



Saanich Water Distribution System 2022 Annual Water Quality Report

Table of Contents

Table of Contents..... 2

1.0 Introduction 3

2.0 Water System Description 3

3.0 Water Quality Regulations..... 4

4.0 Water Quality Monitoring 5

5.0 Bacteriological and Physical Water Quality Results 5

 5.1 Escherichia coli (*E. coli*)..... 5

 5.2 Total Coliforms..... 6

 5.3 Chlorine Residual 7

 5.4 Water Temperature..... 8

 5.5 Turbidity..... 9

6.0 System Maintenance 10

 6.1 Unidirectional Flushing Program 10

 6.2 Monthly Flush Program..... 12

 6.3 Automatic Flush Valve Locations 13

 6.4 Valve Maintenance 13

 6.5 Hydrant Maintenance..... 14

7.0 Summary..... 14

Appendices

Appendix A - Map 3 Saanich Water Pressure Zones & Water Mains 2023..... 15

Appendix B - References..... 16

List of Figures

Figure 1 - 2022 Monthly Median Chlorine Residual..... 8

Figure 2 - 2022 Monthly Median Water Temperature (degrees Celsius) 9

Figure 3 - Example of an Autoflush location 13

List of Tables

Table 1 - Water Quality Standards for Potable Water – BCDWPR & GCDWQ..... 4

Table 2 - Frequency of Monitoring Samples for Prescribed Water Supply Systems - BCDWPR 4

Table 3 - District of Saanich Frequency of Sampling as per Schedule B of BCDWPR 5

Table 4 - Saanich Distribution System Bacteriological Water Quality 2022 7

Table 5 - Saanich Distribution System Turbidity, Chlorine Residual, and Water Temperature 2022 10

Table 6 - Kilometers of Water Main Flushed by Year 11

List of Maps

Map 1 - 2022 Spring Flushing Areas..... 11

Map 2 - 2022 Fall Flushing Areas 12

Map 3 - Saanich Water Pressure Zones & Water Mains 2023..... 15



1.0 Introduction

This report is the 2022 annual overview of the results from water quality samples collected from the Saanich Drinking Water System (Map 3). The report summarizes data from District of Saanich owned and operated infrastructure with sample locations including reservoirs, pump stations, pressure regulating stations and locations from the distribution system. The parameters that are routinely monitored in the distribution systems for determining the microbiological quality of the drinking water are *E. coli*, total coliforms, turbidity, and chlorine residual. The water samples are collected by the Capital Regional District (CRD) water quality staff and analytical testing is performed at the CRD Water Quality Lab. Monthly and weekly water quality test result summary reports are posted on the CRD's website at: www.crd.bc.ca/about/data/drinking-water-quality-reports

2.0 Water System Description

The District of Saanich purchases bulk water from the Capital Regional District (CRD) Integrated Water Services. The bulk water primarily originates from the Sooke Lake Reservoir. Once a year, usually in December, the CRD supplies water from their Goldstream water source while performing maintenance on the Sooke Lake Reservoir. The water travels from Sooke Lake Reservoir to Saanich through several transmission mains. These mains are shown on the Saanich Water Pressure Zones & Water Mains 2023 Map (Appendix A). Saanich is supplied by CRD Transmission Mains No. 1, 3, and 4.

There are 19 water connections from the CRD transmission system into the Saanich distribution system.

The Saanich Distribution system consists of 31 different pressure zones where source water comes directly from a Capital Regional District supply main or from another Saanich pressure zone.

The distribution system consists of 18 pumping stations, 49 pressure reducing stations, and 4 water reservoirs.

The Saanich Distribution System reservoirs are used to store and supply drinking water but also provide system balancing and fire and emergency storage. Listed from largest to smallest:

- | | |
|----------------------------|--|
| 1. Rithet Reservoir: | 15,750 m ³ (3,464,516 imperial gallons) |
| 2. Mount Tolmie Reservoir: | 4,063 m ³ (893,735 imperial gallons) |
| 3. Wesley Reservoir: | 2,632 m ³ (578,959 imperial gallons) |
| 4. Hartland Reservoir: | 797 m ³ (175,316 imperial gallons) |

3.0 Water Quality Regulations

The District of Saanich Water Distribution System must comply with the British Columbia Drinking Water Protection Act (BCDWPA) and Drinking Water Protection Regulation (BCDWPR) as well as follow federal Guidelines for Canadian Drinking Water Quality (GCDWQ).

