPs. Two of the most common types of DBPs found in chlorinated drinking water are trihalomethanes (THMs) and halo acetic acids (HAAs). The use of chlorine to treat drinking water has almost completely eliminated waterborne bacteria and diseases like typhoid fever, cholera, dysentery and other gastrointestinal diseases.

Chlorine is the most commonly used drinking water disinfectant. It has been used to disinfect water and make it suitable for drinking for more than 100 years. Some studies have suggested that long-term exposure to consistent high levels of THMs or HAAs might increase the risk of cancer. Experts agree that any health concern from these DBPs come from exposure over many years. The benefits of disinfecting drinking water with chlorine are much greater than the potential health risks of being exposed to higher levels of THMs and HAAs.

Metal Testing Results

White Rock tests the water regularly for various metals as well. The testing results are available on the City web site from 2020 to date at *https://www.whiterockcity.ca/298/Water-Quality-Reports-Data*. The 2023 results for arsenic and manganese are shown in the graph below.

Figure 4 – Water Quality results available from the City web site



Maintenance Programs

Staff conduct the maintenance and day-to-day water operations for the water treatment plant, 2 pumping stations, 3 reservoirs, 80 km of pipes, 7 wells and 361 fire hydrants. All Water Operators are licensed with the Environmental Operators Certification Program (EOCP).

The city has an ongoing preventative maintenance program that includes:

- Daily/weekly/monthly water quality testing and inspections
- Operation and maintenance of two pumping stations (*See picture 1*)
- Valve exercising.
- Hydrant inspection and servicing
- Flushing of water mains through UDF (uni-directional flushing) program
- Testing and calibration of water treatment plant (WTP) automated analyzers
- Regular backwash of filters at the Water Treatment Plant
- Chemicals addition and monitoring
- Secondary disinfection systems at each reservoir/ booster station (two in total)
- Maintain 3 PRV stations.
- Annual full water chemical analysis
- Reservoir maintenance
- Water meter maintenance
- Documentation of the above

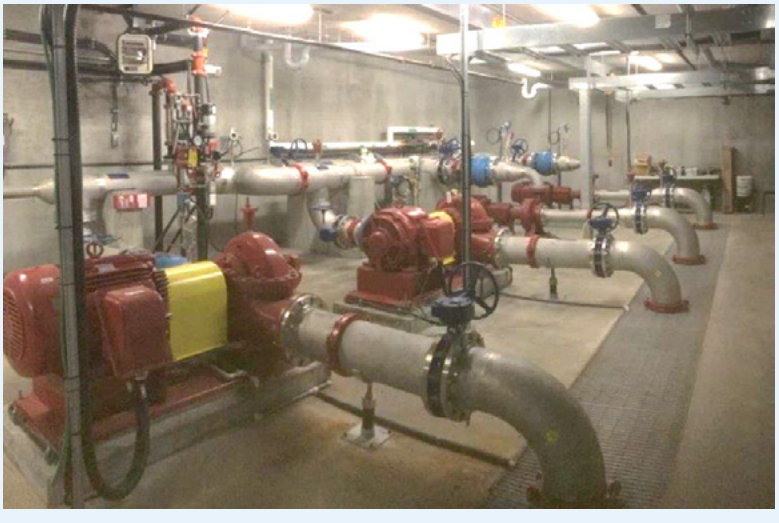
Other services include:

- Installation of water services for new home construction
- Water infrastructure repairs and maintenance
- Water quality sampling and testing
- Respond to resident's request and concerns (sampling may be required)
- Water meter quarterly reading
- New fire hydrant installations. Average of 5 per year (*See picture 2*)
- 24/7 emergency repairs
- Coordinate and perform tie-ins of new watermains from development and capital works.

Maintenance upgrades completed in 2023 include:

- 100 water meter replacements
- 6 new fire hydrants
- 29 water service upgrades/upgrades

Picture 1 – Booster pump station



Picture 2 – Fire Hydrant installation

Facilities Security

Municipal and private water systems security measures throughout Canada are being elevated to reduce the potential for vandalism or other activities that could affect water quality or water supply to the public.

The Oxford Water facility (that includes four wells, reservoir and Treatment) was the last facility to be fenced. Additional security measures on the property mitigate the potential for intrusions.

Cyber security is a worldwide threat to critical infrastructure. The City has implemented several technologies and practices to mitigate cyber security threats and will continue to stay up to date in the current threat environment.

Pressure Monitoring System

Public infrastructure systems are complex, many are underground and therefore difficult to access and inspect. It is standard practice to differentiate between linear assets (pipes, roads, etc.) and non-linear or discrete assets (pumps, plants, etc.) since each category presents different types of management challenges. Providing services to the public requires all the components within a system to perform adequately since the robustness – and therefore the safety and quality of the service is dependent on its components working in unison.

Infrastructure assets also have very long service lives – water mains in the distribution piping are in use for 80 years, or longer. Pressure is one of the primary optimization parameters for the delivery of safe drinking water. The loss of pressure in the distribution system can potentially allow outside groundwater to enter pipes and contaminate the distribution system. Fluctuations in pressure can affect the physical integrity of pipes. Pressure surges are known to generate an increase in leaks, and water main breaks, which affects the service life of the water system. The use of pressure sensors provides a measure of what is occurring along the water distribution pipelines.

Establishing the exposure and sensitivity of infrastructure to threats, whether from extreme climate events, earthquakes, or from uncontrolled activities such as new development opening/closing valves, or unlawful use of water hydrants, is done by monitoring the pressure within the pipes.

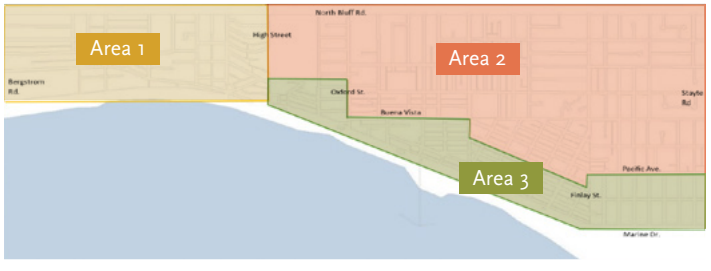
The City has implemented a remote pressure monitoring system that was deployed in 2018. The system contains sensors located throughout the high- and low-pressure zones that relay pressure and temperature to a secure web server. These readings are then poled through the Water Utility SCADA system, which allows the operators to receive real-time information for water pressure and temperature.

Unidirectional Flushing Program

Unidirectional Flushing Program (UDF) is an important component of any water utility's routine distribution system maintenance. Flushing removes sediments, deposits, and biofilm build-up from the water distribution system, which improves water quality and leads to less customer complaints. Incorporating unidirectional flushing techniques allows the utility to improve the degree of water main cleaning, reduces the total time it takes to complete the program, and decreases the frequency of flushing. Flushing of the distribution system is important to the maintenance and to the preservation or improvement of water quality and control of bacterial growth. Our operators review the previous year's flushing results to evaluate the run setup for comparison of the outcomes. Results are reviewed on an annual basis to see if less or more frequent flushing is required.

Water main flushing at the City has been conducted regularly since 2016 for a variety of reasons, including: corrosion control; sediment removal; taste and odor control; maintain low turbidity; maintain disinfectant residual; and to prevent the potential of bacterial growth. The City has been divided into 3 Areas (Figure-5 below) to divide the work into manageable areas.

Figure 5 - Unidirectional Flushing Areas 1, 2 & 3



There have been significant improvements in the amount of time it takes to complete the program since the treatment plant came into operation. On average, the time to complete the program has decreased by 30% over the last eight UDF cycles. The program has been implemented every year, starting in 2016, in the months of October to December. The program was implemented twice in 2017 to have a higher improvement after noticing the results in 2016. After many years of conducting the UDF Program, a significant improvement has been seen in the water quality. In addition, since the end of March 2019, the Water Treatment Plant has been delivering a significantly improved water quality with Manganese concentration reduced significantly.

Table 1 shows the results of the UDF program over the last three years. With this reduction, water operators do not have to take as much time to flush out deposits, which in the long term should decrease flushing volumes, duration, and frequency. Other Factors influencing results include the following:

- Water system upgrades
- Long-term effect of secondary disinfection
- Less frequent flushing
- Operator errors or run design errors

The cost of the UDF Program is expected to decrease over the long term with a reduction of water volume used and staff time. Operators continue to track all the data from the program.

Table 1 – Volume of flushing and time comparison for UDF

Area 1	**2020**	**2021**	**2022**	**2023**
Total Water for flushing Volume	1,698 m³	1,510 m³	1,500 m³	1,423 m³
Time	669 min.	563 min.	570 min.	523 min.
Area 2				
Total Water for flushing Volume	3,930 m³	3,586 m³	3,381 m³	3,710 m³
Time	1,465 min.	1,345min	1,273 min.	1,355 min.
Area 3				
Total Water for flushing Volume	1,582 m³	1,395 m³	1,403 m³	1,594 m³
Time	700 min.	611 min.	635 min.	724 min.

The UDF Program improves the condition of the Distribution System by removing sediment and biofilm, which reduces potential impacts on water quality delivered to the public. This also reduces the potential of having negative aesthetical impacts on the water delivered.

In addition, over the long and short term, the expectation is a reduction of water used and a lower frequency of the flushing program that is an important step in water conservation and in management of water resources considering the relationship between Climate Change and Water Conservation.

Picture 3: Water Operators performing watermain flushing.

New Guidelines for Manganese

(Guidelines for Canadian Drinking Water Quality, Guideline Technical Document Manganese, May 2019)

Manganese occurs naturally in the environment, and is widely distributed in air, water, and soil. Manganese may be present in water from natural sources (rock and soil weathering) or because of human activities (such as mining, industrial discharges, and landfill leaching). It is used in various industries, including in the steel industry, in the manufacture of various products (e.g., fireworks, dry-cell batteries, fertilizers, fungicides and cosmetics and paints). Manganese may also be added to water as an oxidizing agent (permanganate), or as an impurity in coagulants used in the treatment of drinking water.

The recent guideline change for manganese is based on reviews and assesses all identified health risks associated with manganese in drinking water. It incorporates new studies and approaches and takes into consideration the availability of appropriate treatment technology. Based on this review, the drinking water guideline for manganese is a maximum acceptable concentration (MAC) of 0.12 mg/L (120 µg/L), based on infants, the most sensitive population. Although the MAC established is based on infants, this value is intended to protect all Canadians.

Health effects

Manganese is an essential element for humans. Deficiency is considered unlikely in Canada, as adequate amounts are obtained from food. A non-cancer endpoint was chosen for this assessment as available studies are not adequate to support a link between manganese and cancer. Some studies in humans suggest an association between manganese in drinking water and neurological effects in children; however, they can only be used to support the choice of the key health effect. The effects observed in children are consistent with the neurological effects reported in the key animal studies used to establish the MAC.

Aesthetic considerations of Manganese (Mn)

Concerns regarding the presence of manganese in drinking water are often related to consumer complaints regarding discolored water. The new aesthetic objective (AO) of 0.02 mg/L (20 µg/L) is intended to minimize the occurrence of discolored water complaints based on the presence of manganese oxides and to improve consumer confidence in drinking water quality.

The quality of drinking water is of the utmost importance to the city, which is why regular water testing is conducted.

Water Treatment Plant

The quality of drinking water is of the utmost importance to the city, which is why regular water testing is conducted. The City has taken steps to build a water treatment plant to remove arsenic and manganese, hired in-house experts and consultants who have extensive experience.

The City applied for infrastructure grants funding programs by the provincial and federal governments, which is not available to private organizations. The Government of Canada and the Province of British Columbia provided funding from the Clean Water and Wastewater Fund (CWWFA) to the City of White Rock for the "Arsenic and Manganese Water Treatment Project No. C40174."

