



City of Richmond

Report to Committee

To: Public Works and Transportation Committee **Date:** May 15, 2024
From: Suzanne Bycraft
 Director, Public Works Operations **File:** 10-6000-01/2024-Vol 01
Re: **Richmond Water Quality and Conservation Report 2023**

Staff Recommendations

1. That the annual report titled “Richmond Water Quality and Conservation Report 2023” dated May 15, 2024, from the Director of Public Works Operations, be endorsed; and
2. That the “Richmond Water Quality and Conservation Report 2023” be made available to the community on the City’s website and through various communication tools including social media channels and as part of community outreach initiatives.

Suzanne Bycraft
 Director, Public Works Operations
 (604-233-3338)

Att. 1

REPORT CONCURRENCE		
ROUTED TO: Engineering	CONCURRENCE <input checked="" type="checkbox"/>	CONCURRENCE OF DEPUTY CAO
SENIOR STAFF REPORT REVIEW	INITIALS: 	APPROVED BY CAO

Staff Report

Origin

In 2001, the Province of British Columbia enacted the Drinking Water Protection Act, which gave authority to the Minister of Health to implement and enforce standards for water supply systems in British Columbia. In May 2003, regulations to be implemented under the Act were adopted by the legislature as the Drinking Water Protection Regulation. These Acts were updated on April 29, 2014, under Bill 18 – 2014: the Water Sustainability Act. These regulations are designed to ensure the safe supply of drinking water.

This report presents the City’s “Richmond Water Quality and Conservation Report 2023” (the Report), which enables the City to meet its obligations for public reporting to comply with applicable requirements in accordance with these regulations. The City ensured the safe and adequate supply of essential water services throughout 2023. The Report also provides information on the City’s water system and water conservation efforts. The Report is presented as Attachment 1.

This report supports Council’s Strategic Plan 2022-2026 Focus Area #2 Strategic and Sustainable Community Growth:

2.3 Ensure that both built and natural infrastructure supports sustainable development throughout the city.

This report supports Council’s Strategic Plan 2022-2026 Focus Area #3 A Safe and Prepared Community:

3.3 Ensure the community is collectively prepared for emergencies and potential disasters.

3.4 Ensure civic infrastructure, assets and resources are effectively maintained and continue to meet the needs of the community as it grows.

This report supports Council’s Strategic Plan 2022-2026 Focus Area #5 A Leader in Environmental Sustainability:

5.3 Encourage waste reduction and sustainable choices in the City and community.

This report supports Council’s Strategic Plan 2022-2026 Focus Area #6 A Vibrant, Resilient and Active Community:

6.1 Advance a variety of program, services, and community amenities to support diverse needs and interests and activate the community.

Analysis

The Drinking Water Protection Regulation requires water purveyors in BC to possess an operating permit, which confirms the Drinking Water Officer for the area has approved the water supply. Vancouver Coastal Health is responsible for the placement and function of the Drinking

Water Officer, who has the authority to monitor water purveyors to ensure they are providing safe drinking water through compliance with the British Columbia Drinking Water Protection Regulation, and any other conditions of the operating permit.

Under the Regulation, the City of Richmond is required to:

- Develop and maintain a process to notify the Drinking Water Officer and the Medical Health Officer of situations or conditions that could render unsafe drinking water;
- Implement and maintain a plan for collecting, shipping and analyzing water samples that adequately represent all areas within the City, in compliance with the direction set by the Drinking Water Officer; and
- Implement and maintain a plan for reporting results to the Drinking Water Officer and to water users.

Richmond thrives on its ability to provide water to residents and businesses, and water for fire protection services. To ensure a consistent supply, the Capital Construction Watermain Replacement program and the Pressure Management program are two proactive approaches to reduce the risk of breaks and have proven to be reliable and valuable tools in water distribution management. The Capital Construction program replaces aging infrastructure that is susceptible to breaks and the Pressure Management program lowers the strain on existing infrastructure to make it less likely to develop leaks and breaks. The City's Leak Detection program also assists in quickly identifying leaks and reducing the amount of breaks and water losses by proactively scanning the City's system to find non-visible leaks before they surface. In 2023, Public Works staff attended to 14 watermain breaks and repaired 69 leaks without compromising the integrity of the water distribution system. These three proactive programs are essential to minimizing costs and ensuring minimal disruptions in water quality and supply.

Water conservation is an important aspect of Richmond's Water Services operations. Climate change, extreme heat events and increasingly dry summers in recent years have emphasized a critical need for city-wide water conservation efforts. The City implements various programs to promote the conservation of water and to minimize the wastage of potable water. Richmond's various water conservation programs are outlined in the Report.

Highlights of the Report include:

- Delivered 34M cubic metres of water to 234,644 residents, businesses and other institutions.
- The water met all drinking water quality guidelines and Richmond residents and visitors enjoyed high quality, safe and reliable drinking water.
- 2,074 water samples were collected to ensure water quality and each passed with exceptional results.
- Compared to the year that Richmond's water metering program started in 2003, the City's total water usage in 2023 decreased by 14%, from 39.7M cubic in 2003 to 34.0M cubic metres in 2023, despite a population increase of 32% from 178,319 to 234,644 residents over the same period.
- Richmond's 39 outdoor water fountains found in parks and other public areas provided potable water to the public while promoting tap water consumption as an alternative to bottled water.

- City staff completed three watermain replacement projects, replacing a total of five kilometres; and installed 39 multi-family meters.

In addition to these highlights, the City is continuously evaluating and improving proactive maintenance and detection programs to ensure safe and uninterrupted water service to the community.

These and many other initiatives are detailed in the Report.

Proposed Communication

Subject to Council's approval, the Report will be posted on the City's website and made available through various communication tools including social media channels and as part of community outreach activities.

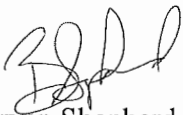
Financial Impact

None.

Conclusion

The Report outlines the methods in which the City manages its water system to ensure compliance with applicable provincial requirements under the Drinking Water Protection Act. In 2023, the City's water quality met and exceeded the required standards to ensure residents enjoyed high quality, reliable and safe drinking water.

This report will be reviewed and endorsed by the Medical Health Officer of Vancouver Coastal Health Authority as part of the City's reporting obligations.



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BS:dp

Att. 1: Richmond Water Quality and Conservation Report 2023



Richmond **Water Quality and Conservation Report 2023**



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1.0 Year in Review

1.1 Excellence and Innovation

Ensuring a safe and reliable water supply is one of the core essential services provided by local governments, including the City of Richmond. We are proud to report that in 2023 the City met all drinking water guidelines to ensure the delivery of safe, high-quality water to residents and businesses in Richmond.

The City consistently strives to achieve excellence in service delivery and apply innovation for continuous improvement in managing Richmond's water distribution system. As part of this commitment, the City operates a rigorous water quality testing program, and in 2023, more than 2,000 samples were tested. All samples met drinking water quality guidelines.

Water quality and delivery reliability are also supported through comprehensive construction and maintenance programs, including an ongoing Watermain Replacement Program, the City's Five-Year Capital Plan and other long-term infrastructure management plans. In 2023, this included the replacement of five kilometres of existing watermain and the completion of 172 new service connections installations.

With its focus on excellence, the City's highly trained Water Services staff have become the go-to crews for new construction projects. City crews have a comprehensive understanding of Richmond's water system, the expertise to complete the projects and the ability to deliver projects at a competitive price, which provides added value to taxpayers. This past year, City crews completed the replacement of 2.2 kilometres of watermain located

at the Minler, Lucas and Danube Road areas, which was the final phase of a neighbourhood upgrade of all the watermains in the area.

Focusing on innovation, staff consistently embrace the use of new technologies and products to upgrade City infrastructure and improve water operations. Innovative practices in 2023 included the development of new digital dashboards for data analysis use and a drone-supported aerial mapping project.

The City is also using innovation to improve the performance of the community's more than 5,100 fire hydrants, which play a critical role in Richmond's civic infrastructure and safety. Since 2022, the City has had an active retrofit program to replace slide gate hydrants with compression hydrants. The new compression hydrants close when they are damaged, preventing major water loss and infrastructure damage. Since starting the retrofits, City staff have replaced 24 hydrants throughout the community. All new hydrants being installed in Richmond through Capital Construction or developer-driven projects are compression-style.



PWT - 30

As part of our commitment to excellence in service delivery 24-hour patrols were established to respond to service requests such as watermain breaks and other service disruptions. Quick response ensures service disruption time is limited and water loss or damages from leaks and breaks are minimized. During 2023, patrol staff responded to more than 1,000 service requests.

The City is also expanding and upgrading its delivery of water to the community at large. In 2023, an ongoing upgrade program was initiated to improve the 39 permanent water fountains located across the community. These improvements include installing new fountains with bottle fillers and ground-level drinking bowls for pets. The City also continues to develop a growing inventory of portable

water fountains, which are used at community events and other locations to provide the public with ready access to safe drinking water. This helps reduce the use of plastic water bottles, provides a free, healthy alternative to commercial products and helps prevent cases of dehydration and heat exhaustion.

With heat domes and other extreme weather becoming more frequent occurrences, the City developed an Extreme Heat and Poor Air Operations Plan to respond to conditions that increase public health risks. As part of this plan, City staff designed and built misting stations that can provide a way for people to stay cool. Over the past two summers, misting stations have been regularly deployed in parks and popular outdoor locations such as Minoru Plaza and



Garry Point Park during extreme high temperature events to provide heat relief.

Another primary responsibility for the City is the promotion of water conservation. A growing regional and local population is placing increasing strain on available water supplies. Recent droughts and other weather impacts have caused seasonal spikes in water use, which have further depleted supply and led to stricter limits on water sprinkling in the summer and fall of 2023.

The City of Richmond has long been a regional leader in innovative practices to promote water conservation, beginning with a move to universal water metering in 2003. Over the past two decades, the City has succeeded in transitioning 100% of single-family homes, along with all commercial, industrial and institutional users, to metered services. The City is now working to transition all multi-family residences to water meters. In 2023, 39 new water meters were installed at multi-family complexes, which means more than 56% of those complexes are now metered. The City aims to have all multi-family residences on meters within the next 15 years.

The City's efforts to reduce water usage are further bolstered by dedicated leak-prevention and leak-reduction programs. Undetected or unaddressed leaks can cause significant losses of water, which drive up user costs and waste valuable supply. As part of this program, staff used acoustic equipment to inspect 324 kilometres of watermain and identified and repaired 69 leaks over the past year.

The City also works to raise public awareness and support for water conservation through ongoing community engagement initiatives. Project WET, an outreach program delivered to Richmond elementary school students, returned in 2023. The award-winning education program had been suspended since 2019 due to the COVID-19 pandemic. City staff from Water Services and other City departments and community partners welcomed over 200 students to the City Works Yard in May for the return of this very popular program.

Looking ahead, the City will continue to build upon its record of providing safe and reliable water to the community, use innovation to improve service excellence and maintain its leadership in encouraging water conservation.



2023 Top Accomplishments

This report showcases some key Water Services achievements in the past year, along with our ongoing commitment to excellence and innovation in service delivery.

1

Safe delivery of water

Delivered 34 million cubic metres of water to 234,644 residents, plus businesses and others. The water met all drinking water quality guidelines to ensure the delivery of safe and high quality water.

2

Water services and conservation outreach

Engaged over 200 students in learning about Richmond's water system, how we get our water and why it's important to conserve it.

4

Installed new pressure-reducing valve

Commissioned the new Pressure-Reducing Valve Station on Boundary Rd. to bolster the water distribution system in East Richmond.

5

Expanded multi-family water metering

Installed 39 multi-family water meters of various sizes, advancing our goal of achieving universal water metering.

6

Replaced aging infrastructure

Replaced five kilometres of asbestos cement watermain under the 2023 Water Capital Construction Program ahead of schedule.

7

Completed digital mapping project

Used an aerial drone and a photogrammetry program to stitch together thousands of aerial images to create a highly detailed, high-resolution map of the Alexandra District Energy Utility service area for Lulu Island Energy Corporation.

8

Enhanced data analytics

Created various data analysis dashboards, which help organize and review data captured from various sections and will support improved business decisions.

9

Upgraded water flushing equipment

Installed water diffusers on flushing trucks, which reduce spray concentration in order to protect surrounding landscapes and assets while flushing.

10

Trained fire rescue recruits

Provided a workshop for 13 Richmond Fire-Rescue recruits to teach them about the water system and the operation of a fire hydrant.

1.2 Year in Review Highlight



Children make the connection between the rain that falls on their heads and the water that comes out of their taps.

Kids Soak Up Big Ideas at Project WET

Every year, City of Richmond Water Services crews, who usually install, operate and maintain pipes or install and repair fire hydrants, take part in the appropriately named Project WET, an interactive science program aimed at educating Grade 4 to 7 students about the importance of water.

WET stands for Water Education Team and the program is delivered by Water Services staff working in partnership with local teachers. **The main objective is to promote higher-level thinking skills in children while they learn about the fundamentals of water quality, water consumption and waste in an interactive and fun environment.**

It's hard to say who has more fun – the students on the half-day field trip to the Richmond Works Yard or the staff who collectively spend weeks preparing for the annual event. Ken LaBoucane, a pipelayer in Water Services for about 12 years, has participated in Project WET for the last five. LaBoucane says he and his colleagues set up an above-ground watermain to mimic what they do underground to get around other buried utilities.



PWT - 33



The display also illustrates how watermain connect to residences, businesses, fire hydrants and other distribution points. Students also pass through other interactive learning displays as well as some actual Water Services work areas during their fun and informative visit. In addition to showing the young field-trippers how the equipment is put together, he says staff share facts on the water cycle – evaporation, condensation, precipitation – as well as information on water conservation.

But the highlight for both students and staff, LaBoucane says, is when everyone gets a little wet. Water is fired into the air to spray everyone in the area, and City employees even volunteer to get soaked in a dunk tank.

"They love it. We're all smiling and laughing, and I'm soaked from head to toe," LaBoucane says. "They keep wanting to come back and do it again. It's a lot of fun. I look forward to doing it every year."

He adds, "It's a little more laid back than being out in the field, digging around underground utilities and staging trucks and material."

Colleague John Crocker, a hydrant mechanic, agrees, saying, "It's a lot of hard work setting it up, but at the end of the day, we're all smiling as much as the kids are.

"It's a joy to be able to talk to the public, seeing the kids smile, watching them have fun, getting excited about being around something I'm around every day. I like sharing my joy. I have a passion towards it," says Crocker.

Teacher Dawn Lessoway appreciates the enthusiasm and hard work of Richmond staff members who put on Project WET, and emphasizes that enjoying the whole experience and getting soaked is not only fun, but a great way to learn.

"I love it because it helps my students to understand systems," says Lessoway, who teaches Grades 3 to 5



It's an inspirational, educational and motivational event.

Montessori classes at Steves Elementary School and has taught in Richmond for 25 years. Her lesson plans include the City's water, sewer and storm drainage systems as well as natural systems like the hydrological cycle.

"When we learn about the different parts, such as the water cycle and then the watersheds, by going to Project WET, we get a much better sense of how they're all connected and inter-connected, and then we start thinking three-dimensionally," she says, noting the event helps children make the connection between the rain that falls on their heads and the water that comes out of their taps. "That's taking a lot of really big ideas and making the abstract become very visible and concrete."

The experience also cements the connection to the City and the important work of its employees. Project WET field trips are part of the City's celebration of National Public Works Week. 2023 saw the return of the popular program, which had been suspended since 2019 due to the global pandemic.

"It's an inspirational, motivational and educational event," says Carly Smith, a 17-year Richmond employee who has worked in various areas in Water Services. "We inspire and teach the younger generations about potential career paths and give them a better understanding of how civil infrastructure works."

While Water Services takes the lead for Project WET, the program also incorporates displays and demonstrations from a number of City departments and community partners. Project WET is truly a community experience as staff from numerous City departments volunteer to be tour guides, making it an enriching experience for all those involved.



1.3 Setting Goals and Objectives

The goals for Water Services are to provide clean and high-quality tap water to Richmond residents; ensure adequate supply of water to meet demand; apply innovative technology, equipment and operational practices as part of continuous improvement to secure water quality and support water conservation; and improve water conservation in the community.