The water quality standards for potable water systems are shown in Schedule A of the British Columbia Drinking Water Protection Regulation and in the Guidelines for Canadian Drinking Water Quality Summary Table. These standards are provided in Table 1 of this report:

Table 1 - Water Quality Standards for Potable Water – BCDWPR & GCDWQ

Parameter:	Standard:
<i>Escherichia coli</i>	No detectable <i>Escherichia coli</i> per 100 ml
Total coliform bacteria	
(a) 1 sample in 30 day period	No detectable total coliform bacteria per 100 ml
(b) More than 1 sample in a 30 day period	At least 90% of samples have no detectable total coliform bacteria per 100 ml and no sample has more than 10 total coliform bacteria per 100 ml
	No detectable total coliform from consecutive samples from the same site

Schedule B of the BCDWPR requires the number of water samples collected to correspond with population size as shown in Table 2:

Table 2 - Frequency of Monitoring Samples for Prescribed Water Supply Systems - BCDWPR

Population Served by the Prescribed Water Supply System:	Number of Samples Per Month:
Less than 5,000	4
5,000 to 90,000	1 per 1,000 population
More than 90,000	90 plus 1 per 10,000 population in excess of 90,000

4.0 Water Quality Monitoring

The population of Saanich is approximately 117,735 (based on 2021 Census data). Based on Schedule B of the BCDWPR, Saanich is required to collect 93 compliance samples per month. In 2022, a total of 1171 samples were collected from 64 dedicated sampling stations within Saanich. The requirements from Schedule B of the BCDWPR and the actual samples taken from the Saanich Distribution System are summarized in Table 3.

Table 3 - District of Saanich Frequency of Sampling as per Schedule B of BCDWPR

Year	Population	Number of Sample sites	Required Number of Samples per Month ¹	Actual	
				Average Number of Samples Per Month Collected	Number of Samples Per Year Collected
2022	117,735	64	93	97.6	1,171

¹ Minimum number of samples per month required by Schedule B of BCDWPR and Island Health Drinking Water Officer

In 2022, the water quality samples were collected by Capital Regional District staff for compliance each month. The monthly average number of samples has exceeded minimum requirements of 93 samples per month as shown in Table 3.

5.0 Bacteriological and Physical Water Quality Results

Microbiological pathogens are considered to be the most significant threat to public drinking water affecting the public's health. The effects of microbiological pathogens are acute. If they are ingested, pathogens can give people gastro-intestinal illness within a matter of hours or days; some severe cases can cause acute illness or even be fatal.

5.1 Escherichia coli (*E. coli*)

E. coli is used as an indicator of the microbiological safety of drinking water. *E. coli* is a member of the coliform group of bacteria that is naturally found in the intestines of humans and warm blooded animals. No detectable presence in a 100ml water sample is the maximum acceptable concentration (MAC) for potable water. Monitoring for *E. coli* provides information on the microbial condition of the distribution system. The presence of *E. coli* indicates recent fecal contamination and the potential presence of microorganisms capable of gastrointestinal illnesses. The absence of *E. coli* in drinking water generally indicates that the water system is free of gastrointestinal illness causing bacteria.

If *E. coli* is detected in a water sample, the BCDWPA stipulates that the lab conducting the analysis (CRD) must notify the water supplier (Saanich), the Drinking Water Officer, and the Medical Health Officer. In turn, Saanich must also immediately notify the Drinking Water Officer and the Medical Health Officer. Together, an assessment will be made of the possible health risk to the public and the most effective means to protecting the public. The assessment will take into account past water samples, the temperature, turbidity, chlorine residual of the water sample as well as operational changes or disturbances creating low pressures and other relevant information. The water will be resampled immediately. If the risk assessment deems the water system is operating as expected, a decision may be made to wait for results from the second water sample to determine if further action is required.

In 2022, there were 1,171 water samples taken with no samples resulting in an *E.coli* positive result.

5.2 Total Coliforms

Coliform bacteria are used as operational indicators in water distribution systems. Their presence indicates water quality has degraded, possibly by bacterial regrowth or system contamination. Alternatively, coliform bacteria positive samples can also indicate contamination during sample collection.

Monitoring for total coliforms allows for the detection of changing conditions, intrusion of contaminants, or areas of reduced water quality, which can then be investigated, and corrective actions determined.