As part of the City's acquisition and operation of the water utility, the City is under mandate by the Fraser Health Authority to implement a secondary form of water disinfection and to reduce the arsenic and manganese concentration levels in the drinking water. The work is necessary to treat the water supply to meet the Canadian Drinking Water Guidelines. The completion of the Water Treatment Plant in 2019 met that requirement.

The City of White Rock has been successful in maintaining the manganese level well below the limits set by the Guidelines for Canadian Drinking Water Quality for the drinking water leaving the Water Treatment Plant (WTP). Ferric chloride was introduced as a coagulation in February 2020 in order to improve the removal of arsenic and phosphate in the Greensand Filters. This reduced the amount of arsenic and phosphate entering the E33 contactors, which helps to extend the E33 filter life.

Arsenic Analyzer

Arsenic EZ-Analyzer was installed and commissioned in September 2020, which provides Real-Time Arsenic results for raw water, Post green sand plus (GS+) and Post E33 filter media. This helps to make changes to the system without any delays. It also helps to compare the Analyzer Data to the analysis done by the Laboratory.

Figure 6 – Online chemical analyzer

Water Treatment Process and Objectives

The White Rock Water Treatment Plant is designed to treat the City's existing groundwater supplies to remove naturally occurring manganese and arsenic to ensure that it meets the guidelines and aesthetic objectives. The plant is built next to the Oxford Pumping Station.

The Water Treatment Plant process is a multi-stage process and includes the following key treatment components:

- Pre-Oxidation with ozone for arsenic and manganese in the raw water supply.
- Ferric Chloride was added to the process.
- Removal of manganese using Greensand Plus media filters.
- Removal of arsenic using Bayoxide E33 media filters.

Ozone pre-oxidation

Research has shown that the application of ozone for water treatment processes can enhance the ability to remove many emerging contaminants and reduce disinfectant byproducts. Ozone, a strong oxidant, is very effective in the oxidation of organic and inorganic compounds more effectively than chlorine. Arsenic present in groundwater in As(III) form needs to be oxidized to As(V). To have an optimum removal of As(III) which is neutrally charged, it should be oxidized to As(V) which is negatively charged. Strong chemical oxidants like ozone oxidize As(III) very rapidly, thus contact time generally is not a critical factor for optimizing arsenic removal. The simple oxidation reactions between ozone and arsenic, and manganese are as follows:

Figure 6 – Chemical formulas as arsenic and manganese is made into a larger molecule to filter out in the treatment plant.

$$O_3 + H_3AsO_3 = H_2AsO_4^- + O_2 + H^+ \text{ (@ pH 6.5)}$$

$$O3 + H_3AsO_3 = HAsO_4^{2-} + O_2 + 2H^+ \text{ (@ pH 8.5)}$$

$$O_3 + H_2O + Mn^{2+} = MnO_2(s) + 2H^+ + O_2$$

Manganese and arsenic removal

Manganese removal in groundwater supply has been practiced for many decades. Technology approaches are mature, and improvements in treatment efficiency have been only incremental. The focus on arsenic removal technologies has been increasing due to more emerging evidence of concerns over human exposure risks of arsenic that led to changes of guidelines for arsenic in drinking water. Knowledge of raw water quality is an important factor in the selection of the technology and processes to remove certain organic or inorganic compounds that might interfere in achieving the targeted effluent water quality.

The City of White Rock's groundwater has elevated, naturally occurring arsenic and manganese. The research conducted by the City of White Rock and RES'EAU WaterNet showed that the use of ozone as a pre-oxidant, followed by greensand and adsorption filter media for the removal of manganese and arsenic, respectively, is effective for groundwater sources like White Rock's water supply. NAC/Associated Engineering, the Design/Build Team developed the design to include filtration using Greensand Plus media for manganese reduction, and AdEdge E33 adsorption media, for arsenic polishing to achieve the low target levels required by the City.

The use of ozone for pre-oxidation of the arsenic and manganese prior to the two-stage process; filtration and adsorption process were included in the design due to the facts that:

- Many arsenic removal technologies are effective at removing the pentavalent form of arsenic, arsenate, As(V) than, As(III). Therefore, many treatment systems include a peroxidation step to convert Arsenite, As(III) to Arsenate As(V)
- Ozone can achieve 100% oxidation of As(III) to As(V)
- Oxidation alone does not remove arsenic from solution and must be coupled with a removal process such as coagulation, adsorption, or ion exchange.
- Manganese removal was very effective using ozone followed by Greensand Plus media.

Water Treatment Objectives

The treatment objectives of the White Rock WTP are to deliver drinking water meeting the following operational targets:

- Mn < 0.02 mg/L
- As < 0.002 mg/L (95% of time, 0.005 mg/L for 5% of operation)

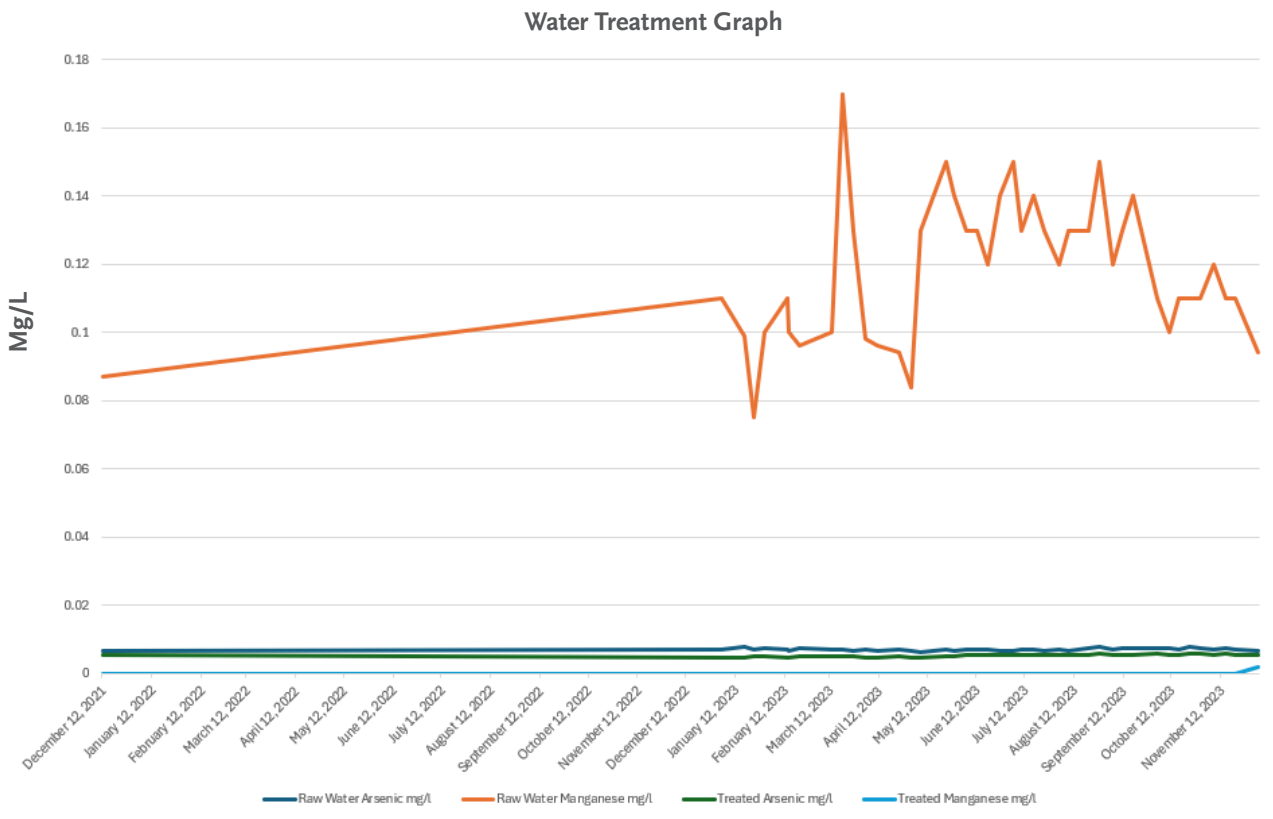
All other water quality parameters shall meet the objectives of the Guidelines for Canadian Water Quality (GCDWQ).

The Water Treatment Plant started operation in March 2019. Water quality improvement was noticed immediately in relation to the removal of arsenic and manganese. Although staff continued to work diligently to make adjustments to ensure optimal performance of arsenic and manganese removal.

Adjustments were made to initial ozone dosages and monitoring the impact on manganese concentration in the Greensand Plus effluent. Remarkable results were achieved, bringing manganese concentration to below detection limit.

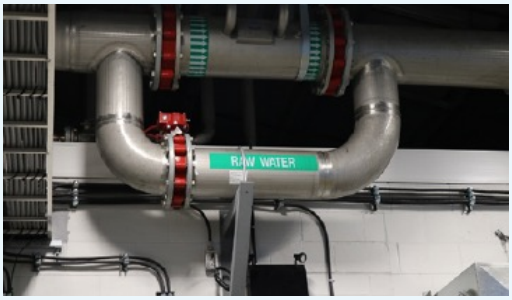
Arsenic Speciation was monitored to make sure that process change did not have an impact on arsenic oxidation. The analysis confirmed complete oxidation of As(III) to As(V) at low ozone dosages. To improve arsenic removal, an introduction of a coagulant was recommended to improve the removal of arsenic and to bring the arsenic level to be within the Plant Design Objectives.

Figure 7 – Graph of the 2021 to 2023 arsenic and manganese levels before and after the treatment plant.



White Rock Water Treatment Plant

Picture 5 - Water Treatment Plant Ozone System



Picture 6 – Ozone injector into raw water before filtering

Picture 7 – Greensand filter tanks to remove manganese

Picture 8 – Adedge E33 filter tanks to remove arsenic

Climate Change Implications

The water quality analysis indicated a significant improvement in drinking water quality supplied to the residents of the City of White Rock after the implementation of Water Treatment Plant. Many positive comments came from residents who indicated that they are using tap water instead of bottled water, which reduces waste in landfills and plastics pollution in our water sources.

The new Water Treatment Plant delivered drinking water with significantly lower manganese, which almost eliminated the addition of manganese to the distribution system. The Unidirectional Flushing (UDF) of the distribution system made a noticeable reduction in deposited manganese in the distribution system, reducing water used for flushing, and the energy used to produce and pump that amount of water.

Communications and Education

Since acquiring the water utility from EPCOR in October of 2015, the City of White Rock has provided unprecedented information to the public on the state of the City's water. This includes steps the City must take as mandated by Health Canada and the Fraser Health such as providing a secondary disinfection throughout the entire system, as well as important capital infrastructure work. This information is readily available on the City's website under the Water page, which includes links to various projects and initiatives so the public is aware of City action and plans to address and improve the water quality.

EOCP provides standards to classify Water systems and the training the Operators are to receive. Facility classification is an important step in ensuring that safe drinking water is provided in order to protect public health. An accurate and current facility classification will determine what training and certifications a facility operator will need. The classification is based on the complexity of the water facility. Higher levels of classification require more training and experience to ensure the water system is operating within the safe drinking water guidelines.

Since the City has a Water Treatment Plant classified at Level 3 the Foreman operating the plant is to be at Level 3 or greater.

The Environmental Operators Certification Program (EOCP) is responsible for certifying water and wastewater Operators in British Columbia and the Yukon. Once an operator is certified they must continue to keep training to remain in good standing with their certification level. They must submit all training documents to the EOCP.

For operators to remain in good standing operators must submit 2.4 Continuing Education Credits or 24 hours of training to the EOCP every two years. Certified Operators is the most valuable resource in a water or wastewater system. With water and wastewater employees properly certified, the public, the corporation, regulatory agencies, owners and managers, and peers can be confident that certified employees have the skills, knowledge, abilities, experience, and judgment necessary to competently operate their systems.