Flushing water using a truck-mounted water diffuser.



Staff helping an excavator line up a fitting during a watermain capital construction project.

The objectives listed here support achieving our goals.

- 1 Water conservation outreach and community engagement**
 Generate and launch a water conservation campaign aimed at educating residents on ways to conserve water in their homes, while also reducing their utility costs.
- 2 Continue watermain upgrades**
 Upgrade watermains along No. 7 Road, No. 2 Road and in the Seacote and Burkeville neighbourhoods to decrease the City's asbestos cement pipe inventory and continue upgrading our water system.
- 3 Expand water fountains upgrade**
 Upgrade four permanent drinking fountains to include bottle fillers and pet bowls to keep people in the community hydrated while enjoying the many parks, dikes, trails and active transportation initiatives the City provides.
- 4 Enhance water meter monitoring**
 Replace existing Water Meter readers with new units to allow more efficient and cost-effective remote monitoring and reading of meters through fixed-base towers.

- 5 Install enhanced fire hydrants**
 Replace 60 slide gate fire hydrants with compression fire hydrants to reduce property damage costs from water flow when hydrants are damaged by motor vehicle accidents. This will increase the percentage of compression hydrants to 71% of the total inventory.

- 6 Continue shift to paperless operations**
 Expand use of digital processes and dashboards to continue a move toward paperless operations to reduce waste, supporting sustainability objectives and further improving program tracking and analysis.

- 7 Upgrade water flushing infrastructure**
 Upgrade eight existing permanent blow-off stations that allow flushing of dead-end watermains to ensure good water quality is maintained throughout the system.

- 8 Expand wireless monitoring of flushing equipment**
 Upgrade all Automatic Flushing Units to Bluetooth to facilitate their maintenance and help ensure consistent, good water quality.

1.4 Tracking Our Progress

As part of tracking its progress, the City collects data across a broad spectrum of programs, services and activities. This data shows how Richmond meets its mandates for reliable delivery of safe drinking water and water conservation.

The mix of data reported reflects the effectiveness of Water Services' many programs and its commitment to excellence and innovation.

WATER QUALITY TESTING

Every week, Water Services collects water samples for analysis from multiple locations across Richmond. In 2023, there were no key contaminants found in the water supply.

100%
All tested samples were free of key contaminants

2,074
water samples tested

40
testing locations

WATER SUPPLY AND USAGE

Since the water metering program started in 2003, water use has declined by 14%. This is despite the fact that the City's population grew by 32% (56,325 people) since 2003 for a total of 234,644 residents in 2023. Our individual and collective efforts have made a huge difference.

14%
water use reduction

in annual volume use in 2023 compared to 2003

2023 TOTAL WATER USE
34 million
cubic metres*

2023 WATER USE PER PERSON
145.1
cubic metres*

REDUCTION IN ANNUAL WATER USE
per person
SINCE 2003
77.7
cubic metres*



5.7 million
cubic metres
Reduction in total annual water use in 2023 compared to 2003 (by volume)



6x
That's enough water to fill BC PLACE STADIUM six times.

*One cubic metre = 1,000 litres

WATER METERS

Richmond's reductions in water use have been largely driven by the City's move toward universal water metering. All single-family homes and businesses and are now on water meters. More than half of multi-family homes are now on meters as well.

83%
of water use
in Richmond
is metered

56%
Multi-family
properties have
water meters

100%
Single family
homes +
businesses have
water meters



Lawn sprinkling causes a significant increase in water use during the high demand months from May to October. Regional sprinkling limits are introduced annually to encourage people to use less water and water less often. However, despite those limits, summer consumption levels continue to place a strain on the water supply.

AVERAGE MONTHLY USE
2023 LOW DEMAND MONTHS
2,423,677
cubic metres

AVERAGE MONTHLY USE
2023 HIGH DEMAND MONTHS
3,249,503
cubic metres

WATER CONSERVATION PROGRAMS

In addition to water metering, the City has a number of ongoing programs to promote water conservation, from leak detection and repairs to rain barrel sales and a rebate program for purchase of low-flow toilets.

355
Rebates for
low-flow toilet
purchases



123
Rain
barrels
sold



69
Water leaks
detected and
repaired

Due to the water usage in the summer of 2023, watering restrictions were increased from Stage 1 to Stage 2 in early August and continued until mid-October.

95 days
of Stage 1
watering
restrictions



74 days
of Stage 2
watering
restrictions

WATER DISTRIBUTION NETWORK

The City has a comprehensive network of watermains, service connections, hydrants and other infrastructure to ensure reliable water delivery to its users. Through a series of pressure-reducing valves, the City's network connects to Metro Vancouver's system, which delivers water across the region from its mountain reservoirs.

INFRASTRUCTURE

636

Total kilometres of City watermains



13

Pressure reducing valves



5,134

Fire hydrants



33,750

Properties are connected to the City's water network



CONSTRUCTION AND MAINTENANCE

Annual maintenance and construction programs help to ensure Richmond's community has access to a reliable, high-quality water supply.

NEW CONSTRUCTION

5 KM

of new watermain constructed

3

Capital construction projects completed



172

New service connection installations

MAINTENANCE

132

Service connection repairs



14

Watermain breaks repaired



1,057

Service requests received by patrollers



COMMUNITY SERVICE

As an added benefit to serve residents and visitors, Water Services provides both permanent and portable water fountains around the community and at events, as well as misting stations during extreme heat periods.

4
Mobile water fountains

39
Permanent water fountains

156
Days mobile water fountains in service

1,420
Fire hydrants re-painted by summer students to improve visibility

To support work experience opportunities for local youth and provide increased capacity to perform seasonal work, the City hires extra staff for the summer. Some tasks performed by summer students included important fire hydrant maintenance.

1,030
Sites with improved access to fire hydrants thanks to work done to clear vegetation overgrowth around hydrants.

WATER COST COMPARISON

The cost of municipal water remains one of the best values around.

\$1.56
AVERAGE METERED RATE for one cubic metre (1,000 litres of water)

\$5.69
COST FOR ONE PACK OF 35 X 500 ml bottles of water at a local retailer

In the City of Richmond the equivalent of 35 bottles of store-bought water (500 ml) costs just \$0.03 (three cents) when it comes from your tap. The same amount of water at a major local retailer cost \$5.69 in a recent price check.

Bottled water costs about 189 times more than the same amount from the tap.

VS

CITY OF RICHMOND WATER



Cost of equivalent amount of water (35 x 500 ml) from your tap

LOCAL STORE BOUGHT WATER



Cost for one pack of 35 x 500 ml bottles of water at local retailer

2.0

Safe and Reliable Water Delivery

2.1 Where Our Water Comes From

The City of Richmond's drinking water is supplied by Metro Vancouver via three large transmission mains. The water then enters the City's water distribution system through various connections and is delivered to residences and businesses through our system via service connections at each property.

The region's water supply originates from three local watersheds:

Capilano, Seymour and Coquitlam. The watersheds contain large collection lakes called reservoirs, which collect and store rainfall and snowmelt from the mountains. Water from the reservoirs is treated at two water treatment facilities: the Seymour Capilano Filtration Plant, which treats water from the Seymour and Capilano reservoirs, and supplies two thirds of the region's drinking water; and the Coquitlam Water Treatment Plant, which treats water from the Coquitlam reservoir and supplies the remaining third of the region's drinking water. The City of Richmond gets the majority of its water from the Seymour and Capilano reservoirs.

The Seymour plant is the largest filtration plant in Canada and has the capacity to filter and disinfect up to 1.8 billion litres of water per day.

It is located in the Seymour watershed so water has to be transmitted from the Capilano reservoir to the Seymour plant and back by two underground watermains called "Twin Tunnels," which are over seven kilometres long and 3.8 metres in diameter. Water at this facility undergoes filtration and ultraviolet (UV) disinfection.

The Coquitlam plant is located north of the City of Coquitlam and treats 380 million litres of water per day. Water at this facility undergoes ozone and UV disinfection. The treatment methods at each plant are designed to address the specific characteristics of the source water.



Metro Vancouver Watershed and Water Transmission Map



How does water get to your home?



2.2 Our Water System

The City of Richmond owns, operates and maintains a complex water distribution system, which delivers water to its residents, businesses and other customers.

Once Metro Vancouver treats the water, it is carried into Richmond via three large transmission mains: Angus Drive main, Lulu Island-Delta main and Tilbury main. Richmond then draws water through 13 connection points along Metro Vancouver's mains. Each connection has a pressure-reducing valve station that reduces the pressure from the transmission mains to match the pressure set in the City's system. The pressure-reducing valve stations are monitored from the Works Yard through a supervisory control and data acquisition (SCADA) system.

Downstream of the pressure-reducing valve stations is the rest of the City's water distribution system consisting of more than 630 kilometres of distribution mains.

The water mains are all interconnected in different ways to supply high-quality water to our residents and businesses. Individual service connections feed water from the main network to homes and businesses. All businesses and single-family homes, as well as many multi-family complexes, have been provided with water meters, which record consumption. A network of fire hydrants, valves, service connections and other infrastructure further supports delivery of water where and when it is needed. An overview of our water system is shown on Figure 1 on page 28.



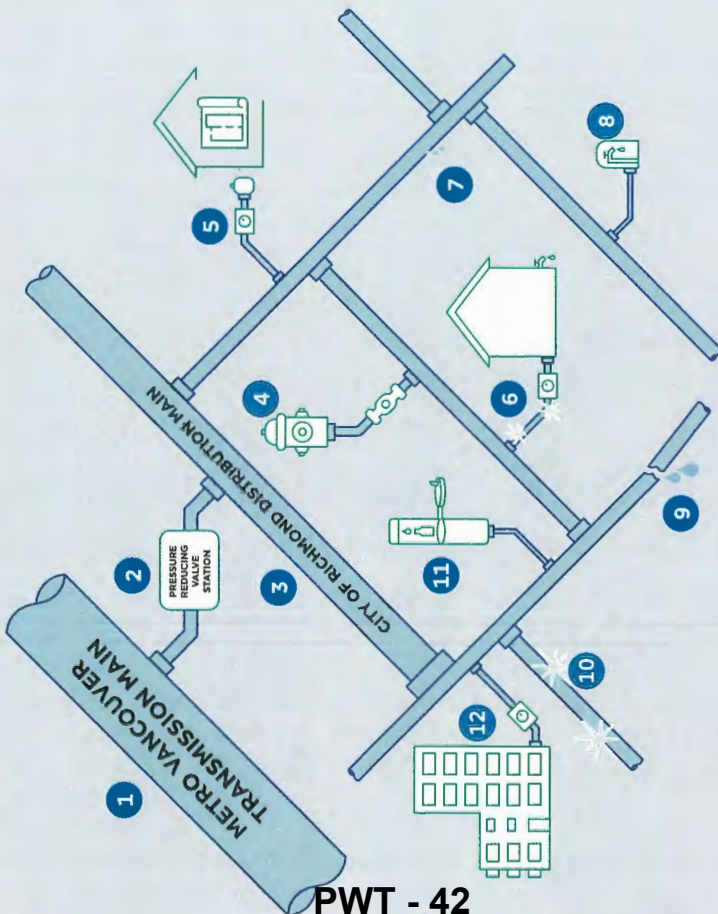
34 CUBIC METRES
million of **water**
IS DELIVERED TO
234,644 residents
in Richmond.



Metro Vancouver's Seymour Falls Dam, located on the Seymour River, immediately upstream of the Lower Seymour Conservation Reserve and Seymour River Fish Hatchery.

Richmond's Water System

- 1 Metro Vancouver supplies drinking water to the City of Richmond via three transmission mains.
- 2 Pressure-reducing valve (PRV) stations are the interface between Metro Vancouver's mains and the City of Richmond's water system. Water Services crews operate and maintain PRV stations throughout the City.
- 3 The City of Richmond's water system is made up of more than 630 km of watermains. The watermains are all interconnected in different ways to supply high-quality water to Richmond residents.
- 4 Fire hydrants play an important role in the City's water system. They deliver large quantities of water for fighting fires and help keep the City's drinking water safe by providing a way for water to be safely flushed out of the water system.
- 5 Water service connections link City of Richmond's watermains to houses and businesses.
- 6 Sometimes service connections can get damaged or break for different reasons. Water Services crews are always ready to repair water connections to prevent service disruptions to residents.
- 7 The City of Richmond's Leak Detection Program uses specialized equipment to find underground leaks in the water system.
- 8 Water Sampling Stations help Water Services staff monitor the quality of the City's drinking water. Stations are located in strategic locations throughout the City.
- 9 All pressurized systems can develop breaks due to the strain on the pipes. Water Services staff minimize breaks by replacing aging infrastructure and implementing a Pressure Management Program.
- 10 Water metering is important since it measures how much water each property has used. This makes sure that residents only pay for what they use and it also keeps residents informed of their water usage and promotes water conservation.
- 11 Drinking water fountains help bring fresh drinking water to City of Richmond residents and are a sustainable way of keeping hydrated while on the go. Water Services staff maintain and service fountains along Richmond's dikes and in parks.
- 12 Water metering is important since it measures how much water each property has used. This makes sure that residents only pay for what they use and it also keeps residents informed of their water usage and promotes water conservation.



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Figure 1

2.3 Mobile Emergency Response Unit

The City has a mobile emergency response unit to provide a supply of safe, drinkable water in the event of a disruption to regular service.

Water Services staff are trained to operate the City's mobile emergency water treatment trailer for use during a major emergency where the City's water is contaminated or unavailable. The emergency mobile unit is flexible and can be used to respond to both large-scale emergencies and smaller, neighbourhood-contained incidents.

All components of the emergency mobile unit that come in contact with the treated water are compliant with the Guidelines for Canadian Drinking Water Quality. The water is pumped into the system and through cartridges to reduce turbidity and through activated carbon to improve taste and odour. Next, it goes through UV units to disinfect the water. Lastly, sodium hypochlorite is added to provide a second source of disinfection and to act as free chlorine, which provides residual disinfection in the water.

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The treatment trailer is capable of filtering approximately **60 litres of water per minute** and can draw water straight from the Fraser River.



3.0 Ensuring Our Water Quality and Safety

3.1 Water Quality Standards

In 2002, the City of Richmond implemented a Drinking Water Quality Monitoring Program to comply with provincial and federal legislation: the British Columbia Drinking Water Protection Act, the British Columbia Drinking Water Protection Regulations, the Water Quality Monitoring and Reporting Plan for Metro Vancouver, and the Guidelines for Canadian Drinking Water Quality.

Under these regulations, the City of Richmond is required to:

Develop a process to notify the Vancouver Coastal Health (VCH) Drinking Water Officer and the VCH Medical Health Officer of any condition that could render unsafe drinking water.

Implement a sampling program that adequately represents all areas within the City.

Ensure test results are immediately available to the VCH Medical Health Officer.

Receive an annual construction permit for the construction, installation and extension of the water distribution system.

Produce an annual report detailing the results of the City's water quality monitoring program for review by VCH.

The conditions set out in the Drinking Water Protection Act require all water systems in B.C. to be classified as a Level I through IV facility through the Environmental Operators Certification Program (EOCP). Richmond's system is classified as a Level III facility so all staff that work on the system are responsible for possessing a valid Level I to Level III EOCP certificate.

To obtain and maintain their level of certification, staff have to successfully complete the required training and hands-on experience. This ensures staff are able to respond appropriately and immediately to problems prior to them becoming a risk to health or property.



3.2 Ensuring Water Quality



FLUSHING PROGRAM

Water Services conducts a unidirectional flushing program every year. Unidirectional flushing involves forcing water in a single direction through a specific route through the pipes by closing or opening valves in a strategic way. Forcing the water in a single direction increases the velocity of the water flow and ensures that the inside of the pipes is being scoured and cleaned while the water is safely flushed out of the watermain network. The water is then drained through hydrants at the end of the flushing sequence to remove the debris from the system. Cleaning the inside of the pipes is important because it prevents bacterial growth and removes sediment. Staff take measures to control the flow of water during flushing. When practical, the water that is flushed is captured to be reused for irrigation. The City also conducts regular weekly, monthly and annual flushing at lower velocities to eliminate stagnant water in dead-end water mains and other low-demand areas.

our drinking water safe by preventing this ingress of ground water. The Leak Detection and Pressure Management programs help reduce watermain breaks and minimize weak spots in the distribution system where ground water can get into the pipes. You can learn more about these programs in Section 6 of this report.