In 2022, there were 1,171 water samples taken with 3 testing positive for total coliforms and one of the positive samples exceeding the 10 CFU/100 ml total coliform concentration standard. The sampling stations that tested positive were immediately retested and subsequent results showed no total coliforms present. This likely is an indication that the positive samples were contaminated during original sample collection. There were no consecutive samples from the same sample site showing total coliforms which is in compliance with the BCDWPR. The remaining 1,168 water samples tested met the BCDWPR standard and Canadian Drinking Water Quality Guidelines.

In August of 2022, Saanich Water Distribution system did not comply with the BCDWPR as one sample exceeded 10 Total coliform per 100 ml. However, the annual average total coliform percentage positive was well below the 10% threshold limit at 0.25% as demonstrated in Table 4.

Table 4 - Saanich Distribution System Bacteriological Water Quality 2022

Month	Bacterial Water Samples Collected	Total Coliforms				E.coli Samples > 0 CFU/100ml
		Samples TC > 0 CFU/100ml	TC > 0 Percent	Resamples TC > 0 CFU/100ml	Samples TC > 10 CFU/100ml	
January	95	0	0.0	0	0	0
February	94	0	0.0	0	0	0
March	100	0	0.0	0	0	0
April	96	0	0.0	0	0	0
May	96	0	0.0	0	0	0
June	101	1	1.0	0	0	0
July	98	1	1.0	0	0	0
August	99	1	1.0	0	1.0	0
September	99	0	0.0	0	0	0
October	96	0	0.0	0	0	0
November	101	0	0.0	0	0	0
December	96	0	0.0	0	0	0
Total	1171	3	0.25	0	1.0	0

5.3 Chlorine Residual

Chlorine is used to treat the raw water from Sooke Lake to produce potable, disinfected water. The chlorine residual in the drinking water post treatment is there to safeguard against microbial regrowth or contamination in the water distribution system. Monitoring the chlorine residual in the drinking water gives valuable information on the quality of the water currently in the system. A stable chlorine residual indicates that there is no microbial regrowth in the system. Alternately, if the chlorine residual were to suddenly decrease or disappear altogether would indicate that something has changed in the system and further investigation is needed to determine the cause and ensure that there has not been a contamination event somewhere in the water system.

The annual median chlorine residual in the Saanich Water Distribution System was 1.44 mg/L (Table 5). The lowest monthly median was in October (1.28 mg/L) and the maximum monthly median was in December (1.59 mg/L) (Figure 1). The recommended acceptable range concentration for chlorine in drinking water is 0.2 mg/L - 3.0 mg/L.