The City Water Utility requires EOCP Certified Operators to work on the drinking water system. The utility is operated by seven professional Water Operators and supported by the Engineering Division for capital improvements. Others in the Finance Department and Engineering Clerical provide supporting resources for water meter reading, billing and water servicing.

Certification of the Water Operations staff are:

Water Treatment Level 4	1 staff
Water Treatment Level 2	1 staff
Water Treatment Level 1	3 staff
Water Distribution Level 4	0 staff
Water Distribution Level 3	1 staff
Water Distribution Level 2	3 staff
Water Distribution Level 1	2 staff

Water Quality Testing

The City has been consolidating all the testing data from January to December 2022. This data is included in *Appendix-B: City of White Rock Water Quality Testing for 2023*. In addition, testing data is updated regularly on the City of White Rock's website: *www.whiterockcity.ca/300/Water-Quality*.

Water Utility staff perform approximately 5,200 in-house testing for PH, conductivity, turbidity, chlorine residuals, temperature. Additional sampling is performed at strategic points in the distribution system with the testing conducted by a 3ed party laboratory. All results are copied to Fraser Health. Testing was also conducted for; arsenic, copper, iron, lead, manganese, Chloroform, Bromodichloromethane, Dibromochloromethane, Bromoform, Total THMs, Dibromofluoromethane, Toluene-d8, Bromofluorobenzene, Monochloroacetic Acid, Monobromoacetic Acid, Dichloroacetic Acid, Bromochloroacetic Acid, Dibromoacetic Acid, Trichloroacetic Acid and Total HAA6 throughout 2023.

The City also recommends to residents anytime the water in a particular faucet has not been used, to flush the cold-water pipes by running the water until you notice a change in temperature. This could take a short time if there has been recent heavy water use such as showering or toilet flushing. The more time water has been sitting in your home's pipes, the more manganese it may contain.

Conserving water is still important. Rather than just running the water down the drain, residents could use the water for their plants, garden, or lawn.

Water Consumption

Water consumption patterns are tracked to ensure that the White Rock system continues to provide sufficient water services to customers. Annual, average daily water consumptions and the highest daily consumption (peak day) are shown below in Table 2.

Table 2 - Total Annual Water Consumption

2023 Water Consumption (ML)[1]	
Total Potable Water Produced	2,680.8
Max. Day (July 2, 2023)	9.6
Annual Average Daily Consumption	7.3

[1] ML: 1,000,000 Liters

[2] MDD: Maximum daily demand

Storage Capacity

The storage requirements for forecasted demands are as shown in the following table. It is noted that the 16% value for balancing storage is based on past studies estimating the specific balancing requirement needs for the City of White Rock's system (Kerr Wood Leidal, 2010).

The available storage capacity was provided in the 2024 Water Master Plan Update. A summary is shown in the table 3 below.

Table 3 - Required Storage versus Available Storage

Description		**ML[1]**
Required Balancing Storage	16% of MDD[2]	1.49
Required Fire Storage	212 L/s for 2.6 hours	1.98
Required Emergency Storage	25% of the sum of above storage	0.87
	TOTAL REQUIRED	**4.34**
Available Storage:	Merklin Reservoirs	2.80
	Oxford Reservoir	1.95
	Roper Reservoir (Low Pressure Zone)	1.14
	TOTAL AVAILABLE	**5.89**

Capital Projects

Construction of Well 5

Drillwell Enterprises Ltd. was awarded the work to drill the well in early 2023 and completed the work in May 2023.

Piteau Associates Geotechnical Consultants (who specialize in ground water) managed the drilling phase of work. Following completion they provide a Well Completion Report that identifies the characteristics of the well for design of the related mechanical equipment. The well provided a sustained 34 L/s.

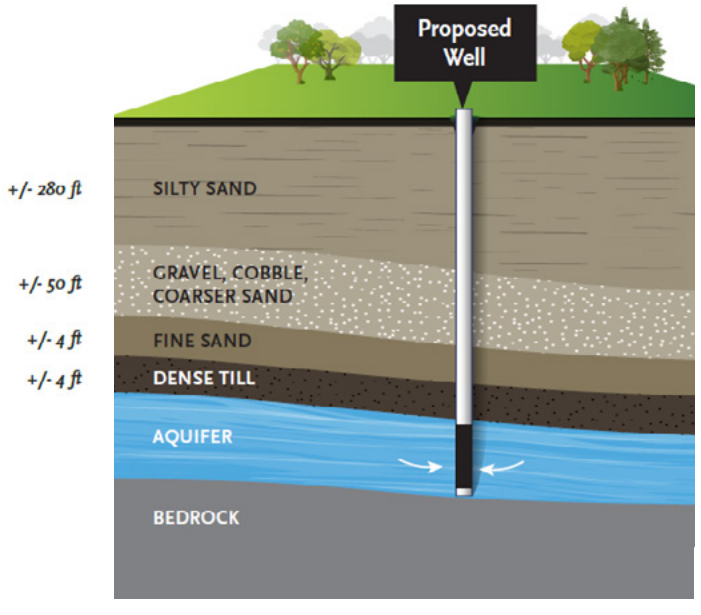
The City awarded the construction of the site works to Drake Excavating (2016) Ltd. in January 2024 and due to long delivery schedule on some items this project will not be completed until 2025.

Project Budget: $2.625 Million

Schedule:
Well Drilling, May 2023
Construction, Summer 2024

Scope of Work:
- Well construction (Completed)
- Site Works (Summer 2024)
- Emergency Generator (2025)

Figure 8 - Proposed New Groundwater Well



Water Master Plan Update

The last Water Master Plan Update was completed in 2017. Numerous changes have been made to the Water System since then, such as the Water Treatment Plant and pipe upgrades. This plan needs to be updated about every 5 years to remain current and to focus capital and development improvements to meet the long-term objectives of the City.

Kerr Wood Liedal Consulting Engineers was awarded the work in June 2023. Through consultations with City staff recommendations were included in the 2024 to 2029 capital plan prior to completion of the report. The final report will be sent to the City in May 2024.

Project Budget: $100,000

Schedule: 2023

Scope of Work:
- Update city water distribution piping installed since 2017 in the Water model.
- Update population growth and water demand to 2045.
- Calibrate the water model.
- Analysis of the network through various scenarios.
- Recommend improvements to the distribution system.
- Provide final report in 2024.

Figure 9 – 2023 Water Master Plan Update

Capital Projects

Treatment Plant Upgrades

The chemical room was originally planned to have 5-gallon totes of chemicals to dispense into the chemical holding tanks. This has since changed to deliveries of 45-gallon PVC drums which are heavy for staff to handle through doorways and move to the dispensing tanks.

This project installed overhead cranes at Oxford Treatment Plant, Oxford Reservoir and Merklin reservoir. This project will remove the lifting of heavy chemical drums that can lead to injury of staff.

Project Budget: $30,000

Schedule: Summer 2023

Scope of Work:
Determined the swing and location to base the cranes. Assessed each site to install anchor bolts into the concrete floor of each facility, missing the reinforcing steel. The cranes were fabricated off site and assembled on site to lessen the interruptions to plant operations.

The treatment plant had the SCADA software upgraded to be current. This is important to add all software patches to prevent cyber intrusions.

Picture 9 – New crane to move 45-gallon chemical drums.

Next Steps for 2024

- Complete the 2023 approved Capital Works projects.
- Work on the 2024 Capital Works projects.
- Maintain and upgrade the water distribution system to realize cost savings when possible. Continue the optimization of the Water Treatment Plant processes.
- Provide training for the Water Operators to have them update/upgrade their certification.
- Work with the Communication Department and the IT Department to ensure information on the city website is always current.
- Redevelop Well 7.
- Integrate Well 5 into the treatment plant operations.
- Replace the primary SCADA server.
- Oxford booster pump couplings upgrade.
- Upsizing of the raw water line

Summary

The City of White Rock has now owned the water utility for eight years. During 2023, Water Operations staff collected and sent samples for water quality testing. Unidirectional flushing of the watermains is seeing less accumulation of manganese as compared to previous years. This is expected as manganese is filtered out in the treatment plant.

Water System improvements such as the addition of another well and SCADA improvements will reduce costs and improve the resiliency of the system to meet the community demands. Roadwork in front of developments includes the upgrading of the water main when required.

The treatment plant continues to provide water that meets the Canadian Drinking Water Guidelines. City Operations staff work year-round to deliver this vital service to White Rock residents.

Definitions

Ammonium Sulphate: In the treatment of drinking water, ammonium sulfate is used in combination with chlorine to generate monochloramine for disinfection.

Arsenate (As (v): an arsenate is a chemical compound where arsenic has oxidation to state +5. Because it is positively charged it is easier to filter out.

Arsenite (As (iii): an arsenite is a chemical compound where arsenic has oxidation state +3. Is in the City raw water.

Sodium Hypochlorite: is Liquid chlorine (Cl) 12% is used as a disinfectant in the treated water.

Chlorine Residual: Residual chlorine is the amount of chlorine residual remaining in water after initial application.

Coagulant: A coagulant is a chemical that is used to remove select containment from drinking water.

Maximum acceptable concentration (MAC): Maximum allowable concentration of a substance per the Guidelines for Canadian Drinking Water Quality.

Abbreviations

°C	degrees Celsius
°F	degrees Fahrenheit
µ	micron
µg	microgram
µm	micrometer
ac	acres
ac-ft	acre-feet
amp	amperes
atm	atmosphere
CFM	cubic feet per minute
CFS	cubic feet per second
Ci	Curie
cm	centimeters
cu ft	cubic feet
cu in	cubic inches
cu m	cubic meters
cu yd	cubic yards
D	Dalton
dB	decibel
ft	feet or foot
ft-lb/min	foot-pounds per minute
g	gravity
gal	gallons
gal/day	gallons per day
GFD	gallons of flux per square foot per day
gm	grams
GPCD	gallons per capita per day
GPD	gallons per day
gpg	grains per gallon
GPM	gallons per minute
GPY	gallons per year
gr	grains
ha	hectares
HP	horsepower
hr	hours
Hz	hertz
in	inches
J	joules
k	kilos
kg	kilograms
km	kilometers
kN	kilonewtons
kPa	kiloPascals
kW	kilowatts
kWh	kilowatt-hours
L	liters
lb	pounds
lbs/sq in	pounds per square inch
M	mega
M	million
M	molar (or molarity)
m	meters
mA	milliampere
meq	milliequivalent
mg	milligrams
MGD	million gallons per day
mg/*L*	milligrams per liter
min	minutes
m*L*	milliliters
mm	millimeters
N	Newton
N	normal (or normality)
nm	nanometer
ohm	ohm
Pa	Pascal
pCi	picoCurie
pCi/*L*	picoCuries per liter
ppb	parts per billion
ppm	parts per million
psf	pounds per square foot
psi	pounds per square inch
psig	pounds per square inch gauge
RPM	revolutions per minute
SCFM	standard cubic feet per minute
sec	seconds
SI	*Le Système International d'Unités*
sq ft	square feet
sq in	square inches
W	watt
yd	yards

Appendix A

Fraser Health Permit to Operate

fraserhealth HEALTH PROTECTION

PERMIT
TO OPERATE
A Drinking Water System with
301-10000 Connections

Water Supplier: Corporation of the City of White Rock, The
Facility Name: City of White Rock Water System

Conditions of Permit
1. The drinking water must be treated to provide an acceptable secondary disinfectant to the whole system that meets requirements of the Guidelines for Canadian Drinking Water Quality and is acceptable to Fraser Health Authority.
2. Arsenic and Manganese levels of the treated water must be monitored on a quarterly basis as a minimum. The results are to be provided to Fraser Health.