QUICK RESPONSE TO WATERMAIN LEAKS AND BREAKS

Not only is reducing watermain breaks in the system important, but responding quickly when leaks and breaks happen is just as crucial. Quick response by staff reduces water loss and eliminates the chance or the amount of time that ground water can enter the system, which in turn prevents contaminants from getting into the water mains. Water Services staff are always on call and trained to respond to all levels of watermain breaks.

REDUCE WATERMAIN LEAKS AND BREAKS

The City has various programs that reduce leaks and breaks in the system, which help keep our drinking water safe and clean. Whenever there is a watermain break, the system can experience a loss of pressure, which can result in negative pressure. This means that the pressure on the inside of the main is lower than the pressure from the soil on the outside of the main. When a watermain along the system has cracks or gaps between joints, there is a possibility that ground water can be siphoned back into the system during times of negative pressure. Two programs that promote water conservation also help keep

BACKFLOW PREVENTER PROGRAM

A Backflow Program supports safe, temporary use of hydrants by farm, construction and film industries, and others who sometimes require access to bulk volumes of water or where other connections to the water distribution system are not feasible or viable. Water Services staff install a backflow preventer at every hydrant that has an active hydrant-use permit. The backflow preventer acts as a one-way valve and helps keep outside water from getting into the City's water system, which keeps possible contaminants out.

3.3 Monitoring Water Quality

The City of Richmond collects water samples on a weekly basis at 40 dedicated sampling sites. These sites are strategically located throughout the City to provide a suitable representation of the City's water quality across the whole network.

Water samples collected by City staff are taken to Metro Vancouver laboratories for analysis. Sample results are reviewed by City staff and Vancouver Coastal Health, the Health Authority in Richmond, to ensure the drinking water meets the standards and parameters outlined in the British Columbia Drinking Water Protection Regulations. The 2023 water quality testing results are included in Appendix A of this report. Tests results for specific parameters can be found in Appendices B, C, D and E. Test samples are analyzed to ensure the water quality is within defined standards, including bacterial, physical and chemical parameters. A complete description of the testing parameters can be found in Appendix F.

In addition to testing water to look for contaminants, water is also monitored for taste, odour, temperature and appearance. The sampling stations are split up into three groups, and each group is sampled on a different day of the week. Additional information on sampling sites can be found in Appendix G.



Checking the chlorine residual of a water sample using a chlorometer.

Results that are outside of these parameters are considered 'Failed Samples'. It is important for City staff to deal with failed sample results immediately. The City's standard response to a failed water sample is:

- Re-sample from the same station.
- Flush the watermain extensively.
- Re-sample again from the same station.
- Isolate the watermain to one feed until test results confirm compliance with the British Columbia Drinking Water Protection Regulations.

Under the Drinking Water Protection Act, the Metro Vancouver laboratory must immediately inform the City of Richmond, the Drinking Water Officer and the Medical Health Officer if a water supply system result fails to meet established guidelines. Water Services staff then take immediate action and precautions, and issue required notifications.

Water safety situations such as chemical or biological contamination, excessive turbidity, disinfection failure, loss of pressure due to high demand, or a watermain break where there is suspected contamination, would be considered an emergency.

See Appendix H for more details about the actions taken by Water Services staff in these situations.



WATER QUALITY ADVISORIES ARE ISSUED TO THE GENERAL PUBLIC WHEN NECESSARY.

4.0 Constructing and Maintaining a Reliable Water System

4.1 Comprehensive Water Network

The extensive network of watermains and other infrastructure has been carefully planned to provide redundancy. This ensures system and service stability and minimizes service disruptions.

The system's network of pressure-reducing valves and gate valves provide a broad variety of options to control water flow on an area-specific basis. In addition, most watermains are looped so that water can be fed to properties from both ends of their fronting mains. Therefore, system valves can be used to isolate portions of the system that require repairs, maintenance or replacement, limiting the number of customers that are impacted by service disruptions while necessary work is completed.

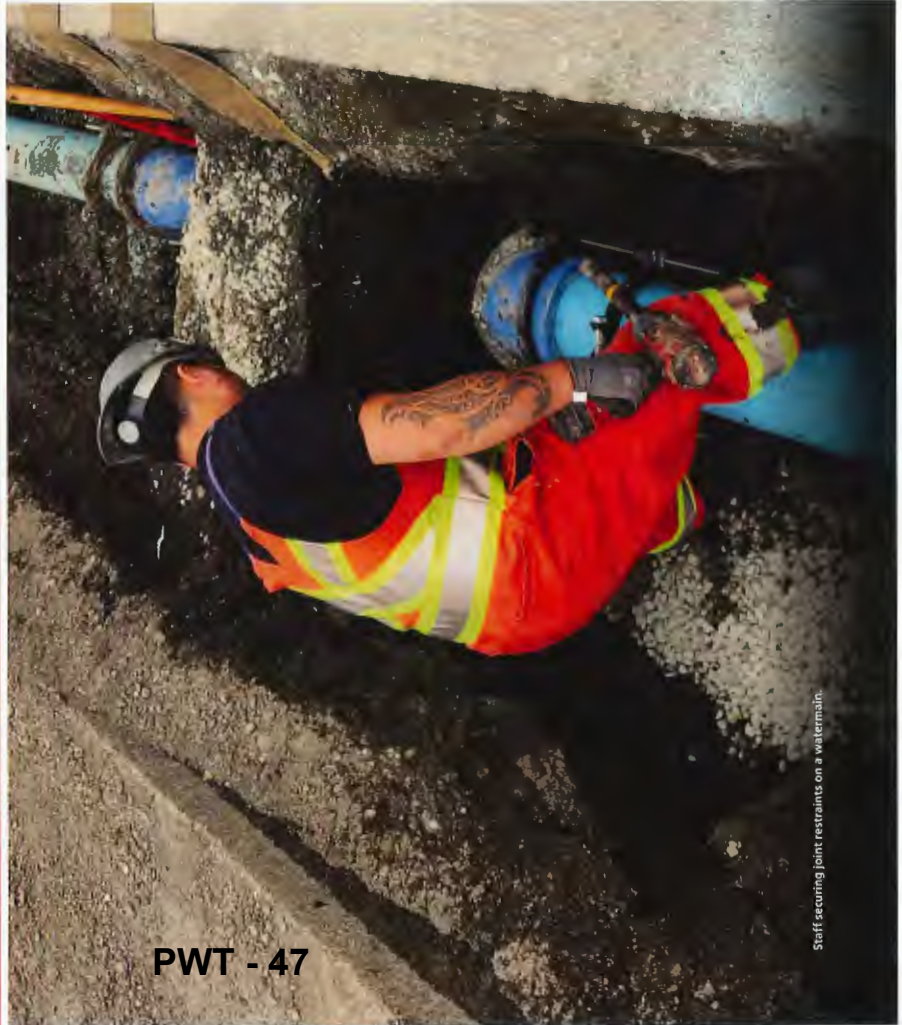
The City's municipal water distribution service includes more than:

600 KM OF watermains

ANNUALLY DELIVERING MORE THAN

30 million CUBIC METRES OF water

TO OUR CUSTOMERS



Staff securing joint restraints on a watermain.



CITY CREWS ADD VALUE

Water Services crews work year-round to replace aging water mains and infrastructure across the City as well as to install new water mains, service connections and water meters.

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Staff guiding a loader while dumping backfill into a watermain trench.

4.2 Capital Construction Programs

The dedicated watermain crew is responsible for completing the annual planned capital construction program. Annual construction programs include installation of new water mains, upgrades to existing water distribution infrastructure, provision of service connections to new construction and multi-family water meter installation.

Crews are tasked with meeting project scope, schedule and budget, while minimizing service and other disruptions to residents, businesses and others. The crews make extra effort to maintain positive relationships and communication with the immediate community within project areas.

Water Services crews have become the service provider of choice for many capital projects that might otherwise be contracted externally.



Crews are able to deliver projects at a competitive price, providing value to taxpayers.



Staff installing backfill underneath and around the watermain to create proper pipe bedding.

4.3 Maintenance and Repairs

Water Services also undertakes system repairs as required, including fixing watermain breaks and repairing damaged or broken water service connections. In addition, Water Services utilizes specialized equipment to identify, locate and repair underground leaks in our water system.

Water Services crews are also tasked with responding to maintenance and service requests from a wide variety of customers, including residents, businesses, developers, contractors and other utilities such as Fortis BC, BC Hydro and Metro Vancouver.

This includes:

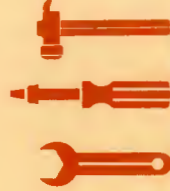


Staff compacting the trench backfill to make sure the trench doesn't settle after paving.

Additional ongoing preventative maintenance and repair programs help extend the life of the infrastructure and reduce service disruptions due to equipment or infrastructure breakdowns. This helps reduce ongoing operating and capital costs. Dedicated preventative maintenance programs are in place for all valves, hydrants and the system's pressure-reducing valves.

Preventative maintenance can identify the need for demand maintenance, a more in-depth maintenance process that is only done if required. This includes valve box raising, hydrant parts replacement, valve replacements and other work. Demand repairs can arise at any time and crews are available to respond to emergencies at all hours of the day.

The department's rapid response standards include a team of staff who work after-hours and overnight to quickly respond to issues arising with the water system and other City utilities and assets. This ensures major disruptions to water services, such as pipe breaks and leaks and other issues, are dealt with quickly and efficiently, minimizing impact on the system, its users and the community at large.



4.4 Fire Protection

Fire hydrants play an important role in our water system as they serve multiple needs. Hydrants deliver large quantities of water for fighting fires and help keep our drinking water safe by providing a way for water to be flushed out of our system.

Water Services conducts extensive annual maintenance on the City's 5,000-plus fire hydrants to ensure they are ready to provide large volumes of water during fire fighting efforts.

In addition to replacing hydrants as part of the City's Capital Construction Watermain Replacement Program, or demand replacements due to damage or malfunction, Water Services actively performs hydrant retrofits to replace slide gate hydrants with compression hydrants. Compression hydrants close when they are compromised, preventing major water loss and infrastructure damage. Since starting the retrofits, Water Services has replaced 24 hydrants throughout the City. Slide gate hydrants are being phased out and all new hydrants being installed in the City are compression-style.



Staff performing preventative maintenance on a slide-gate hydrant.

Fire hydrants play an important role in our water system.



ANNUAL MAINTENANCE ON **5,000+** fire hydrants

24 hydrant retrofits in two years

Staff performing preventative maintenance on a compression hydrant.

5.0

Accessible Water in the Community

5.1 Water Where You Are

Universal access to safe drinking water is critical to public health and quality of life, whether you are at home, at work or out in the community.

The City ensures this access by providing free water at its network of permanent public water fountains and at mobile water fountains deployed at special events. This helps the public maintain healthy hydration levels at all times while also protecting the environment and promoting sustainability by reducing the need to use plastic water bottles for this purpose.

Water misting stations, deployed during extreme heat events, also support public health.



Staff taking a water sample from a fountain to ensure great water quality throughout the season.

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Water fountain with a pet bowl located in Steveston Village.

A permanent water fountain upgrade program was launched in 2023.

5.2 Water Fountains

The water fountains found in Richmond parks and other public areas are maintained by Water Services. This ensures the public has ready access to free, safe drinking water throughout the community.

The water fountains are tested and inspected regularly to ensure they provide high-quality drinking water. The fountains are turned off in winter months to prevent freezing and costly damage, and are turned back on in the spring for the public to enjoy.

A permanent water fountain upgrade program was launched in 2023. The program involves

upgrading older fountains with new and longer-lasting fountains. The new fountains have improved designs that also incorporate a bottle water-fill station. Some of the fountains also include ground-level spouts to keep pets hydrated. Part of the upgrades might also include relocating the fountains to another location within the

same area to better serve the community. The first fountain to be upgraded as part of this program is located at Bernard Park. A new fountain with a water bottle filler and pet drinking bowl at ground level was installed in a more convenient location for the public. Four additional fountain upgrades are planned for 2024.

5.3 Portable Water Fountains

City staff proudly maintain four portable drinking water units that are used at numerous community events. Two of the units have the ability to chill water when connected to a power source. The units provide the public with access to free, potable tap water at events and promote tap water usage as an alternative to bottled water consumption.

The portable water fountains are deployed at a variety of popular community events such as the Steveston Salmon Festival, Richmond Maritime Festival and dozens of other local events annually.

In addition to the larger, wheeled water fountains, the City also maintains a number of drinking water fountains that can be attached to the tops of fire hydrants. These units provide an alternative potable water source at events or camps where other service options are not available or practical. The units can also be used at large events like the Salmon Festival to provide additional drinking water sources.



Portable water fountain located at the Gateway Theatre.

The water from the portable fountains is tested upon installation to ensure we provide good quality water for the public to enjoy.



5.4 Misting Stations

In response to recurring extreme hot weather, Water Services staff designed and built misting stations that can be placed at a water source, like a hydrant, and provide a way for people to cool down.

In coordination with Emergency Programs, misting stations are regularly deployed in parks and popular outdoor locations, such as Minoru Plaza and Garry Point Park, during extreme high temperature events to provide heat relief.

Misting stations are also deployed outside of extreme heat events throughout the City to provide the public with a fun way to keep cool while enjoying being out and about in the community.



Misting station set up at Aberdeen Neighbourhood Park.





Conserving Our Water Supply



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6.1 Reducing Water Consumption

Water conservation efforts are important to ensure that our regional system can keep up with the growing population to safeguard our water supply and to help maintain our beautiful environment.

The City of Richmond continues to succeed in reducing annual water consumption despite a growing population by implementing corporate and community-wide initiatives. These include water metering, lawn watering regulation, pressure management, leak-reduction and leak-detection programs, a toilet rebate program and a rain barrel sale program.



6.2 Water Metering Programs

AVERAGE SAVINGS OF NEARLY **50%**

Residents and businesses are **billed based on actual amount of water they use**, rather than a flat-rate system, providing a **financial incentive to conserve water.**

Water metering plays a significant role in the City's water management program as it promotes water conservation by encouraging users to reduce their water consumption.

The City implemented its single-family water metering program in 2003. Initially voluntary, water meters eventually became mandatory. All single-family homes in Richmond have been metered since the end of 2017. All industrial, commercial and institutional properties are also metered. Most users have experienced significant savings in costs over the previous flat-rate billing system. The program has contributed to significant overall reductions in water consumption in Richmond.

The City is now working to achieve water meter universality in multi-family residences. Currently, more than half of Richmond's multi-family residential complexes have water meters. All remaining unmetered properties are scheduled to be metered over the next 15 years.

Nearly all multi-family residences that have installed meters have experienced reductions in their water costs, with average savings of nearly 50%. Multi-family water meter installations are undertaken by experienced City crews and are completed with minimal service disruptions.

Water Consumption vs. Population | 2013 to 2023



The graph above shows how the City of Richmond has been conserving water despite an increase in population over the years. Water consumption has been steadily decreasing since its peak in 2006, except for small year-to-year increases in 2021 and 2023. The steady decrease in consumption parallels the City's steady and ongoing transition toward universal water metering for all users.

Despite this progress, the whole Metro Vancouver region, including Richmond, saw a spike in consumption due to extreme heat in the summers of 2021 and 2023, placing a strain on our regional water supply. This has reinforced the City's determination to continue to expand and place increased emphasis on our water conservation programs in order to further decrease our consumption and do our part in the region's push to conserve water.

6.3 Pressure Management Program

Using the pressure-reducing valve stations, the City of Richmond reduces water pressure in the system by 10 pounds per square inch (PSI) from October to May, lowering the system pressure from 90 PSI to 80 PSI.

The purpose of this practice is to reduce the volume of leakage during a lower demand period, decrease the risk of watermain breaks, and extend the life of our water infrastructure.