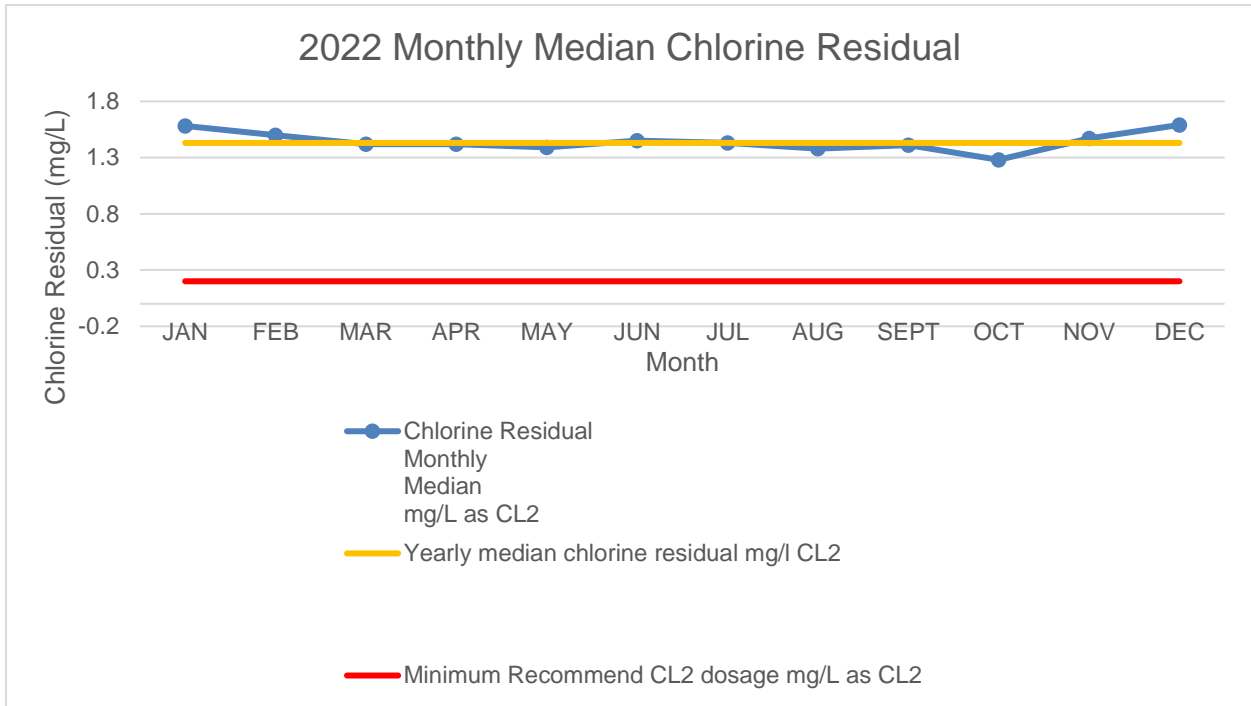


Figure 1 - 2022 Monthly Median Chlorine Residual

5.4 Water Temperature

The CRD’s Sooke Lake Reservoir is a surface raw water source subject to a wide seasonal variation in ambient temperatures which affects the water temperature within the Saanich Distribution System. Guidelines for Canadian Drinking Water Quality classify temperature as being an aesthetic objective. Preferably, the drinking water temperature would be $\leq 15^{\circ}\text{C}$. Aesthetic objective limits apply to certain characteristics of the drinking water that can lower user acceptance due to the perceived palatability of the water. Temperatures above 15°C in the water system can lead to unpleasant tastes and odours. From a consumer perspective, cool water tastes better than warm water.

The annual median water temperature in the Saanich Water Distribution System was 11.3°C . Monthly medians ranged from 6.0°C in January to 18.2°C in September (Figure 2). Drinking water temperatures in the Saanich Distribution System were below the Aesthetic Objective limit for most of the year except during the three summer months from July to September. This was due to the unseasonably warm weather and lack of precipitation during this period, resulting in elevated source water temperature, and subsequently elevating the temperature in the water distribution system.

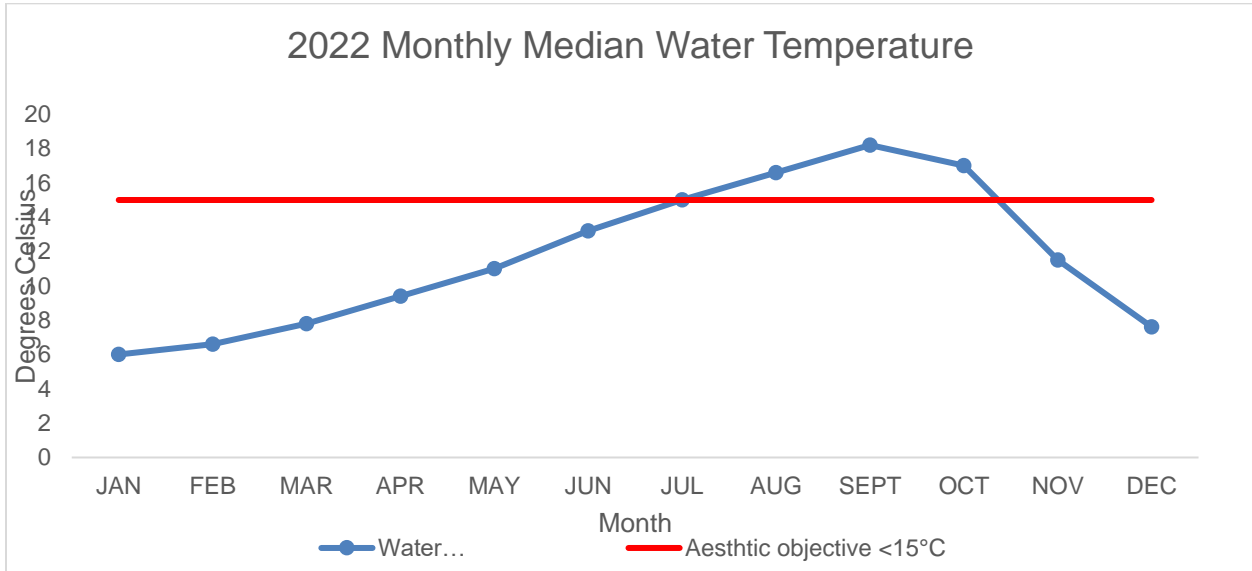


Figure 2 - 2022 Monthly Median Water Temperature (degrees Celsius)

5.5 Turbidity

Turbidity refers to the suspension of small particles of sediment or organic matter within water that causes a cloudy appearance. Turbidity is measured by the amount of light scattered by the particles within the water sample. Turbidity is measured in nephelometric turbidity units (NTU). Guidelines for Canadian Drinking Water Quality recommends that water entering a water distribution system have turbidity of 1.0 NTU or less.