27-Nov-2023
Effective Date

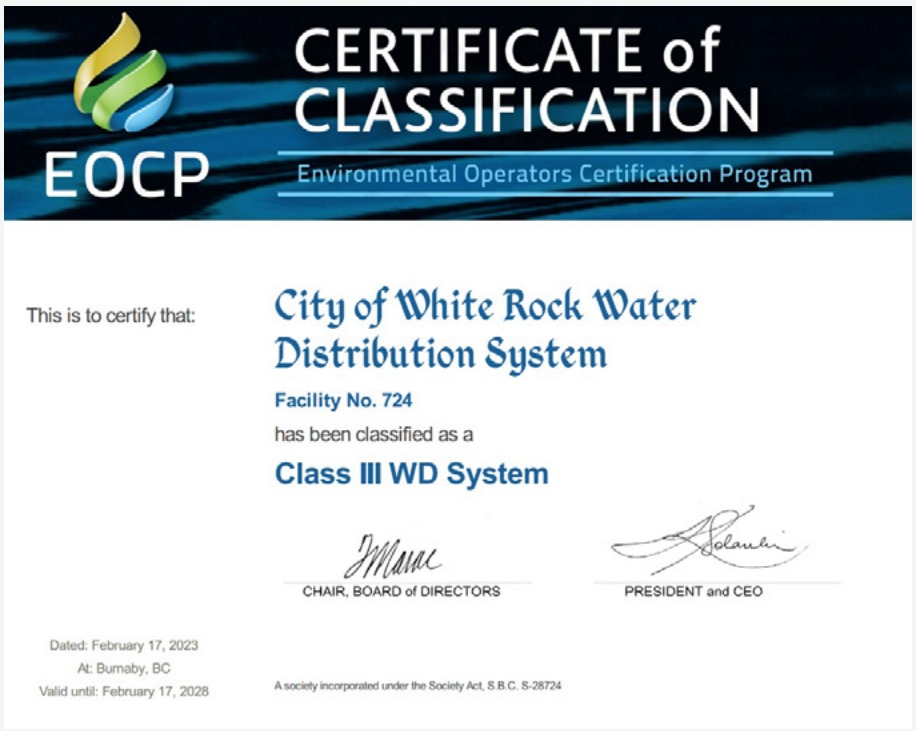
Environmental Health Officer

fraserhealth
Expires March 31 2024
907675

This permit must be displayed in a conspicuous place and is nontransferable

Appendix A

EOCP Water Distribution Classification



EOCP

CERTIFICATE of CLASSIFICATION

Environmental Operators Certification Program

This is to certify that:

City of White Rock Water Distribution System

Facility No. 724

has been classified as a

Class III WD System

CHAIR, BOARD of DIRECTORS

PRESIDENT and CEO

Dated: February 17, 2023
At: Burnaby, BC
Valid until: February 17, 2028

A society incorporated under the Society Act, S.B.C. S-28724

EOCP

CERTIFICATE of CLASSIFICATION

Environmental Operators Certification Program

This is to certify that:

City of White Rock Water Treatment Plant

Facility No. 2469

has been classified as a

Class III WT Facility

CHAIR, BOARD of DIRECTORS

PRESIDENT and CEO

Dated: May 02, 2024
At: Burnaby, BC
Valid until: May 02, 2029

A society incorporated under the Society Act, S.B.C. S-28724

Appendix B

City of White Rock Water Quality Testing Results January - December 2023

Water Treatment Plant Metal Results 2023

Sample Location	Date Sampled	Arsenic µg/L	Copper µg/L	Lead µg/L	Iron µg/L	Manganese µg/L	Colour Colour Units	pH
Guideline Limit		**10**	**2000**	**5**	**300**	**120**		**7.0-10.5**
WTP - Raw Water	**03/Jan/23**	7.0	<0.5	<0.01	32	110	<5	7.91
Treated Water	**03/Jan/23**	4.7	<0.5	0.07	<4	<1	<5	7.89
WTP - Raw Water	**09/Jan/23**	7.3	<0.5	<0.01	8	100	<5	7.91
Treated Water	**09/Jan/23**	4.7	<0.5	<0.01	<4	<1	<5	7.90
WTP - Raw Water	**17/Jan/23**	7.7	<0.5	<0.01	<4	99	<5	7.87
Treated Water	**17/Jan/23**	4.7	<0.5	<0.01	<4	<1	<5	7.87
WTP - Raw Water	**23/Jan/23**	7.0	<0.5	<0.01	<4	75	<5	7.88
Treated Water	**23/Jan/23**	4.9	<0.5	<0.01	4	<1	<5	7.91
WTP - Raw Water	**30/Jan/23**	7.2	<0.5	<0.01	<4	100	<5	7.86
Treated Water	**30/Jan/23**	4.8	<0.5	<0.01	<4	<1	<5	7.86
WTP - Raw Water	**13/Feb/23**	7.0	1.0	0.02	9	110	<5	7.76
Treated Water	**13/Feb/23**	4.7	<0.5	<0.01	<4	<1	<5	7.75
WTP - Raw Water	**21/Feb/23**	7.3	<0.5	<0.01	<4	96	<5	7.75
Treated Water	**21/Feb/23**	4.9	0.6	0.02	<4	<1	<5	7.80
WTP - Raw Water	**28/Feb/23**	6.6	<0.5	<0.01	10	100	<5	7.77
Treated Water	**28/Feb/23**	4.4	<0.5	<0.01	<4	<1	<5	7.83
WTP - Raw Water	**06/Mar/23**	6.4	<0.5	<0.01	<4	85	<5	7.72
Treated Water	**06/Mar/23**	4.4	<0.5	<0.01	<4	<1	<5	7.71
WTP - Raw Water	**13/Mar/23**	7.0	<0.5	0.01	7	100	<5	8.11
Treated Water	**13/Mar/23**	4.8	<0.5	<0.01	5	<1	<5	7.97
WTP - Raw Water	**20/Mar/23**	7.0	<0.05	0.01	5	170	<5	7.88
Treated Water	**20/Mar/23**	4.8	<0.5	<0.01	4	<1	<5	7.83
WTP - Raw Water	**27/Mar/23**	6.4	<0.5	<0.01	4	130	<5	7.77
Treated Water	**27/Mar/23**	4.9	<0.5	<0.01	<4	<1	<5	7.67
WTP - Raw Water	**03/Apr/23**	4.7	<0.5	<0.01	<4	<1	<5	7.67
Treated Water	**03/Apr/23**	4.7	<0.5	<0.01	<4	<1	<5	7.67
WTP - Raw Water	**11/Apr/23**	6.6	<0.5	<0.01	<4	96	<5	7.79
Treated Water	**11/Apr/23**	4.5	<0.5	0.01	<4	<1	<5	7.72
WTP - Raw Water	**17/Apr/23**	6.7	<0.5	<0.01	<4	93	<5	7.65
Treated Water	**17/Apr/23**	4.9	<0.5	<0.01	<4	<1	<5	7.69
WTP - Raw Water	**24/Apr/23**	6.9	<0.5	<0.01	<4	94	<5	7.54
Treated Water	**24/Apr/23**	4.9	<0.5	<0.01	<4	<1	<5	7.75
WTP - Raw Water	**02/May/23**	6.7	<0.5	<0.01	<4	84	<5	7.80
Treated Water	**02/May/23**	4.7	<0.5	<0.01	<4	<1	<5	7.74
WTP - Raw Water	**08/May/23**	6.2	<0.5	0.02	<4	130	<5	7.84
Treated Water	**08/May/23**	4.7	<0.5	<0.01	<4	<1	<5	7.84
WTP - Raw Water	**23/May/23**	6.9	<0.5	0.02	9	150	<5	7.73
Treated Water	**23/May/23**	5.1	<0.5	<0.01	<4	<1	<5	7.78
WTP - Raw Water	**29/May/23**	6.7	<0.5	<0.01	5	140	<5	7.90
Treated Water	**29/May/23**	5.0	<0.5	<0.01	<4	<1	<5	7.85
WTP - Raw Water	**05/Jun/23**	6.9	<0.5	<0.01	13	130	<5	7.63
Treated Water	**05/Jun/23**	5.3	<0.5	<0.01	<4	<1	<5	7.83
WTP - Raw Water	**12/Jun/23**	6.9	<0.5	<0.01	<4	130	<5	7.71
Treated Water	**12/Jun/23**	5.3	<0.5	<0.01	<4	<1	<5	7.70
WTP - Raw Water	**19/Jun/23**	7.1	<0.5	<0.01	<4	120	<5	7.72
Treated Water	**19/Jun/23**	5.4	<0.5	<0.01	<4	<1	<5	7.71
WTP - Raw Water	**26/Jun/23**	6.7	<0.5	<0.01	5	140	<5	7.82
Treated Water	**26/Jun/23**	5.3	<0.5	<0.01	<4	<1	<5	7.79
WTP - Raw Water	**05/Jul/23**	6.4	<0.5	0.01	15	150	<5	7.84
Treated Water	**05/Jul/23**	5.2	<0.5	<0.01	<4	<1	<5	7.87
WTP - Raw Water	**10/Jul/23**	7.1	<0.5	<0.01	<4	130	<5	7.81
Treated Water	**10/Jul/23**	5.3	<0.5	<0.01	<4	<1	<5	7.72

Appendix B

City of White Rock Water Quality Testing Results January - December 2023

Water Treatment Plant Metal Results 2023

Sample Location	Date Sampled	Arsenic µg/L	Copper µg/L	Lead µg/L	Iron µg/L	Manganese µg/L	Colour Colour Units	pH
Guideline Limit		**10**	**2000**	**5**	**300**	**120**		**7.0-10.5**
WTP - Raw Water	**17/07/23**	7.0	<0.5	<0.01	7	140	<5	7.56
Treated Water	**17/07/23**	5.5	<0.5	<0.01	<4	<1	<5	7.71
WTP - Raw Water	**02/Aug/23**	6.8	<0.5	<0.01	11	120	<5	7.74
Treated Water	**02/Aug/23**	5.3	<0.5	<0.01	<4	<1	<5	7.73
WTP - Raw Water	**08/Aug/23**	6.7	<0.5	<0.01	5	130	<5	7.73
Treated Water	**08/Aug/23**	5.5	<0.5	<0.01	<4	<1	<5	7.72
WTP - Raw Water	**21/Aug/23**	7.2	<0.5	<0.01	6	130	<5	7.75
Treated Water	**21/Aug/23**	5.3	<0.5	<0.01	<4	<1	<5	7.72
WTP - Raw Water	**28/Aug/23**	7.6	<0.5	0.02	10	150	<5	7.55
Treated Water	**28/Aug/23**	5.6	<0.5	<0.01	6	<1	<5	7.65
WTP - Raw Water	**05/Sep/23**	6.9	<0.5	<0.01	5	120	<5	7.67
Treated Water	**05/Sep/23**	5.2	<0.5	<0.01	<4	<1	<5	7.66
WTP - Raw Water	**11/Sep/23**	7.3	<0.5	<0.01	<4	130	<5	7.65
Treated Water	**11/Sep/23**	5.2	<0.5	<0.01	<4	<1	<5	7.53
WTP - Raw Water	**18/Sep/23**	7.2	<0.5	<0.01	30	140	<5	7.63
Treated Water	**18/Sep/23**	5.2	<0.5	<0.01	<4	<1	<5	7.62
WTP - Raw Water	**25/Sep/23**	7.1	<0.5	<0.01	9	100	<5	7.76
Treated Water	**25/Sep/23**	5.2	<0.5	<0.01	<4	<1	<5	7.80
WTP - Raw Water	**03/Oct/23**	7.4	<0.5	<0.01	<4	110	<5	7.63
Treated Water	**03/Oct/23**	5.6	<0.5	<0.01	<4	<1	<5	7.86
WTP - Raw Water	**10/Oct/23**	7.3	<0.5	<0.01	6	100	<5	7.71
Treated Water	**10/Oct/23**	5.5	<0.5	<0.01	<4	<1	<5	7.69
WTP - Raw Water	**16/Oct/23**	7.0	<0.5	<0.01	<4	110	<5	7.72
Treated Water	**16/Oct/23**	5.4	<0.5	<0.01	<4	<1	<5	7.74
WTP - Raw Water	**23/Oct/23**	7.6	<0.5	<0.01	<4	110	<5	7.75
Treated Water	**23/Oct/23**	5.7	<0.5	<0.01	<4	<1	<5	7.72
WTP - Raw Water	**30/Oct/23**	7.2	<0.5	<0.01	10	110	<5	7.70
Treated Water	**30/Oct/23**	5.6	<0.5	<0.01	8	<1	<5	7.65
WTP - Raw Water	**07/Nov/23**	7.0	<0.5	<0.01	<4	120	<5	7.72
Treated Water	**07/Nov/23**	5.4	<0.5	<0.01	<4	<1	<5	7.67
WTP - Raw Water	**15/Nov/23**	7.3	<0.5	<0.01	<4	110	<5	7.62
Treated Water	**15/Nov/23**	5.7	<0.5	<0.01	<4	<1	<5	7.64
WTP - Raw Water	**21/Nov/23**	7.1	<0.5	<0.01	<4	110	<5	7.68
Treated Water	**21/Nov/23**	5.5	<0.5	0.01	<4	<1	<5	7.82
WTP - Raw Water	**05/Dec/23**	6.6	<0.5	<0.01	9	94	<5	7.63
Treated Water	**05/Dec/23**	5.2	<0.5	<0.01	<4	<1	<5	7.63
WTP - Raw Water	**12/Dec/23**	6.4	<0.5	<0.01	6	87	<5	7.69
Treated Water	**12/Dec/23**	5.2	<0.5	<0.01	<4	<1	<5	7.76