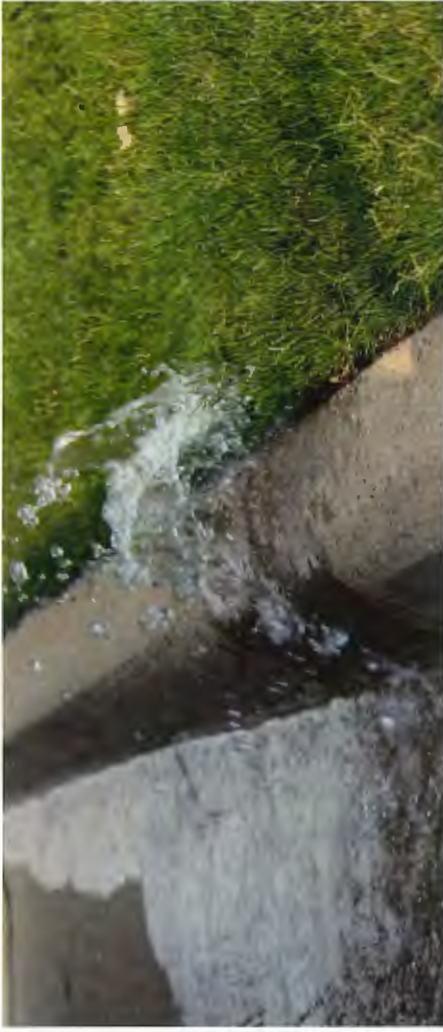
During summer months, the daytime pressure is set to 90 PSI to meet the increased water demand on the system.

A timer-based system is used to lower the pressure to 80 PSI daily from 1:00 to 5:00 a.m. as water demand decreases during that time over the summer.

This program has successfully decreased watermain leaks and breaks in the water system.



A look inside a pressure-reducing valve station.



6.4 Leak Reduction and Detection Programs

The City has made significant progress identifying and eliminating leaks through programs that target residential users and the City's own network.

The Leak Reduction Program identifies single-family properties with continuous flow using our metering system. City staff then inform the homeowner about the potential leak. The program can significantly reduce overall private property leakage since leaks can be detected by the metering system before they become visible or obvious.

The Leak Detection Program discovers non-visible underground leaks within the City's distribution system without the need to excavate. City crews use special equipment called noise loggers to measure sound frequencies along the targeted pipe. The frequencies are then recorded for staff review. A leak in the pipe creates different sound patterns than typical water flow in the watermain, allowing the crew to pinpoint leaks and provide swift action to excavate and repair the affected asset.

It is estimated that most municipalities in North America lose 12% to 15% of their potable water to undiscovered underground leakage.

6.5 Toilet Rebate Program

This program encourages homeowners to replace older, high-volume toilets with low-flush toilets to conserve water and reduce costs.



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Toilets account for almost one quarter of the water used in the average home. Switching to a low-flush toilet could save more than 70 litres of water per day per person and, when combined with a water meter, will result in cost savings.

In addition to reducing water use and costs, installing low-flush toilets ensures homes reflect current best practices and market preferences.

Single and multi-family homeowners are eligible to apply for a lifetime maximum of two rebates per property. Industrial, commercial and other non-residential properties are not eligible at this time.



The City of Richmond's Toilet Rebate Program provides a utility account rebate of \$100 to homeowners when they install a low-flush toilet.

6.6 Rain Barrel Sale Program

Rain barrels are excellent outdoor water-saving devices that collect and store rainwater from rooftops for lawn and garden use.

Rain barrels are available for purchase at the City's Recycling Depot by Richmond residents only. The barrels can hold up to 208 litres and are made from safe and durable recycled materials. The barrels include a mosquito mesh to keep out bugs and leaves. Installation instructions are included with each rain barrel.

Rainwater is a great water source for lawns, plants and gardens, and washing outside surfaces. Using rainwater will reduce the amount of tap water you use, therefore saving money on your utility bill.



Collecting water using a rain barrel to water flowers and plants.

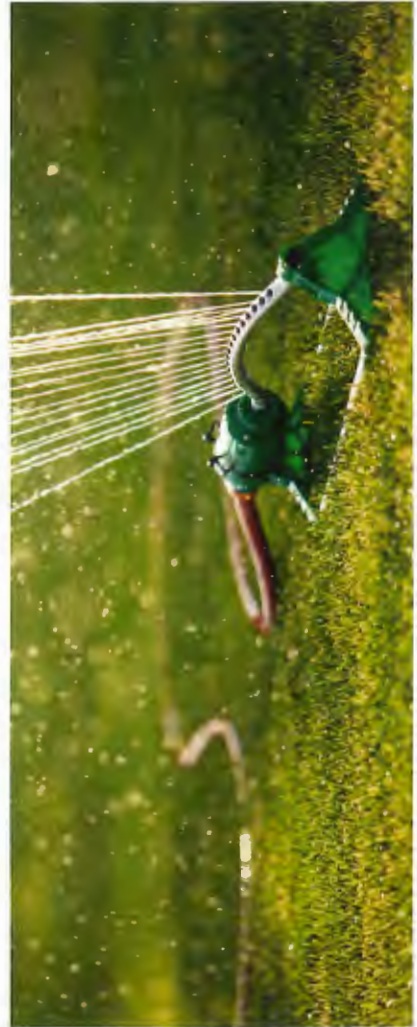
6.7 Lawn Watering Regulations

As the temperature increases, water consumption increases with it. During summer months, average water use can increase by as much as 50%, largely due to lawn watering. Overall, lawn watering typically represents nearly 40% of all water used in an average single family home.

The higher water demand combined with the decrease in precipitation during the summer causes water levels in the Metro Vancouver reservoirs to drop at a greater pace. Water conservation, particularly in summer, is vital in order to maintain a minimum amount of water in the reservoirs in case of emergency. Conservation is particularly important in years when snowpack levels are low and seasonal rainfall is below normal.

To help manage the high demand for drinking water during the hot and dry summer months in 2023, Metro Vancouver initiated Stage 1 lawn watering regulations from May 1 to August 3. The drought severity increased and Metro Vancouver escalated to Stage 2 regulations on August 4 for the remainder of the season, until October 15, 2023. Regional lawn watering and other water usage

restrictions are applied on an annual basis to limit consumption and ensure adequate supply levels are maintained. The staged water restrictions are applied and adjusted throughout the summer based on demand and available supply. Lawn watering and other water usage is regulated through the Water Use Restriction Bylaw No. 7784. Failure to comply with lawn watering restrictions is an offence subject to fines.



6.8 Waterwise Demonstration Garden

Lawn and garden watering are major consumers of water during the summer. Overwatering can place a strain on the regional water supply and can be detrimental to the health of many plants. In addition, with the advent of water metering for most Richmond homes, excessive lawn and garden watering can significantly increase utility bills.

The City of Richmond's Waterwise Demonstration Garden acts as a resource for local residents, providing tips on how they can reduce their water usage and still have beautiful, healthy gardens, lawns and landscapes. The garden shows a variety of plants that residents and businesses can use in their landscaping that are drought-tolerant and do not require a lot of water to grow and thrive in our unique climate. The garden also offers lawn maintenance tips, and provides information on micro-irrigation with different ways and systems of watering plants like driplines, bubblers, micro-sprays and others.

The demonstration garden is located within Terra Nova Rural Park and can be visited year-round for those looking for useful information on reducing their water consumption.

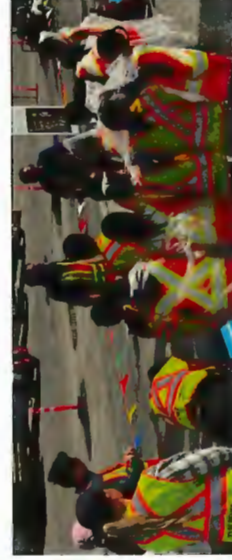


7.1 Project WET

Project WET is an interactive elementary school program aimed at educating students on the importance of water.

In partnership with Richmond elementary school teachers, City of Richmond Public Works staff invite students in Grades 4 to 7 to the Works Yard to learn about water conservation, supply and quality. Students also learn about other Public Works areas like Sewerage and Drainage, Environmental Programs, and Inspections.

There are several interactive displays, with staff guiding students through key learning objectives for each. Project WET field trips take place as a celebration of National Public Works Week. The available class spaces are in high demand and are always fully booked.



Kids learning about water distribution and the importance of fire hydrants at Project WET.



7.0 Community Outreach



7.2 Community Engagement

When the City undertakes a new project in the community, it makes every effort to ensure residents and businesses in the area are kept aware of what will be happening, the projected timeline, potential service impacts and more.

Water Services strives to remain engaged with the community throughout the year,

both through its day-to-day activities and specific initiatives.

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Before every project, the City sends letters to all area residents who will be affected by the construction work. In addition, the City regularly conducts direct outreach with individuals and groups in the project area. Staff often meet directly with local residents, schools and others to answer their questions and address concerns about the project. This has included inviting school classes to the project site and learn firsthand about the work being done.

A major highlight of the City's engagement activity is the Public Works Open House and National Public Works Week. Water Services staff annually work to develop new displays for the Open House with information and activities to help keep the public informed about the work being done to deliver high-quality water to their taps, promote water conservation and provide excellent value to taxpayers. During the past year, Water Services set up an above-ground water system display that included water meters, valves and blow-offs to teach Open House attendees

about the water system and water conservation. The Emergency Water Treatment trailer was also set up to educate people on the importance of water quality and emergency preparedness. Staff volunteered their time and effort on a non-working day to educate and interact with the public.

The Public Works Open House also features the City's portable water fountains and misters to help keep attendees hydrated and cool during the warm weather.

Community engagement is also undertaken through various communication initiatives with the public through a variety of mediums. The watermain construction crew were featured in a National Public Works Week media campaign for hosting a class of elementary school children at one of their sites. The visit allowed a great teaching opportunity for kids to learn about the water system and ask questions of our staff. City staff take pride in their work and embrace opportunities to raise awareness about their contributions and their benefits to the community.

Appendices

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 Water sample test results from our 2023 Drinking Water Quality Monitoring Program, listed by sampling site. Results include total coliform, E. coli, HPC, free chlorine, temperature and turbidity.
- B THM and HAA Test Results** 108
 Disinfection by-product amounts in the water samples from specific sites that were established in the Drinking Water Quality Monitoring Program and are representative of the City's system.
- C Metal Levels Guidelines** 110
 Metal level guidelines allowed in drinking water established by the federal government.
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- F Water Quality Testing Parameters** 114
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- G Water Sampling Sites** 117
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- H Specific Emergency Response Plans** 118
 Emergency response plans that City staff follow in specific situations.
- I References** 121
 A list of references used to produce this report.



Appendix A | 2023 Water Quality Results

Water Sampling | Type: GRAB | Station Number: RMD-202 | Address: 1500 Valemont Way

Water Sampling | Type: GRAB | Station Number: RMD-203 | Address: 23260 Westminster Highway

Sampled Date	Total Coliform (MPN/1000 ml)	Total Coliform (CFU/1000 ml)	E. coli (MPN/1000 ml)	E. coli (CFU/1000 ml)	HPC (CFU/ml)	Chlorine Free (mg/l)	Turbidity (NTU)	Temperature (°C)
2023-01-06 09:30	<1	<1	<1	<1	<2	0.8	0.15	6
2023-01-12 09:50	<1	<1	<1	<1	<2	0.78	0.21	7
2023-01-20 09:25	<1	<1	<1	<1	<2	0.67	0.22	7
2023-01-26 09:30	<1	<1	<1	<1	<2	0.73	0.11	7
2023-02-03 09:30	<1	<1	<1	<1	<2	0.7	0.19	7
2023-02-09 09:25	<1	<1	<1	<1	<2	0.8	0.1	6
2023-02-17 09:25	<1	<1	<1	<1	<2	0.81	0.21	6
2023-02-23 09:30	<1	<1	<1	<1	<2	0.83	0.12	7
2023-03-03 09:45	<1	<1	<1	<1	<2	0.86	0.14	6
2023-03-09 09:20	<1	<1	<1	<1	<2	0.8	0.1	6
2023-03-17 09:50	<1	<1	<1	<1	<2	0.71	0.12	7
2023-03-23 09:30	<1	<1	<1	<1	2	0.75	0.18	7
2023-03-31 09:25	<1	<1	<1	<1	<2	0.82	0.15	8
2023-04-05 09:30	<1	<1	<1	<1	<2	0.79	0.13	8
2023-04-14 09:35	<1	<1	<1	<1	<2	0.67	0.21	8
2023-04-20 09:45	<1	<1	<1	<1	<2	0.72	0.16	7
2023-04-28 09:25	<1	<1	<1	<1	<2	0.62	0.16	8
2023-05-04 09:25	<1	<1	<1	<1	<2	0.63	0.21	9
2023-05-12 09:35	<1	<1	<1	<1	<2	0.71	0.19	10
2023-05-18 09:45	<1	<1	<1	<1	<2	0.67	0.23	10
2023-05-26 09:30	<1	<1	<1	<1	<2	0.63	0.26	10
2023-06-01 09:30	<1	<1	<1	<1	<2	0.63	0.14	12
2023-06-09 09:30	<1	<1	<1	<1	<2	0.68	0.12	12
2023-06-15 09:30	<1	<1	<1	<1	<2	0.67	0.42	13
2023-06-23 09:30	<1	<1	<1	<1	6	0.7	0.19	12
2023-07-07 09:30	<1	<1	<1	<1	<2	0.7	0.12	12
2023-07-13 09:30	<1	<1	<1	<1	<2	0.69	0.15	14
2023-07-21 09:30	<1	<1	<1	<1	2	0.45	0.17	14
2023-07-27 09:30	<1	<1	<1	<1	<2	0.52	0.14	15
2023-08-04 09:55	<1	<1	<1	<1	2	0.5	0.14	16
2023-08-10 09:40	<1	<1	<1	<1	8	0.64	0.1	16
2023-08-18 09:20	<1	<1	<1	<1	4	0.51	0.11	16
2023-08-24 09:40	<1	<1	<1	<1	10	0.72	0.12	16
2023-09-01 09:25	<1	<1	<1	<1	<2	0.58	0.18	16
2023-09-07 09:40	<1	<1	<1	<1	4	0.52	0.2	17
2023-09-15 09:40	<1	<1	<1	<1	1400	0.57	0.15	17
2023-09-21 09:25	<1	<1	<1	<1	<2	0.54	0.13	17
2023-09-29 09:30	<1	<1	<1	<1	<2	0.58	0.37	16
2023-10-05 09:50	<1	<1	<1	<1	<2	0.62	0.23	15
2023-10-13 09:50	<1	<1	<1	<1	<2	0.74	0.15	13
2023-10-19 09:25	<1	<1	<1	<1	2	0.52	0.15	12
2023-10-27 09:30	<1	<1	<1	<1	2	0.68	0.2	11
2023-11-02 09:20	<1	<1	<1	<1	<2	0.82	0.16	10
2023-11-10 09:25	<1	<1	<1	<1	<2	0.69	0.2	10
2023-11-16 09:40	<1	<1	<1	<1	<2	0.83	0.2	9
2023-11-24 09:30	<1	<1	<1	<1	<2	0.76	0.19	9
2023-11-30 09:25	<1	<1	<1	<1	<2	0.59	0.12	8
2023-12-08 09:50	<1	<1	<1	<1	<2	0.7	0.29	7
2023-12-14 09:20	<1	<1	<1	<1	<2	0.68	0.24	8
2023-12-20 14:25	<1	<1	<1	<1	NA	0.64	0.27	8
2023-12-28 09:30	<1	<1	<1	<1	NA	0.64	0.27	8

Water Sampling | Type: GRAB | Station Number: RMD-212 | Address: Across from 8600 Ryan Road

Table with 12 columns: Sampled Date, Total Coliform (MPN/1000 ml), Total Coliform (CFU/1000 ml), E. coli (MPN/1000 ml), E. coli (CFU/1000 ml), HPC (CFU/ml), Chlorine Free (mg/l), Turbidity (NTU), Temperature (C°). Rows include dates from 2023-01-06 to 2023-12-28.