In 2022, there were 62 turbidity samples taken at various locations within the distribution system with 1 sample in May and another in July exceeding the guideline parameters. When localized turbidity events occur, they are likely caused by water main flushing activities, fire hydrant use, and/or hydraulic changes due to construction or maintenance activities. The resulting discolouration or cloudiness can be an aesthetic concern to customers. Turbidity events are generally temporary and flushing of domestic cold-water taps can clear up the water.

Table 5 - Saanich Distribution System Turbidity, Chlorine Residual, and Water Temperature 2022

Month	Turbidity		Chlorine Residual Monthly Median mg/l as CL2	Water Temperature Monthly Median Degrees C
	Samples Collected	Adverse > 1 NTU		
January	3	0	1.58	6.0
February	5	0	1.50	6.6
March	5	0	1.42	7.8
April	4	0	1.42	9.4
May	6	1	1.39	11.0
June	6	0	1.45	13.2
July	6	1	1.43	15.0
August	6	0	1.38	16.6 ¹
September	4	0	1.41	18.2 ¹
October	6	0	1.28	17.0 ¹
November	7	0	1.47	11.5
December	4	0	1.59	7.6
Total or Median	62	2	1.44	11.3

¹ Exceeded Canadian Drinking Water Quality guideline parameter of $\leq 15^{\circ}\text{C}$

6.0 System Maintenance

Saanich undertakes daily, monthly, and annual maintenance functions to ensure that the drinking water system and its components are in good working order. These ongoing maintenance functions help to ensure system reliability and that the components have the longest service life possible, limiting unplanned customer service disruptions.

6.1 Unidirectional Flushing Program

Saanich operates an annual Unidirectional Flushing Program to remove sediment and biofilm from the water mains to maintain good water quality. Unidirectional flushing involves isolating segments of the water system by closing valves to flush sequentially from the source to periphery of the system.

Removing sediment and biofilm is important as sediment in water mains gives bacteria a place to live and inhibits contact with the chlorine residual. Sediment also reduces the flow capacity of the pipe network and sediment, and biofilm may get disturbed if normal flow patterns change during fire hydrant use or construction work. Flushing out the sediment on an annual basis helps maintain proper flow and reduce dirty water complaints and reduce the opportunity for non-compliant water quality test results.

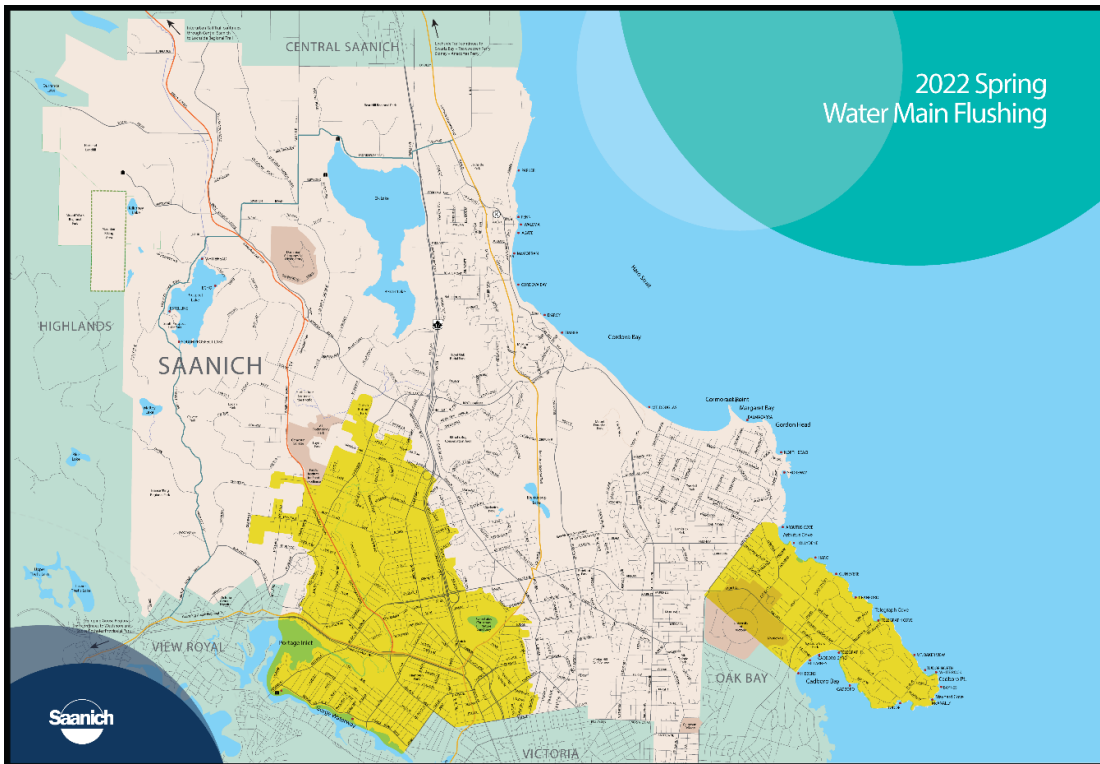
The Saanich water distribution system consists of over 540 km of pipe. During the 2022 Unidirectional Flushing Program, 241.8 km of water mains were flushed. Due to the size of the distribution system, it typically takes two years to complete the whole program. The two largest water pressure zones in the system are flushed every other year with the remaining 29 pressure zones typically flushed yearly.