Appendix B

City of White Rock Water Quality Testing Results January - December 2023

Bacterial Results - 2023

Microbioligical Analysis MPN / 100mL	Date	Guideline Limit 0 per 100 ml	# of Samples	Pass	Fail	Guideline Comments
Total Coliforms	3-Jan-23	0 per 100 mL	7	7	0	Below Guideline
Escherichia Coli	4-Jan-23	0 per 100 mL	8	8	0	Below Guideline
Total Coliforms	9-Jan-23	0 per 100 mL	7	7	0	Below Guideline
Escherichia Coli	10-Jan-23	0 per 100 mL	8	8	0	Below Guideline
Total Coliforms	16-Jan-23	0 per 100 mL	8	6	2	Above Guideline
Escherichia Coli	17-Jan-23	0 per 100 mL	7	7	0	Below Guideline
Total Coliforms	23-Jan-23	0 per 100 mL	7	7	0	Below Guideline
Escherichia Coli	24-Jan-23	0 per 100 mL	8	8	0	Below Guideline
Total Coliforms	30-Jan-23	0 per 100 mL	8	8	0	Below Guideline
Escherichia Coli	31-Jan-23	0 per 100 mL	6	6	0	Below Guideline
Total Coliforms	6-Feb-23	0 per 100 mL	7	7	0	Below Guideline
Escherichia Coli	7-Feb-23	0 per 100 mL	8	8	0	Below Guideline
Total Coliforms	13-Feb-23	0 per 100 mL	7	7	0	Below Guideline
Escherichia Coli	14-Feb-23	0 per 100 mL	8	8	0	Below Guideline
Total Coliforms	21-Feb-23	0 per 100 mL	7	7	0	Below Guideline
Escherichia Coli	22-Feb-23	0 per 100 mL	8	8	0	Below Guideline
Total Coliforms	27-Feb-23	0 per 100 mL	7	7	0	Below Guideline
Escherichia Coli	1-Mar-23	0 per 100 mL	8	8	0	Below Guideline
Total Coliforms	6-Mar-23	0 per 100 mL	7	7	0	Below Guideline
Escherichia Coli	7-Mar-23	0 per 100 mL	8	8	0	Below Guideline
Total Coliforms	13-Mar-23	0 per 100 mL	7	7	0	Below Guideline
Escherichia Coli	14-Mar-23	0 per 100 mL	8	8	0	Below Guideline
Total Coliforms	20-Mar-23	0 per 100 mL	8	8	0	Below Guideline
Escherichia Coli	21-Mar-23	0 per 100 mL	7	7	0	Below Guideline
Total Coliforms	27-Mar-23	0 per 100 mL	7	7	0	Below Guideline
Escherichia Coli	28-Mar-23	0 per 100 mL	8	8	0	Below Guideline
Total Coliforms	3-Apr-23	0 per 100 mL	7	7	0	Below Guideline
Escherichia Coli	4-Apr-23	0 per 100 mL	8	8	0	Below Guideline
Total Coliforms	11-Apr-23	0 per 100 mL	7	7	0	Below Guideline
Escherichia Coli	12-Apr-23	0 per 100 mL	7	7	0	Below Guideline
Total Coliforms	18-Apr-23	0 per 100 mL	7	7	0	Below Guideline
Escherichia Coli	24-Apr-23	0 per 100 mL	7	7	0	Below Guideline
Total Coliforms	25-Apr-23	0 per 100 mL	8	8	0	Below Guideline
Escherichia Coli	1-May-23	0 per 100 mL	7	7	0	Below Guideline
Total Coliforms	2-May-23	0 per 100 mL	8	8	0	Below Guideline
Escherichia Coli	8-May-23	0 per 100 mL	7	7	0	Below Guideline
Total Coliforms	9-May-23	0 per 100 mL	8	8	0	Below Guideline
Escherichia Coli	15-May-23	0 per 100 mL	7	7	0	Below Guideline
Total Coliforms	16-May-23	0 per 100 mL	8	8	0	Below Guideline
Escherichia Coli	23-May-23	0 per 100 mL	7	7	0	Below Guideline
Total Coliforms	24-May-23	0 per 100 mL	8	8	0	Below Guideline
Escherichia Coli	29-May-23	0 per 100 mL	7	7	0	Below Guideline
Total Coliforms	30-May-23	0 per 100 mL	7	7	0	Below Guideline
Escherichia Coli	5-Jun-23	0 per 100 mL	7	7	0	Below Guideline
Total Coliforms	6-Jun-23	0 per 100 mL	8	7	1	Above Guideline
Escherichia Coli	12-Jun-23	0 per 100 mL	7	7	0	Below Guideline
Total Coliforms	13-Jun-23	0 per 100 mL	8	8	0	Below Guideline
Escherichia Coli	19-Jun-23	0 per 100 mL	7	7	0	Below Guideline
Total Coliforms	20-Jun-23	0 per 100 mL	8	7	1	Above Guideline
Escherichia Coli	26-Jun-23	0 per 100 mL	7	7	0	Below Guideline
Total Coliforms	27-Jun-23	0 per 100 mL	8	8	0	Below Guideline
Escherichia Coli	4-Jul-23	0 per 100 mL	7	7	0	Below Guideline
Total Coliforms	5-Jul-23	0 per 100 mL	8	8	0	Below Guideline
Escherichia Coli	10-Jul-23	0 per 100 mL	7	7	0	Below Guideline

Appendix B

City of White Rock Water Quality Testing Results January - December 2023

Bacterial Results - 2023

Microbioligical Analysis MPN / 100mL	Date	Guideline Limit 0 per 100 ml	# of Samples	Pass	Fail	Guideline Comments
Total Coliforms	11-Jul-23	0 per 100 mL	8	8	0	Below Guideline
Escherichia Coli	17-Jul-23	0 per 100 mL	7	7	0	Below Guideline
Total Coliforms	18-Jul-23	0 per 100 mL	8	8	0	Below Guideline
Escherichia Coli	24-Jul-23	0 per 100 mL	8	8	0	Below Guideline
Total Coliforms	25-Jul-23	0 per 100 mL	7	7	0	Below Guideline
Escherichia Coli	1-Aug-23	0 per 100 mL	8	8	0	Below Guideline
Total Coliforms	2-Aug-23	0 per 100 mL	7	6	1	Above Guideline
Escherichia Coli	8-Aug-23	0 per 100 mL	7	7	0	Below Guideline
Total Coliforms	9-Aug-23	0 per 100 mL	8	8	0	Below Guideline
Escherichia Coli	14-Aug-23	0 per 100 mL	7	7	0	Below Guideline
Total Coliforms	15-Aug-23	0 per 100 mL	8	8	0	Below Guideline
Escherichia Coli	21-Aug-23	0 per 100 mL	7	7	0	Below Guideline
Total Coliforms	22-Aug-23	0 per 100 mL	8	8	0	Below Guideline
Escherichia Coli	28-Aug-23	0 per 100 mL	7	7	0	Below Guideline
Total Coliforms	29-Aug-23	0 per 100 mL	8	8	0	Below Guideline
Escherichia Coli	5-Sep-23	0 per 100 mL	7	7	0	Below Guideline
Total Coliforms	6-Sep-23	0 per 100 mL	8	8	0	Below Guideline
Escherichia Coli	11-Sep-23	0 per 100 mL	7	7	0	Below Guideline
Total Coliforms	12-Sep-23	0 per 100 mL	8	8	0	Below Guideline
Escherichia Coli	18-Sep-23	0 per 100 mL	7	7	0	Below Guideline
Total Coliforms	19-Sep-23	0 per 100 mL	8	8	0	Below Guideline
Escherichia Coli	25-Sep-23	0 per 100 mL	7	7	0	Below Guideline
Total Coliforms	26-Sep-23	0 per 100 mL	8	7	1	Above Guideline
Escherichia Coli	3-Oct-23	0 per 100 mL	7	7	0	Below Guideline
Total Coliforms	4-Oct-23	0 per 100 mL	8	8	0	Below Guideline
Escherichia Coli	10-Oct-23	0 per 100 mL	7	7	0	Below Guideline
Total Coliforms	11-Oct-23	0 per 100 mL	7	7	0	Below Guideline
Escherichia Coli	16-Oct-23	0 per 100 mL	7	7	0	Below Guideline
Total Coliforms	17-Oct-23	0 per 100 mL	7	7	0	Below Guideline
Escherichia Coli	23-Oct-23	0 per 100 mL	7	7	0	Below Guideline
Total Coliforms	24-Oct-23	0 per 100 mL	7	7	0	Below Guideline
Escherichia Coli	30-Oct-23	0 per 100 mL	7	7	0	Below Guideline
Total Coliforms	31-Oct-23	0 per 100 mL	7	7	0	Below Guideline
Escherichia Coli	6-Nov-23	0 per 100 mL	7	7	0	Below Guideline
Total Coliforms	7-Nov-23	0 per 100 mL	7	7	0	Below Guideline
Escherichia Coli	14-Nov-23	0 per 100 mL	7	7	0	Below Guideline
Total Coliforms	15-Nov-23	0 per 100 mL	7	7	0	Below Guideline
Escherichia Coli	20-Nov-23	0 per 100 mL	7	7	0	Below Guideline
Total Coliforms	21-Nov-23	0 per 100 mL	7	7	0	Below Guideline
Escherichia Coli	27-Nov-23	0 per 100 mL	7	7	0	Below Guideline
Total Coliforms	28-Nov-23	0 per 100 mL	7	7	0	Below Guideline
Escherichia Coli	4-Dec-23	0 per 100 mL	7	7	0	Below Guideline
Total Coliforms	5-Dec-23	0 per 100 mL	7	7	0	Below Guideline
Escherichia Coli	11-Dec-23	0 per 100 mL	7	7	0	Below Guideline
Total Coliforms	12-Dec-23	0 per 100 mL	7	7	0	Below Guideline
Escherichia Coli	18-Dec-23	0 per 100 mL	7	7	0	Below Guideline
Total Coliforms	19-Dec-23	0 per 100 mL	7	7	0	Below Guideline