PWT - 65

Water Sampling | Type: GRAB | Station Number: RMD-214 | Address: 11720 Westminster Highway

Table with 12 columns: Sampled Date, Total Coliform (MPN/1000 ml), Total Coliform (CFU/1000 ml), E. coli (MPN/1000 ml), E. coli (CFU/1000 ml), HPC (CFU/ml), Chlorine Free (mg/l), Turbidity (NTU), Temperature (C°). Rows include dates from 2023-01-06 to 2023-12-28.

Water Sampling | Type: GRAB | Station Number: RMD-252 | Address: 9751 Pendleton Road

Table with 10 columns: Sampled Date, Total Coliform (MPN/1000 ml), Total Coliform (CFU/1000 ml), E. coli (MPN/1000 ml), E. coli (CFU/1000 ml), HPC (CFU/ml), Chlorine Free (mg/l), Turbidity (NTU), Temperature (C). Rows include dates from 2023-01-03 to 2023-12-27.

PWT - 68

Water Sampling | Type: GRAB | Station Number: RMD-251 | Address: 11051 No. 3 Road

Table with 10 columns: Sampled Date, Total Coliform (MPN/1000 ml), Total Coliform (CFU/1000 ml), E. coli (MPN/1000 ml), E. coli (CFU/1000 ml), HPC (CFU/ml), Chlorine Free (mg/l), Turbidity (NTU), Temperature (C). Rows include dates from 2023-01-03 to 2023-12-27.

Water Sampling | Type: GRAB | Station Number: RMD-252 | Address: 5300 No. 3 Road

Table with 12 columns: Sampled Date, Total Coliform (MPN/1000 ml), E. coli (MPN/1000 ml), HPC (CFU/ml), Chlorine Free (mg/l), Turbidity (NTU), Temperature (C), and others. Rows show sampling data from 2023-01-03 to 2023-12-27.

PWT - 69

Water Sampling | Type: GRAB | Station Number: RMD-251 | Address: 6000 block Miller Road

Table with 12 columns: Sampled Date, Total Coliform (MPN/1000 ml), E. coli (MPN/1000 ml), HPC (CFU/ml), Chlorine Free (mg/l), Turbidity (NTU), Temperature (C), and others. Rows show sampling data from 2023-01-03 to 2023-12-27.

Water Sampling | Type: GRAB | Station Number: RMD-256 | Address: 1000 block McDonald Road

Table with 12 columns: Sampled Date, Total Coliform (MPN/1000 ml), Total Coliform (CFU/1000 ml), E. coli (MPN/1000 ml), E. coli (CFU/1000 ml), HPC (CFU/ml), Chlorine Free (mg/l), Turbidity (NTU), Temperature (C). Rows contain sampling data from 2023-01-03 to 2023-12-27.

Water Sampling | Type: GRAB | Station Number: RMD-257 | Address: 6640 Blundell Road

Table with 12 columns: Sampled Date, Total Coliform (MPN/1000 ml), Total Coliform (CFU/1000 ml), E. coli (MPN/1000 ml), E. coli (CFU/1000 ml), HPC (CFU/ml), Chlorine Free (mg/l), Turbidity (NTU), Temperature (C). Rows contain sampling data from 2023-01-04 to 2023-12-27.

Water Sampling | Type: GRAB | Station Number: RMD-258 | Address: 7000 block Dyke Road

Table with 12 columns: Sampled Date, Total Coliform (MPN/1000 ml), Total Coliform (CFU/1000 ml), E. coli (MPN/1000 ml), E. coli (CFU/1000 ml), HPC (CFU/ml), Chlorine Free (mg/l), Turbidity (NTU), Temperature (C). Rows range from 2023-01-04 to 2023-12-27.

PWT - 71

Water Sampling | Type: GRAB | Station Number: RMD-259 | Address: 10020 Amethyst Avenue

Table with 12 columns: Sampled Date, Total Coliform (MPN/1000 ml), Total Coliform (CFU/1000 ml), E. coli (MPN/1000 ml), E. coli (CFU/1000 ml), HPC (CFU/ml), Chlorine Free (mg/l), Turbidity (NTU), Temperature (C). Rows range from 2023-01-04 to 2023-12-27.

Water Sampling | Type: GRAB | Station Number: RMD-261 | Address: 9911 Sidaway Road

Table with 10 columns: Sampled Date, Total Coliform (MPN/1000 ml), Total Coliform (CFU/1000 ml), E. coli (MPN/1000 ml), E. coli (CFU/1000 ml), HPC (CFU/ml), Chlorine Free (mg/l), Turbidity (NTU), and Temperature (C). Rows contain sampling data from 2023-01-04 to 2023-12-27.

Water Sampling | Type: GRAB | Station Number: RMD-260 | Address: 11111 Horseshoe Way

Table with 10 columns: Sampled Date, Total Coliform (MPN/1000 ml), Total Coliform (CFU/1000 ml), E. coli (MPN/1000 ml), E. coli (CFU/1000 ml), HPC (CFU/ml), Chlorine Free (mg/l), Turbidity (NTU), and Temperature (C). Rows contain sampling data from 2023-01-04 to 2023-12-27.

Water Sampling | Type: GRAB | Station Number: RMD-262 | Address: 13799 Commerce Parkway

Table with 14 columns: Sampled Date, Total Coliform (MPN/1000 ml), Total Coliform (CFU/1000 ml), E. coli (MPN/1000 ml), E. coli (CFU/1000 ml), HPC (CFU/ml), Chlorine Free (mg/l), Turbidity (NTU), Temperature (C°)

Water Sampling | Type: GRAB | Station Number: RMD-263 | Address: 12560 Cambie Road

Table with 14 columns: Sampled Date, Total Coliform (MPN/1000 ml), Total Coliform (CFU/1000 ml), E. coli (MPN/1000 ml), E. coli (CFU/1000 ml), HPC (CFU/ml), Chlorine Free (mg/l), Turbidity (NTU), Temperature (C°)

PWT - 73

Water Sampling | Type: GRAB | Station Number: RMD-266 | Address: 9380 General Currie Road

Sampled Date	Total Coliform (MPN/1000 ml)	Total Coliform (CFU/1000 ml)	E. coli (MPN/1000 ml)	E. coli (CFU/1000 ml)	HPC (CFU/ml)	Chlorine Free (mg/l)	Turbidity (NTU)	Temperature (°C)
2023-01-04 12:45	<1	<1	<1	<1	<2	0.91	0.15	6
2023-01-11 13:00	-	-	<1	<1	12	0.72	0.16	6
2023-01-18 12:45	-	<1	<1	<1	<2	0.72	0.15	7
2023-01-25 13:00	-	<1	<1	<1	<2	0.69	0.15	6
2023-02-01 12:50	-	<1	<1	<1	<2	0.79	0.14	6
2023-02-08 13:00	-	<1	<1	<1	<2	0.84	0.27	6
2023-02-15 12:45	-	<1	<1	<1	<2	0.86	0.13	6
2023-02-22 13:00	-	<1	<1	<1	<2	0.98	0.13	7
2023-03-01 13:00	-	<1	<1	<1	<2	0.98	0.1	6
2023-03-08 12:45	-	<1	<1	<1	100	0.69	0.1	6
2023-03-15 13:00	-	<1	<1	<1	<2	0.72	0.21	6
2023-03-22 13:00	-	<1	<1	<1	<2	0.85	0.24	7
2023-03-29 13:00	-	<1	<1	<1	8	0.75	0.13	7
2023-04-04 13:00	-	<1	<1	<1	<2	0.84	0.23	7
2023-04-12 13:00	-	<1	<1	<1	<2	0.77	0.15	7
2023-04-19 13:00	-	<1	<1	<1	<2	0.73	0.28	7
2023-04-26 13:00	-	<1	<1	<1	<2	0.91	0.2	7
2023-05-03 13:15	-	<1	<1	<1	<2	0.73	0.61	8
2023-05-10 13:05	-	<1	<1	<1	2	0.81	0.17	9
2023-05-17 13:00	-	<1	<1	<1	<2	0.73	0.74	9
2023-05-24 12:50	-	<1	<1	<1	<2	0.77	0.15	10
2023-05-31 13:00	-	<1	<1	<1	<2	0.82	0.44	10
2023-06-07 13:00	-	<1	<1	<1	<2	0.78	0.3	12
2023-06-14 13:00	-	<1	<1	<1	<2	0.74	0.18	12
2023-06-21 13:00	-	<1	<1	<1	<2	0.82	0.13	12
2023-06-28 13:00	-	<1	<1	<1	<2	0.69	0.11	12
2023-07-05 13:00	-	<1	<1	<1	<2	0.66	0.2	13
2023-07-12 12:45	-	<1	<1	<1	<2	0.79	0.12	13
2023-07-19 13:00	-	<1	<1	<1	10	0.7	0.13	14
2023-07-26 13:00	-	<1	<1	<1	160	0.68	1.4	15
2023-08-02 12:45	-	<1	<1	<1	12	0.74	0.31	15
2023-08-09 13:00	-	<1	<1	<1	12	0.62	0.12	17
2023-08-16 13:00	-	<1	<1	<1	8	0.68	0.12	17
2023-08-23 13:00	-	<1	<1	<1	10	0.72	0.11	16
2023-08-30 12:45	-	<1	<1	<1	2	0.66	0.16	17
2023-09-06 08:00	-	<1	<1	<1	18	0.45	0.19	18
2023-09-13 13:00	-	<1	<1	<1	4	0.78	0.12	16
2023-09-20 13:00	-	<1	<1	<1	6	0.78	0.37	16
2023-09-27 12:45	-	<1	<1	<1	8	0.63	0.15	16
2023-10-04 12:45	<1	<1	<1	<1	22	0.65	0.15	15
2023-10-11 13:00	-	<1	<1	<1	4	0.71	0.32	13
2023-10-18 12:45	<1	<1	<1	<1	2	0.64	0.11	13
2023-10-25 12:45	<1	<1	<1	<1	<2	0.63	0.21	12
2023-11-01 13:00	<1	<1	<1	<1	2	0.74	0.12	12
2023-11-08 13:00	-	<1	<1	<1	2	0.66	0.12	11
2023-11-15 13:00	-	<1	<1	<1	<2	0.73	0.15	11
2023-11-22 13:00	-	<1	<1	<1	<2	0.77	0.38	9
2023-11-29 13:00	-	<1	<1	<1	<2	0.76	0.18	9
2023-12-06 13:00	-	<1	<1	<1	16	0.68	0.2	9
2023-12-13 13:00	-	<1	<1	<1	6	0.74	0.24	7
2023-12-19 13:00	-	<1	<1	<1	NA	0.56	0.18	8
2023-12-28 09:45	-	<1	<1	<1	NA	0.62	0.18	10

Water Sampling | Type: GRAB | Station Number: RMD-267 | Address: 17240 Fedoruk Road

Sampled Date	Total Coliform (MPN/1000 ml)	Total Coliform (CFU/1000 ml)	E. coli (MPN/1000 ml)	E. coli (CFU/1000 ml)	HPC (CFU/ml)	Chlorine Free (mg/l)	Turbidity (NTU)	Temperature (C)
2023-01-06 10:10	-	<1	-	<1	<2	0.66	0.11	6
2023-01-12 10:30	-	<1	-	<1	<2	0.84	0.16	7
2023-01-20 10:00	-	<1	-	<1	<2	0.55	0.15	8
2023-01-26 10:10	-	<1	-	<1	<2	0.64	0.12	8
2023-02-03 10:10	-	<1	-	<1	<2	0.68	0.18	7
2023-02-09 10:00	-	<1	-	<1	2	0.83	0.16	7
2023-02-17 10:00	-	<1	-	<1	<2	0.78	0.15	7
2023-02-23 10:10	-	<1	-	<1	<2	0.79	0.17	7
2023-03-03 10:30	-	<1	-	<1	<2	0.75	0.14	5
2023-03-09 10:00	-	<1	-	<1	340	0.72	0.1	6
2023-03-17 10:10	-	<1	-	<1	<2	0.56	0.14	7
2023-03-23 10:10	-	<1	-	<1	<2	0.68	0.16	6
2023-03-31 10:00	-	<1	-	<1	<2	0.71	0.17	7
2023-04-05 10:05	-	<1	-	<1	<2	0.8	0.18	8
2023-04-14 10:15	-	<1	-	<1	<2	0.67	0.18	8
2023-04-20 10:15	-	<1	-	<1	<2	0.72	0.18	8
2023-04-28 10:00	-	<1	-	<1	<2	0.72	0.3	8
2023-05-04 10:00	-	<1	-	<1	<2	0.59	0.15	9
2023-05-12 10:10	-	<1	-	<1	2	0.83	0.22	10
2023-05-18 10:15	-	<1	-	<1	<2	0.69	0.21	11
2023-05-26 10:10	-	<1	-	<1	<2	0.8	0.29	11
2023-06-01 10:10	-	<1	-	<1	<2	0.66	0.19	12
2023-06-09 10:10	-	<1	-	<1	<2	0.71	0.22	13
2023-06-15 10:10	-	<1	-	<1	<2	0.73	0.23	13
2023-06-23 10:10	-	<1	-	<1	<2	0.84	0.16	13
2023-06-29 10:10	-	<1	-	<1	<2	0.71	0.15	14
2023-07-07 10:10	-	<1	-	<1	<2	0.71	0.19	14
2023-07-13 10:10	-	<1	-	<1	<2	0.64	0.27	15
2023-07-21 10:10	-	<1	-	<1	<2	0.66	0.15	16
2023-07-27 10:10	-	<1	-	<1	<2	0.85	0.14	16
2023-08-04 10:25	-	<1	-	<1	<2	0.88	0.13	17
2023-08-10 10:30	-	<1	-	<1	<2	0.6	0.13	17
2023-08-18 10:00	-	<1	-	<1	2	0.66	0.2	17
2023-08-24 10:20	-	<1	-	<1	<2	0.85	0.15	17
2023-09-01 10:00	-	<1	-	<1	<2	0.66	0.16	18
2023-09-07 10:20	-	<1	-	<1	6	0.6	0.17	17
2023-09-15 10:20	-	<1	-	<1	6	0.71	0.24	17
2023-09-21 10:00	-	<1	-	<1	6	0.69	0.25	17
2023-09-29 10:10	-	<1	-	<1	4	0.63	0.19	17
2023-10-05 10:30	<1	<1	<1	<1	4	0.84	0.19	15
2023-10-13 10:25	-	<1	-	<1	<2	0.69	0.13	14
2023-10-19 10:00	<1	<1	<1	<1	6	0.59	0.12	14
2023-10-27 10:10	<1	<1	<1	<1	<2	0.63	0.17	11
2023-11-02 09:55	<1	<1	<1	<1	<2	0.67	0.12	10
2023-11-10 10:00	<1	<1	<1	<1	<2	0.64	0.15	11
2023-11-16 10:10	-	<1	-	<1	<2	0.73	0.17	9
2023-11-24 10:10	-	<1	-	<1	<2	0.62	0.18	10
2023-11-30 10:00	-	<1	-	<1	2	0.66	0.14	8
2023-12-08 10:10	-	<1	-	<1	<2	0.68	0.18	8
2023-12-14 10:00	-	<1	-	<1	<2	0.61	0.23	7
2023-12-20 15:00	-	<1	-	<1	NA	0.65	0.21	8
2023-12-28 10:45	-	<1	-	<1	NA	0.7	0.15	8

PWT - 75

Water Sampling | Type: GRAB | Station Number: RMD-268 | Address: 13800 No. 3 Road