Table 6 - Kilometers of Water Main Flushed by Year

Year	Total Kilometers Flushed
2022	241.8
2021	425.9
2020	409.4
2019	286.3
2018	244.2

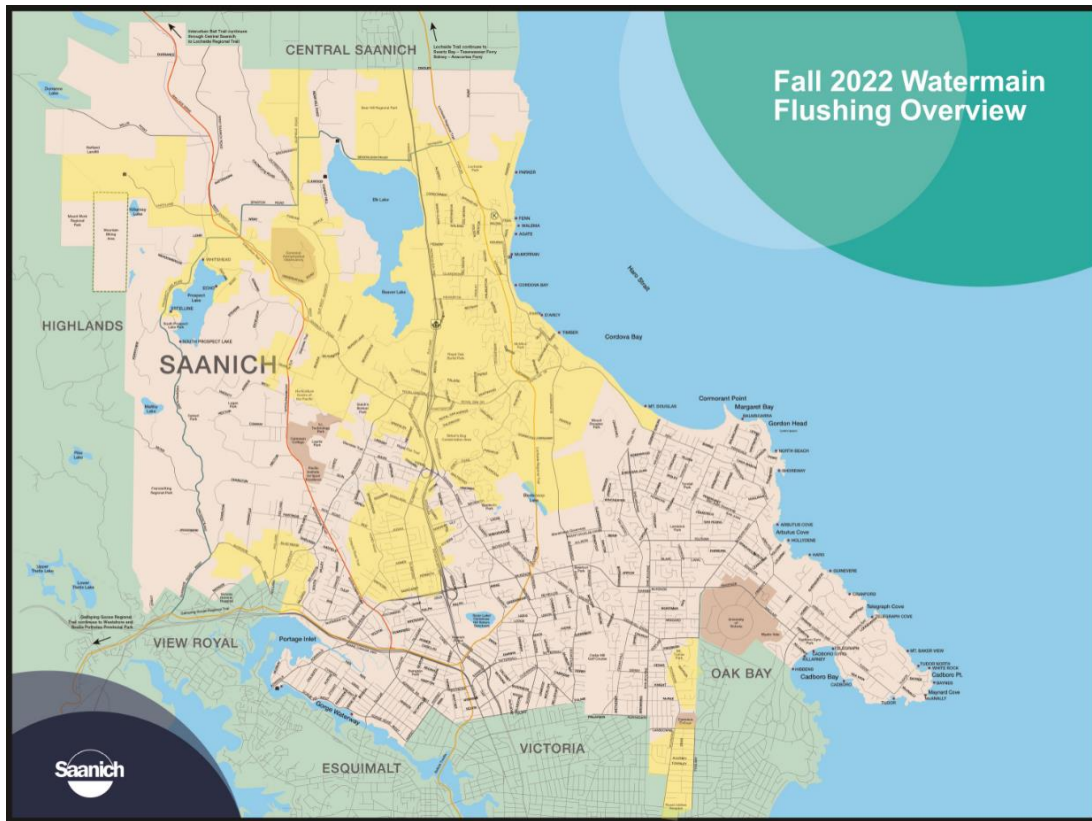
The Unidirectional Flushing program runs twice a year during Spring and Fall flushing seasons. Spring flushing runs from February to June. Fall flushing typically runs from mid-September to the end of December or into January.