Appendix B

City of White Rock Water Quality Testing Results January - December 2023

Non Routine Water Quality Results for Source and Distribution Water 2023

Sampling Point Name	Date Sampled	TC MPN / 100 ml	E-coli MPN / 100 ml	Comments
14811 Buena Vista	16-Jan-23	<1	<1	Below MAC
Everall Stn	19-Jan-23	<1	<1	Below MAC
Russell Stn	19-Jan-23	<1	<1	Below MAC
Marine & Stevens St #1	25-Apr-23	<1	<1	Below MAC
Marine & Stevens St #2	27-Apr-23	<1	<1	Below MAC
Finlay Station Resample 2	12-Jun-23	<1	<1	Below MAC
Stevens St & Marine Dr -Resample	23-Jun-23	<1	<1	Below MAC
Chestnut & North Bluff - Resample	4-Aug-23	<1	<1	Below MAC
Finaly Sample Station 1130	29-Sep-23	<1	<1	Below MAC
15611 Marine Dr	8-Dec-23	<1	<1	Below MAC
1171 Lee St	12-Dec-23	<1	<1	Below MAC
Amount of Times 1.0 or Higher:		0	0	

Appendix B

City of White Rock Water Quality Testing Results January - December 2023

Distribution Metal Results 2023								
Sample Location	Date Sampled	Arsenic µg/L	Copper µg/L	Lead µg/L	Iron µg/L	Manganese µg/L	Colour Colour Units	pH
Guideline Limit		**10**	**2000**	**5**	**300**	**120**		**7.0-10.5**
Everall Sample Station	30-Jan-23	4.6	1.1	0.07	<4	<1	<5	7.87
Malabar Sample Station	30-Jan-23	4.7	2.5	0.16	<4	3	<5	7.86
Chestnut & North Bluff Station	30-Jan-23	4.7	1.9	0.04	<4	4	<5	7.87
Russell Avenue Sample Station	30-Jan-23	4.8	1.2	0.07	<4	<1	<5	7.87
Roper Reservoir	30-Jan-23	4.7	0.7	0.11	<4	<1	<5	7.89
Roper PRV	30-Jan-23	4.7	5.4	0.03	<4	<1	<5	7.88
Stevens Sample Stn	30-Jan-23	4.7	3.0	0.15	<4	<1	<5	7.87
Stayte Road Station	30-Jan-23	4.8	4.2	0.90	16	2	<5	7.86
Oxford & Buena Vista Station	31-Jan-23	4.6	7.9	0.20	<4	2	<5	7.78
Museum Sampling Station	31-Jan-23	4.7	2.1	<0.01	5	<1	<5	7.82
Balsam & Marine Station	31-Jan-23	4.8	0.9	0.06	<4	<1	<5	7.83
Merklin Low Reservoir	31-Jan-23	<0.1	<0.5	<0.01	7	<1	<5	7.85
Merklin New Reservoir	31-Jan-23	4.5	0.8	<0.01	<4	<1	<5	7.83
Oxford Reservoir	31-Jan-23	4.5	0.5	0.02	<4	<1	<5	7.83
Everall Sample Station	27-Feb-23	4.5	1.1	0.04	<4	<1	<5	7.65
Malabar Sample Station	27-Feb-23	4.5	2.2	0.15	<4	2	<5	7.66
Chestnut Sample Station	27-Feb-23	4.5	1.4	0.03	<4	4	<5	7.67
Russell Avenue Sample Station	27-Feb-23	4.7	1.3	0.07	<4	<1	<5	7.67
Roper Reservoir	27-Feb-23	4.5	0.5	0.07	<4	<1	<5	7.68
Roper PRV	27-Feb-23	4.6	9.0	0.05	<4	<1	<5	7.70
Stevens Sample Station	27-Feb-23	4.6	2.6	0.15	<4	<1	<5	7.69
Oxford & Buena Vista Station	01-Mar-23	4.7	7.4	0.16	<4	1	<5	7.66
Museum Sampling Station	01-Mar-23	4.8	1.9	<0.01	<4	<1	<5	7.67
Balsam & Marine Station	01-Mar-23	4.8	0.8	0.04	4	<1	<5	7.68
Stayte Road Station	01-Mar-23	4.7	3.5	0.76	19	2	<5	7.69
Finlay Station	01-Mar-23	4.7	0.6	0.02	7	<1	<5	7.68
Merklin Low Reservoir	01-Mar-23	4.7	7.9	<0.01	<4	<1	<5	7.69
Merklin New Reservoir	01-Mar-23	4.7	<0.5	<0.01	4	<1	<5	7.69
Oxford Reservoir	01-Mar-23	4.8	<0.5	<0.01	<4	<1	<5	7.70
Everall Sample Station	27-Mar-23	5.0	1.2	0.04	<4	<1	<5	7.73
Malabar Sample Station	27-Mar-23	4.9	2.8	0.18	7	2	<5	7.74
Chestnut & North Bluff Station	27-Mar-23	4.9	2.2	0.05	5	3	<5	7.76
Russell Avenue Sample Station	27-Mar-23	5.0	1.3	0.08	<4	<1	<5	7.78
Roper Reservoir	27-Mar-23	4.9	0.8	0.11	<4	<1	<5	7.77
Roper PRV	27-Mar-23	4.9	5.4	0.04	<4	<1	<5	7.78
Stevens Sample Station	27-Mar-23	4.7	2.7	0.15	6	<1	<5	7.78
14811 Buena Vista Ave	28-Mar-23	4.8	10	0.24	<4	<1	<5	7.73
Museum Sampling Station	28-Mar-23	4.8	2.8	<0.01	<4	1	<5	7.74
Balsam & Marine Station	28-Mar-23	4.8	1.2	0.06	<4	<1	<5	7.73
Stayte Road Station	28-Mar-23	4.7	5.2	1.20	32	2	<5	7.73
Finlay Station	28-Mar-23	4.8	0.8	0.03	4	<1	<5	7.76
Merklin Low Reservoir	28-Mar-23	4.7	8.1	0.01	<4	<1	<5	7.74
Merklin New Reservoir	28-Mar-23	4.8	<0.5	<0.01	<4	<1	<5	7.74
Oxford Reservoir	28-Mar-23	4.8	<0.5	<0.01	<4	<1	<5	7.79
Everall Sample Station	24-Apr-23	4.8	1.2	0.04	<4	<1	<5	7.70
Malabar Sample Station	24-Apr-23	4.8	2.6	0.15	<4	1	<5	7.80
Chestnut & North Bluff Station	24-Apr-23	4.8	2.6	0.04	<4	4	<5	7.81
Russell Avenue Sample Station	24-Apr-23	4.8	1.3	0.07	<4	<1	<5	7.63
Roper Reservoir	24-Apr-23	4.7	0.8	0.09	<4	1	<5	7.78
Roper PRV	24-Apr-23	4.8	7.2	0.06	<4	1	<5	7.81
Stevens Sample Station	24-Apr-23	4.6	2.6	0.13	<4	1	<5	7.82
14811 Buena Vista Ave	25-Apr-23	4.6	13	0.29	4	3	<5	7.71
Museum Sampling Station	25-Apr-23	4.7	2.6	<0.01	<4	<1	<5	7.76

Appendix B

City of White Rock Water Quality Testing Results January - December 2023

Distribution Metal Results 2023								
Sample Location	Date Sampled	Arsenic µg/L	Copper µg/L	Lead µg/L	Iron µg/L	Manganese µg/L	Colour Colour Units	pH
Guideline Limit		**10**	**2000**	**5**	**300**	**120**		**7.0-10.5**
Balsam & Marine Station	25-Apr-23	4.6	1.4	0.07	11	3	<5	7.77
Stayte Road Station	25-Apr-23	4.6	2.0	0.18	27	15	<5	7.78
Finlay Station	25-Apr-23	4.7	0.9	0.03	<4	2	<5	7.80
Merklin Low Reservoir	25-Apr-23	4.6	9.7	<0.01	<4	<1	<5	7.80
Merklin New Reservoir	25-Apr-23	4.5	<0.5	0.01	<4	<1	<5	7.80
Oxford Reservoir	25-Apr-23	4.7	<0.5	<0.01	<4	<1	<5	7.79
Everall Sample Station	29-May-23	5.2	1.4	0.06	<4	<1	<5	7.81
Mann Park Sample Station	29-May-23	5.2	3.7	0.10	<4	2	<5	7.83
Marine Sample Station	29-May-23	5.1	3.7	2.70	<4	3	<5	7.83
Russell Avenue Sample Station	29-May-23	5.2	1.3	0.08	<4	<1	<5	7.83
Roper Reservoir	29-May-23	5.1	0.6	0.09	<4	<1	<5	7.84
Roper PRV	29-May-23	5.0	7.5	0.04	<4	1	<5	7.86
Stevens Sample Station	29-May-23	5.0	4.8	0.41	<4	1	<5	7.85
14811 Buena Vista Ave	30-May-23	5.1	11	0.27	<4	1	<5	7.60
Museum Sampling Station	30-May-23	5.2	1.3	<0.01	<4	<1	<5	7.65
Balsam & Marine Station	30-May-23	5.2	1.1	0.13	<4	<1	<5	7.71
Stayte Road Station	30-May-23	5.1	7	1.60	7	2	<5	7.70
Finlay Station	30-May-23	5.2	1.1	0.05	<4	1	<5	7.68
Merklin Low Reservoir	30-May-23	5.1	9.0	0.01	<4	<1	<5	7.68
Merklin New Reservoir	30-May-23	5.1	<0.5	<0.01	<4	<1	<5	7.69
Oxford Reservoir	30-May-23	5.1	<0.5	<0.01	<4	<1	<5	7.70
Everall Sample Station	26-Jun-23	5.3	1.3	0.06	<4	<1	<5	7.78
Mann Park Sample Station	26-Jun-23	5.4	2.3	0.06	<4	1	<5	7.79
Marine Sample Station	26-Jun-23	5.2	3.2	0.23	<4	2	<5	7.78
Russell Avenue Sample Station	26-Jun-23	5.4	1.3	0.08	<4	<1	<5	7.80
Roper Reservoir	26-Jun-23	5.4	0.7	0.10	<4	<1	<5	7.82
Roper PRV	26-Jun-23	5.3	9.3	0.12	<4	<1	<5	7.82
Roper Ave, Sample Station	26-Jun-23	5.3	3.7	0.35	<4	<1	<5	7.82
14811 Buena Vista Ave	27-Jun-23	5.4	12	0.27	<4	<1	<5	7.80
Museum Sampling Station	27-Jun-23	5.3	1.4	<0.01	<4	<1	<5	7.74
Balsam & Marine Station	27-Jun-23	5.3	1.0	0.09	<4	<1	<5	7.74
Stevens St & Marine Dr	27-Jun-23	5.3	2.0	0.20	<4	1	<5	7.74
Finlay St Sample Station	27-Jun-23	5.2	0.9	0.03	<4	1	<5	7.74
Merklin Low Reservoir	27-Jun-23	5.2	9.3	<0.01	<4	<1	<5	7.76
Merklin New Reservoir	27-Jun-23	5.3	<0.5	<0.01	<4	<1	<5	7.75
Oxford Reservoir	27-Jun-23	5.3	<0.5	<0.01	<4	<1	<5	7.73
Everall Sample Station	24-Jul-23	5.4	1.6	0.07	<4	<1	<5	7.68
Mann Park Sample Station	24-Jul-23	5.4	2.4	0.07	<4	1	<5	7.73
Marine Sample Station	24-Jul-23	5.3	3.2	0.22	<4	2	<5	7.74
Russell Avenue Sample Station	24-Jul-23	5.4	1.3	0.10	<4	<1	<5	7.74
Roper Reservoir	24-Jul-23	5.4	0.8	0.15	<4	<1	<5	7.75
Roper PRV	24-Jul-23	5.4	3.7	0.09	<4	<1	<5	7.76
Roper Avenue Station	24-Jul-23	5.4	4.4	0.49	<4	<1	<5	7.75
Stevens Sample Station	24-Jul-23	5.4	1.9	0.43	5	2	<5	7.75
14811 Buena Vista Ave	25-Jul-23	5.5	15	0.41	<4	<1	<5	7.74
Museum Sampling Station	25-Jul-23	5.5	1.9	<0.01	<4	<1	<5	7.76
Balsam & Marine Station	25-Jul-23	5.4	1.0	0.11	<4	<1	<5	7.74
Finlay St Sample Station	25-Jul-23	5.4	1.1	0.06	<4	<1	<5	7.75
Merklin Low Reservoir	25-Jul-23	5.6	8.0	0.02	<4	<1	<5	7.73
Merklin New Reservoir	25-Jul-23	5.5	<0.5	<0.01	<4	<1	<5	7.62
Oxford Reservoir	25-Jul-23	5.5	<0.5	<0.01	<4	<1	<5	7.72
Everall Sample Station	28-Aug-23	5.6	2.0	0.08	<4	<1	<5	7.67
Russell Avenue Sample Station	28-Aug-23	5.6	1.6	0.09	<4	<1	<5	7.67