Sampled Date	Total Coliform (MPN/1000 ml)	Total Coliform (CFU/1000 ml)	E. coli (MPN/1000 ml)	E. coli (CFU/1000 ml)	HPC (CFU/ml)	Chlorine Free (mg/l)	Turbidity (NTU)	Temperature (C)
2023-01-04 15:15	-	<1	-	<1	4	0.82	0.14	6
2023-01-11 15:10	-	<1	-	<1	<2	0.7	0.26	6
2023-01-18 15:15	-	<1	-	<1	4	0.73	0.13	7
2023-01-25 15:10	-	<1	-	<1	<2	0.78	0.61	7
2023-02-01 15:15	-	<1	-	<1	<2	0.77	0.17	7
2023-02-08 15:10	-	<1	-	<1	<2	0.79	0.18	7
2023-02-15 13:15	-	<1	-	<1	<2	0.71	0.1	7
2023-02-22 15:10	-	<1	-	<1	<2	0.8	0.16	7
2023-03-01 15:10	-	<1	-	<1	<2	0.93	0.12	5
2023-03-08 15:15	-	<1	-	<1	<2	0.72	0.1	7
2023-03-15 15:10	-	<1	-	<1	<2	0.76	0.11	6
2023-03-22 13:10	-	<1	-	<1	<2	0.73	0.14	7
2023-03-29 15:10	-	<1	-	<1	<2	0.73	0.18	6
2023-04-04 15:10	-	<1	-	<1	<2	0.76	0.23	8
2023-04-12 15:15	-	<1	-	<1	<2	0.74	0.11	7
2023-04-19 15:15	-	<1	-	<1	10	0.81	0.22	7
2023-04-26 15:10	-	<1	-	<1	<2	0.85	0.19	8
2023-05-03 15:25	-	<1	-	<1	<2	0.62	0.16	8
2023-05-10 15:15	-	<1	-	<1	<2	0.79	0.16	10
2023-05-17 15:15	-	<1	-	<1	<2	0.69	0.15	10
2023-05-24 15:15	-	<1	-	<1	<2	0.72	0.2	10
2023-05-31 15:10	-	<1	-	<1	<2	0.72	0.35	10
2023-06-07 15:10	-	<1	-	<1	2	0.95	5.8	11
2023-06-09 08:50	-	<1	-	<1	<2	0.63	0.13	12
2023-06-14 15:10	-	<1	-	<1	<2	0.7	0.25	12
2023-06-21 15:10	-	<1	-	<1	<2	0.84	0.14	13
2023-06-28 15:10	-	<1	-	<1	<2	0.64	0.12	13
2023-07-05 15:10	-	<1	-	<1	<2	0.65	0.21	14
2023-07-12 15:15	-	<1	-	<1	14	0.7	0.11	15
2023-07-19 15:15	-	<1	-	<1	<2	0.63	0.15	16
2023-07-26 15:10	-	<1	-	<1	<2	0.62	0.17	16
2023-08-02 15:15	-	<1	-	<1	6	0.66	0.11	17
2023-08-09 15:15	-	<1	-	<1	<2	0.53	0.09	17
2023-08-16 15:15	-	<1	-	<1	8	0.51	0.09	17
2023-08-23 15:15	-	<1	-	<1	2	0.57	0.23	18
2023-08-30 15:15	-	<1	-	<1	<2	0.52	0.14	17
2023-09-06 10:10	-	<1	-	<1	<2	0.6	0.14	16
2023-09-13 15:15	-	<1	-	<1	<2	0.68	0.26	17
2023-09-20 15:15	-	<1	-	<1	2	0.56	0.12	17
2023-09-27 15:15	-	<1	-	<1	<2	0.51	0.14	17
2023-10-04 15:15	<1	<1	<1	<1	<2	0.47	0.12	16
2023-10-11 15:20	<1	<1	<1	<1	2	0.6	0.34	14
2023-10-18 15:15	<1	<1	<1	<1	18	0.46	0.09	13
2023-10-25 15:15	<1	<1	<1	<1	2	0.54	0.16	12
2023-11-01 15:15	<1	<1	<1	<1	<2	0.57	0.12	12
2023-11-08 15:15	<1	<1	<1	<1	<2	0.6	0.14	11
2023-11-15 15:15	<1	<1	<1	<1	<2	0.69	0.22	11
2023-11-22 15:15	<1	<1	<1	<1	<2	0.81	1.3	9
2023-11-29 15:10	<1	<1	<1	<1	4	0.79	0.58	9
2023-12-06 15:10	<1	<1	<1	<1	<2	0.61	0.12	9
2023-12-13 15:15	<1	<1	<1	<1	<2	0.69	0.14	7
2023-12-19 15:15	<1	<1	<1	<1	NA	0.6	0.15	8
2023-12-27 09:40	<1	<1	<1	<1	NA	0.52	0.24	8

Water Sampling | Type: GRAB | Station Number: RMD-270 | Address: 8200 Jones Road

Sampled Date	Total Coliform (MPN/1000 ml)	Total Coliform (CFU/1000 ml)	E. coli (MPN/1000 ml)	E. coli (CFU/1000 ml)	HPC (CFU/ml)	Chlorine Free (mg/l)	Turbidity (NTU)	Temperature (C)
2023-01-03 13:50	<1	<1	<1	<1	<2	0.74	0.14	6
2023-01-09 14:15	-	<1	<1	<1	6	0.56	0.2	6
2023-01-16 14:15	-	<1	<1	<1	4	0.73	0.14	7
2023-01-23 14:10	-	<1	<1	<1	<2	0.68	0.11	7
2023-01-30 14:15	-	<1	<1	<1	<2	0.74	0.19	7
2023-02-06 14:15	-	<1	<1	<1	<2	0.79	0.11	6
2023-02-13 14:15	-	<1	<1	<1	46	0.88	0.17	7
2023-02-21 14:10	-	<1	<1	<1	12	0.82	0.18	7
2023-02-27 14:15	-	<1	<1	<1	<2	0.85	0.12	6
2023-03-06 14:15	-	<1	<1	<1	42	0.78	0.11	6
2023-03-13 14:15	-	<1	<1	<1	34	0.73	0.18	6
2023-03-20 14:15	-	<1	<1	<1	6	0.7	0.19	7
2023-03-27 14:15	-	<1	<1	<1	2	0.77	0.2	6
2023-04-03 14:15	-	<1	<1	<1	4	0.83	0.14	7
2023-04-11 14:10	-	<1	<1	<1	24	0.7	0.11	7
2023-04-17 15:45	-	<1	<1	<1	6	0.69	0.16	8
2023-04-24 14:20	-	<1	<1	<1	12	0.71	0.15	7
2023-05-01 14:15	-	<1	<1	<1	6	0.73	0.14	9
2023-05-08 14:10	-	<1	<1	<1	6	0.72	0.14	9
2023-05-15 12:10	-	<1	<1	<1	26	0.88	0.26	11
2023-05-23 14:10	-	<1	<1	<1	6	0.76	0.33	10
2023-05-29 14:15	-	<1	<1	<1	6	0.74	0.14	13
2023-06-05 14:15	-	<1	<1	<1	18	0.85	0.22	12
2023-06-12 14:15	-	<1	<1	<1	10	0.71	0.12	13
2023-06-19 14:15	-	<1	<1	<1	22	0.73	0.22	12
2023-06-27 14:15	-	<1	<1	<1	52	0.72	0.11	14
2023-07-04 14:15	-	<1	<1	<1	60	0.74	0.12	15
2023-07-10 14:10	-	<1	<1	<1	48	0.72	0.14	14
2023-07-17 14:15	-	<1	<1	<1	88	0.6	0.17	16
2023-07-24 14:15	-	<1	<1	<1	150	0.64	0.17	18
2023-07-31 14:15	-	<1	<1	<1	16	0.6	0.11	17
2023-08-08 14:10	-	<1	<1	<1	58	0.65	0.36	16
2023-08-14 14:15	-	<1	<1	<1	44	0.68	0.1	18
2023-08-21 14:10	-	<1	<1	<1	140	0.56	0.11	16
2023-08-28 14:15	-	<1	<1	<1	46	0.62	0.16	17
2023-09-06 14:10	-	<1	<1	<1	46	0.54	0.22	17
2023-09-11 14:15	-	<1	<1	<1	24	0.59	0.08	18
2023-09-18 14:10	-	<1	<1	<1	<2	0.48	0.11	16
2023-09-25 14:15	-	<1	<1	<1	10	0.64	0.11	17
2023-10-03 14:10	<1	<1	<1	<1	24	0.59	0.13	16
2023-10-10 14:15	<1	<1	<1	<1	16	0.57	0.15	15
2023-10-16 14:15	<1	<1	<1	<1	6	0.53	0.13	15
2023-10-23 14:15	<1	<1	<1	<1	<2	0.61	0.11	13
2023-10-30 14:15	<1	<1	<1	<1	10	0.53	0.23	12
2023-11-06 14:10	<1	<1	<1	<1	10	0.63	0.15	11
2023-11-14 14:10	<1	<1	<1	<1	2	0.66	0.12	11
2023-11-20 14:15	<1	<1	<1	<1	2	0.72	0.17	10
2023-11-27 14:10	<1	<1	<1	<1	<2	0.75	0.18	9
2023-12-04 14:10	<1	<1	<1	<1	2	0.58	0.17	9
2023-12-11 14:15	<1	<1	<1	<1	16	0.71	0.37	8
2023-12-18 14:15	<1	<1	<1	<1	NA	0.62	0.17	8
2023-12-27 11:15	<1	<1	<1	<1	NA	0.61	0.26	10

Water Sampling | Type: GRAB | Station Number: RMD-269 | Address: 14951 Triangle Road

Sampled Date	Total Coliform (MPN/1000 ml)	Total Coliform (CFU/1000 ml)	E. coli (MPN/1000 ml)	E. coli (CFU/1000 ml)	HPC (CFU/ml)	Chlorine Free (mg/l)	Turbidity (NTU)	Temperature (C)
2023-01-03 13:50	<1	<1	<1	<1	2	0.41	0.12	6
2023-01-09 13:50	<1	<1	<1	<1	<2	0.7	0.13	6
2023-01-16 13:50	<1	<1	<1	<1	2	0.74	0.13	7
2023-01-23 13:50	<1	<1	<1	<1	<2	0.67	0.13	7
2023-01-30 13:50	<1	<1	<1	<1	<2	0.78	0.1	7
2023-02-06 13:50	<1	<1	<1	<1	<2	0.85	0.13	7
2023-02-13 13:50	<1	<1	<1	<1	<2	0.74	0.41	6
2023-02-21 13:50	<1	<1	<1	<1	4	0.7	0.41	7
2023-02-27 13:50	<1	<1	<1	<1	<2	0.76	0.13	5
2023-03-06 13:50	<1	<1	<1	<1	<2	0.76	0.12	5
2023-03-13 13:50	<1	<1	<1	<1	2	0.68	0.18	6
2023-03-20 13:50	<1	<1	<1	<1	<2	0.71	0.18	7
2023-03-27 13:50	<1	<1	<1	<1	<2	0.69	0.21	7
2023-04-03 13:50	<1	<1	<1	<1	<2	0.68	0.16	8
2023-04-11 13:50	<1	<1	<1	<1	<2	0.67	0.18	7
2023-04-17 15:20	<1	<1	<1	<1	<2	0.68	0.19	7
2023-04-24 13:55	<1	<1	<1	<1	<2	0.65	0.26	7
2023-05-01 13:50	<1	<1	<1	<1	<2	0.69	0.15	8
2023-05-08 13:50	<1	<1	<1	<1	<2	0.88	1.1	8
2023-05-15 13:50	<1	<1	<1	<1	<2	0.81	0.73	9
2023-05-23 13:50	<1	<1	<1	<1	<2	0.72	0.4	9
2023-05-29 13:50	<1	<1	<1	<1	<2	0.69	0.19	11
2023-06-05 13:50	<1	<1	<1	<1	<2	0.68	0.31	11
2023-06-12 13:50	<1	<1	<1	<1	2	0.8	0.14	11
2023-06-19 13:50	<1	<1	<1	<1	<2	0.72	0.21	11
2023-06-27 13:50	<1	<1	<1	<1	<2	0.7	0.16	11
2023-07-04 13:50	<1	<1	<1	<1	<2	0.69	0.12	12
2023-07-10 13:50	<1	<1	<1	<1	<2	0.74	0.2	13
2023-07-17 13:50	<1	<1	<1	<1	<2	0.75	0.25	14
2023-07-24 13:50	<1	<1	<1	<1	<2	0.79	0.12	15
2023-07-31 13:50	<1	<1	<1	<1	<2	0.73	0.18	15
2023-08-08 13:50	<1	<1	<1	<1	10	0.68	0.16	16
2023-08-14 13:50	<1	<1	<1	<1	2	0.67	0.13	20
2023-08-21 13:50	<1	<1	<1	<1	4	0.68	0.13	16
2023-08-28 13:50	<1	<1	<1	<1	2	0.58	0.16	17
2023-09-06 13:50	<1	<1	<1	<1	<2	0.64	0.16	17
2023-09-11 13:50	<1	<1	<1	<1	<2	0.65	0.17	16
2023-09-18 13:50	<1	<1	<1	<1	130	0.62	0.27	16
2023-09-25 13:50	<1	<1	<1	<1	8	0.72	0.17	17
2023-10-03 13:50	<1	<1	<1	<1	14	0.76	0.14	14
2023-10-10 13:50	<1	<1	<1	<1	<2	0.76	0.18	15
2023-10-16 13:50	<1	<1	<1	<1	4	0.66	0.2	13
2023-10-23 13:50	<1	<1	<1	<1	<2	0.6	0.15	11
2023-10-30 13:50	<1	<1	<1	<1	<2	0.67	0.26	11
2023-11-06 13:50	<1	<1	<1	<1	10	0.7	0.13	10
2023-11-14 13:50	<1	<1	<1	<1	<2	0.8	0.11	10
2023-11-20 13:50	<1	<1	<1	<1	4	0.8	0.22	9
2023-11-27 13:50	<1	<1	<1	<1	<2	0.73	0.21	8
2023-12-04 13:50	<1	<1	<1	<1	<2	0.57	0.19	8
2023-12-11 13:55	<1	<1	<1	<1	<2	0.7	0.13	8
2023-12-18 13:55	<1	<1	<1	<1	NA	0.74	0.2	8
2023-12-27 10:40	<1	<1	<1	<1	NA	0.58	0.21	8

Water Sampling | Type: GRAB | Station Number: RMD-271 | Address: 3800 Cessna Drive

Table with 11 columns: Sampled Date, Total Coliform (MPN/1000 ml), E. coli (MPN/1000 ml), HPC (CFU/ml), Chlorine Free (mg/l), Turbidity (NTU), Temperature (C). Rows contain sampling data from 2023-01-05 to 2023-12-27.

Water Sampling | Type: GRAB | Station Number: RMD-272 | Address: 751 Catalina Crescent

Table with 11 columns: Sampled Date, Total Coliform (MPN/1000 ml), E. coli (MPN/1000 ml), HPC (CFU/ml), Chlorine Free (mg/l), Turbidity (NTU), Temperature (C). Rows contain sampling data from 2023-01-03 to 2023-12-27.

Water Sampling | Type: GRAB | Station Number: RMD-273 | Address: Across from 8331 Fairfax Place

Table with 10 columns: Sampled Date, Total Coliform (MPN/1000 ml), Total Coliform (CFU/1000 ml), E. coli (MPN/1000 ml), E. coli (CFU/1000 ml), HPC (CFU/ml), Chlorine Free (mg/l), Turbidity (NTU), Temperature (C). Rows include dates from 2023-01-03 to 2023-12-27.

Water Sampling | Type: GRAB | Station Number: RMD-274 | Address: 10920 Springwood Court

Table with 10 columns: Sampled Date, Total Coliform (MPN/1000 ml), Total Coliform (CFU/1000 ml), E. coli (MPN/1000 ml), E. coli (CFU/1000 ml), HPC (CFU/ml), Chlorine Free (mg/l), Turbidity (NTU), Temperature (C). Rows include dates from 2023-01-03 to 2023-12-27.