Map 1 - 2022 Spring Flushing Areas



Areas flushed: Gorge/Tillicum, Saanich Core, Carey, Cadboro Bay and 10 Mile Point.

Map 2 - 2022 Fall Flushing Areas



Areas flushed: Glanford and Carey, West Saanich, Royal Oak, Cordova Bay, Broadmead, Blenkinsop, Helmcken/Wilkinson and Blue Ridge.

6.2 Monthly Flush Program

Saanich operates an ongoing Monthly Flush Program to flush out water from dead end sections of water main to maintain water quality and reduce customer complaints caused by taste and odours. Dead end sections of water main tend to have higher water age (length of time from treatment to consumption) than other parts of the system. Typically, the higher water age is due to insufficient customer demand to effectively exchange the water in the pipe. These dead end sections are also more prone to sedimentation where particles that enter the water system from Sooke Lake Reservoir can settle out due to the low flow.

The locations that are currently part of the Monthly Flush Program have been determined by customer complaints, field data and observations from Saanich staff throughout the years. The Monthly Flush Program is used to pro-actively maintain water quality in the dead-end water mains within the Saanich Distribution System by removing sediment and bringing in fresh water with a higher chlorine residual to help prevent microbial growth in these areas. In 2022 Saanich pro-actively flushed on 453 occasions as part of the Monthly Flush Program.

6.3 Automatic Flush Valve Locations

Where site conditions are favourable, Saanich Waterworks has begun to install automatic flush valves at the end of dead-end sections of water main. These “auto-flushes” are the equivalent of an irrigation valve on a programmable timer. This allows these sites to run weekly, bi-weekly, or as needed to pro-actively maintain water quality in the dead-end water mains.

The auto-flushes are designed and installed to avoid freezing so they can operate year-round. They have a built-in drain system with de-chlorination to ensure water discharged into the environment is treated appropriately.

Auto-flushes are primarily buried below ground with only a small portion above of the ground surface in a small protective box to minimize the aesthetic impact to the neighbourhood boulevards.

In 2022, District of Saanich staff added a programmable controller in a site-specific application, increasing the pressure in the area by 3 psi for 1 hour on a weekly basis and inducing flow in the water mains. This additional flow had immediate positive effects in reducing the water age in the area.



Figure 3 - Example of an Auto-flush location

6.4 Valve Maintenance

Water distribution valves are installed in the system to isolate small areas for emergency maintenance or repairs. Saanich undertakes an extensive program of inspection, exercising (opening and closing), and maintenance and repair of valves annually to ensure that valves operate when needed.

There are almost 10,000 valves in the Saanich Water Distribution System. Due to the number of valves in the system it takes four to five years to complete the valve program.