Appendix B

City of White Rock Water Quality Testing Results January - December 2023

Distribution Metal Results 2023								
Sample Location	Date Sampled	Arsenic µg/L	Copper µg/L	Lead µg/L	Iron µg/L	Manganese µg/L	Colour Colour Units	pH
Guideline Limit		**10**	**2000**	**5**	**300**	**120**		**7.0-10.5**
Roper Reservoir	28-Aug-23	5.8	0.6	0.09	4	<1	<5	7.68
Chestnut Sample Station	28-Aug-23	5.6	2.0	0.06	<4	3	<5	7.67
Roper PRV	28-Aug-23	5.7	6.9	0.12	6	<1	<5	7.68
Stevens Sample Station	28-Aug-23	5.6	3.0	0.29	<4	<1	<5	7.67
Malabar Sample Station	28-Aug-23	5.6	3.0	0.23	<4	1	<5	7.70
14811 Buena Vista Ave	29-Aug-23	5.6	13.0	0.30	<4	<1	<5	7.64
Museum Sampling Station	29-Aug-23	5.6	3.0	<0.01	<4	<1	<5	7.66
Balsam & Marine Station	29-Aug-23	5.6	1.4	0.14	<4	<1	<5	7.66
Stevens St & Marine Dr	29-Aug-23	5.5	1.8	0.23	<4	1	<5	7.67
Finlay St Sample Station	29-Aug-23	5.7	1.1	0.06	<4	<1	<5	7.66
Merklin Low Reservoir	29-Aug-23	5.6	9.3	0.27	<4	<1	<5	7.68
Merklin New Reservoir	29-Aug-23	5.6	<0.5	<0.01	<4	<1	<5	7.69
Oxford Reservoir	29-Aug-23	5.6	<0.5	0.02	<4	<1	<5	7.68
Everall Sample Station	20-Sep-23	5.0	1.2	0.07	<4	<1	<5	7.69
Mann Park Sample Station	20-Sep-23	5.0	3.2	0.10	<4	2	<5	7.68
Marine Sample Station	20-Sep-23	5.0	3.9	0.23	<4	2	<5	7.70
Russell Avenue Sample Station	20-Sep-23	5.0	1.7	0.10	<4	<1	<5	7.70
Roper Reservoir	20-Sep-23	5.0	0.7	0.10	<4	<1	<5	7.70
Roper PRV	20-Sep-23	5.0	1.2	0.14	<4	<1	<5	7.69
Stevens Sample Station	20-Sep-23	4.9	6.1	0.56	<4	<1	<5	7.70
Museum Sampling Station	20-Sep-23	5.0	3.8	<0.01	<4	1	<5	7.71
Balsam & Marine Station	20-Sep-23	5.0	1.2	0.14	4	<1	<5	7.71
Roper Ave St	20-Sep-23	5.1	6.9	0.53	7	<1	<5	7.71
Finlay Station	20-Sep-23	4.9	1.2	0.06	<4	1	<5	7.70
Merklin Low Reservoir	20-Sep-23	5.0	7.6	<0.01	<4	<1	<5	7.67
Merklin New Reservoir	20-Sep-23	5.0	<0.5	<0.01	4	<1	<5	7.67
Oxford Reservoir	20-Sep-23	5.0	10.0	0.09	<4	<1	<5	7.68
Malabar Sample Station	20-Sep-23	4.9	2.9	0.21	<4	1	<5	7.69
Chestnut & North Bluff Stn	20-Sep-23	5.0	1.6	0.07	<4	3	<5	7.70
14811 Buena Vista Ave	20-Sep-23	5.0	13.0	0.29	<4	1	<5	7.71
Stevens & Marine Dr Stn	20-Sep-23	5.0	2.2	0.13	<4	1	<5	7.70
Everall St Sample Station	30-Oct-23	5.6	1.1	0.06	<4	<1	<5	7.61
Mann Park Sample Station	30-Oct-23	5.6	2.6	0.07	<4	<1	<5	7.64
Marine Drive Sample Station	30-Oct-23	5.6	3.1	0.17	6	1	<5	7.65
Russell Ave Sample Station	30-Oct-23	5.6	1.2	0.08	<4	<1	<5	7.62
Roper Resevoir	30-Oct-23	5.7	0.7	0.09	<4	<1	<5	7.67
Roper PRV	30-Oct-23	5.5	14.0	0.23	7	<1	<5	7.67
Roper Ave Sample Station	30-Oct-23	5.5	4.8	0.33	<4	<1	<5	7.66
14811 Buena Vista Ave	31-Oct-23	5.6	12.0	0.24	<4	1	<5	7.64
Museum Sampling Station	31-Oct-23	5.7	2.2	<0.01	<4	<1	<5	7.74
Balsam & Marine Station	31-Oct-23	5.7	1.0	0.08	<4	<1	<5	7.70
Stevens St & Marine Dr	31-Oct-23	5.6	1.5	0.04	<4	1	<5	7.74
Merklin Low Reservoir	31-Oct-23	5.7	7.0	<0.01	<4	<1	<5	7.75
Merklin New Reservoir	31-Oct-23	5.6	<0.5	<0.01	<4	<1	<5	7.74
Oxford Reservoir	31-Oct-23	5.7	<0.5	0.02	<4	<1	<5	7.81
Everall St Sample Station	27-Nov-23	5.5	1.4	0.06	<4	<1	<5	7.73
Mann Park Sample Station	27-Nov-23	5.7	3.3	0.07	<4	2	<5	7.76
Marine Drive Sample Station	27-Nov-23	5.7	3.4	0.14	<4	2	<5	7.78
Russell Ave Sample Station	27-Nov-23	5.7	1.5	0.08	<4	<1	<5	7.77
Roper Resevoir	27-Nov-23	5.7	0.6	0.07	<4	<1	<5	7.79
Roper PRV	27-Nov-23	5.7	1.0	0.10	<4	<1	<5	7.80
Roper Ave Sample Station	27-Nov-23	5.6	3.4	0.18	<4	1.0	<5	7.79
14811 Buena Vista Ave	28-Nov-23	5.4	11.0	0.21	<4	1.0	<5	7.71
Museum Sampling Station	28-Nov-23	5.5	2.9	<0.01	<4	<1	<5	7.77

Appendix B

City of White Rock Water Quality Testing Results January - December 2023

Distribution Metal Results 2023								
Sample Location	Date Sampled	Arsenic µg/L	Copper µg/L	Lead µg/L	Iron µg/L	Manganese µg/L	Colour Colour Units	pH
Guideline Limit		**10**	**2000**	**5**	**300**	**120**		**7.0-10.5**
Balsam & Marine Station	28-Nov-23	5.5	1.4	0.09	<4	<1	<5	7.78
Stevens St & Marine Dr	28-Nov-23	5.5	1.2	0.03	<4	2.0	<5	7.59
Merklin Low Reservoir	28-Nov-23	5.5	7.6	<0.01	<4	<1	<5	7.74
Merklin New Reservoir	28-Nov-23	5.4	<0.5	<0.01	<4	<1	<5	7.78
Oxford Reservoir	28-Nov-23	5.4	<0.5	<0.01	<4	<1	<5	7.78

Appendix B

City of White Rock Water Quality Testing Results January - December 2023

THM & HAA RESULTS 2023

Sample	Unit of Measure	Nominal Detection Limit	Sample Location				Sampled Date
			Marine Dr Station	Roper PRV	Stevens Station	Stayte Station	
Chloroform	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	30-Jan-23
Bromodichloromethane	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	30-Jan-23
Dibromochloromethane	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	30-Jan-23
Bromoform	mg/L	0.001	<0.001	<0.001	0.001	<0.001	30-Jan-23
Total THMs	mg/L	0.001	<0.001	<0.001	0.001	<0.001	30-Jan-23
Dibromofluoromethane	%	50-140	94	100	95	96	30-Jan-23
Toluene-d8	%	50-140	101	99	100	101	30-Jan-23
Bromofluorobenzene	%	50-140	98	97	94	94	30-Jan-23
Monochloroacetic Acid	ug/L	2.0	<2.0	<2.0	<2.0	<2.0	30-Jan-23
Monobromoacetic Acid	ug/L	2.0	<2.0	<2.0	<2.0	<2.0	30-Jan-23
Dichloroacetic Acid	ug/L	2.0	<2.0	<2.0	<2.0	<2.0	30-Jan-23
Bromochloroacetic Acid	ug/L	2.0	<2.0	<2.0	<2.0	<2.0	30-Jan-23
Dibromoacetic Acid	ug/L	2.0	<2.0	<2.0	<2.0	<2.0	30-Jan-23
Trichloroacetic Acid	ug/L	2.0	<2.0	<2.0	<2.0	<2.0	30-Jan-23
Total HAA6	ug/L	12.0	<12.0	<12.0	<12.0	<12.0	30-Jan-23
2,3-Dibromopropionic Acid	%	50-150	84	100	93	97	30-Jan-23
Sample	Unit of Measure	Nominal Detection Limit	Sample Location				Sampled Date
			Marine Dr Station	Roper PRV	Stevens Station	Stayte Station	
Chloroform	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	17-Apr-23
Bromodichloromethane	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	17-Apr-23
Dibromochloromethane	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	17-Apr-23
Bromoform	mg/L	0.001	<0.001	0.001	<0.001	<0.001	17-Apr-23
Total THMs	mg/L	0.001	<0.001	0.001	<0.001	<0.001	17-Apr-23
Dibromofluoromethane	%	50-140	104	111	102	107	17-Apr-23
Toluene-d8	%	50-140	98	94	102	99	17-Apr-23
Bromofluorobenzene	%	50-140	104	105	102	100	17-Apr-23
Monochloroacetic Acid	ug/L	2.0	<2.0	<2.0	<2.0	<2.0	17-Apr-23
Monobromoacetic Acid	ug/L	2.0	<2.0	<2.0	<2.0	<2.0	17-Apr-23
Dichloroacetic Acid	ug/L	2.0	<2.0	<2.0	<2.0	<2.0	17-Apr-23
Bromochloroacetic Acid	ug/L	2.0	<2.0	<2.0	<2.0	<2.0	17-Apr-23
Dibromoacetic Acid	ug/L	2.0	<2.0	<2.0	<2.0	<2.0	17-Apr-23
Trichloroacetic Acid	ug/L	2.0	<2.0	<2.0	<2.0	<2.0	17-Apr-23
Total HAA6	ug/L	12.0	<12.0	<12.0	<12.0	<12.0	17-Apr-23
2,3-Dibromopropionic Acid	%	50-150	93	87	84	82	17-Apr-23
Sample	Unit of Measure	Nominal Detection Limit	Sample Location				Sampled Date
			Marine Dr Station	Roper PRV	Stevens Station	Stevens & Marine	
Chloroform	mg/L	0.001	<0.5	<0.5	<0.5	<0.5	24-Jul-23
Bromodichloromethane	mg/L	0.001	<0.5	<0.5	<0.5	<0.5	24-Jul-23
Dibromochloromethane	mg/L	0.001	<0.5	<0.5	<0.5	<0.5	24-Jul-23
Bromoform	mg/L	0.001	<0.5	<0.5	<0.5	<0.5	24-Jul-23
Total THMs	mg/L	0.001	<2.0	<2.0	<2.0	<2.0	24-Jul-23
Dibromofluoromethane	%	50-140	90	90	90	94	24-Jul-23
Toluene-d8	%	50-140	110	110	110	103	24-Jul-23
Bromofluorobenzene	%	50-140	96	101	102	108	24-Jul-23
Monochloroacetic Acid	ug/L	2.0	<2.0	<2.0	<2.0	<2.0	24-Jul-23
Monobromoacetic Acid	ug/L	2.0	<2.0	<2.0	<2.0	<2.0	24-Jul-23
Dichloroacetic Acid	ug/L	2.0	<2.0	<2.0	<2.0	<2.0	24-Jul-23
Bromochloroacetic Acid	ug/L	2.0	<2.0	<2.0	<2.0	<2.0	24-Jul-23
Dibromoacetic Acid	ug/L	2.0	<2.0	<2.0	<2.0	<2.0	24-Jul-23
Trichloroacetic Acid	ug/L	2.0	<2.0	<2.0	<2.0	<2.0	24-Jul-23
Total HAA6	ug/L	12.0	<12.0	<12.0	<12.0	<12.0	24-Jul-23
2,3-Dibromopropionic Acid	%	50-150	68	97	68	94	24-Jul-23
Sample	Unit of Measure	Nominal Detection Limit	Sample Location				Sampled Date
			Marine Dr Station	Roper PRV	Stevens Station	Stevens & Marine	
Chloroform	mg/L	0.001	<0.5	<0.5	<0.5	<0.5	24-Oct-23
Bromodichloromethane	mg/L	0.001	<0.5	<0.5	<0.5	<0.5	24-Oct-23