Water Sampling | Type: GRAB | Station Number: RMD-275 | Address: 5180 Smith Crescent

Sampled Date	Total Coliform (MPN/1000 ml)	Total Coliform (CFU/1000 ml)	E. coli (MPN/1000 ml)	E. coli (CFU/1000 ml)	HPC (CFU/ml)	Chlorine Free (mg/l)	Turbidity (NTU)	Temperature (C°)
2023-01-06 10:55	<1	<1	<1	<1	<2	0.56	0.17	6
2023-01-12 11:15	<1	<1	<1	<1	<2	0.86	0.14	6
2023-01-20 10:45	<1	<1	<1	<1	<2	0.61	0.13	7
2023-01-26 10:55	<1	<1	<1	<1	<2	0.6	0.11	7
2023-02-03 10:55	<1	<1	<1	<1	<2	0.9	0.14	6
2023-02-09 10:45	<1	<1	<1	<1	<2	0.79	0.17	6
2023-02-17 10:45	<1	<1	<1	<1	<2	0.77	0.15	6
2023-02-23 10:55	<1	<1	<1	<1	<2	0.71	0.15	6
2023-03-03 11:15	<1	<1	<1	<1	<2	0.73	0.16	5
2023-03-09 10:45	<1	<1	<1	<1	210	0.71	0.11	6
2023-03-17 10:55	<1	<1	<1	<1	<2	0.68	0.16	6
2023-03-23 10:55	<1	<1	<1	<1	<2	0.69	0.17	6
2023-03-31 10:45	<1	<1	<1	<1	<2	0.74	0.19	7
2023-04-05 10:50	<1	<1	<1	<1	<2	0.77	0.16	8
2023-04-14 11:00	<1	<1	<1	<1	<2	0.66	0.16	8
2023-04-20 11:00	<1	<1	<1	<1	<2	0.67	0.12	7
2023-04-28 10:45	<1	<1	<1	<1	<2	0.91	0.13	8
2023-05-01 12:00	<1	<1	<1	<1	<2	0.61	0.13	9
2023-05-04 10:45	<1	<1	<1	<1	<2	0.62	0.18	9
2023-05-12 10:55	<1	<1	<1	<1	<2	0.62	0.33	10
2023-05-18 11:00	<1	<1	<1	<1	<2	0.68	0.35	10
2023-05-26 10:55	<1	<1	<1	<1	<2	0.73	0.23	10
2023-06-01 10:45	<1	<1	<1	<1	6	0.59	0.27	13
2023-06-09 10:55	<1	<1	<1	<1	6	0.7	0.26	13
2023-06-15 10:55	<1	<1	<1	<1	<2	0.66	0.21	13
2023-06-23 10:55	<1	<1	<1	<1	<2	0.74	0.19	13
2023-06-29 10:55	<1	<1	<1	<1	6	0.72	0.13	14
2023-07-07 10:45	<1	<1	<1	<1	8	0.66	0.39	15
2023-07-13 10:55	<1	<1	<1	<1	22	0.62	0.28	16
2023-07-21 10:55	<1	<1	<1	<1	12	0.61	0.16	15
2023-07-27 10:45	<1	<1	<1	<1	2	0.68	0.13	17
2023-08-04 11:10	<1	<1	<1	<1	18	0.58	0.17	16
2023-08-10 11:15	<1	<1	<1	<1	2	0.63	0.16	16
2023-08-18 11:00	<1	<1	<1	<1	10	0.68	0.53	18
2023-08-24 11:15	<1	<1	<1	<1	8	0.65	0.14	18
2023-09-01 10:45	<1	<1	<1	<1	8	0.61	0.33	16
2023-09-07 11:15	<1	<1	<1	<1	28	0.53	0.3	18
2023-09-15 11:15	<1	<1	<1	<1	8	0.67	0.31	18
2023-09-21 10:45	<1	<1	<1	<1	12	0.33	0.24	16
2023-09-29 10:55	<1	<1	<1	<1	22	0.4	0.17	16
2023-10-05 11:15	<1	<1	<1	<1	30	0.67	0.19	14
2023-10-13 11:10	<1	<1	<1	<1	22	0.44	0.15	14
2023-10-19 10:45	<1	<1	<1	<1	2	0.4	0.24	13
2023-10-27 10:55	<1	<1	<1	<1	6	0.64	0.11	11
2023-11-02 10:40	<1	<1	<1	<1	6	0.36	0.29	10
2023-11-10 10:45	<1	<1	<1	<1	<2	0.84	0.18	10
2023-11-16 10:55	<1	<1	<1	<1	<2	0.58	0.19	9
2023-11-24 10:55	<1	<1	<1	<1	4	0.54	0.14	9
2023-12-01 10:45	<1	<1	<1	<1	4	0.53	0.23	8
2023-12-08 10:55	<1	<1	<1	<1	<2	0.58	0.16	8
2023-12-14 10:45	<1	<1	<1	<1	NA	0.62	0.21	9
2023-12-20 15:45	<1	<1	<1	<1	NA	0.62	0.21	9
2023-12-28 11:30	<1	<1	<1	<1	NA	0.62	0.21	9

Water Sampling | Type: GRAB | Station Number: RMD-276 | Address: 22271 Cochrane Drive

Sampled Date	Total Coliform (MPN/1000 ml)	Total Coliform (CFU/1000 ml)	E. coli (MPN/1000 ml)	E. coli (CFU/1000 ml)	HPC (CFU/ml)	Chlorine Free (mg/l)	Turbidity (NTU)	Temperature (C°)
2023-01-06 10:40	<1	<1	<1	<1	<2	0.63	0.13	6
2023-01-12 11:00	<1	<1	<1	<1	<2	0.78	0.2	6
2023-01-20 10:30	<1	<1	<1	<1	<2	0.63	0.12	7
2023-01-26 10:40	<1	<1	<1	<1	<2	0.62	0.11	7
2023-02-03 10:40	<1	<1	<1	<1	<2	0.89	0.14	6
2023-02-09 10:30	<1	<1	<1	<1	2	0.82	0.16	6
2023-02-17 10:30	<1	<1	<1	<1	<2	0.72	0.13	6
2023-02-23 10:40	<1	<1	<1	<1	<2	0.73	0.12	7
2023-03-03 11:00	<1	<1	<1	<1	<2	0.7	0.17	5
2023-03-09 10:30	<1	<1	<1	<1	<2	0.71	0.1	6
2023-03-17 10:40	<1	<1	<1	<1	<2	0.65	0.21	6
2023-03-23 10:40	<1	<1	<1	<1	2	0.77	0.26	6
2023-03-31 10:30	<1	<1	<1	<1	<2	0.73	0.3	7
2023-04-05 10:35	<1	<1	<1	<1	2	0.76	0.14	8
2023-04-14 10:45	<1	<1	<1	<1	2	0.68	0.23	8
2023-04-20 10:45	<1	<1	<1	<1	<2	0.68	0.17	7
2023-04-28 10:30	<1	<1	<1	<1	<2	0.83	0.29	8
2023-05-04 10:30	<1	<1	<1	<1	2	0.61	0.24	9
2023-05-12 10:40	<1	<1	<1	<1	<2	0.79	0.19	10
2023-05-18 10:45	<1	<1	<1	<1	<2	0.7	0.48	10
2023-05-26 10:40	<1	<1	<1	<1	<2	0.64	0.18	10
2023-06-01 10:40	<1	<1	<1	<1	<2	0.56	0.16	13
2023-06-09 10:40	<1	<1	<1	<1	<2	0.67	0.18	12
2023-06-15 10:40	<1	<1	<1	<1	<2	0.58	0.34	13
2023-06-23 10:40	<1	<1	<1	<1	<2	0.79	0.18	13
2023-06-29 10:40	<1	<1	<1	<1	<2	0.65	0.09	15
2023-07-07 10:40	<1	<1	<1	<1	<2	0.62	0.13	15
2023-07-13 10:40	<1	<1	<1	<1	<2	0.64	0.18	15
2023-07-21 10:40	<1	<1	<1	<1	6	0.64	0.17	16
2023-07-27 11:00	<1	<1	<1	<1	<2	0.6	0.13	15
2023-08-04 10:55	<1	<1	<1	<1	6	0.7	0.14	17
2023-08-10 11:00	<1	<1	<1	<1	2	0.65	0.2	16
2023-08-18 10:40	<1	<1	<1	<1	14	0.63	0.17	16
2023-08-24 11:00	<1	<1	<1	<1	4	0.59	0.22	18
2023-09-01 10:30	<1	<1	<1	<1	8	0.65	0.09	18
2023-09-07 11:00	<1	<1	<1	<1	8	0.52	0.11	16
2023-09-15 11:00	<1	<1	<1	<1	8	0.48	0.14	18
2023-09-21 10:30	<1	<1	<1	<1	<2	0.72	0.2	17
2023-09-29 10:40	<1	<1	<1	<1	2	0.53	0.22	17
2023-10-05 11:00	<1	<1	<1	<1	<2	0.67	0.17	15
2023-10-13 10:55	<1	<1	<1	<1	<2	0.6	0.16	14
2023-10-19 10:30	<1	<1	<1	<1	6	0.54	0.15	13
2023-10-27 10:40	<1	<1	<1	<1	<2	0.58	0.14	11
2023-11-02 10:25	<1	<1	<1	<1	<2	0.73	0.14	11
2023-11-10 10:30	<1	<1	<1	<1	<2	0.55	0.27	11
2023-11-16 10:40	<1	<1	<1	<1	<2	0.66	0.13	10
2023-11-24 10:40	<1	<1	<1	<1	<2	0.59	0.18	10
2023-12-01 10:30	<1	<1	<1	<1	<2	0.64	0.19	9
2023-12-08 10:40	<1	<1	<1	<1	2	0.67	0.32	8
2023-12-14 10:30	<1	<1	<1	<1	8	0.63	0.16	8
2023-12-20 15:30	<1	<1	<1	<1	NA	0.68	0.15	8
2023-12-28 11:15	<1	<1	<1	<1	NA	0.65	0.15	9

Water Sampling | Type: GRAB | Station Number: RMD-277 | Address: 11280 Twigg Place

Table with 11 columns: Sampled Date, Total Coliform (MPN/1000 ml), E. coli (CFU/1000 ml), HPC (CFU/ml), Chlorine Free (mg/l), Turbidity (NTU), Temperature (C°), Total Coliform (CFU/1000 ml), E. coli (MPN/1000 ml), HPC (CFU/ml), Chlorine Free (mg/l), Turbidity (NTU), Temperature (C°)

Water Sampling | Type: GRAB | Station Number: RMD-278 | Address: 6651 Fraserwood Place

Table with 11 columns: Sampled Date, Total Coliform (MPN/1000 ml), E. coli (CFU/1000 ml), HPC (CFU/ml), Chlorine Free (mg/l), Turbidity (NTU), Temperature (C°), Total Coliform (CFU/1000 ml), E. coli (MPN/1000 ml), HPC (CFU/ml), Chlorine Free (mg/l), Turbidity (NTU), Temperature (C°)

Appendix B | 2023 Trihalomethanes (THMs) and Haloacetic Acids (HAAs) Test Results

THM (ppb) Sample	Sampled Date	Bromochloromethane	Bromoform	Chlorodibromomethane	Chloroform	Total Trihalomethanes	Total THM Quarterly Average (Guideline Limit 100 ppb)
RMD 250	2022-11-17	2	<1	<1	28	30	26
	2023-02-02	<1	<1	<1	47	47	33
	2023-06-01	<1	<1	<1	22	24	31
	2023-08-28	1	<1	<1	29	30	34
RMD 251	2023-11-29	<1	<1	<1	33	35	36
	2022-11-17	2	<1	<1	27	29	25
	2023-02-02	<1	<1	<1	47	47	32
	2023-06-01	<1	<1	<1	21	23	30
RMD 258	2023-08-28	<1	<1	<1	26	27	33
	2023-11-29	<1	<1	<1	33	34	35
	2022-11-17	2	<1	<1	28	30	29
	2023-02-02	<1	<1	<1	58	59	39
RMD 259	2023-06-01	<1	<1	<1	24	26	36
	2023-08-28	1	<1	<1	33	35	38
	2023-11-29	<1	<1	<1	37	38	43
	2022-11-17	2	<1	<1	32	34	32
RMD 259	2023-02-02	<1	<1	<1	54	55	40
	2023-01-06	<1	<1	<1	23	25	36
	2023-08-28	1	<1	<1	32	33	38
	2023-11-29	<1	<1	<1	38	40	40

HAA (ppb) Sample	Dibromoacetic Acid	Dichloroacetic Acid	Monobromoacetic Acid	Monochloroacetic Acid	Trichloroacetic Acid	Total Haloacetic Acid	Total HAA Quarterly Average (Guideline Limit 40 ppb)
RMD 250	<0.5	7.3	<0.5	0.8	6	14	14
	<0.5	9.8	<0.5	0.8	7	17	15
	<0.5	12	<0.5	1.9	8	22	17
	<0.5	8.2	<0.5	1.1	5.6	15	18
RMD 251	<0.5	13	<0.5	1	8.3	22	20
	<0.5	6.9	<0.5	<0.5	5	12	13
	<0.5	9.3	<0.5	1.1	6	16	14
	<0.5	11	<0.5	<0.5	7	18	15
RMD 258	<0.5	8	<0.5	1.3	5.2	14	15
	<0.5	12	<0.5	0.5	8	21	17
	<0.5	6.9	<0.5	0.6	6	14	16
	<0.5	12	<0.5	0.8	9	21	18
RMD 259	<0.5	6.5	<0.5	<0.5	8.1	15	19
	<0.5	14	<0.5	1.1	9	24	21
	<0.5	6.7	<0.5	0.6	5.7	13	17
	<0.5	11	<0.5	1.1	8.4	20	18
RMD 259	<0.5	12	<0.5	<0.5	7.5	19	18
	<0.5	9	<0.5	<0.5	7.9	17	17
	<0.5	13	<0.5	0.8	9.2	23	20
	<0.5	9	<0.5	<0.5	7.9	17	17

Appendix C | 2023 Metal Level Guidelines

Parameter	Canadian Guideline Limit	Reason Guideline Established	Guideline Recently Updated
Aluminum Total (µg/L)	2000	Health	2021
Antimony Total (µg/L)	6	Health	
Arsenic Total (µg/L)	10 (ALARA)	Health	
Barium Total (µg/L)	2000	Health	2020
Boron Total (µg/L)	5000	Health	
Cadmium Total (µg/L)	7	Health	2020
Calcium Total (µg/L)	none		
Chromium Total (µg/L)	50	Health	2018
Cobalt Total (µg/L)	none		
Copper Total (µg/L)	2000	Health	2019
Iron Total (µg/L)	≤ 300	Aesthetic	
Lead Total (µg/L)	5 (ALARA)	Health	2019
Magnesium Total (µg/L)	none		
Manganese Total (µg/L)	120	Health	2019
Mercury Total (µg/L)	1.0	Health	
Molybdenum Total (µg/L)	none		
Nickel Total (µg/L)	none		
Potassium Total (µg/L)	none		
Selenium Total (µg/L)	50	Health	
Silver Total (µg/L)	none		
Sodium Total (µg/L)	≤ 200,000	Aesthetic	
Zinc Total (µg/L)	≤ 5000	Aesthetic	



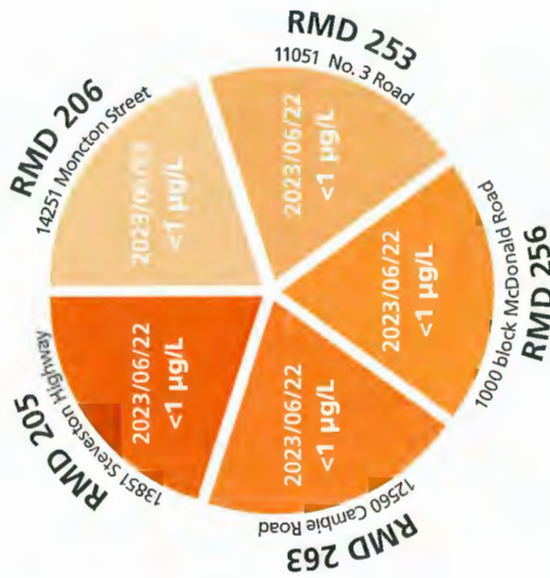
Appendix D | 2023 Metal Testing Results

Analysis	Units			RMD 263 12560 Camden Road 2023/9/13
	RMD 250 6071 Azul Road 2023/9/13	RMD 257 6640 Blundell Road 2023/9/13	RMD 263 12560 Camden Road 2023/9/13	
Aluminum Total	33	33	41	
Antimony Total	<0.5	<0.5	<0.5	
Arsenic Total	<0.5	<0.5	<0.5	
Barium Total	3.1	3.2	2.9	
Boron Total	<10	<10	<10	
Cadmium Total	<0.2	<0.2	<0.2	
Calcium Total	8130	8440	6300	
Chromium Total	<0.05	<0.05	<0.05	
Cobalt Total	<0.5	<0.5	<0.5	
Copper Total	0.7	0.7	0.8	
Iron Total	8	8	21	
Lead Total	<0.5	<0.5	<0.5	
Magnesium Total	212	218	183	
Manganese Total	6.5	6.7	7.6	
Mercury Total	<0.05	<0.05	<0.05	
Molybdenum Total	<0.5	<0.5	<0.5	
Nickel Total	<0.5	<0.5	<0.5	
Potassium Total	205	211	191	
Selenium Total	<0.5	<0.5	<0.5	
Silver Total	<0.5	<0.5	<0.5	
Sodium Total	2450	2480	4040	
Zinc Total	<3.0	<3.0	<3.0	