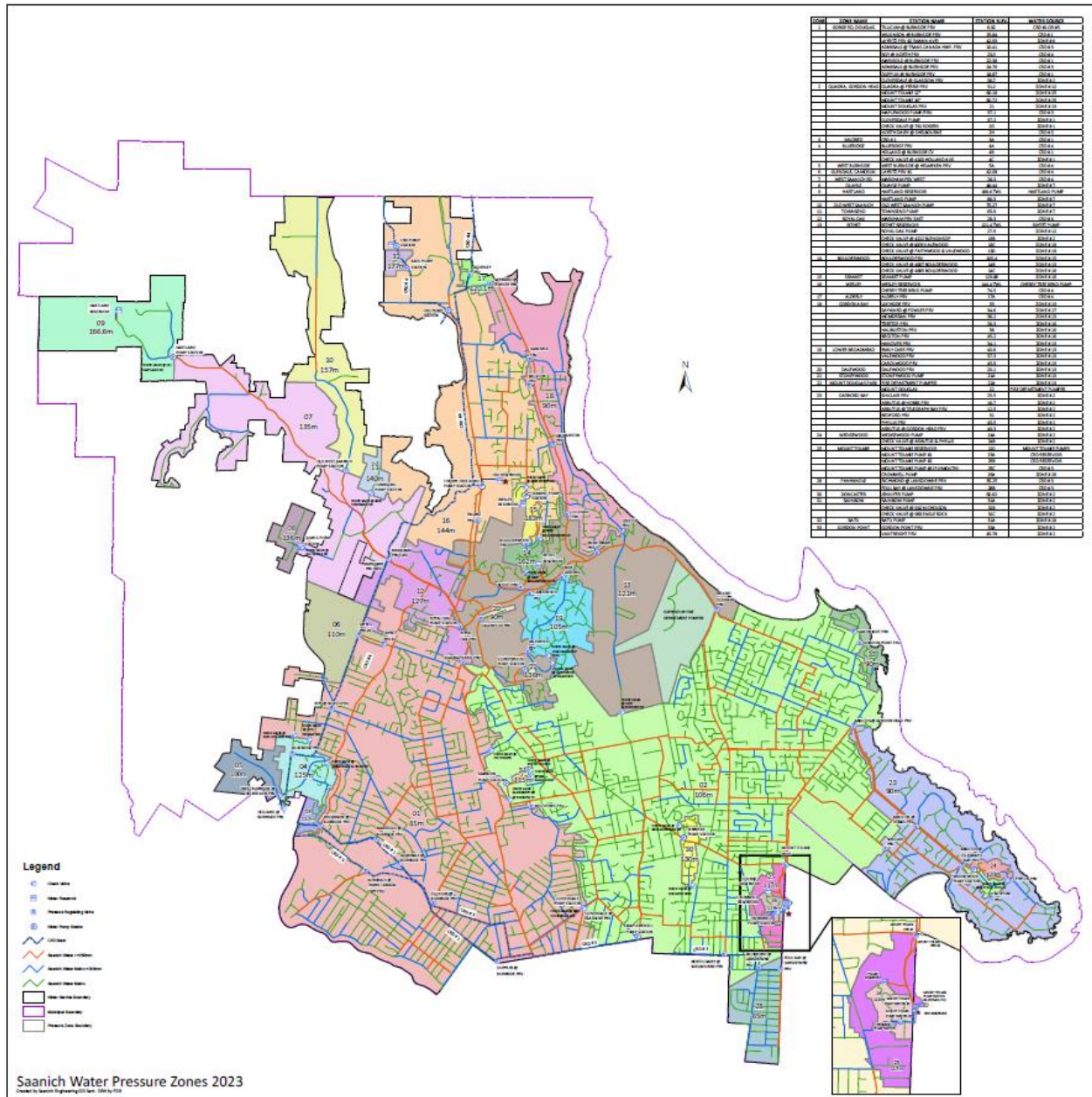
6.5 Hydrant Maintenance

The Saanich Water Distribution System has 2,349 fire hydrants. As part of the hydrant maintenance program all hydrants are inspected and serviced on a 3 – 4 year cycle.

7.0 Summary

1. The water quality data collected in 2022 indicates that the drinking water in the Saanich Distribution System is of good quality and safe to drink. Temperatures in the Saanich Distribution System stayed below the Aesthetic Objective of 15°C for most of the year except during the summer months.
2. The monthly average for water samples taken in 2022 was 97.6 samples. This exceeds the required number of 93 samples each month based on the British Columbia Drinking Water Protection Act and Regulation.
3. The Saanich Distribution System had no *E. coli* positive sample in 2022.
4. The Saanich Distribution System had greater than the 90% compliance requirement for Total Coliform standard for all months with a monthly average of 99.74%. The system had one sample exceeding the 10 CFU/ 100 ml limit. The sample results that had Total Coliforms were immediately retested and found no consecutive Total Coliform positive samples from the same sample sites. This likely is an indication that the positive samples were contaminated during original sample collection.

Appendix A - Map 3 Saanich Water Pressure Zones & Water Mains 2023



Appendix B - References

Canadian Drinking Water Guidelines:

<https://www.canada.ca/en/health-canada/services/environmental-workplace-health/water-quality/drinking-water/canadian-drinking-water-guidelines.html>

Guidelines for Canadian Drinking Water Quality Summary Table 2017:

https://www.canada.ca/content/dam/hc-sc/migration/hc-sc/ewh-semt/alt_formats/pdf/pubs/water-eau/sum_guide-res_recom/sum_guide-res_recom-eng.pdf

From Source to Tap: Guidance on the multi-barrier approach to Safe drinking Water:

[tap-source-robinet-eng.pdf \(canada.ca\)](#)

British Columbia Drinking Water Protection Act:

http://www.bclaws.ca/civix/document/id/complete/statreg/01009_01

British Columbia Drinking Water Protection Regulation:

http://www.bclaws.ca/civix/document/id/complete/statreg/200_2003

Vancouver Island Health Authority: Drinking Water webpage

[Drinking Water | Island Health](#)