Appendix B

City of White Rock Water Quality Testing Results January - December 2023

THM & HAA RESULTS 2023

Sample	Unit of Measure	Nominal Detection Limit	Sample Location				Sampled Date
			Marine Dr Station	Roper PRV	Stevens Station	Stevens & Marine	
Dibromochloromethane	**mg/L**	**0.001**	<0.5	<0.5	0.6	<0.5	24-Oct-23
Bromoform	**mg/L**	**0.001**	<0.5	<0.5	1.1	0.5	24-Oct-23
Total THMs	**mg/L**	**0.001**	<2.0	<2.0	1.7	0.5	24-Oct-23
Dibromofluoromethane	**%**	**50-140**	108	114	114	110	24-Oct-23
Toluene-d8	**%**	**50-140**	116	120	116	112	24-Oct-23
Bromofluorobenzene	**%**	**50-140**	104	107	104	107	24-Oct-23
Monochloroacetic Acid	**ug/L**	**2.0**	<2.0	<2.0	<2.0	<2.0	24-Oct-23
Monobromoacetic Acid	**ug/L**	**2.0**	<2.0	<2.0	<2.0	<2.0	24-Oct-23
Dichloroacetic Acid	**ug/L**	**2.0**	<2.0	<2.0	<2.0	<2.0	24-Oct-23
Bromochloroacetic Acid	**ug/L**	**2.0**	<2.0	<2.0	<2.0	<2.0	24-Oct-23
Dibromoacetic Acid	**ug/L**	**2.0**	<2.0	<2.0	<2.0	<2.0	24-Oct-23
Trichloroacetic Acid	**ug/L**	**2.0**	<2.0	<2.0	<2.0	<2.0	24-Oct-23
Total HAA6	**ug/L**	**12.0**	<12.0	<12.0	<12.0	<12.0	24-Oct-23
2,3-Dibromopropionic Acid	**%**	**50-150**	100	99	110	100	24-Oct-23

Appendix C

Fraser Health – Notice to Flush Faucet

fraserhealth Better health. Best in health care.

March 3, 2023

Water System Operators

Re: Metals in Drinking Water – "Flush" Message in Annual Reports

Anytime the water in a particular faucet has not been used for six hours or longer, "flush" your cold-water pipes by running the water until you notice a change in temperature. (This could take as little as five to thirty seconds if there has been recent heavy water use such as showering or toilet flushing. Otherwise, it could take two minutes or longer.) The more time water has been sitting in your home's pipes, the more lead it may contain.

Use only water from the cold-tap for drinking, cooking, and especially making baby formula. Hot water is likely to contain higher levels of lead.

The two actions recommended above are very important to the health of your family. They will probably be effective in reducing lead levels because most of the lead in household water usually comes from the plumbing in your house, not from the local water supply.

Conserving water is still important. Rather than just running the water down the drain you could use the water for things such as watering your plants.

If you have any questions, please contact our Drinking Water Program at 604-870-7903 or 1-866-749-7900.

Sincerely,

Blair Choquette
Manager, Drinking Water Program
Health Protection

Appendix D

Drinking Water Officers Guide for Maintaining Water Quality

minimal concentration; whereas, other water supply systems may require a higher concentration due to the absence of some BMPs or other factors.

Water suppliers should maintain secondary disinfection at concentrations that will maximize benefits while minimizing the impact on the aesthetic quality of the drinking water (e.g., taste and smell) and disinfection by-product formation.

Chlorine

The *Guidelines for Canadian Drinking Water Quality* (Health Canada, 2009a) state that there is no evidence to demonstrate that free chlorine is toxic to humans at the concentrations needed to maintain distribution system integrity, normally less than 5 mg/L. The guidelines suggest that chlorine "concentration be determined on a system-specific basis to ensure effectiveness of disinfection and maintenance of an appropriate residual, while minimizing by-product formation and aesthetic concerns" (Health Canada, 2009a).

A generally accepted target range concentration for free chlorine at distribution system end points is at least detectable to 0.2 mg/L for control of bacterial growth (LeChevallier, Welch and Smith, 1996). Due to individual characteristics between systems, most distribution systems in Canada operate with a free chlorine concentration in the range of 0.4 to 2.0 mg/L leaving the treatment plant, and 0.04 (detectable) to 0.8 mg/L at distribution system end points (Health Canada, 2009a).

Individual sensitivities to chlorine in the population vary widely. Sensitive individuals may notice it at levels as low as 0.6 mg/L, but the majority of people will not likely detect it at the concentrations discussed in this guideline (Health Canada, 2009a). At these concentrations, taste and odour related to chlorine or its by-products are generally within the range of acceptability for most consumers.

Chloramine

Health Canada (1995) recommends a maximum acceptable concentration of 3.0 mg/L for chloramines in drinking water. A generally accepted target concentration for chloramines as they enter the distribution system is at least 2.0 mg/L with a residual of no less than 0.5 mg/L throughout the distribution system (Health Canada, 1995).

3.2.5. What are the Recommended Monitoring Practices?

In addition to the microbiological monitoring requirements of Schedule A of the Drinking Water Protection Regulation, the water supplier should monitor for the secondary disinfectant. The drinking water officer may specify monitoring locations and frequencies that differ from those listed in the regulation for microbiological monitoring. Records should be kept for inspection and to provide a context by which the operator may identify water quality issues by a change in disinfectant residual for a particular location.

Appendix D

Drinking Water Officers Guide for Maintaining Water Quality

Water supply systems using chloramines should consider monitoring for N-nitrosodimethylamine (NDMA), which is a by-product of chloramination. The *Canadian Guidelines for Drinking Water Quality* recommend a Maximum Acceptable Concentration of 0.04 µg/L of NDMA in drinking water. Other recommended monitoring parameters for chloraminated systems include: ammonia, monochloramine, dichloramine, nitrite, nitrate, HPC, pH and alkalinity.

3.3. Operating Without Secondary Disinfection

3.3.1. Is There an Opportunity to Operate Without Secondary Disinfection?

Water supply systems may be allowed to operate without secondary disinfection if they demonstrate to the satisfaction of the drinking water officer that the physical characteristics of the system and the other BMPs in place adequately protect the microbiological water quality. Water suppliers should be able to say yes to the following questions and provide sound rationale (as confirmed by the drinking water officer) to demonstrate their ability to protect the water without secondary disinfection:

1. Does the system select or produce biologically stable water?
2. Do the physical characteristics (e.g., design elements) of the system in conjunction with the use of a comprehensive set of the other BMPS provide the ability to proactively manage risks to the distribution system?
3. Does the system transport microbiologically safe water to system users as demonstrated by the water supplier's monitoring records (e.g., no history of recurring or persistent indicator organisms)?
4. Does the system display an ongoing commitment to meet the BMPs as demonstrated by the water supplier's monitoring records, compliance with conditions on permit, annual reports and inspection records?

The use of a comprehensive set of the BMPs listed in section 3.1 (e.g., maintaining hydraulic integrity and using a cross-connection control program) is highly recommended. Appendix B provides a list of BMPs for designing, building, operating and maintaining distribution system components for maintaining water quality. Appendix C provides some examples of protective factors related to design elements and operations. Section 3.1 and these appendices provide information for water suppliers to consider when developing the rationale to support question #2.

No one factor outweighs the others. A water supplier should have the ability to demonstrate the use of a well-rounded suite of BMPs and protective factors, and that they work together to protect microbiological water quality.

Appendix E

How to Read Your Neptune Water Meter

HOW TO READ YOUR WATER METER

The Utility staff will read your meter for billing purposes, but **should you wish to monitor your own consumption**, here's how:

- Continually shine a flashlight over the solar panel (located on the register) to activate the LCD display *
- Take a reading at a set time of the day
- Take a 2nd reading at the same time the next day
- The difference between the two readings is your daily water consumption
- Note: when the register display is first activated via a flashlight, all icons will be briefly displayed followed by firmware information. The register display will then toggle (every 8 seconds) displaying the reading and then the flow rate. The flow rate is per minute. When the display indicates "RATE", the flow rate is being displayed.

Leak Indicator
– displays a possible leak

- **OFF** – indicates no leaks
- **Flashing** – water usage for more than 50% of time in 24 hour period
- **Continuous ON** – there is most likely a leak in your home

The 9 digit LCD displays your meter reading in cubic metres
The last 4 digits of the reading are decimal points.
(e.g. – 26.3987 cubic metres)
(decimal will be displayed)

Flow Indicator
– displays direction of water flow

- **ON**– water in use
- **OFF** – water not in use
- **Flashing** – water is running slowly
- **(–)** - indicates reverse flow
- **(+)** – indicates forward flow

Appendix E

How to Read Your Water Meter - Generic

HOW TO READ YOUR WATER METER

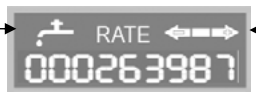
Should you wish to monitor your own consumption, here's how:

- Shine a flashlight over the flashlight icon (located on the register) to turn the LCD display on
- Take a reading at a set time of the day
- Take a 2nd reading at the same time the next day
- The difference between the two readings is your daily water consumption

Leak Indicator

– displays a possible leak

- **OFF** – indicates no leaks
- **Flashing** – water usage for more than 50% of time in 24 hour period
- **Continuous ON** – there is most likely a leak in your home



LCD display toggles between flow rate and total consumption every 6 seconds when illuminated.

The 9 digit LCD displays your meters volume and rate in cubic meters per minute

The last 4 digits of the reading are decimal points. (e.g. – 26.3987 cubic meters)

Flow Indicator

– displays direction of water flow

- **ON**– water in use
- **OFF** – water not in use
- **Flashing** – water is running slowly
- **(–)** - indicates reverse flow
- **(+)** – indicates forward flow

Contact

White Rock Engineering & Operations
877 Keil Street
Monday to Friday
8:30 a.m. to 4:30 p.m.
604-541-2181

Email
water@whiterockcity.ca

or for general inquiries:
operations@whiterockcity.ca

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City by the Sea