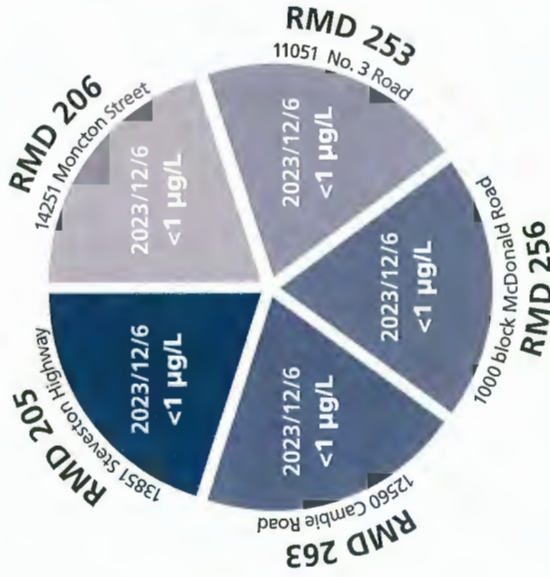


Appendix E | 2023 Vinyl Chloride Results

June 2023



November 2023



Appendix F | Water Quality Testing Parameters

Weekly sampling is conducted at 40 specific locations throughout the City of Richmond. Sample testing is conducted at Metro Vancouver laboratories to ensure the City's drinking water meets the standards and parameters outlined in the British Columbia Drinking Water Protection Act. Testing is based on the parameters outlined below. Detailed testing results based on these parameters are included in Appendices A through G.

1. Bacterial Parameters

The City of Richmond and Metro Vancouver conduct bacteriological tests for total coliform, fecal coliform and heterotrophic plate counts (HPC). The presence of these organisms in drinking water indicates that the water may be contaminated and may contain potentially harmful bacteria, viruses or parasites.

TOTAL COLIFORMS

Total coliform bacteria reproduce in water, soil or digestive systems of animals. The presence of total coliforms indicates water may have been contaminated or that the disinfection process is inadequate. The number, frequency and location of samples for total coliform testing will vary depending on the type and size of the system and jurisdictional requirements. Provincial standards state that no sample contain more than 10 total coliforms per 100 ml, and that 90% of samples must have zero coliform bacteria in a sample over a 30-day period.

FECAL COLIFORMS

Fecal coliforms are present in large numbers in the feces and intestinal tracts of humans and other warm-blooded animals, and can enter bodies of water and water systems through contamination by human and animal waste. Due to the high risk of diseases and parasites, provincial standards state there can be no detectable fecal coliforms per 100 ml sample.

HETEROTROPHIC PLATE COUNT

HPC tests measure the level of the heterotrophic microorganism population in the City's drinking water. HPC tests indicate the presence of nutrients that could facilitate the growth of harmful bacteria, and can be a sign of changes in water quality if levels are elevated during treatment and distribution. Higher than normal HPC levels inform operators that there is an unusual increase of stagnant water or low chlorine residuals in the water mains. By reducing the HPC levels through our flushing programs, the possibility of bacteriological growth is decreased because the pipes become an inhospitable environment for bacteria to thrive. The small amount of free chlorine residual in our water also disinfects and eliminates harmful substances within our distribution system.

2. Chemical Parameters

Testing is done for chemicals in the water to ensure the proper amount of chlorine is in the system, to confirm that by-products from the disinfection process do not remain in the water, and to ensure that naturally occurring chemicals in the water are at acceptable levels.

CHLORINE RESIDUAL

Chlorine residual is a measurement of the free chlorine remaining in the distribution system at the point of delivery to the customer. Chlorine is added to our drinking water by Metro Vancouver as part of the disinfection process to prevent bacterial growth during distribution. When the source takes experience high turbidity (e.g., during a storm), Metro Vancouver will increase the chlorine that is added to the water at their plants to ensure that the water quality is maintained despite the higher-than-desired turbidity. Typically, the slightly higher concentration of free chlorine in the system dissipates by the time it reaches our system. Sometimes the higher concentration remains in the system and can cause a chlorine taste and smell in the water. Despite the increased chlorine, the water is still safe to drink.

There also needs to be a minimum level of chlorine residual to protect Richmond's water supply from bacteriological contamination or growth. The minimum parameter for free chlorine residual in the water is 0.2 mg/L. In recent years, the City has made great progress in improving chlorine residuals by executing our annual flushing program to clean and flush the water mains.

DISINFECTION BY-PRODUCTS

Disinfection by-products are potentially harmful compounds produced by the reaction of a water disinfectant (such as chlorine or ozone) with naturally occurring organic matter in water. Two common chlorination by-products are trihalomethanes (THMs) and haloacetic acids (HAAs).

THMs that are present in drinking water can enter the human body via multiple routes of exposure. These include

ingestion by consuming water and inhalation, and skin absorption from showering and bathing. Under the Guidelines for Canadian Drinking Water Quality (GCDWQ), the maximum acceptable concentration for THMs is 100 parts per billion (ppb). The maximum level for THMs is based on a running annual average of samples taken every three months. High levels on a particular day are not of concern unless they are consistently high over the latest four samples. Typically, THM levels will be highest in the summer and lowest in the winter months.

Under the GCDWQ, the maximum acceptable concentration for HAAs is 80 ppb. Like THMs, HAAs are also monitored quarterly and are calculated on a running annual average of samples taken every three months.

The City utilizes the Metro Vancouver laboratory to perform quarterly tests for HAAs and THMs. These were carried out at representative sampling sites in accordance with a joint Metro Vancouver and City of Richmond monitoring plan.

ACIDITY (PH VALUE)

The measurement of acidity is known as pH. A pH below 7.0 is considered acidic, above 7.0 is considered basic and 7.0 is neutral. It is recognized that acidic water will accelerate the corrosion of metal pipes, often causing blue-green staining in household fixtures.

The acidity of our water is controlled by Metro Vancouver. The Seymour-Capilano filtration plant includes pH adjustment and corrosion control in its treatment processes. It is expected that the pH of drinking water will rise in the coming years as the filtration plant reaches its full capacity. Since natural acidity in water corrodes metal pipes over time, the pH increase will extend the lifespan of water plumbing systems and enhance water quality.

METALS

The City's water quality program also includes testing for metals that can be present in natural water sources like copper, iron, lead and zinc.

3. Physical Parameters

The water in Richmond's distribution system is tested for turbidity and temperature on a weekly basis. Information is also collected on the taste and odour of Richmond's water by actively tracking water quality complaints.

TURBIDITY

Turbidity is a measure of water clarity and cloudiness in the water, and is caused by dissolved substances that are present in the water. Turbidity is measured in Nephelometric Turbidity Units (NTU). The guideline for turbidity should not exceed 5 NTUs in a distribution system providing that source water protection, monitoring and... water treatment requirements are met, including increased levels of residual chlorine. Turbidity is a concern because increased turbidity compromises the drinking water disinfection process and can allow microbes to grow or indicate that there is a presence of microbes in the system. In general, sites with elevated turbidity are located in sections of the distribution network where there is low demand on the water system or where dead-end water mains exist. The increase may be attributed to sediment disturbance in the distribution system.

TEMPERATURE

High temperatures in the distribution system can affect the amount of chlorine residual and can contribute to bacterial growth. Typically, the temperature of drinking water in the distribution system rises during summer months.

TASTE AND ODOUR

Taste and odour are monitored through customer complaints. If the water quality meets all the other parameters set out in this report, the taste and odour of the water should not change. Most of the time the different taste and odour will be the result of an increase in free chlorine, which is safe to drink. However, it's important for the City and Water Services staff to track and react to complaints because it could mean that contamination has occurred somewhere in the system.

Staff checking the water temperature before collecting a water sample.



Appendix G | Water Sampling Sites

MONDAY	
RMD-250	6071 Azure Road
RMD-251	5951 McCallan Road
RMD-252	9751 Pendleton Road
RMD-253	11051 No. 3 Road
RMD-254	5300 No. 3 Road
RMD-255	6000 block Miller Road
RMD-256	1000 block McDonald Road
RMD-269	14951 Triangle Road
RMD-270	8200 Jones Road
RMD-271	3800 Cesena Drive
RMD-272	751 Catalina Crescent
RMD-273	Across from 8331 Fairfax Place
RMD-274	10920 Springwood Court

WEDNESDAY	
RMD-257	6640 Blundell Road
RMD-258	7000 block Dyke Road
RMD-259	10020 Amethyst Avenue
RMD-260	11111 Horseshoe Way
RMD-261	9911 Sidaway Road
RMD-262	13799 Commerce Parkway
RMD-263	12560 Cambie Road
RMD-264	13100 Mitchell Road
RMD-266	9380 General Currie Road
RMD-268	13800 No. 3 Road
RMD-277	Across from 11280 Twigg Place
RMD-278	6651 Fraserwood Place
RMD-279	Across from 20371 Westminster Highway

FRIDAY	
RMD-202	1500 Valmont Way
RMD-203	23260 Westminster Highway
RMD-204	3180 Granville Avenue
RMD-205	13851 Steveston Highway
RMD-206	4251 Moncton Street
RMD-208	13200 No. 4 Road
RMD-212	Across from 8600 Ryan Road
RMD-214	11720 Westminster Highway
RMD-216	11080 No. 2 Road
RMD-249	23000 block Dyke Road
RMD-267	17240 Fedoruk Road
RMD-275	5180 Smith Crescent
RMD-276	22271 Cochrane Drive
RMD-280	11500 McKenzie Road



Staff with a vial of water ready to be tested.

Appendix H | Specific Emergency Response Plans

Specific Emergency Response Plans

Positive Response for E. Coli or Fecal Coliform

In the event of possible E. coli or fecal coliform contamination, all steps to ensure public health and safety will be taken, including banning water usage if necessary. If a water sample tests positive for fecal coliform, the following response plan will occur:

- The City of Richmond's water quality staff, the Drinking Water Officer and the Medical Health Officer will be notified by the Metro Vancouver laboratory.

- Interim samples from the site will be examined. Interim samples are samples in the period between when the fecal positive sample was taken and when it was determined to be fecal positive.

- Arrangements will be made for the immediate collection of a repeat sample including, where possible, samples from upstream and downstream sources of the fecal-positive sample.

- Chlorine residual for the sample noted on the sampler's data sheet will be reviewed to determine if a localized loss of disinfectant occurred.

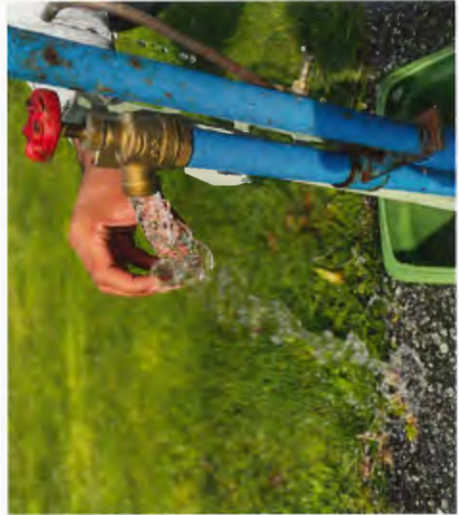
- Water Services staff will be contacted to determine if there was any loss of pressure or other unusual events that may have led to contaminants entering the system.

- The need for a boil-water advisory will be evaluated by the City, the Drinking Water Officer and the Medical Health Officer. If a boil water advisory is deemed necessary, the municipality will carry out various means to inform the public. Metro Vancouver will be informed of this public advisory.

- The City, in consultation with the Medical Health Officer, will determine the need and extent for a boil water advisory.

- The Metro Vancouver laboratory will initiate procedures to identify species of the fecal positive organism with standard biochemical tests.

- The Medical Health Officer will be contacted with the repeat sample results and the results of the species identification on the fecal positive sample when these tests are complete.



Staff collecting a water sample in a vial for testing.

Chemical or Biological Contamination Response

In the event of chemical or biological contamination in source waters or the City's distribution system, the following actions will be taken by the City of Richmond and Metro Vancouver:

- Immediately notify Vancouver Coastal Health.
- Identify the chemical and any public health risk factors associated with its presence in potable water.
- Isolate the contaminated zone area and determine the level of contamination.
- Issue a public advisory in consultation with the Drinking Water Officer and Medical Health Officer.
- In the event of possible biological or chemical contamination, all steps to safety will be taken to ensure public health, including banning water usage if necessary.

Turbidity Response

Turbidity (cloudy water) occurs during periods of heavy rain at and surrounding Metro Vancouver water sources. The City of Richmond, in collaboration with Vancouver Coastal Health, developed a turbidity response plan, which considers the City's responsibility for due diligence without unreasonably constraining the water utility's ability to operate the system.

Should there be a turbidity event, the results will be assessed and staff will:

- begin a rigorous sampling program for microbiological activity and residual chlorine;
- monitor the City's supervisory control and data acquisition (SCADA) system with updates sent to Vancouver Coastal Health on a predetermined schedule;
- flush areas and re-test; and
- if necessary (in consultation with Vancouver Coastal Health), issue a public communication and issue a boil-water advisory to residents receiving turbid water.

Response to Interruption of Primary and/or Secondary Disinfection

Upon notification by Metro Vancouver Operations that an interruption in disinfection has occurred, City staff implement several response measures.

- Staff will monitor residual levels of chlorine at strategic locations in the Metro Vancouver supply area.
- The City's SCADA system will be monitored with updates sent to Vancouver Coastal Health on a predetermined schedule, as set by the health authority.
- In cases where chlorine residual is less than 0.2 ppm, City crews will flush the affected area until an acceptable level is achieved.

These actions will continue until disinfection is resumed and adequate levels of residual chlorine have been reached in the distribution system.

Response to Loss of Pressure Due to High Demand

Staff implement several response measures in the event of a pressure loss due to high demand.

- City staff will attempt to rectify the problem as soon as possible using various demand management techniques and by supplementing supply to problem areas.
- Metro Vancouver, the Drinking Water Officer and the Medical Health Officer will be notified of any water quality issues.
- City staff will perform chlorine residual tests at various locations to determine if adequate disinfectant is present in the distribution.

All water quality complaints from the public will be thoroughly investigated due to the potential for water contamination during low water pressure.

RESPONSE TO WATERMAIN BREAKS WITH SUSPECTED CONTAMINATION

- All watermain breaks where chemical or microbiological contamination of the system are suspected will be immediately reported to the Drinking Water Officer and the Medical Health Officer.
- The municipality will isolate the contaminated section from the rest of the distribution system. Once the watermain has been repaired, chlorine residual testing will be conducted at various locations affected by the main break.

If low chlorine residuals are found, necessary actions to increase the levels of free chlorine will be carried out. If bacterial contamination is suspected, water samples will be analyzed and appropriate action taken.

Appendix I | References

1. Government of Canada – Canadian Drinking Water Guidelines – www.hc-sc.gc.ca/ewh-semt/water-eau/drink-potab/index_e.html
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3. BC Laws – Schedule A Water Quality Standard for Potable Water www.bclaws.ca/EPLibraries/bclaws_new/document/ID/freeside/200_2003#ScheduleA
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